would also have been rational for the industry to have reduced its total capital investments, whereas it did just the opposite.

III

Our review of the circumstances of invention, and the pace and sponsorship of innovation, of the most revolutionary cost-saving development in steelmaking since the Siemens-Martin furnace has, we believe, raised serious doubts concerning the *universality* of the "Schumpeter" hypothesis. If the hypothesis is to have general validity, it must be demonstrably applicable to the most important inventions in concentrated, oligopolized industries. But the history of the development of the oxygen process shows just the opposite.

In the first place, the invention was neither sponsored nor supported by large, dominant firms. Nor were these firms leaders in introducing the revolutionary development. Their indifference is explicable either on the grounds of ignorance or delinquency, and the first of these alternatives must be rejected almost summarily. In view of the wide publicity given to the Leoben conference of 1951, the thousands of articles on oxygen and steelmaking in technical and trade journals, and U.S. Steel's assertion that it is aware of every new development in the industry, it is incredible that the engineers of Big Steel were unaware of the Austrian breakthrough.

Second, it was a small firm that first innovated the new process in the United States, and it was other small firms that followed its lead. We submit that this consequence should not be entirely unexpected because it may well be that the structural and behavioral characteristics of oligopolized industries *prevent* the dominant firms from pioneering. Instead, the small firms may be the innovators because, unlike their giant rivals, what they do in the way of cost reductions is unlikely to cause so violent a disturbance of the status quo. Hence, based on the steel industry experience, it seems as reasonable to assume that innovation is sponsored by firms in inverse order of size as it is to assume the contrary. (In fact, we would hazard a guess that inquiry into innovation in other industries might turn up the same conclusion; for instance, the most important breakthrough in petroleum refining techniques since cracking itself — the development of *catalytic* cracking — was innovated by a small, maverick major. Only after Sun Oil had given positive evidence of its commitment to the Houdry process were its billion-

dollar giant rivals willing to venture into the area to develop competing processes.)

Third, our assessment of the consequences of the lag in United States adoption of the oxygen process has shown that the steel industry's complaint about inadequate profits and lack of modernization funds have been sadly exaggerated. Had the dominant steel firms seized the initiative, and carried out a genuine modernization program in the 1950's, their earnings would have been substantially higher and their depreciation and replacement requirements appreciably lower — due to much lower operating costs per ton of ingot capacity and lower depreciation and replacement costs on a lower investment base. Until the steel industry restates its accounts to reflect the efficiencies that have been possible for at least the past fifteen years, little credence should be given to its plaintive pleas for higher prices or profits.

Finally, there is another implication to our study of the steel industry's curious inversion of the source of innovation. It has often been assumed that, if homogeneous oligopolies do not compete in price, their leading members compete in innovating — and that the public thereby benefits as much as, if not more than, it would by price competition. Yet the oxygen converter history reveals the steel oligopoly as failing to compete in strategic innovations. What benefits, then, remain for large size in steel?

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Senator NELSON. I recall some hearings I conducted some 8 or 9 years ago in this area, not specifically on steel, and I remember a reference made to an article you had written about competition within the steel industry.

Professor ADAMS. I have written quite a few articles on that subject.

Senator NELSON. We would be glad to have those in our record.

Professor ADAMS. Thank you.

In innovation, as in invention, the giants of the American steel industry lagged, not led. Thus, the basic oxygen process, invented in 1950, was first put to large-scale commercial use in an Austrian steel plant (VOEST) in 1952. The first installation of the new process on the North American continent took place in a Canadian plant (DOFASCO) in 1954. The first U.S. company to obtain a license under the Austrian patents was Kaiser Steel in 1953—at the time, a company with less than 1 percent of U.S. ingot capacity. The first U.S. company actually to install the oxygen process was McLouth Steel in 1954—at the time, also a firm with less than 1 percent of U.S. ingot capacity. The first major steel company to do so was Jones and Laughlin in 1957—to be followed by U.S. Steel in December 1963, Bethlehem in 1964, and Republic in 1965. In other words, the leaders of the United States steel industry finally decided to innovate this revolutionary process fully 14 years after an Austrian company of infinitesimal size had done so—successfully. They contented themselves, it seems, with repeating the slogan of their leader, U.S. Steel, which called itself the company "where the big idea is innovation," while installing (during the 1950's) 40 million tons of open-hearth capacity which was obsolete at the moment it was put into place.

That judgment, incidentally, comes from *Business Week*, and not from me.

Our country, of course, is paying the price of this technological lethargy by the steel giants. Today, Japan, not the United States, is the technology leader in world steel. More than 80 percent of Japanese steel is made in modern basic oxygen furnaces compared to only 60 percent in the United States. More than 30 percent of Japanese steel is rolled by continuous casting compared to only 9 percent in the United States. While Japan produces a mere 1 percent of its output in open-hearths, the United States still makes 19 percent of its steel in these anachronistic furnaces. Instead of technological innovation, it seems, the industry prefers to lobby for Government protection from competition. Apparently, it does not regard its degree of concentration, nor the giantism of its firms, as an adequate safeguard for survival.

Mr. GORDON. Is this technological backwardness in any way connected to the drive for protection by the steel industry.

Professor ADAMS. There is no question about it.

The drive for protection by the steel industry today, Mr. Gordon, is a demand for bail-out by the Government for the past failures of the industry to be technologically progressive.

Mr. GORDON. It is a bailout by the public, because if you have higher tariffs, the public will have to pay for it?

Professor ADAMS. Of course, and I noted in this morning's paper, that Pittsburgh Steel is raising the price of steel as a New Year's

present for us, and this of course makes sense given the imposition of the reference price system by the U.S. Government.

If you get Government protection from competition, you have the power to raise prices with impunity. And that is what the steel companies want to do, and by giving the companies protection, of course, this is hardly the way to fight inflation which is presumably a social objective of the U.S. at this time.

Senator NELSON. What justification do the American steel companies give to support their argument we ought to limit Japanese imports?

Do they claim lower wages, is that a factor, or subsidy by the Government, as some industries claim?

What justification do they give?

Professor ADAMS. They make all of these claims combined, but, Senator, I think it is appropriate to note that the United States has always, from the moment of its inception, been a high-wage country, because labor has been scarce relative to land historically, and our ability to compete effectively in the world has rested on technology.

Our ability to convert high wages to low labor costs has always been there.

Now, today the steel industry does not even equal the technology of Japan, let alone surpass it, and when you compare the position of this industry with the position of the Japanese industry, Japan is a country devoid of any natural resources.

It has to import all of its iron ore, it has to import all of its coal.

It then converts these raw materials into steel, and then ships that steel for at least 3,000 miles across the ocean to the United States, and more than 3,000 miles to Europe, and it seems that steel sold at competitive prices is what they have accomplished.

In addition, as you well know, the yen has been appreciating in price, while the dollar has been depreciating, so there is an added amount of built-in protection for the U.S. industry, and with all of these disadvantages Japan suffers, and incidentally, wages in Japan have gone up faster than they have in the United States in the last few years, with all of these disadvantages, our giant firms, our giant domestic firms still say we cannot make it without artificial Government protection from Japanese competition.

In my opinion, in giving them that protection, you are following a suicidal policy, because that will not stimulate the industry to make the technological changes that are imperative in order to compete effectively.

We will not get better performance out of the industry.

All we will be doing is to feed the fires of domestic inflation.

Senator NELSON. Well, would your studies indicate that whatever advantages they may have in terms of labor costs, they are offset by the disadvantages in the importation of iron, and the importation of coal?

To weigh all of those factors as an economist, is it basically that they have more modern equipment, more modern productive methods, that makes it possible to undersell, or are there some other factors?

Professor ADAMS. Senator, in response to your question, possibly, the best statement I could make is that even the American Iron and

Steel Institute, which is the trade associations speaking for the domestic steel industry, as well as the presidents of the major domestic steel companies, take the position that today the costs of producing steel in the United States are as low, if not lower than they are abroad.

So this protection from foreign competition, it seems to me, cannot be justified in terms of a tremendous cost advantage, given all of these factors I have recited, and especially the comparative evaluation of currencies at the present time.

So what it is that industry lacks is price competitiveness, and technological competitiveness.

It would seem to me that any technologically efficient steel industry should be able to compete in the marketplace without Government help to fight off the depredations of Japanese import competition.

Senator NELSON. If, in fact, as the steel industry says, the cost of production is less here than in Japan, is not the profit margin the only thing left?

Professor ADAMS. That is part of it, and what I call a difference in mentality.

It would seem to me the Japanese have perfectly copied what I call the Henry Ford philosophy of pricing, which we once associated with the genius of American industry: That is, the recognition of the importance of volume, because when you talk about the cost of production of a commodity like steel, the question is what is your percentage of capacity of utilization, and it makes a very big difference whether you are producing near a 100-percent capacity, or near 50-percent capacity.

Senator NELSON. Where does Japan get most of the iron and coal for its steel plants?

Professor ADAMS. Australia is one source, and much of the coal is imported from the United States.

Senator NELSON. So they have to ship from a long distance the raw material, and then ship a long distance back?

Professor ADAMS. They surely do.

3. British Experience

Reports of the British Monopolies and Restrictive Practices Commission indicate that in countries where interfirm cooperation and industrial concentration enjoy a more privileged status than in the United States, and where antitrust prohibitions are less comprehensive and less stringent, monopoloid giantism is also no guarantee of technological progressiveness. Richard Stillerman—coauthor of "The Sources of Invention" by Jewkes, Sawers, and Stillerman—has summarized some of the British evidence as follows:

> Though the British Oxygen Co., Ltd., long held a near monopoly on the production of oxygen and acetylene, it had no research department until 1945 and pioneered none of the major inventions in the methods of producing and distributing these industrial gases. The British matchmaking industry, ranked near the top in concentration, still employs the basic chemical process for matchmaking developed in the 19th century. Its leading firm, British Match Corp., Ltd., does no research, has discouraged it among other machinery makers, and relies for its technology on a foreign partner.
>
> Some British firms argue that where companies join together, through a trade association, to fix common prices and exchange technical information, innovation is rapid. In other words, cooperation and the absence of competition breed

progress. However, in Britain, where these arrangements were common, there is no solid evidence that invention increased as a result. In 1950, the members of the Electric Lamp Manufacturers' Association made 60 percent of the filament lamps and 62 percent of the discharge lamps. All of the important inventions in that field between 1875 and 1935 came from outside, and there is question about the claim that an association member invented the fluorescent lamp. Over 75 percent of the firms in the calico printing industry belong to a trade association, the Federation of Calico Printers, formed in 1916 to set minimum prices. The calico-printing machine has not been altered in any basic respect since its invention in the 18th century. Neither the discovery of insulin nor the major improvements in its production stemmed from the British insulin producers, who for a time maintained a price association. Dunlop Rubber Co., Ltd., claimed it was the "corpus of knowledge" on tire and rubber technology in the United Kingdom. An industry trade association to which it belonged was organized in 1929. Nevertheless, most of the inventions claimed by Dunlop were introduced prior to the formation of the association, when the firms competed with each other. Members of the trade association actively opposed the introduction of tire retreading, which was forced upon them by the competition of the small specialist firms who pioneered it.

Without proliferating the empirical evidence on an industry-by-industry or country-by-country basis, one can safely conclude that: (1) Giant firms may have the capacity to invest in research and development, but this does not mean that they will actually make such investment; and (2) industrial concentration may provide a hospitable environment for introducing technological innovations, but this does not mean that—in practice—such innovations will be forthcoming. Indeed, one might conclude—and there is considerable evidence to support this proposition—that industrial giantism stifles creativeness and that concentration discourages innovation. In this view, competition rather than monopoly is the spur to technological progressiveness.

Mr. Chairman, I wonder if I might include as an appendix to my statement a chapter entitled "Invention and Innovation," which comes from a book by John M. Blair, Economic Concentration.

Senator NELSON. We will receive that for the record.

Professor ADAMS. Thank you.

A major part of my testimony concerns the Department of Commerce proposed technology policy that has been referred to earlier.

The draft study is entitled "U.S. Technology Policy."

II. THE DEPARTMENT OF COMMERCE PROPOSED TECHNOLOGY POLICY

Apparently oblivious of historical experience and institutional reality, Dr. Betsy Ancker-Johnson—Assistant Secretary of Commerce for Science and Technology—and Dr. David B. Chang—Deputy Assistant Secretary of Commerce for Science and Technology—have produced a draft study, entitled "U.S. Technology Policy," dated March 1977. It constitutes—to put the matter bluntly—a restatement of the myth that giantism and concentration are the indispensable prerequisite to technological progress. It is replete with suggestions for emasculating the antitrust laws and proliferating governmental grants of privilege.

Time precludes comment on more than three major policy recommendations in the Department of Commerce document. First, Ancker-Johnson and Chang state that "Government-industry cooperation in large R. & D. projects of national concern is promoted at the same time that Federal patent policy discourages this cooperation." Presumably,

they would want the Government to grant firms, doing R. & D. work with Government financing, patents on inventions developed at public expense.

This proposal is stale wine in old bottles. Its anticompetitive consequences have been spelled out by the Department of Justice as long ago as 1947:

> Where patentable inventions are made in the course of performing a Government-financed contract for research and development, the public interest requires that all rights to such inventions be assigned to the Government and not left to the private ownership of the contractor. Public control will assure free and equal availability of the inventions to American industry and science; will eliminate any competitive advantage to the contractor chosen to perform the research work; will avoid undue concentration in the hands of a few large corporations; will tend to increase and diversify available research facilities within the United States to the advantage of the Government and of the national economy; and will thus strengthen our American system of free, competitive enterprise.

Despite this policy pronouncement, however, some Government departments—notably Defense—have made it a practice to grant patent rights along with their R. & D. contracts, as if an extra bonus were required to make a giant bonanza acceptable.

The typical R. & D. contract, it should be noted, is a riskless cost-plus-fixed-fee venture. It usually protects the contractor against increases in labor and materials costs; it provides him with working capital in the form of periodic progress payments; it allows him to use Government plant and equipment; in addition, it guarantees him a fee up to 15 percent of the estimated cost. Nevertheless, some contractors demand additional incentives. With the arrogance characteristic of all privilege recipients, they want to extend and compound such privilege.

Some beneficiaries of Government-financed R. & D. assert "that the ownership of a patent is a valuable property right entitled to protection against seizure by the Government without just compensation." In this view, the patent is a right, not a privilege voluntarily bestowed by the Government to effectuate a public purpose. Instead of being recognized for what it is—an alienation of the public domain—the patent is assumed to be a vested right belonging to private interests, even where it is paid for with public funds. By a curious perversion of logic, it becomes a vested privilege to which the private recipient feels entitled and of which he is not supposed to be deprived without just compensation.

In the United States, patents have traditionally been held out as an incentive "to promote the progress of science and the useful arts"—an incentive to private persons, willing to assume the necessary risks to earn the stipulated reward. They were never conceived to be property rights inherently vested in private hands. Nor were they ever intended to reward persons who perform research at someone else's expense as part of a riskless venture. Therefore, as Professor Wassily Leontief, a Nobel laureate, points out, to allow contractors to retain patents on research financed by and performed for the Government "is no more reasonable or economically sound than to bestow on contractors, who build a road financed by public funds, the right to collect tolls from cars that will eventually use it"—or the right to close down the road altogether. It would be tantamount to socializing the financial

support for research, while permitting private monopolization of its benefits.

In effect, granting contractors patent rights on inventions developed at Government expense would be sanctioning the erection of private toll booths on public access routes to scientific and technical advance. The bulk of the Government's R. & D. expenditures would forge a chain of privilege protection and privilege subsidization. It would solidify an implicit—but crucial—antitrust exemption produced by simple Government fiat.

Second, Ancker-Johnson and Chang charge that "the innovation incentive of patent protection is undermined by the compulsory licensing forced in the name of antitrust." They claim that, between 1941 and 1959, the Department of Justice has obtained compulsory licensing in 107 antitrust judgments—13 in litigated cases and 94 cases settled by consent. These judgments, they contend, have adversely affected "such giant sources of technology" as American Telephone and Telegraph, Western Electric, IBM, General Electric, Westinghouse, RCA, Hughes Tool, Bendix, Combustion Engineering, and Minnesota Mining and Manufacturing.

Apparently, Ancker-Johnson and Chang are unaware of the fact that the Department of Justice cannot simply "demand" compulsory licensing "in the name of antitrust." Compulsory licensing is an antitrust remedy, decreed by the courts, only in those cases where the Department of Justice has shown that the patent privilege was abused—that is that patents were unlawfully used to restrain trade or to monopolize. In other words, compulsory licensing is conceived as a remedy in instances where the restrictive use of technology has undermined the very objectives which Ancker-Johnson and Chang are ostensibly interested in promoting.

Elsewhere, I have described the effects of one such patent conspiracy which was eventually settled by a court order decreeing compulsory licensing (*United States* v. *Standard Oil Co. of New Jersey*, Civil 2091):

> Our experience with the hydrogenation and synthetic rubber processes is a case in point. This, one of the less illustrious chapters in our industrial history, dates back to 1926, when I. G. Farben of Germany developed the hydrogenation process for making oil out of coal—a development that obviously threatened the entrenched position of the major international oil companies. Soon after this process was patented. Standard Oil Company of New Jersey concluded an agreement with I. G. Farben, under which Farben promised to stay out of the world's oil business (except inside Germany) and Standard agreed to stay out of the world's chemical business. "By this agreement, control of the hydrogenation process for making oil outside Germany was transferred to the Standard Oil Company in order that Standard's petroleum investment might be fully protected. In the United States, Standard licensed only the large oil companies which had no interest in exploiting hydrogenation. Outside the United States, Standard . . . proceeded to limit use of the process so far as the threat of competing processes and governmental interest [of foreign countries] permitted." As a result, this revolutionary process was almost completely suppressed, except in Germany where it became an effective tool for promoting the military ambitions of the Nazi government.
>
> The development of synthetic rubber production in the United States was similarly retarded by the I.G.-Standard marriage of 1928. Because Buna rubber, under the agreement of 1928, was considered a chemical process, it came under the exclusive control of I. G. Farben—both in and outside Germany. Farben, however, was not interested in promoting the manufacture of synthetic rubber

anywhere except in Germany, and proceeded, therefore—both the commercial (that is, monopolistic) and nationalistic reasons—to forestall its development in the United States. Farben had, at least, the tacit support of its American partner. As a result, the outbreak of World War II found the United States without production experience or know-how in the vital synthetic rubber field. In fact, when the Goodrich and Goodyear tire companies attempted to embark on synthetic rubber production, the former was sued for patent infringement and the latter formally threatened with such a suit by Standard Oil Company (acting under the authority of the Farben patents). This happened in November 1941, one month before Pearl Harbor. Not until after our formal entry into World War II was the Farben-Standard alliance broken under the impact of antitrust prosecution and the production of vital synthetic rubber started in the United States. Here, as in the case of hydrogenation, monopolistic control over technology had serious implications not only for the nation's economic progress but also its military security.

If I may interpolate here, the German war effort during World War II was based on the use of synthetically produced gasoline. Obviously, in circumstances of this sort, and contrary to the claims of Ancker-Johnson and Chang, compulsory licensing promotes rather than retards the diffusion of technology. It is, therefore, in circumstances of this sort, an indispensable instrument for promoting the public interest.

Third, Ancker-Johnson and Chang state that "cooperative industrial R. & D. on high risk, expensive projects to alleviate national problems is desired, but is discouraged by antitrust attitudes." Here again, antitrust is made a convenient whipping boy, but no persuasive evidence is adduced for doing so.

Those familiar with antitrust history know that industrial cooperation, more often than not, is directed at dampening rather than accelerating the development and diffusion of new technology. The so-called *Smog Control* case, involving General Motors, Ford, Chrysler, American Motors, and the Automobile Manufacturers Association, is a case in point. The following excerpts from a Department of Justice memorandum dealing with this instance of "cooperative industrial R. & D." gives some hint of the kind of cooperation that took place:

The collective activities of the automobile manufacturers to delay the marketing and application of air pollution exhaust control devices and not to take competitive advantage of each other is illustrated by the following instances:

(1) Since the industry was fortified from the beginning of the program with the agreement among its members not to take competitive advantage over each other, all auto manufacturers were able through the years to stall, delay, impede and retard research, development, production and installation of motor vehicle air pollution control equipment. * * *

A letter dated January 27, 1964 written by Mr. Howard Dietrich, of the Rochester Products Division of GM, to one K. F. Lingg, states that "Mr. Gordon [then the President of GM] feels, and has publicly stated, that anti-air pollution vehicle developments are 'agonizingly slow.'" (Tr. Vol. XXXXV, pp. 34–35; GJ Ex. 494).

Dr. Donald Diggs, Asst. Technical Manager of the Petroleum chemical division. Du Pont Corporation, one of the witnesses before the Grand Jury, wrote several reports evaluating the attitude of the automobile industry towards the development of curative smog devices, such as that of April 21, 1959 which contains the following statement:

"They [referring to the big three automobile manufacturers] are not . . . interested in making or selling devices . . . but are working solely to protect themselves against poor public relations and the time when exhaust control devices may be required by law." (GJ Ex. 182; Tr. Vol. XLV, pp. 29–30). * * * J. D. Ullman, another technical expert in the petroleum chemical division of the Du

Pont Corporation also wrote reports on the dilatory approach of the automobile companies toward smog control measures which contain the following statements:

"The automotive industry as a whole has taken a very firm position in relation to the California authorities. Basically, the automotive manufacturers would seek to avoid installing a reactor of any sort on a car because it adds cost, but provides no customer benefits such as improved engine performance or styling advances. [As a result] A smog abatement device will be installed on cars for California market only after being approved and requested by the Government of California." (GJ Ex. 194 dated January 19, 1960).

"We gathered that the automobile industry will continue to do whatever it can within the scope of California legislation and of political pressure to postpone installation of exhaust control devices." * * *

(2) The air injection system developed by General Motors was fully described in a paper read before the Society of American Engineers on March 12–16, 1962, entitled, "A Progress Report on ManAirOx-Manifold Air Oxidation of Exhaust Gas" (GJ Ex. 282), but it was not installed on GM cars until all of the automobile companies simultaneously announced antismog systems for all 1966 California models. * * *

(3) * * * when Chrysler decided to submit their Cleaner Air Package to the California MVPCB in October, 1963 for certification "the rest of the industry felt that this was a breach on the part of Chrysler of the Automobile Manufacturers Agreement [which] specified that all manufacturers would work together as an industry rather than as individual companies . . . The final straw . . . came when after Chrysler had submitted their Clean Air Package to the Board . . . the County government decided that wherever possible they would buy only Chrysler vehicles. This, they stated, was to show their appreciation of the attempts by Chrysler to develop a smog-free automobile." (Tr. Vol. XXX, pp. 140–141; GJ Ex. 226).

Despite the success of the CAP, in 1964 Chrysler showed that it came back into line by joining in the aforementioned resolution calling for product engineering and delay of installation until the 1967 models, and by not equipping its cars with the CAP system until installed by all manufacturers on 1966 models to be sold in California. (Tr. Vol. XXIX, pp. 121–122). Chrysler's concern that the industry cooperative smog program be kept intact is clearly evident from a report by R. A. Pittman of the Ford Motor Company concerning a meeting with Bob Sorenson of Chrysler, dated February 6, 1964:

NOTES ON MY DISCUSSION WITH BOB SORENSON CONCERNING "SMOG"

"B. Chrysler management is sorry that things have progressed to the extent they have in Los Angeles County and they have been trying to determine how they can back off of what's been said already to Los Angeles County.

* * * * * * *

"D. Bob again emphasized that his company wanted nothing but a cooperative effort and would entertain any other suggestions as to how to get back on a cooperative basis." (GJ Ex. 461).

The full text of the Department of Justice memorandum, documenting the industrywide agreement and consipiracy among the auto manufacturers, through AMA, not to compete in the research, development, manufacture and installation of motor vehicle air pollution devices, appeared in the Congressional Record on May 18, 1971. It is attached herewith as an appendix to my statement.

Senator NELSON. Is that process being used now?

Professor ADAMS. It has been superseded now. At the outbreak of World War II, the U.S. was without production experience and know-how in the vital synthetic rubber field.

In fact, when the Goodrich and Goodyear Tire companies attempted to embark on synthetic rubber production, the former was sued for patent infringement, and the latter threatened with suit by the Standard Oil Co. acting under the authority of Farben patents.

This happened in November 1941, literally days before Pearl Harbor.

Mr. Chairman, I request the appendix I mentioned be made a part of the record.

Senator NELSON. It will be made a part of the record.

This is the case in which they pled nolo to a charge of conspiracy?

Professor ADAMS. The criminal case was not tried, and the civil case was settled by consent, but again, it is a classic indication of how the industrial cooperation Ancker-Johnson talked about is used more often to stifle competition than to promote it, and for very obvious reasons.

I am not suggesting here, Mr. Chairman, that the people involved in monopoly industries are evil persons.

I am not suggesting that for 1 minute. I am simply submitting that they are perfectly rational people taking into account the industry structure of which they are a part, and they pursue in their conduct the natural implications of that industry structure, and the power situation in which they find themselves.

That is all I am saying, and from the public's point of view, of course, it is important to create the kind of structure that will be in the public interest, rather than purely in the private interest.

Senator NELSON. So I have it clear in my mind, on page 12, when you quote from the *U.S.* v. *Standard Oil*, and the reference there is made to the exploiting of the hydrogenation process, did I understand you to say that process has been superseded?

Professor ADAMS. I was referring to the rubber process.

Senator NELSON. What about the hydrogenation process?

Professor ADAMS. That raises an interesting question of public policy with reference to whether there should be horizontal divestiture in the petroleum industry.

Some argue that new energy sources will be more rapidly developed if we hand the whole package over to the energy conglomerates, and others point out that this will effectively stifle the rapid development of new technology sources.

I happen to associate myself with the latter group.

In part on the grounds of the experience with the hydrogenation process, it is interesting that Consolidation Coal Co., before it was acquired by Continental Oil, kept saying, "well, we have a process that is almost near fruition. If the price of gasoline goes up by another 2 cents or so, that process will become commercially feasible."

Well, the price of gasoline since those statements were made has practically doubled, and still there is not any sign of Consolidation Coal, which is now owned by Continental Oil, has brought the hydrogenation process to fruition.

It seems a rather suspicious state of affairs.

III. CONCLUSION

Industrial history, I submit, confirms Judge Learned Hand's view:

> That possession of unchallenged economic power deadens initiative, discourages thrift and depresses energy; that immunity from competition is a narcotic, and rivalry is a stimulant, to industrial progress; that the spur of constant stress is necessary to counteract an inevitable disposition to leave well enough alone.

Government policy, therefore, should eshew privilege creation, antitrust exemptions, and the subsidization of vested interests. Competi-

tion, not protectionism, paves the way to economic growth and technological progress.

Thank you very much, Mr. Chairman.

Senator NELSON. Thank you very much, Dr. Adams, for your very thoughtful statement.

We appreciate your taking the time to come and testify.

Mr. GORDON. You referred to the "U.S. Technology Report," Dr. Adams, which was issued by the Department of Commerce.

Professor ADAMS. By the way, that may be unfair, because that report may have come from the previous administration.

I do not know if the present leadership in the Department of Commerce embraces that report.

I certainly hope they do not.

Senator NELSON. I think they do not.

Mr. GORDON. But there is a bill that was introduced as a result.

Let me read from the Department of Commerce report. On page 71, it states as follows:

> * * * Presently, there are more than a score of statutory policies for handling the proprietary rights on inventions arising from Government-funded R&D. Most of these policies mandate Federal ownership of the inventions. The great variety of policies is confusing to would-be contractors, and the emphasis on Government ownership dissuades some well qualified companies from taking Government contracts.
>
> A bill has been drafted which would establish for the first time a uniform Federal policy on patentable technology and other intellectual property resulting from Federally-sponsored research and development. The draft bill establishes policies for (1) the allocation of rights to all inventions (contractor and Federal employee) which result from Federal R&D programs, (2) protection of these invention rights through domestic and foreign patenting, and (3) licensing and commercialization of the patented and related technology. The bill provides for contractors to retain ownership of inventions resulting from Federally sponsored research if they have sufficient interest to seek patent protection and declare an intent to commercialize the invention. The public interest is protected by reserving strong march-in rights to the Government. Enactment of the draft bill would repeal, amend, or abolish the numerous existing differing legislative and Presidential Federal patent policies, and permit maximum utilization of the technology resulting from current Federal R&D annual expenditures of approximately $20 billion. * * *

I have some questions on that.

I just want to mention that a month after the draft report was issued, a bill was introduced with those provisions, so whether the Department of Commerce under this administration agrees, at least a bill was introduced in the House, the bill I referred to when Congressman Seiberling was testifying.

Professor ADAMS. That quotation you read to me, Mr. Gordon, would be perfectly appropriate with the addition of one little word.

Mr. GORDON. What is that?

Professor ADAMS. That contractors should not, et cetera.

In other words, precisely the opposite. There should be a uniform patent policy, but it should not give contractors a right to patents developed at Government expense.

Mr. GORDON. How does a monopoly permit maximum utilization?

Professor ADAMS. Presumably a monopoly would have the financial capability of making the necessary investments for innovation.

Mr. GORDON. But it is a restrictive device, is it not?

Professor ADAMS. But the fact it has the capability does not mean it will have the incentive to do so.

It seems to me diffusion of technology depends on competitive pressures, rather than on monopolization, and to those familiar with industrial history it seems to me, there could be no question that monopoly is a restrictive rather than expansionary device, and, therefore, not in the public interest.

Mr. GORDON. Do you know of any evidence to support the assumption that the prompt working of inventions would be encouraged by granting to private firms patent monopolies on patents or on intellectual property?

Professor ADAMS. I am not aware of any such instances.

Mr. GORDON. Thank you, Doctor.

Professor ADAMS. Thank you.

[The prepared statement and attachments of Professor Adams follow:]

STATEMENT BY DR. WALTER ADAMS, DISTINGUISHED UNIVERSITY PROFESSOR, PROFESSOR OF ECONOMICS, AND PAST PRESIDENT, MICHIGAN STATE UNIVERSITY

Mr. Chairman and Members of the Committee: It is a great myth of our time that monopoloid giants are the new Prometheans bringing the heavenly gift of technology from their celestial abode down to earth, and placing it in the service of mankind. As Galbraith put it, " a benign providence . . . has made the modern industry of a few large firms an almost perfect instrument for inducing technical change. It is admirably equipped for financing technical development. Its organization provides strong incentives for undertaking development and for putting it into use."

As a matter of policy, therefore, it is argued that firms should be allowed to be big, so that they can afford the substantial investments required by modern R&D; and they should be allowed to acquire market power, so that they will have the necessary incentives to make these substantial investments.

This myth, while logically plausible and superficially attractive, is only a myth. It is carefully nutured and vigorously propagated by powerful interests, intent on manipulating Big Government in order to obtain grants of privilege and insulation from competition. Like any myth, it is not supported by solid empirical evidence.

I. SOME EMPIRICAL EVIDENCE

1. Automobiles

The American automobile industry is a classic, tightknit oligopoly, where the Big Three account for more than 95 percent of the industry's output. The leading firm, General Motors, is the nation's second largest industrial corporation, with assets in 1976 of $24.4 billion, annual sales of $47. 2 billion and profits of $2.9 billion after taxes. Ford is the nation's third largest and Chrysler the tenth largest industrial corporation. Even American Motors ranks in the top hundred on Fortune's list of the 500 largest industrials. Yet, despite the giant size of its firms and their impressive market power, the industry's record on invention and innovation is somewhat less than spectacular.

The fastest overall pace of technological progress in the industry seems to have occurred prior to the 1920's—due to the youth of the industry and the ease of entry by new men with new ideas. The Independents accounted for a disproportionately large number of major innovations prior to 1941 (e.g., all-steel bodies, 4 wheel brakes, overdrive, hydraulic valve lifters, and turn signal indicators). In the field of product innovation, the industry's primary emphasis since the 1920's has been on cosmetic styling rather than engineering innovations.

The period since World War II has also been a period of slow improvements rather than fundamental change. As Professor Lawrence White found in his definitive study of the automobile industry.

"The major changes in postwar cars—the introduction of automatic transmissions, power steering, power brakes, and high compression engines—were refinements in prewar technology (which had largely been developed for trucks)

rather than fundamental breakthroughs. A good 1946 mechanic would have little difficulty in understanding a 1968 automobile. In the 1970s, new development in engines, ignition systems, and exhaust systems were encouraged by the pressure of air pollution control requirements. Some developments, such as transitorized ignition (replacing the breaker points) exhaust recycling, exhaust catalysts and interest in the Wankel (rotary combustion) engine, were genuinely new. Others such as renewed interest in the stratified charge engine represented new refinements on basically old technology. Even in the 1970s, however, progress on really different sources of motive power (like electric cars or turbine engines) has been very slow, and success has seemed as far away as it did in the 1960s. It is noteworthy that the firms that were first interested in pursuing different kinds of engines, notably the Diesel. the Wankel, and the stratified charge engine, were not the U.S. firms but the European and Japanese manufactures.

"With fewer Independents, it is not surprising that most of the innovations in the postwar period were introduced by the Big Three. But the companies have tended to rely a great deal on their suppliers for advances in technology. The parts suppliers—for example, Bendix, Budd, Kelsey-Hayes, Wagner Electric, Borg-Warner, Dana, Thompson Products (now TRW), Motorola, and Electric Auto-Life—did much of the pioneering development work on new items like power steering, power brakes, ball joints, alternators, transistorized ignition, and others. Also, many of these items were used in European cars before the American companies decided to adopt them."

["The Automobile Industry," in Walter Adams, ed., *The Structure of American Industry*, 5th edition (New York: The Macmillan Company, 1977), p. 195.]

Thus, on the technology front, since World War II, American automobile manufacturers, particularly the Big Three, have a record of innovative lethargy and unprogressive sluggishness. They have lagged, not led, in the battle to develop cleaner, safer, and more fuel-efficient cars. They have chosen to react to change, rather than to initiate it. They have adapted reluctantly to the two exogenous pressures over which they had only limited control, viz., the government's insistence on minimum safety standards and emission control requirements, on the one hand, and foreign competition, on the other.

In this connection, it is well to remember that Detroit introduced the compact car in response to the import penetration of the late fifties; that it introduced the subcompact car only after the import penetration of the late sixties; and that, in response to the influx of fuel-efficient foreign cars following the oil embargo of 1973, Detroit's "better idea" was to demand government restrictions on the import of low-priced, fuel-efficient autos. In short, the industry since World War II has an almost unblemished record of belated adaptation to exogenously induced change, and lately it has also demanded government protection from competition—protection made necessary by its own unprogressive, self-destructive course of conduct.

2. Steel

The American steel industry is another prototype of industrial oligopoly. Its non-competitive structure militates toward non-competitive behavior which in turn results in non-competitive performance. Although the industry is composed of giant firms and highly concentrated, its record both in invention and innovation is marked by technological backwardness.

Thus, it is noteworthy that all major inventions in basic steel making have come from abroad. The modern steel industry dates from the invention of the Bessemer process by an Englishman. The open-hearth furnace was developed by Siemens, a German, and Martin, a Frenchman. The basic oxygen process was invented by Robert Dürrer, a professor of metallurgy in Berlin who conducted experiments at the miniscule Von Roll Works in his native Switzerland. Continuous casting was devised by Siegfried Junghans, an individual German inventor, who at first conducted private experiments in the family-owned brass works. Vacuum degassing, first suggested by a 19th century inventor, was brought to fruition by the Bochumer Verein, a German steel company rebuilding from the ravages of World War II. None of these major breakthroughs in basic steel making originated in the laboratories of the U.S. steel giants.

In innovation, as in invention, the giants of the American steel industry lagged, not led. Thus, the basic oxygen process, invented in 1950, was first put to large-scale commercial use in an Austrian steel plant (VOEST) in 1952. The first installation of the new process on the North American continent took place in a Canadian plant (DOFASCO) in 1954. The first United States com-

pany to obtain a license under the Austrian patents was Kaiser Steel in 1954 at the time, a company with less than one percent of United States ingot capacity. The first United States company actually to install the oxygen process was McLouth Steel in 1954—at the time, also a firm with less than one percent of United States ingot capacity. The first *major* steel company to do so was Jones and Laughlin in 1957—to be followed by U.S. Steel in December 1963, Bethlehem in 1964, and Republic in 1965. In other words, the leaders of the United States steel industry finally decided to innovate this revolutionary process fully fourteen years after an Austrian company of infinitesimal size had done so—successfully. They contented themselves, it seems, with repeating the slogan of their leader, U.S. Steel, which called itself the company "where the big idea is innovation," while installing (during the 1950's) 40 million tons of open-hearth capacity which was obsolete at the moment it was put into place.

Our country, of course, is paying the price of this technological lethargy by the steel giants. Today, Japan, not the United States, is the technology leader in world steel. More than 80 percent of Japanese steel is made in modern basic oxygen furnaces compared to only 60 percent in the United States. More than 30 percent of Japanese steel is rolled by continuous casting compared to only 9 percent in the United States. While Japan produces a mere one percent of its output in open-hearths, the United States still makes 19 percent of its steel in these anachronistic furnaces. Instead of technological innovation, it seems, the industry prefers to lobby for government protection from competition. Apparently, it does not regard its degree of concentration, nor the giantism of its firms, as an adequate safeguard for survival.

3. British Experience

Reports of the British Monopolies and Restrictive Practices Commission indicate that in countries where inter-firm cooperation and industrial concentration enjoy a more privileged status than in the United States, and where antitrust prohibitions are less comprehensive and less stringent, monopoloid giantism is also no guarantee of technological progressiveness. Richard Stillerman—coauthor of *The Sources of Invention* by Jewkes, Sawers, and Stillerman—has summarized some of the British evidence as follows:

"Though the British Oxygen Co., Ltd., long held a near monopoly on the production of oxygen and acetylene, it had no research department until 1945 and pioneered none of the major inventions in the methods of producing and distributing these industrial gases. The British matchmaking industry, ranked near the top in concentration, still employs the basic chemical process for matchmaking developed in the 19th century. Its leading firm, British Match Corp., Ltd., does no research, has discouraged it among other machinery makers, and relies for its technology on a foreign partner.

"Some British firms argue that where companies join together, through a trade association, to fix common prices and exchange technical information, innovation is rapid. In other words, cooperation and the absence of competition breed progress. However, in Britain, where these arrangements were common, there is no solid evidence that invention increased as a result. In 1950, the members of the Electric Lamp Manufacturers' Association made 60 percent of the filament lamps and 62 percent of the discharge lamps. All of the important inventions in that field between 1875 and 1935 came from outside, and there is question about the claim that a association member invented the fluorescent lamp. Over 75 percent of the firms in the calico printing industry belong to a trade association, the Federation of Calico Printers, formed in 1916 to set minimum prices. The calico-printing machine has not been altered in any basic respect since its invention in the 18th century. Neither the discovery of insulin nor the major improvements in its production stemmed from the British insulin producers, who for a time maintained a price association. Dunlop Rubber Co., Ltd., claimed it was the "corpus of knowledge" on tire and rubber technology in the United Kingdom. An industry trade association to which it belonged was organized in 1929. Nevertheless, most of the inventions claimed by Dunlop were introduced prior to the formation of the association, when the firms competed with each other. Members of the trade association actively opposed the introduction of tire retreading, which was forced upon them by the competition of the small specialist firms who pioneered it."

Without proliferating the empirical evidence on an industry-by-industry or country-by-country basis, one can safely conclude that (1) giant firms may have the capacity to invest in research and development, but this does not mean that

they will actually make such investments; and (2) industrial concentration may provide a hospitable environment for introducing technological innovations, but this does not mean that—in practice—such innovations will be forthcoming. Indeed, one might conclude—and there is considerable evidence to support this proposition—that industrial giantism stifles creativeness and that concentration discourages innovation. In this view, competition rather than monopoly is the spur to technological progressiveness.

II. THE DEPARTMENT OF COMMERCE PROPOSED TECHNOLOGY POLICY

Apparently oblivious of historical experience and institutional reality, Dr. Betsy Ancker-Johnson (Assistant Secretary of Commerce for Science and Technology) and Dr. David B. Chang (Deputy Assistant Secretary of Commerce for Science and Technology) have produced a draft study, entitled "U.S. Technology Policy," dated March 1977. It constitutes—to put the matter bluntly—a restatement of the myth that giantism and concentration are the indispensable prerequisite to technological progress. It is replete with suggestions for emasculating the antitrust laws and proliferating governmental grants of privilege.

Time precludes comment on more than three major policy recommendations in the Department of Commerce document. *First*, Ancker-Johnson and Chang state that "Government-industry cooperation in large R&D projects of national concern is promoted at the same time that Federal patent policy discourages this cooperation." Presumably, they would want the government to grant firms, doing R&D work with government financing, patents on inventions developed at public expense.

This proposal is stale wine in old bottles. Its anticompetitive consequences have been spelled out by the Department of Justice as long ago as 1947:

"Where patentable inventions are made in the course of performing a Government-financed contract for research and development, the public interest requires that all rights to such inventions be assigned to the Government and not left to the private ownership of the contractor. Public control will assure free and equal availability of the inventions to American industry and science; will eliminate any competitive advantage to the contractor chosen to perform the research work; will avoid undue concentration in the hands of a few large corporations; will tend to increase and diversify available research facilities within the United States to the advantage of the Government and of the national economy; and will thus strengthen our American system of free, competitive enterprise."

Despite this policy pronouncement, however, some government departments—notably Defense—have made it a practice to grant patent rights along with their R&D contracts, as if an extra bonus were required to make a giant bonanza acceptable.

The typical R&D contract, it should be noted, is a riskless cost-plus-fixed-fee venture. It usually protects the contractor against increases in labor and materials costs; it provides him with working capital in the form of periodic progress payments; it allows him to use government plant and equipment; in addition, it guarantees him a fee up to 15 percent of the estimated cost. Nevertheless, some contractors demand additional incentives. With the arrogance characteristic of all privilege recipients, they want to extend and compound such privilege. Some beneficiaries of government-financed R&D assert "that the ownership of a patent is a valuable property right entitled to protection against seizure by the Government without just compensation." In this view, the patent is a right, not a privilege voluntarily bestowed by the government to effectuate a public purpose. Instead of being recognized for what it is—an alienation of the public domain—the patent is assumed to be a vested right belonging to private interests, even where it is paid for with public funds. By a curious perversion of logic, it becomes a vested privilege to which the private recipient feels entitled and of which he is not supposed to be deprived without just compensation.

In the United States, patents have traditionally been held out as an incentive "to promote the progress of science and the useful artist"—an incentive to private persons, willing to assume the necessary risks to earn the stipulated reward. They were never conceived to be property rights inherently vested in private hands. Nor were they ever intended to reward persons who performed research at someone else's expense as part of a riskless venture. Therefore, as Professor Wassily Leontief, a Nobel laureate, points out, to allow contractors to retain patents on research financed by and performed for the government "is no more

reasonable or economically sound than to bestow on contractors, who build a road financed by public funds, the right to collect tolls from cars that will eventually use it"—or the right to close down the road altogether. It would be tantamount to socializing the financial support for research, while permitting private monopolization of its benefits.

In effect, granting contractors patent rights on inventions developed at government expense would be sanctioning the erection of private toll booths on public access routes to scientific and technical advance. The bulk of the government's R&D expenditures would forge a chain of privilege protection and privilege subsidization. It would solidify an implicit (but crucial) antitrust exemption produced by simple government fiat.

Second, Ancker-Johnson and Chang charge that "the innovation incentive of patent protection is undermined by the compulsory licensing forced in the name of antitrust." They claim that, between 1941 and 1959, the Department of Justice has obtained compulsory licensing in 107 antitrust judgments—13 in litigated cases and 94 in cases settled by consent. These judgments, they contend, have adversely affected "such giant sources of technology" as American Telephone and Telegraph, Western Electric, IBM, General Electric, Westinghouse, RCA, Hughes Tool, Bendix, Combustion Engineering and Minnesota Mining and Manufacturing.

Apparently, Ancker-Johnson and Chang are unaware of the fact that the Department of Justice cannot simply "demand" compulsory licensing "in the name of antitrust." Compulsory licensing is an antitrust remedy, decreed by the courts, only in those cases where the Department of Justice has shown that the patent privilege was abused—i.e. that patents were unlawfully used to restrain trade or to monopolize. In other words, compulsory licensing is conceived as a remedy in instances where the restrictive use of technology has undermined the very objectives which Ancker-Johnson and Chang are ostensibly interested in promoting.

Elsewhere, I have described the effect of one such patent conspiracy which was eventually settled by a court order decreeing compulsory licensing (U.S. Standard Oil Company of N.J., Civil 2091):

"Our experience with the hydrogenation and synthetic rubber processes is a case in point. This, one of the less illustrious chapters in our industrial history, dates back to 1926, when I. G. Farben of Germany developed the hydrogenation process for making oil out of coal—a development that obviously threatened the entrenched position of the major international oil companies. Soon after this process was patented. Standard Oil Company of New Jersey concluded an agreement with I. G. Farben, under which Farben promised to stay out of the world's oil business (except inside Germany) and Standard agreed to stay out of the world's chemical business. "By this agreement, control of the hydrogenation process for making oil outside Germany was transferred to the Standard Oil Company in order that Standard's petroleum investment might be fully protected. In the United States, Standard licensed only the large oil companies which had no interest in exploiting hydrogenation. Outside the United States, Standard * * * proceeded to limit use of the process so far as the threat of competing processes and governmental interest [of foreign countries] permitted." As a result, this revolutionary process was almost completely suppressed, except in Germany where it became an effective tool for promoting the military ambitions of the Nazi government.

"The development of synthetic rubber production in the United States was similarly retarded by the I.G.-Standard marriage of 1928. Because Buna rubber, under the agreement of 1928, was considered a chemical process, it came under the exclusive control of I. G. Farben—both in and outside Germany. Farben, however, was not interested in promoting the manufacture of synthetic rubber anywhere except in Germany, and proceeded, therefore—both for commercial (that is, monopolistic) and nationalistic reasons—to forestall its development in the United States. Farben had, at least, the tacit support of its American partner. As a result, the outbreak of World War II found the United States without production experience or know-how in the vital synthetic rubber field. In fact, when the Goodrich and Goodyear tire companies attempted to embark on synthetic rubber production, the former was sued for patent infringement and the latter formally threatened with such a suit by Standard Oil Company (acting under the authority of the Farben patents). This happened in November 1941, one month before Pearl Harbor. Not until after our formal entry into World War II was the Farben-Standard alliance broken under the impact of antitrust

prosecution and the production of vital synthetic rubber started in the United States. Here, as in the case of hydrogenation, monopolistic control over technology had serious implications not only for the nation's economic progress but also its military security."

Obviously, in circumstances of this sort, and contrary to the claims of Ancker-Johnson and Chang, compulsory licensing promotes rather than retards the diffusion of technology. It is, therefore, in circumstances of this sort, an indispensable instrument for promoting the public interest.

Third, Ancker-Johnson and Chang state that "cooperative industrial R&D on high risk, expensive projects to alleviate national problems is desired, but is discouraged by antitrust attitudes." Here again, antitrust is made a convenient whipping boy, but no persuasive evidence is adduced for doing so.

Those familiar with antitrust history know that industrial cooperation, more often than not, is directed at dampening rather than accelerating the development and diffusion of new technology. The so-called Smog Control case, involving General Motors, Ford, Chrysler, American Motors, and the Automobile Manufacturers Association, is a case in point. The following excerpts from a Department of Justice memorandum dealing with this instance of "cooperative industrial R&D" gives some hint of the kind of cooperation that took place:

The collective activities of the automobile manufacturers to delay the marketing and application of air pollution exhaust control devices and not to take competitive advantage of each other is illustrated by the following instances:

(1) Since the industry was fortified from the beginning of the program with the agreement among its members not to take competitive advantage over each other, all auto manufacturers were able through the years to stall, delay, impede and retard research, development, production and installation of motor vehicle air pollution control equipment.

A letter dated January 27, 1965 written by Mr. Howard Dietrich, of the Rochester Products Division of GM, to one K. P. Lingg, states that "Mr. Gordon [then the President of GM] feels, and has publicly stated, that anti-air pollution vehicle developments are 'agonizingly slow.'" (Tr. Vol. XXXXV, pp. 34–35; GJ Ex. 494).

Dr. Donald Diggs, Asst. Technical Manager of the Petroleum chemical division Du Pont Corporation, one of the witnesses before the Grand Jury, wrote several reports evaluating the attitude of the automobile industry towards the development of curative smog devices, such as that of April 21, 1959 which contains the following statement:

"They [referring to the big three automobile manufacturers] are not * * * interested in making or selling devices * * * but are working solely to protect themselves against poor public relations and the time when exhaust control devices may be required by law." (GJ Ex. 182; Tr. Vol. XLV, pp. 28–30). * * *

J. D. Ullman, another technical expert in the petroleum chemical division of the Du Pont Corporation also wrote reports on the dilatory approach of the automobile companies toward smog control measures which contain the following statements:

"The automotive industry as a whole has taken a very firm position in relation to the California authorities. Basically, the automotive manufacturers would seek to avoid installing a reactor of any sort on a car because it adds cost, but provides no customer benefits such as improved engine performance or styling advances. [As a result]. A smog abatement device will be installed on cars for California market only after being approved and requested by the Government of California." (GJ Ex. 194 dated January 19, 1960).

"We gathered that the automobile industry will continue to do whatever it can within the scope of California legislation and of political pressure to postpone installation of exhaust control devices."

(2) The air injection system developed by General Motors was fully described in a paper read before the Society of American Engineers on March 12–16, 1962, entitled, "A Progress Report on ManAirOx-Manifold Air Oxidation of Exhaust Gas" (GJ Ex. 282), but it was not installed on GM cars until all of the automobile companies simultaneously announced antismog systems for all 1966 California models.

(3) * * * when Chrysler decided to submit their Cleaner Air Package to the California MVPCB in October, 1963 for certification "the rest of the industry felt that this was a breach on the part of Chrysler of the Automobile Manufacturers Agreement [which] specified that all manufacturers would work together as an industry rather than as individual companies. . . . The final straw

* * * came when after Chrysler had submitted their Clean Air Package to the Board * * * the County government decided that wherever possible they would buy only Chrysler vehicles. This, they stated, was to show their appreciation of the attempts by Chrysler to develop a smog-free automobile." (Tr. Vol XXX, pp. 140–141; GJ Ex. 226).

Despite the success of the CAP, in 1964 Chrysler showed that it came back into line by joining in the aforementioned resolution calling for product engineering and delay of installation until the 1967 models, and by not equipping its cars with the CAP system until installed by all manufacturers on 1966 models to be sold in California. (Tr. Vol. XXIX, pp. 121–122). Chrysler's concern that the industry cooperative smog program be kept intact is clearly evident from a report by R. A. Pittman of the Ford Motor Company concerning a meeting with Bob Sorenson of Chrysler, dated February 6, 1964:

"NOTES ON MY DISCUSSION WITH BOB SORENSON CONCERNING 'SMOG'

"B. Chrysler management is sorry that things have progressed to the extent they have in Los Angeles County and they have been trying to determine how they can back off of what's been said already to Los Angeles County.

* * * * * * *

"D. Bob again emphasized that his company wanted nothing but a cooperative effort and would entertain any other suggestions as to how to get back on a cooperative basis." (GJ Ex. 461).

The full text of the Department of Justice memorandum, documenting the industry-wide agreement and conspiracy among the auto anufacturers, through AMA, not to complete in the research, development, manufacture and installation of motor vehicle air pollution devices, appeared in the Congressional Record on May 18, 1971. It is attached herewith as an appendix to my statement.

III. CONCLUSION

Industrial history, I submit, confirms Judge Learned Hand's view "that possession of unchallenged economic power deadens initiative, discourages thrift and depresses energy; that immunity from competition is a narcotic, and rivalry is a stimulant, to industrial progress; that the spur of constant stress is necessary to counteract an inevitable disposition to leave well enough alone."

Government policy, therefore, should eschew privilege creation, antitrust exemptions, and the subsidization of vested interests. Competition, not protectionism, paves the way to economic growth and technological progress.

[From Congressional Record—House, May 18, 1971]

SMOG CONTROL ANTITRUST CASE

(Mr. BURTON asked and was given permission to address the House for 1 minute, to revise and extend his remarks and include extraneous matter.)

Mr. BURTON. Mr. Speaker, on September 13, 1969—see Congressional Record for that date—I joined with 17 of my colleagues in urging an open trial in the smog control antitrust case.

Just this week I have received a document which I am offering today for my colleagues to examine, a document presented to me by reliable persons, and which is described as a confidential memorandum of the U.S. Department of Justice. This memorandum recommended to the Attorney General that criminal charges be brought against American auto manufacturers for conspiring to retard the development of a smog-free motor vehicle.

This memorandum, which spells out in detail previously undisclosed evidence, was prepared before January 10, 1969, when the Department of Justice decided to proceed with a civil suit. Subsequently, the Department of Justice agreed to settle the matter with a consent decree.

These disclosures are especially painful in light of the settlement of the Government's civil case in September 1969 which was filed in lieu of any criminal case. This settlement by a consent decree increased the legal burdens for later litigants, failed to provide for any restitution of damage done, failed to contain adequate reporting requirements, and failed to prohibit the destruction of past documents—all in tradition of ex parte negotiations which form the cornerstone of the consent decree program.

I release this document today because I agree with the metaphor principle behind Louis Brandeis' statement that "sunlight is the best of all disinfectants." Public exposure of these formerly secret materials can only serve to educate the people as to the industry's capability for a major health problem. The consent decree settlement deprived the public of an open trial on all the issues. An open trial would educate the unreformed and deter the potential violator, especially in the auto industry which has for too long been dealt with by gentlemanly trustbusters in the shadow of Government. Sunlight will do it well.

The material follows:

PROPOSED DEFENDANTS AND COCONSPIRATORS

PROPOSED DEFENDANTS

Corporation and State of incorporation

Automobile Manufacturers Association, Inc., New York.
General Motors Corporation, Delaware.
Ford Motor Company, Delaware.
Chrysler Corporation, Delaware.
American Motors Corporation, Maryland.

The entire conspiracy was organized and nurtured in and operated through the Automobile Manufacturers Association (AMA), the trade association of the automobile industry with a membership of nearly 99% of all domestic car and truck manufacturers. The Board of Directors of AMA made all policy decisions in the motor vehicle air pollution control field and the members adopted those policies. AMA is, therefore, proposed to be named as a defendant.

The big four of the industry—General Motors, Ford, Chrysler, and American Motors—were most active in the conspiracy primarily because they were most affected financially if required to install pollution control devices on the millions of cars they manufactured annually, amounting to a vast majority of all domestic car production. General Motors, Ford, Chrysler, and American Motors are, therefore, proposed as defendants.

The conspiracy, which started at least as early as 1955, has lasted so long that many of the participants have abandoned their participation by severing connection with the employers they represented by retirement or otherwise. Too, so many people were involved on behalf of the companies involved that it would be unrealistic to name them all as defendants. The following representative officials who were active in the conspiracy were selected, therefore, as proposed defendants:

PROPOSED COCONSPIRATORS

Corporations and State of incorporation

Checker Motor Corporation (successor to Checker Cab Manufacturing Corporation), New Jersey.
Diamond T Motor Car Company, Illinois.
International Harvester Company (a consolidation of International Harvester Company, a New Jersey corporation, and International Harvester Corporation, a Delaware corporation), Delaware.
Studebaker Corporation (successor to Studebaker-Packard Corporation), Michigan.
White Motor Corporation (successor to The White Motor Company), Ohio.
Kaiser Jeep Corporation (successor to Willys Motors, Inc. a Pennsylvania corporation), Nevada.
Mack Trucks, Inc. (successor to Mack Manufacturing Corporation), New York.

INDIVIDUALS PROPOSED AS COCONSPIRATORS

All members of the Board of Directors of AMA from January 1, 1953 to the date of the indictment, other than those named as defendants herein.

All members of the Engineering Advisory Committee of AMA from January 1, 1953 to the date of the indictment, other than those named as defendants herein.

All members of the Vehicle Combustion Products Committee of AMA from December 4, 1953 to the date of the indictment, other than those named as defendants herein.

All members of all Task Groups which were subcommittees of the Vehicle Combustion Products Committee from December 4, 1953 to the date of the indictment.

All members of the Patent Committee from January 1, 1953 to the date of the indictment.

———, employed by AMA, acted as its liaison officer between it and its members in the air pollution control equipment field and also as its representative before state, county, and local boards and agencies concerned with motor vehicle air pollution control.

The foregoing corporations are all AMA members and signatories to the cross-licensing agreement, the vehicle about which the conspiracy revolved. They are, therefore, proposed as co-conspirators.

The other proposed co-conspirators are the many participants in the conspiracy.

BACKGROUND

Air pollution is a national problem. Polluting emissions from automobiles is one of the causes. Because of the topography [1] of Los Angeles, California and the high concentration [2] of automobiles in that area, the problem was first recognized by the country and then California state officials, and efforts to compel remedies were first imposed there. This memorandum relates to collusive activities of the automobile manufacturers in connection with research, developent, manufacture, and installation of motor vehicle air pollution control devices. As background, the Los Angeles story is important.

The word "smog," derived from abbreviations of smoke and fog, is a misnomer. What is commonly called "smog" is really the result of chemical reactions that take place in polluted air, heated by the sun's rays, and is evidenced by one or more effects much as eye irritation, reduced visibility, high ozone concentration, plant damage, and odor. It is recognizable by a "brownish" or "bluish" haze which many times obscures the surrounding mountains.

The air pollution control program was commenced by the State of California in 1947. In early 1951, Dr. Arie J. Haagen-Smit, a renowned research chemist at the California Institute of Technology, discovered that when oxides of nitrogen, ozone and gasoline (hydrocarbon) vapors were introduced into a plexiglass test chamber and exposed to ultra violet light (artificial sunlight), an irritating haze with all the properties of natural smog was formed. It was this research that pinpointed the motor vehicle as one of the major sources of air pollution and became known as the Haagen-Smit or hydrocarbon theory of smog formation.

Following the publication and general acceptance of the Haagen-Smit theory, the automobile industry finally acknowledged that motor vehicles contributed to air pollution, which it had steadfastly denied prior thereto. The problem of how to control motor vehicle emissions was then turned over by the industry to the Automobile Manufacturers Association (AMA), of which all the automobile manufacturers were and are members.

From the very outset the industry realized that air pollution control devices do not help sell automobiles (Tr. Vol. XXXVIII, p. 11; Tr. Vol. LVII, p. 170).

In his testimony (Tr. Vol. XXXV, pp. 32–33), Supervisor Hahn of Los Angeles County confirmed the following statement appearing in Ralph Nader's book, "Unsafe at Any Speed" at page 100:

"When Mr. Hahn went to Detroit to get some direct answers about adoption of exhaust controls, a senior official of one of the companies asked: "Well, Mr. Hahn, will that device sell more cars?' 'No,' said Mr. Hahn. 'Will it look prettier, will it give us more horsepower? If not, we are not interested.' "

A letter of November 17, 1938 from Lloyd Withrow, head of the Fuels and Lubricants Department of General Motors (GM), directed to Dr. L. R. Hafsted of that company, states in part: "financing this work is most expensive, and the incentives for carrying it out are closely related to political considerations." The letter goes on to state that "[t]he development of exhaust control devices cannot be justified on a business basis; the only hope of a return on such an investment is possible legislation requiring their use." After pointing out that none of the devices contribute appreciably to the efficiency, performance, or appearance of the automobile, the letter concludes that on account of the reasons advanced, "the managements of Corporation Divisions are reluctant to undertake the engineering and development of devices, even though they appear to be based on sound principles." (Tr. Vol. XXXVII, pp. 101–105; GJ Ex. 525).

While the general public talks a lot about air pollution, most people prefer doing without control devices rather than to pay for them. As a result the industry engaged in lip service concerning the health and welfare of the com-

Footnotes at end of article.

munity and the necessity for prompt research, development, and installation of motor vehicle air pollution control devices. In fact, as hereinafter shown, the automobile manufacturers, through AMA, conspired not to compete in research, development, manufacture, and installation of control devices, and collectively did all in their power to delay such research, development, manufacturing, and installation.[3] Indicative of this industry attitude is the very firm position taken in regard to the California authorities, as reported by Dr. J. D. Ullman of E. I. Du Pont after a visit to Detroit in January, 1960:

"Basically, the automotive manufacturers would seek to avoid installing a reactor of any sort on a car because it adds cost, but provides no customer benefits such as improved engine performance or styling advances. From this thinking [the following fact, among others, evolves]:

"(1) A smog abatement device will be installed on cars for California market only after being approved and requested by the Government of California. The industry has told California that cars will be equipped with devices designated by California one year from the date of designation." (GJ Ex. 194).

Also, failure on the part of the manufacturers to purchase devices of independent companies, produced at costs of millions of dollars, discouraged such independents from further research, development, or manufacture of control devices to the great detriment of the American people, science and industry.

An AMA internal memorandum prepared for presentation at Vehicle Combustion Products Committee (VCP) and Engineering and Advisory Committee (EAC) meetings disclosed that as recently as January 15, 1965 the same dilatory considerations prevailed:

"On the basis of the facts the industry is not convinced that exhaust emissions devices or systems are necessary for nationwide application to motor vehicles but believes instead that they will be an economic and maintenance burden on motorists. It is, therefore, not prepared or desirous to initiate any voluntary program to impose these systems or devices on all customers nationwide, or to accept the responsibility for such a decision, in the face of a lack of convincing evidence." (GJ Ex. 411).

The seriousness of the basic problem of air pollution in Los Angeles is highlighted by the following statistics: As late as January 1967, even with the installation of air pollution control devices compelled by law, 12,465 tons out of a total of 14.601 tons per day of contaminants within Los Angeles County are caused by gasoline powered motor vehicles, or in other words, 85.3% of all contaminants in the area are still caused by motor vehicles. (GJ Ex. 486).

THE AUTOMOBILE MANUFACTURERS ASSOCIATION

The AMA is a trade association whose members manufacture 99% of the cars, trucks, and buses produced annually in the United States. (Tr. Vol. XX, p. 52; Tr. Vol. XXI, p. 124; GJ Ex. 394). The policies of AMA are made by and the activities of AMA are carried on under the direction of its Board of Directors. (Tr. Vol. XX, p. 59). The Board of Directors is comprised of the President and Chairman of the Board of the automobile and truck companies who are members of the Association. (Tr. Vol. XVII, p. 5). Until recently,[4] the President of AMA was chosen from among the members of the Board of Directors. (GJ Ex. 255 and 300).

Most of the work of AMA is done by committee. (Tr. Vol. XVII, p. 6). When the air pollution control program was commenced, the VCP, a subcommittee of the EAC (which consists of the Vice-Presidents in charge of the engineering department of each member company), was established by the AMA. (Tr. Vol. I, pp. 88–89, GJ Ex. 260; Tr. Vol. XXXXVI, pp. 52–56, GJ Ex. 565). Membership in the VCP consists of project engineers of the various member companies. (Tr. Vol. XXXXV, p. 32). The following excerpts from documents and testimony illustrate the broad scope of the assigned VCP responsibilities:

The Vehicle Combustion Products Committee of the Automobile Manufacturers Association which has been assigned the responsibility for the past four and one-half years of conducting an intensive cooperative program dealing with all aspects of the automobile exhaust problem . . . (GJ Ex. 258, excerpt from draft, dated March 10, 1958, prepared for presentation to House Safety Committee).

"As the role of the automobile in smog formation was being disclosed, the AMA Board of Directors, in 1954, instructed industry engineers to look into the situation immediately and make recommendations for industry action.

Footnotes at end of article.

"INDUSTRY ACTION

"As a result of this investigation, the AMA Board decided that the problem should be dealt with on an industry team basis. Accordingly, it formed the Vehicle Combustion Products Committee to direct all industry efforts on a noncompetitive basis." (Tr. Vol. XXXXVI, pp. 52–54; GJ Ex. 565).

Mr. Robert T. Van Derveer, director of Motor Vehicle Components Laboratory, United States Department of Health, Education and Welfare, formerly head of the Fuels and Exhaust Emissions Department, American Motors Corporation (American), testified that this noncompetitive industrywide approach concerned not only research and development, but also the installation and marketing of devices; that is, that all aspects of company activity in this field were to be coordinated through the AMA (Tr. Vol. XXXXVI, pp. 53–55).

A number of task groups report and make recommendations to the VCP on specific areas of the automobile which affect emissions; e.g., the Crankcase Ventilation Task Group, the Exhaust System Task Group, and the Fuel System Emission Task Group. (Tr. Vol. XVII, pp. 8–10).

The VCP in turn reports and makes recommendations to the EAC. (Tr. Vol. XVII, p. 6). The following excerpt from GJ Exhibit 335, (Tr. Vol. XX, pp. 56, 61–62) sheds light on the role and composition of the EAC:

"The industry cooperative program is directed by the AMA Board of Directors but is under the technical control of our Engineering Advisory Committee whose chairman, Herb Misch, of Ford Motor Company, will preside this noon. Mr. Misch and all of the other members of the Engineering Advisory Committee are vice presidents in charge of engineering affairs of their companies and are therefore in an excellent position to direct the technical activities which are carried on by the Vehicle Combustion Products Committee and its various working groups and panels."

The EAC in its turn reports and makes recommendations to the Board of AMA. (Tr. Vol. XX, p. 62). It is, however, the Board of Directors which makes all of the policy decisions of AMA. (Tr. Vol. XX, pp. 59, 62; Tr. Vol. XXXXVI, p. 4).

THE CONSPIRACY

As early as 1955 and even prior thereto, public speeches and statements made by the top brass of the leading automobile companies heralded the fact that cooperative effort was being undertaken in the automobile industry in order to accomplish a solution to the motor vehicle air pollution control problem as expeditiously as possible.

In a speech made on April 18, 1955, James C. Zeder, then Vice President of the Chrysler Corporation (Chrysler), said:

"Perhaps you are somewhat surprised to find that we are acting cooperatively in the battle against 'smog.' Our industry has a reputation for being fiercely competitive, and we're proud of it. Ordinarily, competition in research and engineering, as well as in production and sales, can be proved to be the best way to get maximum results and progress. The automobile industry and business has been demonstrating this for more than 50 years. But it has also demonstrated that under some conditions, where the public interest is primarily involved, it is possible to get to a solution of a problem quicker by sharing knowledge and by helping each other bear the work load. At such times we cooperate as energetically as at other times we compete." (GJ Ex. 326).

Similarly, in the language of Charles A. Chayne, then Vice President of General Motors and Chairman of the EAC in 1954:

"Before I go further, therefore, let me pause to add my personal salute to the civic spirit that launched the cooperative program, 'Operation Teamwork' which went into effect last August. It is the kind of teamwork which we have adopted in the automotive industry on a number of historic occasions when it was obviously more beneficial to the American people generally for us to set aside for a time our concern about the immediate advantages of competitive action, and apply the combined talents and facilities of the whole industry to the solution of some problem that affected the public interest adversely." (GJ Ex. 583; Cf. Remarks of John F. Gordon, President, AMA, and President of GM, July 31, 1963, GJ Ex. 335, p. 2 of remarks).

Minutes of the Engine and Vehicle Modification Task Group Meeting, September 12, 1962, gives the source of AMA policy in this matter as follows:

"The AMA Board of Directors has instructed the Engineering Advisory Committee to solve the vehicle emission problem through industry co-operative effort

and to explore any and all avenues necessary to accomplish this." (GJ Ex. 286; Cf. GJ Ex. 258).

On February 7, 1955, the VCP in accordance with a directive of the Board of Directors submitted in draft a plan whereby an information pool would be established and that "research and test data, devices, methods and the like, whether or not the subject matter of a patent or patent application, as may be submitted by any Vehicle Manufacturing Company to the VCP Subcommittee, and owned or controlled by such Company, are to be available on a royalty-free basis to all Vehicle Manufacturing Member Companies and such non-member companies as the VCP Subcommittee may select which agree to conform to the terms of the Resolution of the Board of Directors approving this report." (GJ Ex. 260, p. Ia; Cf. GJ Ex. 285, p. 4).

The plan, however, was never adopted. In place thereof, the Board of Directors of AMA "instruct[ed] legal counsel and the AMA Patents Committee to develop a Cross-licensing Agreement which was the key part of the implementation of the cooperative research and development program." (GJ Ex. 258, AMA Staff Report on Smog Problems to Board of Directors, p. 1). The cross-licensing agreement limited the field of activity to six categories. The Patent Committee Minutes of April 5, 1955 at which this plan for a formal cross-licensing agreement was adopted, contains the following statement (similar ones of which were made many times thereafter by the project and industry leaders): "Mr. Heinen has repeatedly expressed the feeling of his Committee (the VCP) that no one company should be in a position to capitalize upon or obtain competitive advantage over the other companies in the industry as a result of its solution to this problem." (GJ Ex. 292).

This position and its antitrust implications are indicated in a May 10, 1954 AMA document authored by Mrs. G. J. Gaudson, former secretary of the VCP, now Detroit Branch Manager of the Society of Automotive Engineers (SAE), as follows:

"Heinen asked whether a company coming across a satisfactory device either submitted by an inventor, developed during the course of normal company research, or during the course of Subcommittee studies should make the device and its details known to the other companies participating in the Subcommittee work. The alternative, of course, would be for the company to say nothing and then 'scoop' the other manufacturers with an anti-smog device. In view of the common importance of the smog problem to all of the companies and in view of the satisfactory cooperative nature of the work thus far, the individual company approach was not generally favorable. However, it was recognized that very serious legal problems might be involved in the cooperative acceptance and review of devices." (GJ Ex. 590).

Mr. J. M. Chandler, then Unit Supervisor of the Engineering Research Department, Engineering Staff, Ford Motor Company (Ford), in an intracompany communication dated November 16, 1954, wrote in part:

"LEGAL ASPECTS OF COOPERATIVE ACTION

"Another subject discussed at this VCP meeting was that of the legal complications involved in a cooperative industry solution to the smog problem. Mr. Cronin, General Manager of the Automobile Manufacturers Association, indicated that the legal study had not yet been completed, and that he was not sure how complex it was going to be. There is some difficulty concerned with antitrust action which is being carefully surveyed. The Subcommittee indicated a general moral feeling of free cooperation, but with no binding agreements legally available, there is still some question as to competition versus cooperation. Whatever the legal solution it would not hurt for us to be competitively prepared." (GJ Ex. 593).

To the same effect, the Minutes of the Patent Committee of April 5, 1955, read in part as follows:

"In discussing the need for a formal agreement as opposed to adoption by the member companies of a Board resolution accepting the report on purpose and procedure, Mr. Willits pointed to the cross-licensing agreement employed between the lamp and automobile manufacturers in solving the headlighting problem."

* * * * * * *

"Mr. Willits raised some fundamental questions as to the extent of accomplishment possible through a cooperative arrangement such as that contemplated here, as opposed to the progress which might be achieved from the strictly com-

petitive approach. It was agreed that, from the standpoint of public relations, concerted action by the members of the industry and their suppliers appeared to be the only satisfactory solution to the problem." (GJ Ex. 260).

The cross-licensing agreement was originally entered into in 1955. It was amended in 1957 and again in 1960. Five year extensions were executed by the signatories in 1960 and 1965. Thus, the basic provisions of the cross-licensing agreement are in effect today. (GJ Ex. 263, 264, 265, and 266). It provides for a royalty-free exchange of patents between the participants and a formula for sharing the costs of acquisition of patents. The provisions of the cross-licensing agreement which accomplish this result are as follows:

"ARTICLE III—LICENSES GRANTED BY EACH PARTY

"(a) Each party to this Agreement grants to each of the other parties and to their respective subsidiaries, a royalty-free, nonexclusive license to make, use and sell and to have others make for it or them Licensed Devices and parts thereof coming under any patents, domestic or foreign (subject to the conditions set forth in paragraphs (b) and (c) of this Article), owned or controlled, either directly or indirectly, by said grantor on July 1, 1955, or at any time thereafter prior to June 30, 1960, or granted at any time hereafter on inventions owned or controlled, either directly or indirectly, by said grantor on July 1, 1955, or at any time thereafter prior to June 30, 1960.

* * * * * * *

"(c) If any of the parties hereto acquires directly or indirectly a patent otherwise coming within the scope of this Agreement at a cost, exclusive of the expense incurred in prosecuting the patent application or negotiating the purchase, in excess of three hundred dollars ($300), no license thereunder shall be acquired by any other party by operation of this Agreement except upon such party sharing the cost of the patent equitably with the first party and with any other parties electing to take a license thereunder." (GJ Ex. 263).

Section (a) provides for a royalty-free exchange of defined patented devices by all participants provided that development costs in excess of $300 are shared equally. As hereinbefore stated, there is admitted little or no economic incentive for automobile manufacturers to develop and install air pollution control equipment on vehicles they manufacture. (Tr. Vol. XXII, p. 54). Since the results of any industry advances are to be shared by all, there is no private incentive for gain inasmuch as each company must share the benefits of such advantages with the rest of the automobile industry. (GJ Ex. 566). Delays in technological development engendered by inadequate manpower or facilities will result in no disadvantage to any company should it become desirable or necessary to install such equipment in the future. At the same time it is apparent that the participants in the cross-licensing agreement possess sufficient resources to engage in competitive research and development programs.

Section (c) provides for a royalty-free exchange, between the participants, of patents acquired from third parties, provided that the purchase price in excess of $300 is shared equally. In effect, this provision presents a third party seeking to market a patent to automobile companies with but a single purchaser—i.e., the whole industry. The provision eliminates price competition among the participants with respect to the purchase of patents from third parties. (Tr. Vol. XXII, p. 53).

The intent to control prices of inventions by cross-licensing agreement is shown by the fact that this agreement, including the above-quoted provision, was modeled after a similar agreement concerning sealed beam headlights. In discussing this agreement, a report of the VCP dated January 10, 1958 reads in part: "There are some industry precedents established in the arrangements which the industry made to insure multiple sources for Sealed Beam headlight units, and *to set the terms for the maximum royalties to be paid for use of light polarizing material.*" (GJ Ex. 338, underscoring supplied).

The cross-licensing agreement provides a most "favored nation clause" whereby third parties must license all participants at the same royalty rate. (Tr. Vol. XXII, p. 48). The provision of the cross-licensing agreement which accomplishes this result is as follows:

"ARTICLE III—LICENSES GRANTED BY EACH PARTY

"(b) If any party hereto has acquired or does in the future acquire directly or indirectly the ownership, control, or right to license others under patents

otherwise coming within the scope of this Agreement conditioned on the payment of royalty, no license thereunder shall be acquired from such party by any other party by operation of this Agreement except upon the latter's agreeing to pay and paying to the licensor of said first party, royalty at the same rate as such first party would have been required to pay had the licensed article been made or sold by it. Royalties accruing under the provision of this subsection (b), if for sales within the United States and Canada, shall be payable in the next succeeding month of January, April, July or October, as the case may be, following the close of the calendar quarter in which said sales occur. * * *" (GJ Ex. 263).

Mr. William L. Scherer, manager of the Patent Department of AMA, interpreted the meaning of this provision for the grand jury. He testified that it enables any other party to the agreement to obtain the same kind of arrangements with respect to rights as the first party making arrangement with a patentee. (Tr. Vol. XXII, p. 46). In other words, if one of the companies acquires a license under a given patent, that company must endeavor to make it possible for any other party to the agreement to also obtain a license under that patent, for which royalty would be paid at the same rate as the first company acquiring rights under the patent would have negotiated. (Tr. Vol. XXII, p. 47). This ensures to anyone else who may want to come into the program, or use that patent, that they will get the same royalty treatment as the first individual does. (Tr. Vol. XXII, pp. 48–49).

This provision of the cross-licensing agreement was intended by the participants to eliminate competition between them in the purchase from third parties of rights under existing patents. This conclusion is based on Mr. Scherer's testimony which was as follows:

"The Juror. Wasn't the patentee told that it would be available to all of the companies? Or was that kept a deep, dark secret?

"The Witness. No, I think that when he came, for instance, if John Doe has a device that he says will solve the problem, and he wanted to come to Company A and deal with that company, he could have done so.

"Now, the only understanding is that, if that John Doe, I believe I called him, were to deal with Company B, the only understanding is that he is going to get the same royalty arrangement that Company A has.

* * * * * * *

"The Witness. And he will be glad to do that, believe me.

"The Juror. Well, in other words, he might go into Company A and agree on a royalty of 10¢ an item, let's say.

"The Witness. Yes.

"The Juror. Now, he went to Company B and he is faced with the fact that that is as much as he can get; is 10¢, because the other company has now made it available to them.

"The Witness. That's right. But, remember, he has got a lot more volume.

"The Juror. Well, that may be so or it may not be so. But, it depends on, in other words, his 10¢ now because a fixed——

"The Witness. Ceiling.

"The Juror. Ceiling.

"The Witness. That's right.

"The Juror. He cannot go above that ceiling once he submits to one company, he cannot go above that ceiling. He is hooked.

"The Witness. Under what we call the "favored nation clause," yes.

"The Juror. Well, whatever you call it, he is hooked for that amount.

"The Witness. That's right.

"The Juror. Thanks." (Tr. Vol. XXII, pp. 56–57).

The participants to the cross-licensing agreement have agreed upon a method whereby a third party wishing to do business with any participant must agree with his device may be considered by all of the participants through the Automobile Manufacturers Association.

In 1955, the cross-licensing agreement provided in pertinent part:

"Article VIII—Ideas submitted by persons other than parties

"It is agreed that each idea relating to the subject matter of this Agreement submitted by a person other than a party to this Agreement shall be first submitted to one of said parties accompanied by a waiver in a form approved by

the Patent Committee of the Automobile Manufacturers Association by which the submitter shall authorize such party to disclose the idea for appraisal and test to any third party or parties and grant immunity to said party as well as to all parties to whom such disclosure is made from all liability to the submitter arising from such disclosure other than such liability arising from the infringement of any valid patent covering the subject matter disclosed. Each such party shall then submit such ideas to the Vehicle Combustion Products Subcommittee for consideration, after which said Party shall report to the submitter the findings of said Subcommittee, and shall file a copy of said report with the secretary of said Subcommittee." (GJ Ex. 263).

This provision was amended in 1957 to read as follows:

"ARTICLE VIII—IDEAS AND INVENTIONS SUBMITTED BY PERSONS OTHER THAN PARTIES

"Nothing in this Agreement shall prevent any of the parties from receiving, considering or purchasing ideas or inventions submitted by others relating to the subject matter of this Agreement. In the event that such ideas or inventions are submitted to a party by a person other than a party to this Agreement or other than a person under contract to assign such ideas or inventions to a party, such party may submit such ideas or inventions to the Vehicle Combustion Products Subcommittee for consideration provided such party has obtained from the submitter a waiver in a form approved by the Patent Committee of the Automobile Manufacturers Association by which the submitter shall authorize such party to disclose the idea or invention for appraisal and test to any third party or parties and grant immunity to said party as well as to all parties to whom such disclosure is made from all liability to the submitter arising from such disclosure other than such liability arising from the infringement of any valid patent covering the subject matter disclosed. The said party shall thereafter report to the submitter the findings of said Subcommittee, and shall file a copy of said report with the secretary of said Subcommittee." (GJ Ex. 264).

Mr. Scherer testified as follows as to the substantive change worked by the 1957 amendment to Article VIII:

"A. * * * it enables, as I understand it, to have each participating company consider ideas submitted by outside parties, not parties to the agreement, for consideration and test without the necessity of reporting that inormation to the (other) participant[s] under the cross-licensing agreement." (Tr. Vol. XVII, pp. 44–46).

Plainly, Article VIII of the 1955 Agreement (GJ Ex. 263) requires third parties dealing with any participant to agree to the submission of their device to the Vehicle Combustion Products Subcommittee of the Automobile Manufacturers Association.[5] As amended in the 1957 agreement (GJ Ex. 264), however, it would seem that referral to the VCP was no longer required. (Tr. Vol. XVII, pp. 44–46).

Mr. Van Derveer, however, testified unequivocally that it was communicated to him by both AMA and his superiors at American Motors that the signatories to the cross-licensing agreement had obligated themselves to insure that before any participant dealt with an independent device manufacturer that the device manufacturer must sign an AMA Suggestion Submission Agreement.[6] (Tr. Vol. XXXXVI, pp. 48–51; GJ Ex. 416). Even after the 1957 amendment, AMA continued to recommend to participants that an AMA Suggestion Submission Agreement be obtained from third parties. (Tr. XVIII, p. 93).

Mr. William K. Steinhagen, a General Motors engineer in charge of their Power Development Group, testified that when a third party came to him with a device, he was instructed to inform the third party of General Motor's obligations under the cross-licensing agreement and to obtain an agreement from the third party allowing tests of the device to be conducted under the terms of the cross-licensing agreement. (Tr. Vol. XXXII, p. 54).

Mr. Harold Lipchik, Vice President and General Manager of the Advanced Products Division, Chromalloy American Corporation, testified that in attempting to market the AMF–Chromalloy device to the automobile company participants in 1964, it was suggested by Mr. Chandler of the Ford Motor Company that the proper method of procedure would be for Lipchik to execute an AMA Suggestion Submission Agreement and to make his initial presentation to the AMA. (Tr. Vol. XVII, p. 50).

Footnotes at end of article.

It is apparent from the foregoing testimony that the language change in the 1957 amendment worked no substantive change in the re requirement that participants not consider third party devices unless an AMA Suggestion Submission Agreement was executed by the third party.

Minutes of the AMA Patent Committee meeting of May 13, 1959, read in part:

"The Committee reconfirmed the position taken at its September 22, 1955 meeting that it disapproved any meetings between industry members and persons who have not signed the Cross-Licensing Agreement unless the outsiders have executed and AMA Suggestion Submission Agreement and that there should be no exceptions to this policy." (GJ Ex. 260).

That AMA highly regarded the method of dealing with third party devices is further illustrated by the following pertinent excerpt from GJ Exhibit 302, an unsigned memorandum dated April 20, 1965:

"Probably not for publication but Mr. Thornton (an AMA employee) says 1957 amendment was made because of antitrust problems in the first agreement. Changed the way people brought ideas to the committees from outsiders.

* * * * * * *

"Also not for publication—Mr. Thornton says the Patent Committee feels we should definitely renew—especially in view of the CID investigation. It would not be wise to discard the agreement at this time."

Mr. Schere's testimony on this amendment was as follows:

"Q. In other words, prior to the amendment in 1957, anybody who had signed the cross-licensing agreement was obligated, with respect to their dealings with outsiders, to submit any ideas which they received from outsiders to the Automobile Manufacturers Association Vehicle Combustion Products Committee? Isn't that correct?

"A. That's correct.

"Q. And it was felt in 1957 that there were some antitrust difficulties with that particular method of procedure, was there not?

"A. All I can say to that is that on advice of counsel, it was changed." (Tr. Vol. XVIII, pp. 87–88).

Basically, there are three parts of an automobile emitting pollutants. One, the crankcase (blow-by); two, the carburetor and fuel tank (evaporation losses); and three, the exhaust. Before any devices were affixed to cars, the experts estimated that 25% of the pollutants were emitted from the crankcase, 15 to 25% from evaporation losses, and 50 to 60% from the exhaust.

In 1959 it was discovered at General Motors that a positive crankcase ventilation (pcv) valve, used even prior to World War II for the purpose of keeping the crankcase of military and other vehicles free of mud, sand, etc., was effective in the elimination of blow-by emissions from the crankcase. (Tr. Vol. XXIX, p. 72; Tr. Vol. XXXVI, pp. 15–16). As a result, General Motors could have installed the device on its cars and obtained a competitive advantage since this type of device was not covered by the cross-licensing agreement. However, this was not done, but to the contrary, the cross-licensing agreement was amended in 1960 by the addition of five categories covering crankcase and evaporation losses so that the industry could act collectively with regard to these areas. (Tr. Vol XXXVI, p. 15; GJ Ex. 265).

A July 27, 1959 memorandum from W. P. Sherman of the AMA staff to the EAC states in part:

"Mr. Delaney called attention to the fact that neither of these areas of investigation or development are covered by the present industry Cross-Licensing Agreement. It was, therefore, the unanimous recommendation of the committee and of Mr. Delaney that the Engineering Advisory Committee should immediately request the AMA Patent Committee to amend the Cross-Licensing Agreement to cover these areas, and to do so in the immediate future to permit the work to go forward rapidly." (GJ Ex. 384).

An agreement was then made by the automobile manufacturers to install the pcv valve on all 1961 model cars to be delivered in California. (Tr. Vol. XXXXIII, pp. 99–100; GJ Ex. 355, 445, 543). This was heralded as a "voluntary" contribution to the elimination of smog by the automobile industry. (Tr. Vol. XXI, pp. 15–17, GJ Ex. 355; Tr. Vol. XXIX, pp. 73–74). However, a document dated November 13, 1959 written by W. S. Berry of American Motors indicates the real motive for the installation of the device on 1961 models. It reads in part as follows:

"There is time to complete our test work on this breather system before the introduction of the 1961 model. The reasons for making the announcement before test work is completed are as follows:

"1. The opportunity for the industry to voluntarily do something in California which will make a major reduction in emissions at a relatively low cost. In advancing this argument the AMA Staff uses a cost to the customer figure of around '$10.'

"2. On December 4th there will be a hearing in Berkeley which will be held between the California State Department of Health to finalize recommendations on tailpipe emissions. An announcement before that date would possibly slow down any regulatory action on this matter. Likewise, this announcement may deter Governor Brown from holding a special session of the Legislature dealing with the air pollution problem." (GJ Ex. 555).

Quite evidently the cross-licensing agreement was not needed for protection or use of any patent. As a matter of fact, no significant patents were then known to exist affecting development of pollution control devices and no lists of patents were then nor have they ever been annexed to the cross-licensing agreement or any extension thereof. (Tr. Vol. XXII, pp. 54–55). It is submitted that the cross-licensing agreement was merely a vehicle to accomplish the noncompetitive and delaying activities of the signatories thereof.[7]

The evidence adduced before the Grand Jury clearly developed that the signatories to the cross-licensing agreement had the following understandings and agreements with respect to the installation of motor vehicle air pollution control devices: (A) not to publicize competitively any solution to the motor vehicle air pollution problem; (B) to adopt a uniform date for announcement of the discovery of any air pollution control device; and (C) to install devices only on an agreed date. (Tr. Vol. XXII, pp. 49–50).

Minutes of the meeting of the Engineering Advisory Committee on January 10, 1958, read in part as follows:

"The Committee report raised a number of questions for decision by EAC. These were taken up in the following order:

"(i) *Statement on exchange of information and publicity on smog research activity.* The VCP asked concurrence of EAC on this statement which was drafted in August by the VCP members. Mr. Kucher stated that there is no misconception or objection to the objective the VCP has in mind, but he questioned what mechanism would be used; he suggested that specific provision be made for the submittal of plans for speeches and text ahead of time. Mr. Heinen said that the VCP would include such ground rules with the statement.

"Mr. Ackerman commented that there was no doubt about the EAC belief that such a program should be carried out on a cooperative basis. Mr. Chayne moved approval of the proposal, with the instruction that it be sent to the company public relations directors, asking them to join in the effort to carry this out properly.

"The VCP report also called attention to the desirability of re-affirming the idea of a single announcement and a uniform adoption date for any device which the industry may decide to use for smog control. Mr. Chayne moved that this view be included with the previous motion; EAC members approved." (GJ Ex. 339; Tr. Vol. XX, p. 78).

The following further excerpts from documents and testimony are illustrations of the understandings and agreements referred to above:

A. As to the agreement not to publicize competitively any solution to the problem:

"1. Grand Jury Exhibit 338, dated January 10, 1958 (Tr. Vol. XX, p. 74), reads in part as follows:

" 'To a large degree, some of the questions in connection with the publication of data involved consideration of publicity effects which often result when some item of interest is released dealing with the smog problem. The Committee believes that it was the intention of AMA in establishing the VCP activity to avoid situations in which competitive publicity advantages would arise and be seized by any one of the company participants. *EAC re-affirmation of this viewpoint would be helpful.*

* * * * * * *

" 'Similarly, there have been some fears expressed that technical developments in the air pollution program, which might happen to occur in one quarter rather

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Footnotes at end of article.

than another, could lead to a situation in which some automobile companies might be more favorably positioned for the introduction of an exhaust control device than other companies. Here it has been the VCP understanding from the beginning that the public service aspects of our cooperative work on the exhaust gas problem are such that no company should expect to take advantage competitively by being the first, or claiming to be the first, to offer such a device. *It will be extremely helpful in the further conduct of our program if the EAC will take cognizance of the importance which is attached to this problem and re-affirm authoritatively that the companies will participate equally in the public relations benefits that will accrue from a single announcement in the uniform adoption date for any device which may be adopted for us.'* "

The report of the EAC of the same date, January 10, 1958 shows that by vote it reaffirmed "the idea of a single announcement and a uniform adoption date for any device which the industry may decide to use for smog control." (GJ Ex. 339).

"2. Grand Jury Exhibit 345, December 3, 1962 (Tr. Vol. XX, pp. 105–106), reads in part as follows:

" 'The Engineering Advisory Committee is in complete agreement with both the public Relations Committee and the Vehicle Combustion Products Committee with regard to the need for more and better publicity about industry activities in the air pollution field.

" 'The Engineering Advisory Committee does, however, share the concern of the Vehicle Combustion Products Committee regarding the dangers of ill-considered unilateral publicity. The EAC recommends, therefore, that the proposal for increased publicity by the individual companies, as well as by the Automobile Manufacturers Association, be approved with the proviso that such releases concern only "actvities" and that releases concerning specific "solutions" be issued by AMA.

" 'It is essential that all releases be coordinated through AMA and that procedures be established to handle such coordination expeditiously.'

"3. Mr. Scherer's testimony on this subject was in part as follows (Tr. Vol. XX, pp. 76–77):

" 'Q. The matter of publicity, is it your understanding that by the terms of the cooperative arrangement in the industry with the respect to motor vehicle air pollution control equipment, that no one company would advertise or publicize the merits of its equipment, vis-a-vis other companies in the field.

" 'A. That was my understanding of their intention, yes.'

"4. An interdepartmental letter of American Motors dated November 28, 1962, reads in part as follows:

" 'In the area of press releases there has been a tacit understanding, if not a written policy, that all individual company press releases will be reviewed by the AMA Public Relations Committee and the VCP. Ford has been the only flagrant violator of this policy, since on two occasions they have issued releases that caught the rest of the industry by surprise (announcement of vanadium pentoxide exhaust catalyst in 1957, and blowby control system in 1962).

" 'The current AMA Public Relations Committee recommendation to the Engineering Advisory Committee, which was initiated by G.M. is somewhat difficult to understand. It has been suggested that it is a "veiled threat" to Chrysler because of that company's success (and related publicity) in making their cars meet the California standard for exhaust emissions without an exhaust treating device. The proponents of this approach say that G.M., because of their overwhelming dominance in the field of smog research (see attached sheet for relative air pollution budgets of AMA member companies), are saying to Chrysler, "Slow down on this approach and don't break the industry front or we will completely submerge you, publicity-wise".' (GJ Ex. 542).

"5. Mr. Van Derveer testified as follows concerning a 1957 publicity release by the Ford Motor Company (Tr. Vol. XXXXV pp. 46, 51–53):

" 'Q. So, Ford issued a publicity statement on the vanadium pentoxide device, and it achieved nationwide recognition.

" 'A. Yes.

Q. And it was a device? A prototype device had been devolped?

" 'A. Yes.

" 'Q. Tested on cars.

" 'A. Yes. Not very extensively, but, yes.

" 'Q. And then there was some unhappiness in the industry over Ford's publicity?

" 'A. Correct.

" 'Q. Now, who was the source of the unhappiness?

" 'A. Well, Heinen was probably the most vocal on the thing.

" 'Q. All right. What did Heinen say?

" 'A. . . . Well, he said lots of things, actually. But, more or less of a breach of a promise; the fact that this put Ford in a lot better light. And just the fact that the company was getting nation-wide attention for something, the other people were working equally hard on other things and they weren't getting any publicity. That sort of thing.

" 'Q. Was there a little feeling that Ford was reaping too much advantage out of its publicity, and, therefore, Ford should not have issued, the publicity statement?

" 'A. Well, that was certainly part of it.

* * * * * * *

" 'Q. So, there was an attempt to dampen the publicity that was issued a little while before.

" 'A. It wasn't actually a retraction. I guess.

" 'Q. Not a retraction, but an attempt to dampen down the publicity.

" 'A. As I remember, yes.

" 'Q. What was the impetus of Ford to dampen down the publicity: Was it because Heinen was disturbed about this?

" 'A. I am sure it was Heinen and General Motors being disturbed, too, I am sure General Motors had an opinion on it. I never heard it expressed particularly.' "

B. As to the agreement for the adoption of a uniform date for announcement of the discovery of a device:

"1. In an interoffice memorandum from R. J. Templin, Cadillac Motor Car Division, to J. H. Lamb, also of GM, dated October 6, 1959, Mr. Templin stated:

" 'Please note that we are bound by an agreement through Mr. C. A. Chayne with the Automobile Manufacturers Association to withhold any public knowledge about these devices until a joint industry announcement can be made through AMA. These devices must, therefore, be treated as confidential.". (GJ Ex. 499).

"2. Mr. Scherer's testimony on this point was in part as follows (Tr. Vol. XXII, pp. 49–50):

" 'Q. Have they also had the understanding to adopt a uniform date for the announcement of the discovery of any air pollution control device?

" 'A. I would say that's the way the program has operated, yes.'

"3. Mr. Scherer further testified (Tr. Vol. XX, pp. 75–76):

* * * * * * *

" 'Now, that's a fact, isn't it, that the industry, from that point on [Jan. 10, 1958], has publicized a uniform adoption date for any device that is produced in this field?

" 'A. You are asking me?

" 'Q. Yes, I am asking you.

" 'A. That's correct. There is one thing to be said for that type of thing: Remember that there were some of the participants in the program who may not have been quite ready to go ahead with the adoption of the device as far as their own testing and knowledge is concerned. They were pressed into going ahead with it, much ahead, perhaps of the time that they were ready.

" 'Yes, and if they weren't ready, they may also have waited until—

" 'A. If they were ready?

" Q. The others could wait——

" 'A. That's possible.

" 'Q. —until the device was ready until everybody could put it on at the same time?

" 'A. That's possible. So, it works both ways.

" 'Q. But, there is no doubt about it that the policy has been consistent and that it is right up to this date, that no device has been adopted by any one company on its own; that they all did it at a uniform adoption date; they all put it on at the same time? Is that correct, sir?

" 'A. I believe that's correct.' "

C. As to the agreement to install devices only on the agreed date:

"1. Testimony by Mr. Scherer on this subject was in part as follows (TR. Vol. XXI, p. 33):

" 'Q. Is this kind of behavior on the part of the individual companies the result of an agreement among all of them to adopt devices at a uniform date, and that

one company would not go ahead with the device unless all of the other companies were in the position to go ahead with the device?

"'A. We did note in the record that there was such an understanding among the companies, yes."

"2. Minutes of the EAC meeting dated May 17, 1962, read in part as follows:

"'UNIFORM ADOPTION AND ANNOUNCEMENT OF SOLUTIONS

"'At this point Mr. Caplan read the rest of his report and raised for discussion the problems that had arisen as a result of publicity and the supplying of some equipment for engine modification to the Los Angeles County officials prior to its being supplied to the State Board. This had resulted in a letter from the County Board of Supervisors, which has been acknowledged but not yet answered, urging AMA action by all of the automobile companies to engage in a similar modification program. Mr. Isbrandt suggested that the handling of these problems required simply that all of the participants be cognizant of the responsibilities already outlined and understood in the EAC and VCP activity'." (Memorandum Report, EAC Meeting, dated May 17, 1962; GJ Ex 379).

Thus we have seen that the non-competitive industry program was not limited to research and development but encompassed promotion, installation, and marketing. On this score Mr. Van Derveer testified (Tr. Vol. XXXXVI, pp. 54–55):

"Q. Mr. Van Derveer, this non-competitive industry program concerned not only the research and development but also the installation and marketing of devices, did it not?

"A. Well, what do you mean by devices? You are talking about——

"Q. Devices or systems, any kind of motor vehicle air pollution control equipment whatsoever.

"A. It was all coordinated through the AMA, yes.

"Q. All aspects of any company activity in this area;

"A. Yes."

POSITIVE CRANKCASE DEVICE (BLOW-BY)

A GM document disclosed that the AMA asked all car manufacturers on June 1, 1961, to give all the reasons that could be developed as to why compliance with a Congressional request that positive crankcase ventilation (pcv) be made standard equipment on all cars would not be desirable. "It must be recognized that they are specifically looking for problems that will justify a negative decision," commented G. R. Fitzgerald, a GM engineer. (GJ Ex. 504). After the successful installation of the pcv valve in California by all companies on 1961 models, a decision was made not to install the device on all 1962 models nationally. Mr. Van Derveer testified that "the board of directors, of course, are the ones that had to make that decision." (Tr. Vol. XXXXV, pp. 71–76). A poll or vote was taken at a meeting of the AMA Crankcase Ventilation Task Group of the VCP on January 26, 1961. (GJ Ex. 360 and 442.) Although Studebaker-Packard and American Motors "agreed to the release of positive crankcase ventilation for all 1962 cars," none of the companies did so, in accordance with the industry agreement.[8] (Tr. Vol. XXI, pp. 32–33; Tr. Vol. XXII, pp. 49–50; Tr. Vol. XXIX, pp. 107–110, 130–133; GJ Ex. 360 and 442.)

All GM divisions could have supplied the internal crankcase device as standard equipment for 1962, if required to do so. H. F. Barr, then Chief Engineer of Chevrolet, writing to C. A. Chayne, then Engineering V. P. of GM, said in part:

"Would all GM Divisions be in a position to supply internal crankcase ventilation as standard equipment for 1962 production?

"(Answer) We could if it was a mandatory GM policy, but we would not willingly do so." (GJ Ex. 474).

Similarly, in a memorandum of the Ford Motor Company dated January 10, 1961, James M. Chandler wrote:

"I have recently checked with John Asselstine of Engine and Foundry regarding engineering release of positive crankcase ventilation devices for nation-wide application. Mr. Asselstine informs me that inasmuch as those devices have been released, nation wide, as a regular production option for 1961 automobiles he sees no reason why they could not be applied on all production in 1962. He also feels that we would be in a position to release the crankcase device nation-wide on all commercial vehicles for 1962." (GJ Ex. 454).

Footnotes at end of article.

As far as International Hrvester was concerned, a September 26, 1961 letter from S. G. Johnson of International Harvester to W. F. Sherman of AMA states in pertinent part:

"II. International Harvester is in position to comply with blowby devices on all motor truck models at any date deemed advisable by AMA." (GJ Ex. 364).

As a matter of fact, the device could have been installed on 1961 models:

"The main reason that the motor vehicle industry did not voluntarily undertake to supply internal venting throughout the country on all its new gasoline-powered vehicles, starting with the 1961 models, was that a need had been estabilshed in California which has not been established elsewhere." (Rough Draft of paper presented at ECS-APCA Meeting, by James M. Chandler, Chairman, VCP-AMA, entitled "Current Status and Future Work on Vehicle Emission Control Devices," undated (GJ Ex. 381)).

As a result of this thinking, an interdepartmental letter of American Motors from its VCP member, Ralph H. Isbrandt, dated December 7, 1961, indicates that the AMA Board of Directors as early as December, 1961 determined and agreed that the device should be installed not one year later, in 1962, but two years later, in 1963.

"At the AMA Board of Directors meeting, held December 6, 1961, it was agreed that the Industry would include Positive Crankcase Ventilation devices as standard equipment on all 1963 model cars." (GJ Ex. 556).

An attempt was even made to delay national installtion on 1963 models. (Tr. Vol. XXX, pp. 27–32; GJ Ex. 373). Robert J. Templin, Asst. Chief Engineer, Cadillac Motor Car Division, G.M. wrote on September 25, 1961: "To sum it up, there is nothing to prevent our going to postive crankcase ventilation as standard equipment for 1963, if policy dictates it. Our lives will be less troubled, however, if we don't do it." (Tr. Vol. XXXVII, p. 7; GJ Ex. 509). This time, however, the pressure of public officials forced the issue. A memorandum by W. F. Sherman of AMA to the EAC, dated May 25, 1961 reads in part as follows:

"The U.S. automobile industry has been asked to help protect the public health by installing 'on your own initiative' a device in all new cars which destroys crankcase fumes.

"Sen. Maurine Neuberger, (D. Oreg.) made the request in a letter sent Monday to 14 manufacturers of cars and trucks. She suggested that in the event the automobile industry failed to seize the initiative, it would be subject to 'responsible legislation to prohibit the transportation in interstate commerce of vehcles without the protective device.'

"Sen. Neuberger noted that the Automobile Manufacturers Association had rejected a request by the Secretary of Health, Education and Welfare that the industry install at the factory a device which destroys crankcase fumes, a factor in air pollution along with an auto exhaust fumes." (GJ Ex. 365).

A similar memornadum for use by Mr. Sherman at the EAC meeting of May 25, 1961, also reads in part as follows:

"Since all of the companies are presumably receiving a letter from Sen. Neuberger, I have a specific suggestion to make. First, I would suggest that as in the recent past with similar letters, be referred to AMA for a reply.

* * * * * * *

"Three, I believe it is very much in the interest of the industry to take the initiative before it is pushed further on this matter and that the Engineering Advisory Committee should therefore recommend to the Board of Directors at their meeting on June 15 that a public statement be issued saying that inasmuch as service experience has proved to be at least reasonably satisfactory, it is being recommended to all member companies that as their tooling and manufacturing permits, they proceed to apply the device to all vehicles for sale in all parts of the United States.

"If this action is not taken by the industry, it seems certain that there will be Federal legislation.

"It also seems to me that the opportunity provided in this instance to make a very big distinction between these inexpensive devices and exhaust control devices for use in California, which are more expensive and which are applicable primarily to the photo-chemical smog problem, might be utilized to position the industry for the future, although we certainly can't ignore the possibility that similar pressures will arise with regard to any muffler devices that are adopted at a later date in California." (GJ Ex. 366).

As a result of this pressure, the attempt to delay installation of the device until at least 1964 failed, and the companies agreed and did install the pcv valve on

all 1963 models nationally. (Tr. Vol. XXXXV, pp. 24–25). The same valve that was installed on all 1961 models in California was used nationally on 1963 models, indicating that bar the industry agreement, the device could certainly have been installed nationally at least on 1962 models. (Tr. Vol. XXXXIII, pp. 101–102).

CLOSED CRANKCASE DEVICE

After the installation of the pcv valve, it was discovered that the slight remaining emission of pollutants from the crankcase could be eliminated by piping it into the air cleaner where it would be completely dissipated. As a result the Motor Vehicle Pollution Control Board (MVPCB) of California adopted an amended test procedure on December 18, 1962 which could only be met by the installation of the closed type system. New York State officials, too, wanted a closed system. The EAC reviewed both the California and New York situations and reached the conclusion on March 1, 1963 "that the industry definitely does not want to be forced into putting the new systems [closed blow-by] on New York cars for 1963 and 1964." (Tr. Vol. XXXVI, p. 151). Since it seemed doubtful that New York would accept less than California for a crankcase device performance, the EAC decided that California was the place to take a firm stand against the new higher capacity systems. To enforce their position, the EAC asked each member company to provide technical information to show why it was impractical to install high-capacity devices for the years 1963 and 1964. (GJ Ex. 507). The Committee was delegated by Mr. Chayne, GM's vice president in charge of engineering, to prepare a specific list of technical problems which might prevent General Motors Car Divisions from supplying crankcase ventilation systems on 1964 models which would meet the new high flow requirements and still be reliable in all respects. (Tr. Vol. XXXVI, pp. 149–152; GJ Ex. 507), (Cf. GJ Ex. 457, a Ford document, which reads in part: "In March we told California we * * * questioned our * * * readyness for closed systems. Early application for certification [by Chrysler] would case doubt."

In an interoffice memo, H. F. Barr, GM's member on the EAC, on March 28, 1963, wrote in part:

"I have recently had a call from Mr. Paul Ackerman of Chrysler which indicates they are pulling back their 1964 start of production releases and will release later, effective January 1, 1964, if required at that time by the California law. We are, of course, all hopeful that this will be further extended to start of production of 1965 models before time for this action arrives.

"It is therefore quite important that no General Motors Division make any changes in their 1963 releases for start of 1964 model year production. Since changes would jeopardize the industry position that is being taken with the Air Pollution Board of California." (GJ Ex. 478).

In an intra company memo, Robert Sorenson of Chrysler informed P. C. Ackerman, its EAC member, on January 11, 1963, in part as follows:

"Attached is a letter received from Ben Jensen Executive Officer, California Motor Vehicle Polution Control Board officially advising us of the action of December 18, 1962 meeting of the board. His letter indicates that two closed crankcase system devices were approved for both factory and used vehicles * * *

* * * * * * *

"AMA staff was not favorable to an immediate approach and Harry Williams has taken the matter over personally. I understand that he will discuss it with some of the California Motor Vehicle Pollution Control Board members at a pre-established meeting early in February.

"Because of Chrysler's commitment to handle this on an industry basis, there appears to be nothing further we can do on this matter at this time on a Chrysler only basis." (GJ Ex. 446).

In an interdepartmental letter from Van Derveer to Isbrandt, also American Motors EAC member, dated April 29, 1963, American Motors' position is stated as follows:

"It is the writer's and C. Harbea's opinion that for our 1964 production we have no other choice but to comply with New York's criteria by either the procedure just outlined or by installing the 'closed' system hardware that is released for California production commencing January 2, 1964. However, if we release the '64 California 'fix' for car one 1964 New York State production, we will run afoul of the A.M.A. policy on this matter, and as you are aware various industry representatives feel quite strongly that industry solidarity is a must on this matter." (GJ Ex. 558).

However, the industry's attempt to delay the installation of the closed blow-by device to the start of production of 1965 models failed since the MVPCB forced the installation of the closed blow-by system as of January 1, 1964. (Tr. Vol. XXI, pp. 68–73; Tr. Vol. XXXVI, pp. 155–157, GJ Ex. 508). AMA's position at the meeting of the MVPCB, in regard to this matter, is indicated in the following GM interoffice memo dated January 24, 1963, as follows:

"At the December meeting, the Board decided to require 'closed' type crankcase devices on new cars beginning with the 1964 model year. George Delaney, representing the AMA, strongly objected to the Boards' action. According to reports. Delaney claimed that the manufacturers had already firmed their 1964 designs and changes could not be made to meet the deadline.

"According to rumors, the AMA was so incensed at the Board's action, they resolved to boycott future meetings, and since the AMA was no represented at the January 17 meting, a proposal was adopted which may be costly to the industry. Of course, the action might have been taken whether or not the AMA was represented, but the Board didn't even have the benefit of hearing the industry's objections." (GJ Ex. 376).

As to the ability of the auto companies to install a closed blow-by system on their cars, our expert, Wallace Linville, testified:

"Q. Is there any reason why that couldn't have been done by the industry prior to 1964?

"A. No. It is similar to a system that you find and have found for years on particularly dump trucks where they are operating in very dirty areas, and again on the army equipment that we mentioned in the second World War, where they are running in convoy, the vehicles following the first vehicle are operating in very dusty terrain, and as a result of this they have had the system closed by means of this tube to the air cleaner for a good number of years, so I see no reason why this should have offered a substantial or major problem at all." (Tr. Vol. XXXXI, p. 25).

Errol J. Gay, a consultant for TRW and others, and an apologist for the auto industry, when asked the same question testified:

"A. Hell, they could have done it prior to 1938, if necessary." (Tr. Vol. LVII, p. 73).

EXHAUST DEVICES

By California statute passed in December, 1959, all automobile manufacturers were required within one year following certification of any two motor vehicle air pollution control devices to affix an air pollution control device on all cars sold.

Chrysler Corporation developed its Cleaner Air Package (CAP), perhaps as early as 1960. (Tr. Vol. XXIX, pp. 18–19, 30). In a memo dated October 5, 1961, D. R. Diggs of E. I. Du Pont, reported:

"I asked Heinen why Chrysler did not seek California certification of their vehicles without devices if they are as good as he says they can be made. While admitting that favorable publicity would result, he was very forceful in telling me that if this was done Chrysler would be severely chastised by the rest of the industry. He reminded me that the AMA agreement says no one company will gain any competitive advantage because of smog; and that Chrysler was a relatively small cog in the industry. He indicated Ford and GM were calling the shots and implied that Chayne was the industry mastermind." (GJ Ex. 183).

The CAP system consisted of a valve (part of which was patented) and adjustments of the carburetor, distributor and spark timing. Several technical papers on the subject were written by Chrysler employees, Heinen and Fagley, and published by SAE. (Tr. Vol. XXX, pp. 105, 120–23.) Despite an understanding among AMA members to deal only with the California Motor Vehicle Pollution Control Board and not with the Los Angeles Pollution Control District and its then executive officer, S. Smith Griswold, Mr. Heinen dealt with Mr. Griswold, applied for state certification of the CAP, installed the device on 100 cars as a test, and agreed to fulfill specifications contained in Los Angeles County car purchasing invitations for devices which would control exhaust pollution to the extent of emitting no more than 300 ppm of hydrocarbons and 1.5% of carbon monoxide. (Tr. Vol. XXIX, p. 119).

In early 1964, Chrysler began to deliver cars to the County of Los Angeles with the CAP system affixed. All told about 1,000 cars were delivered in 1964 with that system. (Tr. Vol. XXIX, p. 120.) The fact that Chrysler got the order to supply cars for Los Angeles County in 1964 was resented by the rest of the industry as a breach of the industry agreement and great effort was made to

bring Chrysler back into the fold, which was successful as will be hereinafter shown. (Tr. Vol. XXX, pp. 130, 140–41; GJ Ex. 183, 226.) The result of Chrysler's action in supplying 1964 cars to the county resulted in Ford, too, offering cars equipped with an exhaust device to the county in 1965 which controlled emissions to the required degree.[9]

By the end of 1963 and early in 1964, it was quite apparent that the California Motor Vehicle's Pollution Control Board (which required that emissions be limited to 275 ppm of hydrocarbons and 1½% CO) would certify at least two devices being produced by independent (not automobile) manufacturers thereby triggering the law and compelling the installation of air pollution exhaust control devices on all 1966 models offered for sale in California in late 1965. (Tr. Vol. XXXVII, pp. 33–37; CJ Ex. 402).

Every effort was thereupon made by the industry members of AMA to delay the installation of such devices at least until 1967. (CJ Ex. 339, 405). A memorandum dated March 9, 1964, from William Sherman of the AMA staff (Secretary-EAC Committee) to his superior Mr. Harry Williams, Managing Director of the AMA, reads in part:

"While we certainly have the objective of holding the line until 1967 models, we know that the stated purpose of the California MVPCB is to approve two catalytic devices in the next few months and trigger the law so it will apply to 1966 models.

"It seems to me that we would be exercising very poor judgment if we suggested or implied that we wanted them to hold off the triggering of the law, or to let ourselves get into any controversial position about it.

"*If they do* act in the near future to approve the catalytic devices, our companies would probably have to take the position, *anyhow*, that there is not enough engineering time to fit the catalytic converters under the frames and chassis of cars in time to meet the schedule of 1966 model production and there would be a strong likelihood of various delays until 1967 introductions.

"It would be very much to our advantage to avoid this topic—shrug it off or ignore it—for a month or two. In the interim a lot of things might change in the picture, including even the withdrawal of the catalytic devices now on tests when the submitters analyze the future possibilities for themselves.

"Thus the problem will have some tendency 'to go away' if we don't aggravate discussion of it at this time." (GJ Ex. 402; Tr. Vol. XXII, pp. 14–15).

On March 10, 1964, prior to any certification of third party devices by the MVPCB but in anticipation that such certification was imminent, the AMA issued a carefully worded press release announcing "that member companies have set a target date of the fall of 1966 in their programs to make 1967 model automobiles and passenger car-like trucks for sale in California comply with the state's motor vehicle emissions standards." (GJ Ex. 407).

The EAC at a meeting on January 17, 1964, had adopted the following resolution:

"Members of the Engineering Advisory Committee resolve that as engineering representatives of the member companies fo AMA they adopt the goal that starting with 1967 models, all American-built passenger cars and passenger car-like trucks to be sold in California meet the California Exhaust Standard of 275 ppm hydrocarbon and 1½ per cent CO; further, the Engineering Advisory Committee will report to the AMA Board of Directors their intention to proceed with product engineering programs on each of the various engine and transmission combinations and, by January, 1965, further report to the Board of Directors whether necessary changes can be made in time to meet the target date, the beginning of 1967 model production." (G.J. Ex. 399; Tr. Vol. XXX, pp. 72–73).

Pursuant to this EAC resolution, the AMA Board of Directors at a meeting on February 26, 1964, accepted the EAC recommendation, and on motion recommended to all companies that they make it the basis for their individual action. (Tr. Vol. XXX, pp. 71–72; GJ Ex. 405). Subsequently, the March 10 press release was issued. At a joint meeting of the AMA Public Relations Committee and the EAC on March 3, 1964, the reasons for the selection of the March 10 date for the press release were given:

"[Mr. Misch, the representative of the Ford Motor Company to the EAC and also its (EAC's) chairman] advised . . . that the Board had discussed the timing of a press release and desired that such a press release should be made on

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Footnotes at end of article.

March 10, before the State Motor Vehicle Pollution Control Board meets on the 11th, but that the industry plan should be reported to the Governor and officials of the Motor Vehicle Pollution Control Board before release is made." (GJ Ex. 401).

The lack of sincerity of the EAC resolution is shown by the fact that the references to product engineering indicated that such engineering had not yet begun. Actually, the Chrysler CAP had already been factory produced on 1964 cars for Los Angeles County. The GM ManAirOx system, the Ford Thermactor system, and the American Motors Air-Guard system, whereby in each the exhaust is burned in the exhaust manifold with the addition of air from an air pump, were then sufficiently ready for production (except for the pump) so that when compelled to do so later in 1964, both GM and Ford announced their ability to apply the device on 1966 models. (GJ Ex. 410). As for the pump, a crash program commenced at GM early in 1964 produced the Saginaw pump within five or six months (Tr. Vol. XXXVII, pp. 32, 42).

As a matter of fact Ford was preparing for Job 1, 1966 with its Thermactor system while adhering to the AMA attempt to delay installation of any exhaust device at least another year. A Ford confidential internal memorandum dated June 26, 1964 reads in part:

"It became apparent that the Board was positioning itself to approve two or more exhaust treating devices in mid 1964 so that 1966 models would need to be equipped with exhaust treating devices.

"In light of these actions, the automobile industry through the A.M.A. reviewed its position relative to the California situation. On March 10, 1964, the A.M.A. board of Directors announced that it had adopted a goal of Job 1, 1967 for supplying passenger cars and passenger car-like trucks to California which would meet California's exhaust requirements. At the same time, the Executive Office directed that the Company be prepared to meet the California exhaust requirements by Job 1, 1966.

* * * * * * *

"It should be recognized that our external program as presented to California is to meet Job 1, 1967, but that our internal program is to meet Job 1. 1966. It is recommended that the 1967 goal remain our public posture." (GJ Ex. 599).

Apparently GM and Ford would have continued their opposition to the installation on 1966 Models of an exhaust device or system, but the possibility of Chrysler's application being granted for certification of its Cleaner Air Package thwarted their hopes:

"There is one disturbing element as far as GM and Ford are concerned in the position they have taken. This is the fact that Chrysler may receive certification in California for their Clean Air Package; if so it is doubtful if Ford and GM can delay until 1937 the installation of comparable systems." (Memorandum Report by D. R. Diggs, E. I. Du Pont, dated July 8, 1964, GJ Ex. 190).

FURTHER DELAYING TACTICS

The collective activities of the automobile manufacturers to delay the marketing and application of air pollution exhaust control devices and not to take competitive advantage of each other is illustrated by the following instances:

(1) Since the industry was fortified from the beginning of the program with the agreement among its members not to take competitive advantage over each other, all auto manufacturers were able through the years to stall, delay, impede and retard research, development, production and installation of motor vehicle air pollution control equipment.

As early as January 20, 1959 the Scientific Director of General Motors, Mr. J. M. Campbell, complained to Dr. J. M. Hafsted, the head of GM's scientific laboratory that "Our effort thus far has been at a minimal level required to cover essential areas of this problem while at the same time protecting other essential research programs at current levels." (Tr. Vol. XXXXV, p. 23; GJ Ex. 492).

On September 10, 1962 Dr. Hafsted expressed his concern in similar vein in writing to Mr. L. C. Goad, an executive vice president of GM, as follows: "It is my conviction that this problem needs more attention than it has been getting all along the line in our engine development programs." (Tr. Vol. XXXXV, p. 26; GJ Ex. 493).

A letter dated January 27, 1964 written by Mr. Howard Dietrich, of the Rochester Products Division of GM, to one K. F. Lingg, states that "Mr. Gordon [then

the President of GM] feels, and has publicly stated, that anti-air pollution vehicle developments are 'agonizingly slow.'" (Tr. Vol. XXXXV, pp. 34–35; GJ Ex. 494).

Dr. Donald Diggs, Asst. Technical Manager of the Petroleum chemical division, Du Pont Corporation, one of the witnesses before the Grand Jury, wrote several reports evaluating the attitude of the automobile industry towards the development of curative smog devices, such as that of April 21, 1959 which contains the following statement:

"They [referring to the big three automobile manufacturers] are not * * * interested in making or selling devices * * * but are working solely to protect themselves against poor public relations and the time when exhaust control devices may be required by law." (GJ Ex. 182; Tr. Vol. XLV, pp. 29–30).

Dr. Diggs also wrote a report dated May 31, 1962 in which he gave the following cogent description of the industry's attitude:

"Therefore, they cannot justify an extensive research program because the competition might devise a solution which, while perhaps not as effective, would be less costly to the motorist. The only incentive is to just barely solve the problem at the minimum cost. For that reason, each company is reluctant to spend large amounts of their own money for the development of cures." (GJ Ex. 186).

Dr. Diggs testified that he felt the industry could have pushed more rapidly than it did toward a solution of the smog abatement problem, inasmuch as their work was conducted "at rather low levels of activity." (GJ Ex. 198; Tr. Vol. XIV, pp. 155–156).

An official of the Maremont Automotive Products Company volunteered a statement to officials of the Du Pont Corporation which is contained in a report dated May 19, 1960 which confirmed Du Pont's thinking in regard to the automobile manufacturers that they "were keeping up a good front, but were not pushing as rapidly as they could toward a solution of the smog abatement problem." (GJ Ex. 196).

As a matter of fact, one of the functions of the AMA smog working group, according to Mr. James Chandler of the Ford Motor Company, was to "contain" the smog problem. Mr. Chandler was of the view as of May 21, 1959 that the problem "is not bad enough to warrant the enormous cost and administrative problems of installing three-million afterburners." (GJ Ex. 418).

J. D. Ullman, another technical expert in the petroleum chemical division of the Du Pont Corporation also wrote reports on the dilatory approach of the automobile companies toward smog control measures which contain the following statements:

"The automotive industry as a whole has taken a very firm position in relation to the California authorities. Basically, the automotive manufacturers would seek to avoid installing a reactor of any sort on a car because it adds cost, but provides no customer benefits such as improved engine performance or styling advances. [As a result] A smog abatement device will be installed on cars for California market only after being approved and requested by the Government of California." (GJ Ex. 194 dated January 19, 1960).

"We gathered that the automobile industry will continue to do whatever it can within the scope of California legislation and of political pressure to postpone installation of exhaust control devices. The crank case vent will be pointed to as a constructive step by the automobile industry and will be given as much credit as possible for reducing hydrocarbon emissions from the automobiles." (GJ Ex. 195, dated April 22, 1960).

(2) The air injection system developed by General Motors was fully described in a paper read before the Society of American Engineers on March 12–16, entitled. "A Progress Report on ManAirOx-Manifold Air Oxidation of Exhaust Gas" (GJ Ex. 282), but it was not installed on GM cars until all of the automobile companies simultaneously announced antismog systems for all 1966 California models.

(3) As early as 1958 Charles Heinen, the engineer in charge of the air pollution control program at Chrysler, and his assistant, Walter S. Fagley, Jr., coauthored a paper entitled, "Maintenance and the Automobile Exhaust." (Tr. Vol. XXX, p. 105): A second report followed in May, 1962. (Tr. Vol. XXX, p. 120). This paper was omitted from an SAE book entitled, "Vehicle Emissions" published in 1964 which purported to contain an anthology of all SAE papers of significant contribution to the air pollution problem. (Tr. Vol. XXX, p. 123; Tr. Vol. XXX, p. 91). Evidently the omission was influenced by Heinen's desire to equip all cars sold in California in 1962 with the CAP. (Tr. Vol. XXX, pp. 132–136, GJ Ex. 448).

Moreover, when Chrysler decided to submit their Cleaner Air Package to the California MVPCB in October, 1963 for certification "the rest of the industry felt that this was a breach on the part of Chrysler of the Automobile Manufacturers Agreement [which] specified that all manufacturers would work together as an industry, rather than as individual companies * * * The final straw * * * came when after Chrysler had submitted their Clean Air Package to the Board * * *, the County government decided that whereever possible they would buy only Chrysler vehicles. This, they stated, was to show their appreciation of the attempts by Chrysler to develop a smog-free automobile." (Tr. Vol. XXX, pp. 140–141; GJ Ex. 226).

Despite the success of the CAP, in 1964 Chrysler showed that it came back into line by joining in the aforementioned resolution calling for product engineering and delay of installation until the 1967 models, and by not equipping its cars with the CAP system until installed by all manufacturers on 1966 models to be sold in California. (Tr., Vol. XXIX, pp. 121–122). Chrysler's concern that the industry cooperative smog program be kept intact is clearly evident from a report by R. A. Pittman of the Ford Motor Company concerning a meeting with Bob Sorenson of Chrysler, dated February 6, 1964:

"NOTES ON MY DISCUSSION WITH BOB SORENSON CONCERNING 'SMOG'

"B. Chrysler management is sorry that things have progressed to the extent they have in Los Angeles County and they have been trying to determine how they can back off of what's been said already to Los Angeles County.

* * * * * * *

"D. Bob again emphasized that his company wanted nothing but a cooperative effort and would entertain any other suggestions as to how to get back on a cooperative basis." (GJ Ex. 461).

A handwritten note on this document written by Arjay Miller, President of Ford, dated February 18, 1964 reads as follows:

"I think Chrysler is playing us as suckers. They get all of the favorable publicity and the *car sales*, while giving up nothing." (GJ Ex. 461).

Despite the pressure of the industry, on March 13, 1964 the MVPCB notified each automobile manufacturer that the Board was then testing four exhaust control devices on an accelerated basis, two of which if certified would automatically trigger the mandatory aspects of the law requiring 1966 models to meet the standards. In a letter to Mr. John F. Gordon, then President of AMA, Dr. J. B. Askew, Chairman of the MVPCB, stated that he was hopeful the industry would "reevaluate your policy decision and work with us to achieve exhaust controls for 1966 models." (Tr. Vol. XXX, pp. 98–99, GJ Ex. 447).

On June 17, 1964 formal approval was given by the MVPCB of California to four devices manufactured by independent concerns outside of the automobile industry. Thereafter, on July 7, 1964, in response to a MVPCB request that the individual car manufacturers present their plans with respect to meeting the California standards for 1966 models required by the certification of outside devices, the automobile companies declared their intention to apply air injection systems (General Motors, Ford and American Motors) and an engine modification system (Chrysler) for 1966 cars sold in the State of California (GJ Ex. 410). This determination was formally announced by the industry at a presentation made to the MVPCB on August 12, 1964. The pressure of events, therefore, compelled the car manufacturers to advance the application date of exhaust devices at least a full year in advance of their resolved plans and then only to meet the requirements of law.

The Chrysler Corporation could actually have installed the CAP on their 1965 model automobiles, according to a report of Mr. J. E. Yingst, of the TRW Corporation dated June 24, 1964, which reads in pertinent part as follows:

"During the last month I have met at the four major automobile corporations with the staff and research level engineering people who are responsible for the exhaust emissions control programs in their respective corporations. These meetings were in conjunction with the presentations of the Texaco-TRW work on a catalytic control system and in response to the interest on the part of Ford, American Motors, and General Motors in our air pump.

* * * * * * *

"(4) Chrysler stated without reservation that they have now engineered their combustion control system into all of their car models and could, if required, offer the system on even their 1965 cars." (GJ Ex. 420).

EVAPORATION LOSSES

As early as June 1958, J. T. Wentworth, a member of the GM research staff prepared a technical paper on the subject of "Carburetor Evaporation Losses" which was published in a compilation of technical papers presented under the auspices of the SAE. This paper was first discussed at a meeting of the Induction System Task Group held on January 14, 1958. (Tr. Vol. XXI, pp. 96–97; GJ Ex. 280). Wentworth's tests were analyzed in his paper and the results showed that evaporation losses of unburned hydrocarbons were as great as those normally emitted from the tailpipe. (Tr. Vol. XXI, p. 98).

On September 16, 1961 a GM engineer named H. H. Dietrich obtained a patent on a method to control evaporation losses which was assigned to General Motors. His application for this patent was filed on August 8, 1960. General Motors thus knew of the Dietrich system and the art involved in its invention as early as 1960. (Tr. Vol. V, p. 35; GJ Ex. 82).

It should be noted that twenty different papers were written on this subject from 1958 to 1964. (Tr. Vol. XXI, p. 123). A report entitled "Fuel System Evaporation Losses" was issued by the AMA in September 1961. (Tr. Vol. XXI, p. 113) Clearance for release of this report to the California authorities by the member companies of AMA was not given until March 3, 1965, because, as Mr. Linville testified:

"It would seem fairly reasonable that this report would have triggered a great deal of comment and a great deal of criticism of the industry when there were certain cars over 2000 percent higher than other cars, so it seemed that this could easily have been the reason that this report was kept internal and not allowed to be read by outsiders until modifications could have been made to bring these high emitters down more nearly in line with the low emitters." Vol. XXI, pp. 114–119; GJ Ex. 391 (d); Tr. Vol. XXXXI, p. 37; Cf. Memo. report of VCP Committee meeting held on Sept. 16, 1960, GJ Ex. 351, p. 1).

The cross-licensing agreement was amended in 1960 to include fuel system evaporation losses, and Ford and Studebaker began a study of this problem in that year. (Tr. Vol. XXI, pp. 100–101, 106). Dr. Norman Alpert, Assistant Director of Research at the Esso Corporation testified that if something had then been done to control evaporation losses it would have been equally as important as the elimination of blow-by emissions. (Tr. Vol. V, p. 13). Most members of the Induction System Task Group were of the opinion that carburetor evaporation running losses could be eliminated in March 1961. (Tr. Vol. XX, p. 111, Tr. Vol. XXX, p. 155; GJ Ex. 389). Yet the minutes of the Fuel System Emission Task Group of the VCP disclose that as of October 15, 1963 "relatively little is being done by the individual companies on vapor loss control." (Tr. Vol. XXI, p. 112; GJ Ex. 390).

In June, 1959 Union Oil Co. developed a system to eliminate evaporation losses but although tested by the industry through AMA it was ignored. (Tr. Vol. IV. pp. 19–26, 43–45; GJ Ex. 52, and 54). Even to date the auto manufacturers maintain that there is no practical, economic or feasible system to control evaporation losses, although a Ford, a Chrysler, and a GM car were equipped with a charcoal filter developed by the Esso Corporation to control such losses, Esso having furnished each of these companies with a car of its own manufacture equipped with the device on April 4, 1966. (Tr. Vol. XXI, pp. 125–127; GJ Ex. 393, 395). Dr. John Gerrard, project engineer for the Esso Research and Engineering Company, Linden, New Jersey testified that the Esso Corporation system (which controls better than 95 percent of such losses), was successfully tested on these cars. (Tr. Vol. V, p. 19; Tr. Vol. VI, p. 5). The response of the automobile industry to the Esso system, known as the ELCD system, ranged from hostility to "spotty," although all except Ford are still testing the system and they agree, in general, with the results obtained by Esso. (Tr. Vol. VI, pp. 28–33; Tr. Vol. V, pp. 31–32). This system involves no major engineering change in the motor despite assertions to the contrary by industry spokesmen. All that is required are minor carburetor modifications and a tube which runs from the gas tank vent to a canister filled with charcoal which acts as a filter for the polluting emissions. (Tr. Vol. VI, pp. 51–55).

The estimated cost of the system as original equipment would run from $5 to $7, but in great volume it would come down from this figure. (Tr. Vol. V, p. 27).

On September 23, 1964, more than six years after publication of the Wentworth paper and three years after issuance of the Dietrich patent, GM concluded that: "It is necessary . . . for us to begin development programs on

devices to control these [evaporation loss] emissions." This action was taken only after the California Air Pollution authorities had advised they would take steps in October, 1964 to require evaporation loss limits on fuel tanks and carburetors. (Tr. Vol. XXXVII, p. 95; GJ Ex. 9524).

OXIDES OF NITROGEN

Oxides of nitrogen (NOx) is a recognized pollutant emitted from the automobile exhaust together with hydrocarbons and carbon monoxide. The noxious contributor to the smog problem can be reduced by recycling the exhaust gas back into the combustion chamber. The general technology for its reduction has been known for many years, since the exhaust gas recycling system for reducing emissions of oxides of nitrogen was developed and patented in 1955. (Tr. Vol. V, pp. 8–10; Tr. Vol. XIX, p. 128). In 1962 a paper written by Dr. R. D. Kopa of UCLA in conjunction with Messrs. Jewell and Spangler described a 60–80% reduction accomplishment in nitrogen oxide emissions. (Tr. Vol. XIX, pp. 125–126).

Mr. Arthur Jesser, a research and mechanical engineer employed by George Cornelius at his laboratory in San Pedro, California described a device for the reduction of oxides of nitrogen developed at the Cornelius laboratory which tested well below the 350 parts per million standard established by the State of California ,and reduced NOx emissions 85%. The cost of this device to the consumer is negligible. (Tr. Vol. XIX, pp. 129–132; Tr. Vol. XIX, p. 128).

Mr. Cornelius is a well-known inventor, formerly associated with the Holley Carburetor Company, who has done extensive work on research and development of motor vehicle air pollution control systems and devices. (Tr. Vol. IV, pp. 51–52).

The automobile industry was notified of the existence of the Cornelius device in the latter part of 1960 (r. Vol. XIX, p. 134), yet none of the companies took any particular interest in the device, and the impression Jesser had of the Ford attitude toward his device was that "this is a sort of nuisance." (Tr. Vol. XIX, p. 148). There were no tangible offers or responses from any automobile manufacturer. (Tr. Vol. XIX, p. 141).

Robert Van Derveer of American Motors testified on June 29, 1967 that none of the automobile manufacturers have come up with a device or system to control the emissions of oxides of nitrogen. (Tr. Vol. XXXXVI, p. 34).

DIESEL ENGINES

Contrary to popular belief, diesel engines do not emit hydrocarbons or carbon monoxide as do gasoline engines; they do, however, emit irritating smoke and odor. Here again, only lip service was given to correcting the problem.

In a statement made before the Muskie Committee (CJ Ex. 429, at p. 931), Dr. P. H. Schweitzer of Schweitzer & Hussmann, State College, Pa., a recognized authority on diesels, said in part:

"I shall not absolve the diesel engine of its polluting effect. I have raised my voice repeatedly in the past against diesel exhaust smoke and odor. In September 1954, at the fifth international symposium on combustion, in Pittsburgh, Pa., I said:

" 'Even enlightened self-interest should induce the industry to take this matter [noise, smoke, and odor] seriously, more seriously than it has in the past. It is easy to predict that government—State or municipal—will soon act if we do nothing about it. An incensed public may force legislators to enact unwise laws to the detriment of all of us.'

"The Automobile Manufacturers Association, which received a copy of my talk, took my advice to heart and formed a task force on diesel emissions. When? Ten years later, in March 1964."

Our expert, Wallace Linville, testified as follows on this problem:

"Q. Can you tell us of any other methods which could have been used since 1955 to reduce smoke and odors?

"A. There are several. Lubrizol has to do largely with the control of smoke. It is a fuel additive and very adequate for the control of smoke. It has very little effect on odor. The fumigation I described a few days ago is a means of getting better combustion in the combustion chamber of the diesel engine and this is utilized in controlling both smoke and odor, and the first paper that was written on this by Mr. Schweitzer was in 1957 entitled "Fumigation Kills Smoke." Mr.

Schweitzer was with the Penn State University at that time." (Tr. Vol. XXXXVII, p. 7).

No manufacturers of diesel engines have utilized Lubrizol or other types of afterburners satisfactory in both smoke and other control, except from the economic standpoint. (Tr. Vol. XXXXVII, pp. 8–11).

OTHER APPROACHES

Reliance on the agreement not to compete in the research, development, manufacture and installation of air pollution control equipment apparently enabled the automobile manufacturers to disregard several other approaches to the problem, thus further delaying its solution.

For instance, in the late 1950's Ralph Heintz, inventor, developed and patented a stratified charge engine (Tr. Vol. VIII, pp. 10, 12, 25–27) which reduced hydrocarbon, carbon monoxide, and oxides of nitrogen emissions, while at the same time effecting a savings in gasoline consumption (Tr. Vol. VIII, pp. 22–25). Moreover, the stratified charge engine would replace the conventional engine with little or no additional cost to the consumer (Tr. Vol. VIII, pp. 27–29). The development of this engine was publicized generally so that the automobile manufacturers knew of its existence and what it would do (Tr. Vol. VIII, pp. 13–18, 30–31). In fact, Victor G. Raviole, former executive director of the Ford engineering staff, stated on several occasions in the early 1960's that the major automobile companies were investigating such an engine and on one occasion predicted that it might be ready for production before 1965 Tr. Vol. VII, pp. 29–30, 33; GJ Ex. 607). However, the automobile manufacturers have evidenced little faith in this approach and no such engine has been produced by any of them (Tr. Vol. VIII, pp. 16, 33–35, 38–39; Tr. Vol. XXXI, pp. 166–168; Tr. Vol. XXXII, pp. 158–160; Tr. Vol. XXXV, pp. 158–159).

Similarly, George Cornelius has developed and patented a direct flame afterburner and an exhaust recycling unit which have proven effective in reducing hydrocarbons, carbon monoxide, and oxides of nitrogen (Tr. Vol. IV, pp. 61–64, 77–79; Tr. Vol. XIX, pp. 130–131). A test by Scott Laboratories shows that with this afterburner hydrocarbons were reduced to 28 ppm and carbon monoxide to 0.95% from 620 ppm hydrocarbons and 4.65% carbon monoxide (GJ Ex. 62). Mr. Cornelius estimated that, if produced in large volume, the combined package (afterburner and recycling devices) would cost the motor vehicle manufacturers about $25 to put on new cars (Tr. Vol. IV, p. 92). However, the major automobile companies have exhibited little or no interest in these devices for controlling automotive pollution (Tr. Vol. IV, p. 57; Tr. Vol. XIX, pp. 132, 134, 141–142, 151). In fact, at a meeting in December, 1963, William Gay, Executive Engineer, Engine and Foundry Division, Ford Motor Company, told Albert Jesser, an employee of Cornelius, that "[i]f General Motors and Chrysler do not control their exhaust, we can do nothing and be competitive" (Tr. Vol. XIX, p. 148). Mr. Gay also stated that if the entire package would cost more than $5, Ford would not be interested (Tr. Vol. XIX, also at p. 148).

Several other approaches to the automotive pollutant emissions problem have apparently received little interest from the automotive manufacturers. Phillip S. Osborne of Raymond G. Osborne Laboratories developed and patented in the early 1960's a preinduction smog control concept which effectively reduced hydrocarbons, carbon monoxide, and oxides of nitrogen (Tr. Vol. XI, p. 20). The estimated manufacturing cost of the Osborne device was about $15 (Tr. Vol. XI, p. 39). Again, the automobile manufacturers exhibited little interest in this approach (Tr. Vol. XI, p. 31; Tr. Vol. XII, pp. 14, 16, 24), and what interest was shown by the Ford Motor Company was coupled with indications that Ford would try to circumvent Osborne's proprietary position if the concept proved effective (Tr. Vol. XI, pp. 28–31; Tr. Vol. XII, pp. 10, 21).

Mr. Leslie Fox of S–C Carburetor, Inc. developed and patented in the late 1950's and early '60's a unique carburetor which effectively reduced hydrocarbons, carbon monoxide, and oxides of nitrogen while also eliminating evaporative losses, at a manufacturer's cost of about $6. (Tr. Vol. XXXIV, pp. 7–9, 13–14, 19). The automobile manufacturers have shown little or no interest in this device. (Tr. Vol. XXXIV, pp. 16, 21–22).

In sum, although various approaches to the motor vehicle pollutant emissions problem have shown considerable promise, the automobile companies apparently have done little with them. It seems likely that the reason for this attitude is

the fact that the AMA cross-licensing agreement placed the automobile producers in a position where they did not have to fear that a competitor would develop an effective device or system for its exclusive use which might become required equipment and thus put the others at a competitive disadvantage.

BOYCOTT

As to the alleged agreement not to purchase or utilize any device developed by a non-signatory to the cross-licensing agreement:

The automobile companies, through AMA, announced in March, 1964 that a target date had been set for the installation of pollution control devices on 1967 model automobiles. The MVPCB of California then approved four devices developed by independent manufacturers (American Machine and Foundry Company—Chromalloy; Universal Oil Products—Arvin Industries; W. R. Grace & Walker Manufacturing Company) which, under California law, made the installation of pollution control equipment mandatory on 1966 production. Instead of utilizing any of the approved devices, all auto companies utilized devices or systems which they themselves developed.

Dr. Askew, a member of the MVPCB since its inception, testified that the systems utilized by the industry in 1966 and 1967 did a better job than the catalytic devices approved by the board. He stated further that while the board was not satisfied with these catalytic devices, it approved them and thereby forced the industry to put on its own systems. Thus the California board's approval of these devices was calculated to and did put pressure on Detroit in order to force them to install pollution control equipment. (Tr. Vol. XXXVIII, pp. 16–17).

While it is true that all of the automobile companies used systems developed by themselves, we do not think that any inference of a boycott can be drawn from this circumstance. From the standpoint of simplicity and performance these systems at least compare favorably with the devices developed by independent manufacturers. From the standpoint of cost, too, these internally developed systems compare favorably. (Fisher, Tr. Vol. XXXXIV, p. 44). Even assuming that testimony could be developed which would justify a conclusion that the independent devices were better (and cheaper) than the systems utilized, we still believe we would need more direct evidence of an agreement among the auto companies to establish a boycott.

Nor do we believe that the evidence warrants the conclusion that the independent device manufacturers did not know long before the middle of 1964 that the auto companies possessed capability to solve the problem. AMF-Chromalloy developed perhaps the best of the four independent devices mentioned above. In a letter to the MVPCB dated October 29, 1964, Lipchik of Chromalloy stated that the auto companies "have no intention of using the AMF/Chromalloy device" or any of the other independent devices approved by the board. (Tr. Vol. XVI pp. 84–85).

This conclusion was based on reports received from his men in the field. The specific conversation with an industry representative upon which this statement is most likely based took place on June 24, 1964 between Chandler of Ford and Ulyate of AMF.

Ulyate testified in this regard as follows:

"A. I felt that he said in general Ford would not use anybody's device, particularly ours." (Tr. Vol. XIII, p. 58).

Although Ulyate does not recall Chandler saying so, he received the impression from Chandler that neither Ford nor any other company would buy the AMF device (Tr. Vol. XVI, p. 125).

This impression was strengthened by other observations contained in a trip report Ulyate made to Lipchik after a June 24–27, 1964 visit to Detroit, which reads in pertinent part as follows:

"In general Ford personnel not very receptive to device concept. They indicated that they doubted any device would ever be installed on a Ford car.

"My impression was that they were just going through the motions in even considering an evaluation. With their attitude, I don't see how they can give a fair evaluation to the burner." (GJ Ex. 171).

Mr. Van Derveer testified, however, that American Motors was seriously considering using the AMF device (Tr. Vol. XVI, p. 116), but that it could not have been engineered into American's production in 1966. (Tr. Vol. XXXXVI, p. 133). After an extensive evaluation, Van Derveer stated, AMF "fell flat on their face." (Tr. Vol. XXXXV, p. 154). Van Derveer also testified that after an evaluation

of the Norris and Walker devices it was determined that they were inadequate for American Motors 1966 needs. (Tr. Vol. XXXXV, pp. 154–155). As to the last of the four approved devices, Van Derveer testified that UOP would not "have any part of" American Motors (Tr. Vol. XXXXV, p. 155).

Ervin C. Lentz, Manager, Advanced Development and Smog Engineering, Walker Manufacturing Company, testified that as far back as 1960 the automobile companies made it clear that they are interested primarily in their own systems; that the only time they would utilize an independent device was if either their own systems would not work or if the independent device was better or cheaper. Lentz further testified that it was the hope of manufacturing a better and cheaper device that kept Walker working in the air pollution control field, so as not to lose its position as a supplier of mufflers to the automobile industry. (Tr. Vol. XXVI, p. 93).

Ward B. Sanford, Manager, Ceramics Project, 3M Company, testified that his company was told by General Motors in early 1962 that the engine modification approach was more practical and a better potential answer to the emissions problem than were the so-called tack on devices. (Tr. Vol. XIX, pp. 67–68).

Grand Jury Exhibit Number 421, dated April 25, 1960, a TRW document, which reads in pertinent part as follows, throws further light on GM's attitude: "The job of emission should eventually be controlled in the engine, and some engines are nearly good enough now."

Grand Jury Exhibit Number 422, dated June 9, 1961, a TRW document, also states in pertinent part as follows:

"Chayne of General Motors has informed Mr. Riley that their attempts to solve the problem in a different way probably at the engine, have had considerable success, and they expect this work to be completed in a month or so, and would inform TRW of the results at the proper time. Ergo, General Motors is not very interested in regenerative direct flame afterburners."

In September, 1963 Chrysler told AMF that its Cleaner-Air-Package would solve the problem for them. (Tr. Vol. XVI, p. 62). Chrysler even submitted its CAP to the MVPCB for approval in July, 1963. Approval of the CAP system was not, however, forthcoming from the board until late in November, 1964.

The emphasized portion of the following quotation indicates that as of March 9, 1964, AMA felt that the catalytic devices approved by the MVPCB would not be used by the automobile manufacturers. Grand Jury Exhibit 402, an AMA document quoted in part, *supra*, at p. 42, states further in pertinent part as follows:

"It would be very much to our advantage to avoid this topics—shrug it off or ignore it—for a month or two. *In the interim a lot of things might change in the picture, including even the withdrawal of the catalytic devices now on tests when the submittors analyze the future possibilities for themselves.*" (Emphasis added.)

It is apparent, also, that AMA's activities were designed to discourage independent manufacturers from proceeding with certification, as is evidenced by the reaction of persons connected with independent concerns, In a report dated May 26, 1964, Mr. D. A. Hirschler of theh Ethyl Corporation wrote as follows concerning his contacts with AMA:

"With the present likelihood that competitive exhaust devices may be approved in June and our own device late in 1964, all of the automobile manufacturers are making major efforts to find alternate mechanical routes to emission reduction for use in 1967 models, to forestall the mandatory use of the approved exhaust devices. The current thinking is that with this work in progress, no manufacturer or an approved device is likely to make his device available for a possible one-year market on 1966 models." (GJ Ex. 223).

Grand Jury Exhibit Number 418, dated May 21, 1959, a TRW, Inc. document also quoted in part, *supra*, at p. 46, states further in pertinent part as follows:

"Mr. Chandler asked that he be given some time in which to explore this subject among the AMA. He explained that the smog working group, of which he is Vice Chairman, reports directly to the Board of the AMA, which includes Mr. Ford, Mr. Curtice and Mr. Colbert among its members. He implied that few people in the automobile industry appreciated the problem. One function of the AMA working group, he said, had been to 'contain' the problem. His own view was that the smog problem is not bad enough to warrant the enormous cost and administrative problems of installing three-million afterburners."

Dr. Stuart L. Ridgway, formerly senior staff member of the research laboratory of Ramo-Woolridge, a division of TRW, Inc., characterized Chandler's

attitude as on seeking to delay the development and installation of anti-smog devices. (Tr. Vol. XXIV, p. 74). Ridgway further testified that the automobile companies acted "in concert" "They acted together and they were all working the same way" (Tr. Vol. XXIV, p. 75).

Ridgway's further testimony was as follows:

"A. What I can distill from a collection of instances, no single one of which I can refer to, was that they were cooperative in making sure that no device was forced upon the automobile industry that would compromise the vehicle. This is the language; this is their position. In other words, they would like to see the problem go away and they stated again and again in all these discussions if there was a device and it was cheap enough and it didn't comprise the vehicle in any way and had no hazards they would be right up front, but what they had done collectively, you know, was to organize to make sure that all of these criteria, performance, of no compromise to the vehicle, of safety, any reasonable criteria that could be put up, cost, these barriers they were cooperating in. They were acting in concert. They made organizations whose purpose was to do these things. They spent money, lots and lots of money on instrumentation, on test tracks, on environmental places, dynamometers, to see whether the afterburner would work when the temperature was 120 degrees Fahrenheit in a driving rainstorm." (Tr. Vol. XXIV, p. 77).

Ridgway also testified as follows on the meaning of "contain" the problem as attributed to Mr. Chandler:

"A. Well, no, I got the—the attitude was * * * here was an attitude: I don't know whether it was wholly Chandler's, but between Chandler and Gay, they said that they spent lots and lots of money in the development of deceleration devices, because it was believed that deceleration was 'the' problem.

"And so, everybody had a deceleration device, and, lo and behold, it turns out that deceleration wasn't the problem. So, they had spent all this money for nothing.

"So, therefore, they had been burned. And they were going to make absolutely sure, first, that the problem was really well understood, and that no device that would cause any detriment to the performance of the car, or anything, would be forced down their throats.

"So, it was clear that, from their point of view, this thing was a defensive organization." (Tr. Vol. XXIII, p. 24).

As to an agreement among the signatories to the cross-licensing agreements to eliminate the competition of third parties in the development of motor vehicle air pollution control equipment, the evidence is as follows:

Dr. Ridgway testified that Woodrow F. Gaines, also a TRW employee, told him that a Ford executive (Gaines' stepfather) reported that GM had, in 1961, increased its valve purchases from TRW by 25% in return for TRW going "slow" on development of its pollution control device. (Tr. Vol. XXIII, pp. 50–56; Tr. Vol. XXIV, p. 327). Mr. Gaines, now employed by the Missile Division, Chrysler Corporation, testified that the source of this report was another TRW employee, a technician in the automotive research lab, whose name he could not recall, and that he was not a Ford executive.[20] (Tr. Vol. XXXIII, pp. 13–15). He also testified that as the story originally came to him, the increase in orders was for pistons, not valves, and the increase was in payment of patent rights purchased by GM from TRW. (Tr. Vol. XXXIII, pp. 10–11).

In response to our additional subpoena *duces tecum*, TRW supplied us with the numbers of units and dollar amounts of sales to GM for valves and pistons for the years 1959, 1960, and 1961. Taking 1959 as the base year, GM's valve purchases from TRW increased by approximately 19 percent in 1960, and declined by a minimal amount in 1961. In 1959, GM purchased no pistons from TRW. In 1960, GM purchased $8,450 worth. In 1961 the amount purchased was $250,321. Total industry passenger car sales in the United States in 1960 were approximately 19 percent ahead of 1959 sales, and 1961 sales were a minimal amount below the 1959 sales. It is apparent that the GM increase in valve purchases from TRW in 1960 can rationally be accounted for by a rising sales increase. It is further apparent that the 1961 valve purchases followed industry sales closely. At the same time, from 1959 to 1961, GM's share of the market increased from 45.7 percent to 49.3 percent. One might even have expected that valve purchases from TRW would have increased. As for the increase in piston sales by TRW to

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Footnotes at end of article.

GM in 1961, the total sales figure of $250,321 seems much too low a "compensation" for TRW to go slow on a program in which they had spent approximately $1 million.

Additional witnesses from TRW were called before the grand jury but shed no light on any pressures applied to TRW by automobile companies in this field which are based upon TRW's position as a supplier of products to the automobile industry. Thus we have not developed evidence that any signatory to the cross-licensing agreement attempted in any way to interfere with the efforts of any of the four independent device manufacturers in developing pollution control equipment, whether or not such persons were suppliers of products to the automobile industry. Moreover, the evidence does not show that the industry announcement of the 1967 target date and subsequent utilization of their own systems on 1966 models was a concerted effort by them to boycott the devices approved by the MVPCB of California.

As a matter of fact, continued work in the air pollution control equipment field by outside concerns has been prompted by encouragement from the automobile industry. Mr. M. F. Venema, President and Chairman of the Board of Directors of Universal Oil Products Company, (UOP), testified that General Motors told them that they will need a device in addition to their air injection systems in order to meet future criteria. (Tr. Vol. XXXIX, p. 44). UOP is now supplying GM with catalysts. (Tr. Vol. XXXIX, p. 43). Venema stated that the industry's attitude is much better today than it was years ago in that the industry now feels it can gain from outsiders as compared to "their feeling a few years back that the outsiders were more intruders than helpers." (Tr. Vol. XXXIX, P. 43).

With respect to various aspects of the entire situation under investigation here, some significant admissions by John D. Caplan, head of the Fuels and Lubricants Department, General Motors Corporation, and former Chairman of the VCP, are contained in Grand Jury Exhibit Number 491, dated December 9, 1965. Mr. Caplan's remarks are in response to a request by Louis C. Lundstrom, Director, Automotive Safety Engineering, GM, for Caplan's review of and comments on Chapter 4 of the book entitled "Unsafe at Any Speed" by Ralph Nader. Chapter 4 deals with the subject "The Power to Pollute." Caplan prefaced his specific comments by stating that "you will note that I have not limited my review only to criticisms of the chapter but have also acknowledged areas wherein Nader's comments may be valid." (Tr. Vol. XXXV, p. 55; GJ Ex. 491). Referring to specific pages of the book, Caplan made *inter alia* the following comments:

Page 101: "(a) The million dollar a year industry expenditure cited on this page is optimistically high for the 1953 era. * * * (GJ Ex. 491, p. 3; Tr. Vol XXXV, p. 55)."

Page 105: "Nader's statement that the California MVPCB action in certifying the four devices 'moved' the automobile industry management to up the target date from the 1967 to the 1966 model year appears valid. However, he fails to point out that this could be done only after the MVPCB cooperated to the extent of allowing exemptions for the 1966 model year on many engine-transmission combinations." [11] (GJ Ex. 491, pp. 3–4; Tr. Vol. XXV, p. 56).

Page 106: "(a) The comment that the industry was guilty of only speaking with one voice' in the automotive air pollution area is true. Although individual company technical personnel were allowed to present 'company' technical papers, essentially all other types of pronouncements emanated only from AMA statements." (GJ Ex. 491, p. 4; Tr. Vol. XXXV, p. 56).

Page 107: "Mr. Nader's remarks concerning the basic issue (paragraph 3) appear to be the crux of this chapter. His criticism of the lack of recognition of the problem and lack of work on the problem by the industry is easily refuted. Where we must give the 'devil his due' is in the area of implementation of our findings. Does such implementation occur only in response to legislative pressure and public criticism? Development of material to refute this criticism is difficult." (GJ Ex. 491, p. 4; Vol. XXV, p. 57).

"ARTICLE V—EXCHANGE OF TECHNICAL DATA AND INFORMATION

"Each of the parties hereto further agrees to exchange through its authorized representative with representatives of the remaining parties hereto all technical data and other information pertaining to said Licensed Devices. Such ex-

Footnotes at end of article.

change of technical data and other information shall be conducted under the direction of the Vehicle Combustion Products Subcommittee of the Engineering Advisory Committee of the Automobile Manufacturers Association." (GJ Ex. 263, 264, 265, and 266).

As explained in our meeting on September 21st, the automotive companies, working through the Automobile Manufacturers Association, have agreed that the treatment of exhaust gas is an industry problem which will be handled on a cooperative basis. The A.M.A. Submission Agreement was developed to be used by all automobile companies in evaluating exhaust devices which are submitted for test. This assures that there will be an interchange of information between the automobile companies and that no one company will attempt to take competitive advantage of any solution which is developed in our current test program. For this reason we have requested that you sign the A.M.A. Submission Agreement. Other suppliers, including chemical manufacturers have signed this agreement recognizing that there is no desire on the part of any automobile company to do anything that would be detrimental to any supplier who can come up with a solution to this problem." (GJ Ex. 534).

FOOTNOTES

[1] Mountains surround the Los Angeles basin on three sides with but one outlet to the ocean. This basin also has a unique condition called temperature inversion. Ordinarily the air becomes cooler the higher it rises. In the Los Angeles area, during inversion periods, the polluted air is trapped beneath an invisible ceiling of warmer air thus preventing the normal upward flow of air pollutants to a level where it would be dissipated or diluted. Thus a concentration of air pollutants occurs to varying degrees, depending upon the height of the inversion lid. Too, in this area, weak winds prevail which at times stagnate completely, lacking the velocity to blow the pollution rapidly out of the basin, thus giving the abundant sunshine of southern California ample time to produce the photochemical reactions between the pollutants more fully defined herein as "smog."

[2] Los Angeles County has the highest registration of cars per person (2.3 persons/car) of any county in the United States.

[3] As late as July 30, 1963 Motor Vehicle Pollution Control Board (MVPCB) officials visiting Detroit were told: "based on the time that it takes to develop any new innovation in motor car design, the solution of the smog problem by the automobile industry was probably 7 to 10 years away . . ." (Tr. Vol. XXXVIII, pp. 7–9; GJ Ex. 227). As hereinafter shown, the industry was able to and did install exhaust systems or devices in late 1965 on 1966 models when forced to do so.

[4] AMA now employs a full-time president. (Tr. Vol. XVIII, pp. 54–55; GJ Ex. 300).

[5] The cross-licensing agreement provides as follows:

"ARTICLE V—EXCHANGE OF TECHNICAL DATA AND INFORMATION.

"Each of the parties hereto further agrees to exchange through its authorized representative with representatives of the remaining parties hereto all technical data and other information pertaining to said Licensed Devices. Such exchange of technical data and other information shall be conducted under the direction of the Vehicle Combustion Products Subcommittee of the Engineering Advisory Commitee of the Automobile Manufacturers Association." (GJ Ex. 263, 264, 265, and 266).

[6] The significance of the AMA Suggestion Submission Agreement is illustrated by the following pertinent excerpt from a letter of October 7, 1960 written by R. H. Isbrandt, Director, Automotive Engineering, American Motors Corporation:

As explained in our meeting on September 21st, the automotive companies, working through the Automobile Manufacturers Association, have agreed that the treatment of exhaust gas is an industry problem which will be handled on a cooperative basis. The A.M.A. Submission Agreement was developed to be used by all automobile companies in evaluating exhaust devices which are submitted for test. This assures that there will be an interchange of information between the automobile companies and that no one company will attempt to take competitive advantage of any solution which is developed in our current test program. For this reason we have requested that you sign the A.M.A. Submission Agreement. Other suppliers, including chemical manufacturers have signed this agreement recognizing that there is no desire on the part of any automobile company to do anything that would be detrimental to any supplier who can come up with a solution to this problem." (GJ Ex. 534).

[7] When an attempt was made in 1963 to broaden the scope of the cross-licensing agreement "to overcome the restrictions that are currently preventing adequate discussion of technical steps that will lead to solutions" (GJ Ex. 305), the attempt was defeated by the opposition of GM. This is explained in a GM internal communication from H. F. Barr, its member on the EAC, dated May 6, 1965, "Subject: G.M. Policy on A.M.A. Vehicle Combustion Products Com. Work" as follows:

"2. In an endeavor to permit technical discussion, the Enigneering Advisory Committee of A.M.A. asked the A.M.A. Patent Committee to propose broader language for the agreement.

* * * * * * *

"3. In subsequent review of this proposed action for the A.M.A. Board of Directors, in our Engineering Policy Group meeting of March 20, 1963, our management reaffirmed that the A.M.A. agreement should not be changed in this way. On April 30, the E.A.C. further discussed this proposal, with G.M. being the only member opposed to extending the agreement to other areas.

FOOTNOTES—Continued

"4. The basic trouble with this problem is the involvement of (1) an established cross licensing agreement for hardware now established, with (2) a need for technical discussion and exchange of information in broader areas. We feel these are two separate items and need not be combined in a new, broader cross licensing agreement for nonexistent hardware." (GJ Ex. 325).

[8] The fact that on occasions the pcv was offered as optional equipment indicates the ability to supply this air pollution control equipment, yet the auto manufacturers did not install them on all models quite evidently because of the agreement previously referred to.

[9] This illustrates that bar an agreement, competition to research, develop and manufacture pollution control devices would stimulate and compel rather than delay the installation of devices by all companies. (Tr. Vol. XXX, p. 147).

[10] The testimony was that this technician was known as "Olie." We called a TRW official named Ohly as a witness, but ascertained that he was not the person involved. We have learned since the last grand jury session that the person involved is Merle E. Olson of Chesterland, Ohio. From our experience in this matter, however, we doubt that his testimony will be helpful.

[11] California State regulations permited only 2% exemptions. At most less than 4% were exempted (Askew, Tr. Vol. XXXVIII, p. 22).

[From Congressional Record—House, May 18, 19711

THE JUSTICE DEPARTMENT AND THE ANTISMOG AUTO POLLUTION CASE

(Mr. ROSENTHAL asked and was given permission to extend his remarks at this point in the RECORD.)

Mr. ROSENTHAL. Mr. Speaker, on September 2, 1969, I joined with Mr. Burton of California, in a letter to Attorney General John Mitchell, protesting reports that the Justice Department was about to compromise one of the most important antitrust cases affecting the health and welfare of the American people. At issue, was the Department's civil case against certain automobile manufacturers and the Automobile Manufacturers Association, for allegedly agreeing to suppress research, development, and application of pollution control devices for automobiles.

Our fears were quickly confirmed. The Justice Department did accept a plea of no contest from the defendants and entered into a consent decree. That action by the Justice Department, after extensive and ex parte discussions with the chief auto industry lobbyist, deprived the American people of their right to know all the facts about one of America's wealthiest industries, raised formidable barriers to the many treble damage suits by cities and States, which could have been initiated after a full and open trial of the issues, and seriously undermined the deterrent effect of our antitrust laws. Most importantly, Justice's anticonsumer manuever, represented a callous disregard for the health of millions of Americans who are suffering the toxic effects of air pollution. 50 percent of which is caused by automobile exhaust.

I am now in possession of an internal Justice Department document, which conclusively demonstrates that folly of the consent decree. The Justice document states, in part:

"We are convinced that we have shown the grand jury and are in possession of evidence to prove beyond a reasonable doubt the existence of an industry-wide agreement and conspiracy among the auto manufacturers, through AMA, not to compete in the research, development, manufacture and installation of motor vehicle air pollution control devices for the purpose of achieving interminable delays, or at least delays for as long as possible.

In Mr. Turner's language, contained in his Supplemental Memorandum for the Attorney General, dated May 12, 1966, "if the grand jury investigation discloses an absence of justification for the agreement not to compete, as seems quite likely, the agreement would be so plainly unlawful as to warrant a criminal proceeding." It is respectfully submitted that the grand jury investigation clearly disclosed such an agreement and absence of justification. Throughout the entire conspiracy, the participants were cognizant of the antitrust implications of their activities. Despite this fact the conspiracy was carried on for economic reasons. The health and welfare of the community were disregarded. In these circumstances, criminal prosecution is clearly indicated.

Mr. Speaker, notwithstanding this recommendation for a criminal prosecution by its antitrust division the Justice Department entered into an innocuous consent order. This flouting of the antitrust laws and abuse of the public interest by the Department of Justice, is intolerable—especially from an administration that alleges concern for the rule of law.

What is at stake here is not merely the rule of law. But also the health of millions of Americans. The automobile is responsible for dumping more than 90 million tons of pollutants into the atmosphere each year, more than twice as much as any other single pollutor. It accounts for 91 percent of all carbon monoxide, 63 percent of the unburned hydrocarbons and 48 percent of the oxides of nitrogen emitted from all sources. In the Los Angeles area, automobile pollution represents 85 percent of the contaminants emitted into the ambient air, daily.

But Los Angeles is not the only city in America under mortal attack from air pollution. In New York City—my city—the death rate from emphysema has increased 500 percent between 1960 and 1970. During the same period, deaths from chronic bronchitis in New York increased 200 percent.

Mr. Speaker, the public loses confidence in their system of government when the chief law enforcement agency looks the other way in the face of law violations. This must not be allowed to happen again.

[From John M. Blair, "Economic Concentration," New York: Harcourt Brace Jovanovich, Inc., 1972, pp. 199–227]

Invention and Innovation

[Chapter 9]

As large corporations have continued to grow and diversify, coming to own scores and even hundreds of separate plants not only in their original industry but in a variety of different and unrelated industries, it has become almost self-evident that their enormous size cannot possibly be explained merely in terms of plant economies. And with evidence lacking that efficiency is promoted by bringing many plants under common ownership and operation, something of a vacuum has developed in the intellectual defense of bigness. Like nature, any well-established status quo abhors a vacuum. It is therefore hardly surprising that, to fill the void, a new and more persuasive rationale has made a timely appearance. Stemming originally from the writings of Joseph Schumpeter,[1] its combination of surface plausibility and a few case examples has proved irresistible even to critical minds; thus J. Kenneth Galbraith writes: "A benign Providence . . . has made the modern industry of a few large firms an almost perfect instrument for inducing technical change. . . . There is no more pleasant fiction than that technical change is the product of the matchless ingenuity of the small man forced by competition to employ his wits to better his neighbor. Unhappily, it is a fiction. Technical development has long since become the preserve of the scientist and the engineer."[2]

A typical expression of the rationale is to be found in a paean of praise to big business by David E. Lilienthal, in which he equates bigness with scientific progress:

Most significant research and development require large resources and often a long period of time during which no results are forthcoming. . . . Only large enterprises are able to sink the formidable sums of money required to develop basic new departures; a small corporation is rarely able to risk those large sums, perhaps enough to wreck the company if the gamble fails, on the success or failure of a major new project in such areas as electronics or chemicals, for example. . . . Bigness and research activity are largely synonymous whether in big business or in government. The greatest single factor in competition today is indeed research and development. This fact alone makes obsolete and inadequate many of our "horse-and-buggy" ideas about how competition can be maintained.[3]

The body of scientific research itself has reached such dimensions, it is held, that further contributions can come only from teams of specialists working in large, well-equipped laboratories; only the large corporations can afford to buy the expensive equipment and facilities, to hire the specialists, and to pay the other costs of conducting research in the world of modern science. The change in the nature of the inventive process, it is concluded, has made concentration a prerequisite to progress. The day of the independent inventor and innovative small enterprise is over.

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[1] Joseph Schumpeter, "Capitalism, Socialism and Democracy," Harper, 1942.
[2] J. Kenneth Galbraith, "American Capitalism, the Concept of Countervailing Power," Houghton Mifflin 1952, p. 91.
[3] David E. Lilienthal, "Big Business: A New Era," Harper, 1952, pp. 69–72.

Like the efficiency justification this "research rationale" has been transformed into a mystique—a product not of objective inquiry but of images—the white-robed scientists in the gleaming laboratories peering into microscopes, holding up test tubes, working with computers, and in other ways comporting themselves as advertising and public-relations men expect scientists to behave. There are two methods of evaluating the contribution of large companies to the invention-innovation process: the statistical and the historical. Studies of the former type have been based primarily on two bodies of data: statistics on expenditures for "research and development" and statistics on patents. Studies of the latter type consist of historical accounts of the origins, development, and progress of individual inventions. Taken together, the studies based on these different approaches constitute an impressive body of empirical evidence with which the validity of the research rationale can be appraised.

STATISTICAL STUDIES

The Census Bureau regularly collects for the National Science Foundation statistics on expenditures for research and development (or "R&D," as it is termed) broken down by size of company. At first glance the data would appear to lend support to the research rationale, since, they regularly show a relatively high degree of concentration in research and development expenditures. But when related to other measures of economic activity, concentration of R&D becomes considerably less impressive. Moreover, pointed criticisms have been advanced concerning the appropriateness of using this body of data for *any* purpose. The criticisms are, first, that expenditures on research and development are measures of *input* rather than of output and, second, that the term R&D has come to embrace a great variety of activities that have little relationship to the traditional meaning. The other body of statistical data—figures on patents—suffers from shortcomings of its own, of which the most important, of course, is the great variation in the significance and use of individual patents.

Studies based on R&D expenditures

It is true that most of the expenditures for research and development are made by a relatively small number of firms. But it is also true that this concentration of R&D outlays is *less* than the concentration of economic activity, as represented by sales or employment. Among 352 of the 500 largest manufacturing corporations, the 4 largest firms accounted in 1955 for only 9.7 percent of their employment in research and development while enjoying 19.9 percent of their sales. The 8 largest accounted for only 16.4 percent of the R&D employment of these companies while accounting for 27.5 percent of their sales. The figures for the 30 largest (corresponding roughly to firms with 1955 sales in excess of $1 billion) were 44.7 and 49.0 percent.[4]

When these companies are distributed by size among 4 broad groups of industries, there is a clear tendency in 3 groups for R&D employment (per billion dollars of sales) to *decline* after a company size of $200 million in sales is reached. The exception is basic chemicals and drugs, in which the R&D employment-sales ratio is highest in the largest size shown—companies with sales of over $1 billion. Similarly, another study found no tendency among firms with more than 5,000 employees for R&D employment in relation to total employment to rise with increasing company size.[5] In this study, based on 340 firms, the relative amount of R&D employment increased with firm size in only 2 of 19 industry groups. A point to be stressed here is that both the size of $200 million in sales (after which in the former study the ratio tended to fall) and the minimal size of 5,000 employees (used in the latter study) are well below any size that might give rise to concern over concentration, either in manufacturing as a whole or in most of the major industries.

The meaning of "research and development"

In addition to the fact that statistics on research and development, when related to sales or employment, provide little support for the "research rationale," the point has been made that even such figures exaggerate greatly the extent of

[4] Hearings on Economic Concentration, Pt. 3, pp. 1194–98, testimony of Frederic M. Scherer. The 352 represented those among the 500 largest for which Scherer could obtain figures on employment in research and development.
[5] Ibid., pp. 1284–85, testimony of Daniel Hamberg.

what has been traditionally thought of as "research" or "inventive" activity. The leading exponent of this criticism has been David Novick, whose position as head of the Cost Analysis Department of the Rand Corporation makes him singularly well qualified to comment on the subject.

According to Novick most of the frequently cited increase in expenditures on research and development—from $1 billion at the end of World War I to $10 billion in 1959 and to $20 billion in 1966—is illusory, since the term has been stretched to embrace such a variety of activities as to be rendered almost meaningless.[6] In a paper before the American Association for the Advancement of Science, Dale Wolfie observed, "If words could talk, research would surely complain of being overworked. The word is used to describe the scholarly activities of a Nobel laureate and to give prestige to such immediately useful records as counting the customers of a chain store." At the same meeting Merle A. Tuve stated, "We have lumped under 'research and development' so many huge technological activities in the national budget, and correspondingly in corporation budgets and elsewhere, that the figures have become practically meaningless."[7] In this connection Novick cited a description of research by Bergen and Cornelia Evans in their *Dictionary of Contemporary English Usage*:

"Research has become very popular in the United States since the outbreak of World War II. As Henry D. Smyth has observed, the idea that the object of research is new knowledge does not seem to be widely understood and "a schoolboy looking up the meaning of a word in the dictionary is now said to be doing research." Indeed, it has been debased even further. Research is frequently used to describe reading by those to whom reading, apparently, is a recherché activity, and for many a graduate student it is a euphemism for wholesale plagiarism. The word needs a rest or at least less promiscuous handling."[8]

In addition to a certain status conveyed by the term itself, a number of more mundane considerations have governed the vast expansion in its usage. For one thing, the investment community came to look with favor upon corporations that were said to be "research oriented."[9] Testifying in 1950 Novick stated,

"That the investing public has bought the thesis that research pays off can be illustrated by the spectacular rise in the price of the securities of Texas Instruments, Thiokol, Minnesota Mining & Manufacturing, International Business Machines, and others of the so-called science stocks. This indicates the investors believe that research does pay."[10]

Probably an even more important inducement is the result of a change in the treatment of research expenditures for tax purposes. Prior to 1954 research expenditures could be capitalized and amortized only over their useful life. If their useful life could not be determined, no deduction at all was available except for losses due to abandonment. But, since the 1954 revision in the Internal Revenue Code, research expenditures can be either capitalized or treated as ordinary business expenses deductible in the year incurred. Moreover, firms wishing to do so can treat research expenditures as "deferred expenses" to be amortized in 5 years or more, but with the amortization period beginning only *after* income resulting from research is realized. In other words, the use of the research expenditures to reduce a corporation's taxes can be held off until the firm is receiving income from the research. Whatever their merits for tax purposes, these new methods of treating research expenditures have obviously had the effect of inducing companies to classify as "research and experimental" many activties formerly carried on under other accounts.

A further consideration of perhaps more than passing importance derives from the lofty status research now enjoys in the public mind. To the extent that its growth can be said to be the result of research, a company secures respectability from the community and immunity from criticism. Institutional advertising

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[6] Novick testified before the Subcommittee on Antitrust and Monopoly on two occasions. See Hearings on Administered Prices, Pt. 18, pp. 10510–23; Hearings on Economic Concentration, Pt. 3 pp. 1241–56.

[7] Quoted by Novick in Hearings on Administered Prices, Pt. 18 p. 10513.

[8] Quoted by Novick in ibid. p. 10512.

[9] In his testimony in 1965 Novick qualified this observation in the light of the more recent performance of the "research stocks." In response to the question of whether "the wise investor will tend to put his money on the corporation that appears to spend more on research and development," Novick replies "Yes. However, I am not sure that that is going to continue, because the science companies that were becoming so nicely in 1959–60, some of them have come very much a cropper in 1965–66." (Hearings on Economic Concentration. Pt. 3.)

[10] Hearings on Administered Prices, Pt. 18.

campaigns stressing research have become *de rigueur* for leading companies, including many to whom it has in fact been something of a *recherché* activity. During an investigation of the drug industry carried out by the Subcommittee on Antitrust and Monopoly, the industry's constant and continuous reiteration of the research argument reflected a keen awareness that it constituted a complete defense; the only problem is that, at best, it left unexplained over 93 percent of the price.

Discussing the more mundane reasons behind the apparent great increase in research and development expenditures, Novick stated:

"I think the first major increase in R & D can be directly attributable to that enactment [the 1954 change in tax treatment], because if you plot the figures, you suddenly get a jump in 1955–56 that just does not have any explanation other than the change in tax treatment. You then get another jump in 1957–58 as a result of the launching of sputnik, meaning that the military should do R & D. Prior to 1957–58 it was the practice of the military departments to play down research and development, and as a consequence the budgets for R & D or code 600 money ran well under a billion. In other words, for all three services as of 1956 the total was probably just about $1 billion of 600 money.

Suddenly after sputnik when they decided that it was fashionable or proper to be in the R & D business, this number jumped to something like $6 or $7 billion. Now, this did not mean that anything had changed. The activities in the development of missiles and aircraft and related components were going forward in the same way in 1954, 1956, and 1958. But in 1954 and 1956, the 600 money was kept down, and the production and procurement money was kept up. Starting in 1958 after sputnik production money was reduced and the R & D money was increased.

This again introduced a major statistical change in the series that no one ever pays much attention to. I mean there was no change in the basic activity of R & D. It was just a reclassification of figures. With sputnik, and the result of this change, everybody decided that they wanted to be in the R & D business. . . ."[11]

It is Novick's position that the process of what is referred to as research and development must, for any meaningful purposes, be broken down into four stages. Step 1 is what is usually thought of as *basic research*—explorations into the "brave new world"—whose promise may be great but is not identified with specific uses and purposes. Of the $10 billion said to have been spent by this country on research and development in 1959, only one percent, according to Novick, went to support this most fundamental form of inquiry. Step 2, or *applied research*, consists of identifying the applications of the fundamental discoveries resulting from Step 1. Here the expenditure was in the neighborhood of 3 percent of the total. Step 3 consists of the *development, evaluation, and testing* of products devised from what was regarded in Step 2 as potential. At this stage "do-ability" has been established. About 25 percent, Novick estimated, was spent at this stage. Step 4, *applied research and testing*, consists of finding new uses, applications, or modifications of *existing* products and methods. In Novick's words, "some success is reasonably assured since it is evoluntionary rather than revoluntionary."[12] It is here that the great bulk—70 percent—of the research and development expenditure is made.

Stressing that each of the subsequent steps is dependent ultimately on basic research itself, Novick questioned whether there has in fact been *any* increase in truly creative activity:

"The bulge in our scientific discoveries in the last twenty-five years is probably more the result of European scientists coming to this country to escape Fascism, Communism, and Naziism than any real expansion in our indigenous capability. Einstein, Fermi, von Neumann, and Teller are a few of the scientists whose U.S. contributions are transplants from Europe. There is no assurance that we have yet developed the essential "climate" for basic research in this country."[13]

Novick also regarded as "useful" (although less meaningful than his four-part classification) the widely employed distinction between "invention" and "innovation"—the former being the creation of new ideas and principles, the making and verifying of discoveries, and their transformation into a *conceptual* design of a new product or process; the latter being the translation of the concept into marketable goods.[14] In terms of this classification Novick would assign only

[11] Hearings on Economic Concentration, Pt. 3.
[12] Hearings on Administered Prices, Pt. 18.
[13] Ibid.
[14] Hearings on Economic Concentration, Pt. 3.

about 5 percent of the R&D expenditures to invention:

"In terms of the problem this committee is addressing, I reject the idea that technological advance under present day conditions requires the resources of bigness. Let me repeat, for the most part basic research and invention are essentially thinking processes, which commonly means one man. Let us recognize this and at the same time stop saying $20 billion for research and development for 1965. It is more appropriate to say $19-plus-billion for development and something less than $1 billion for the basic research and invention where the great new discoveries will be made." [15]

That so little goes to invention is due partly to the nature of the activity itself, which, as Novick says, is essentially a thinking process. It is also due partly to the pressure on scientists from the business community to come up with something of commercial value. The closer a research project comes to the "developmental" or "innovative" stages, the more understandable it appears to corporate managers, and thus the better are its chances for approval. Also at work is a perverse attitude on the part of those who control the funds for research in business, government, and foundations. Because basic research is an exploration into the unknown with only a slight chance of yielding anything of tangible value, requests for financial assistance have to be expressed in the vaguest of terms—the purpose of the project can be described only generally, and no promise nor even much hope can be entertained for a result of tangible value. Also, because the equipment is usually simple, consisting of paper and pencil or blackboard and chalk, secretary, file cabinet, small office, and at most a small laboratory, a request for funds to conduct basic research may amount to only $25,000. Not infrequently, such requests strike the grantors of funds as too small to warrant serious consideration. In Novick's words:

"You have to have a big project to interest the administrators. This means that it is not easy to get support for what one might do for $25,000. So we blow it up into something like $250,000, or more probably $2.5 million, and then we can get somebody interested in it. At this juncture, the scientist who had the idea ceases to be a scientist and instead becomes an administrator. Instead of being a scientist he is a big wheeler and dealer. As a consequence . . . we are getting a lot less for $250,000 or $2.5 million than we could have gotten for $25,000 ten years ago." [16]

Studies based on patents

In the late 1950's the share of U.S. inventive patents held by 448 firms among the 500 largest industrial corporations was found by Frederic M. Scherer to have been *smaller* than their share of total sales.[17] (This finding, it will be noted, parallels the results based on a comparison of concentration in R&D employment with that in sales.) While the 4 largest firms made 18.2 percent of the sales of these firms, they held only 9.9 percent of their patents. The 8 largest made 25.2 percent of the sales of these companies but held only 15.9 percent of their patents; the corresponding figures for the 30 largest were 44.9 and 40.7 percent.

When the figures on patents are distributed by firm size among 4 broad groups of industries, the number of patents in relation to sales does not tend to rise with increasing company size. Indeed, in 3 of the 4 groups the ratio of patents to sales was lower in the largest size group (companies with sales of over $1 billion) than for any of the other size classes except the smallest.[18] The same was found to be true of employment in research and development in relation to sales. In Scherer's words:

"Altogether in six classes out of eight, the highest average rates of patenting and R & D employment per billion dollars of sales are found for firms with 1955 sales of less than $200 million. These patterns persist when two-digit industries are analyzed one-by-one. The results clearly do not support the hypothesis that bigness per se is especially conducive to technological inventions and innovations. If anything, they imply that giant firms are somewhat less progressive relative to size than their smaller brethren."

Statistics on patents can be related also to the funds spent on research and development to provide an indication of the productivity of R&D expenditures.

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[15] Ibid.
[16] Hearings on Administered Prices, Pt. 18.
[17] Hearings on Economic Concentration, Pt. 3, pp. 1194–98. To allow for the customary 4-year time lag between the application for and the issuance of a patent, the comparison was between sales in 1955 and patents assigned to firms in 1959.
[18] The exception is petroleum products, in which patents per sales in the second largest size class were slightly lower than in the largest.

Such an analysis, prepared by Jacob Schmookler, is presented in Table 9–1, which shows the amounts spent per patent pending in 6 broad industry groups, broken down into 3 size classes.[19]

As will be seen, the largest firm spent more in every industry group on R&D per patent pending than firms in the smallest size class. Except for chemicals, they also spent more than firms in the medium-size group. For the combined industry groups, firms in the largest size class spent about twice as much on research and development per patent pending as did firms in the 2 smaller size classes. Thus, in terms of this standard, the larger the firm, the lower was the productivity of its research and development effort.

Moreover, despite their greater expenditures per patent, the patents secured by the larger corporations appear to be less significant than those of smaller firms. Based upon a 2-percent random sample of inventions patented in 1938, 1948, and 1952, a study by the Patent Foundation of George Washington University found that large firms used only 51 percent of their inventions commercially as compared to 71 percent for small firms.[20] Similarly, a study of large firms by the Harvard Business School revealed that corporations with sales in 1956 of over a half-billion dollars used only 51 percent of their potential inventions as compared to 56 percent for firms with smaller sales.[21] What is perhaps the most surprising finding is that the rate of use by the large companies, 51 percent, was found in the latter study to be virtually the same as that for patents obtained by independent inventors—49 percent.[22] In view of the difficulties encountered by independent inventors in getting their invention used, the logical inference is that on the average the quality of their patents must be superior to those of the large companies.

TABLE 9–1.—RESEARCH AND DEVELOPMENT OUTLAYS PER PATENT PENDING 1953

[In thousands of dollars]

Industry	Size of firm			Industry average (unweighted)
	Under 1,000 employees	1,000 to 4,999 employees	5,000 or more employees	
Machinery	8.5	14.2	24.2	15.6
Chemicals	11.2	24.4	23.6	19.7
Electrical equipment	15.7	12.6	25.6	18.0
Petroleum products and extraction	10.0	8.4	15.6	11.3
Instruments	15.8	14.4	37.5	22.6
All other industries	15.4	7.1	27.8	16.8
Average, all industries (unweighted)	12.8	13.4	25.6	

Source: Hearings on Economic Concentration, pt. 3, p. 1258.

The meaning of patent statistics

Statistics on patents have an important advantage over figures based on R&D expenditures in that they are a measure of *output*. Moreover, they appear to represent an "objective" or "independent" measure. Yet what they measure is the willingness of the Patent Office—and the courts—to issue a monopoly grant. Over the years the standards of patentability have tended, through interpretation, to move away from the original concept of a "creative burst of genius" toward minor changes in novelty and utility. Patents on drugs, for example, have been issued regularly because of a slight difference in molecular structure, even though the compound has no greater utility or therapeutic value than its predecessors.[23] As a result, the securing of a patent has come increasingly to be merely

[19] Hearings on Economic Concentration, Pt. 3, pp. 1258–65, testimony of Jacob Schmookler. The data relate to 1953, which was the last year for which the National Science Foundation collected this type of data on patents.

[20] Barkey S. Sanders, "Patterns of Commercial Exploitation of Patented Inventions by Large and Small Companies," Patent Copyright and Trademark Journal, Spring, 1964, pp. 51–92. Large companies were defined as those holding over 100 patents or with some patents and over $100 million in assets; small firms were defined as the remainder.

[21] Frederick M. Scherer, "Patents and the Corporation," Galvin, 1958, p. 112.

[22] Sanders, op. cit.

[23] See 87th Cong., 1st sess., Senate Subcommittee on Antitrust and Monopoly, Senate Committee on the Judiciary, "Hearings on S. 1552, 'To Amend and Supplement the Antitrust Laws, with Respect to the Manufacture and Distribution of Drugs,'" 1962, Pt. 3.

a function of the resources needed to achieve the requisite minor modification, thereby imparting a strong bias in patent statistics in favor of large enterprises.

Another source of bias operating in the same direction stems from the deliberate practice by large companies of obtaining a succession of minor "improvement" process patents as well as "blocking" patents—i.e., patents covering alternate processes or products.[24] Other distortions were cited in a colloquy during the Antitrust Subcommittee's hearings:

"Dr. BLAIR. A final source of bias would stem from the fact that the smaller firm and the independent inventor who have discovered a patentable invention may not patent it, for the reason that they do not want to make the disclosure which is required by the Patent Office. They may be apprehensive that if they do make the disclosure, the large firm will in effect pirate their invention, and that, being small, they are without the resources required to successfully mount a case involving infringement of patents. As you know, those cases are frequently quite expensive."

"Dr. SCHMOOKLER. Yes; I am sure you are right."

"Dr. BLAIR. In the Subcommittee's drug hearings an official of a medium-size firm, one with fairly considerable resources, testified that when they made discoveries, as they had, they no longer even bothered to try to market them as patented specialties, but rather just licensed them to all firms, since the cost of bringing a patent infringement suit was simply prohibitive. So would this not be a further source of bias?"

"Dr. SCHMOOKLER. I am sure that that source also exists."

The existence of these biases obviously lends greater force to the following summary of the evidence by Schmookler: "Evidently, as the size of firm increases, there is a decrease per dollar of R&D in (a) the number of patented inventions, (b) the percentage of patents used commercially and (c) the number of significant inventions."

HISTORICAL STUDIES

Historical research into the origins and development of individual inventions is slow, laborious "donkey work." Even the simplest of inventions usually has a tangled history, moving from the first conception through successive stages of development and improvement, failure and rejection, reformulation and more improvement, to final success. By the very nature of the subject matter, this type of inquiry does not lend itself readily to compression. Nor, like many other areas of knowledge, does it lend itself to mathematical treatment. As David Novick has observed:

"No one is going to provide a verifiable, analytic summation of the role of the large firm in the advance of technology. It is not possible to state, for example, that large firms account for x percent of technical progress, either in a single industry or in the overall economy. We know of no way to assign values to individual discoveries of new applications of technical knowledge, especially when the effect of discovery or application is to provide goods or services not previously available. In general, it is not possible even to rank individual technical advances. We cannot compare the values of advances in different fields in any meaningful way—for example, compare an advance in medical knowledge with one that provides a new hair spray. The possibility of valuing contributions to science or to basic technical knowledge that have not yet resulted in commercial or social applications is even more remote." [25]

The "Jewkes study"

The most comprehensive study of the history of invention is the important work *The Sources of Invention*, by John Jewkes, David Sawers, and Richard Stillerman (referred to for convenience here as the "Jewkes study").[26] Originally published in 1958, it traced the history of 61 important inventions made during the twentieth century. About two-thirds were made after 1930 and over two-fifths after 1940. Each has been a commercial success or an effective weapon of war.

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[24] The latter might constitute one of the explanations for the relatively low use rate of the largest companies, cited above.

[25] Hearings on Economic Concentration, Pt. 3.

[26] John Jewkes, David Sawers, Richard Stillerman, The Sources of Invention, Macmillan, 1958, rev. ed., 1969. Unless otherwise noted the page citations are to the first edition. For a study of inventions between 1946 and 1955 see Daniel Hamberg, "Research and Development," Random House, 1966 (summarized in Hearings on Economic Concentration, Pt. 3, pp. 1281–92).

Some have transformed ways of living: radio, television, jet engines, nylon, quick freezing, plastics, stainless steel. Some rank among the great medical discoveries: penicillin and insulin. Some represent new techniques, new tools of production, new instruments for research, and new materials: the continuous hot-strip rolling mill, continuous casting of steel, shell molding, tungsten carbide tools, catalytic cracking of petroleum, the cyclotron, the electron microscope, neoprene, the cotton picker. Also included are important consumer goods such as the safety razor, the zip fastener, the self-winding wrist watch, the longplaying record, and the ball-point pen. As the authors observe, the inventions chosen—with such exceptions as atomic energy and the electronic devices employed in automation—seem to constitute a cross-section of the technical progress of the twentieth century.

Far from having vanished during the nineteenth century, the individual inventor was found still to be very much with us. For example, the gyrocompass was invented by a young man who was neither a scientist nor a sailor; the manufacturers of navigational equipment played no part whatever in its invention. A chemist working in the oil industry discovered the process of transforming liquid fats by hardening them for use in soap and, single-handed, pursued his research and efforts to get the process adopted. An independent worker was responsible for the crucial invention in magnetic recording as well as for a number of important improvements; the interest of the companies arose much later. An independent engineer invented the catalytic cracking of petroleum, and it was his efforts that finally forced the industry to adopt the process. Two groups of individual inventors, each working with limited resources, were able to bring their ideas concerning a mechanical cotton picker to the point where large firms were prepared to buy or license their product for subsequent development.

Despite the considerable sums spent on research by the large chemical companies, it was an individual inventor who produced Bakelite, the first of the thermosetting plastics. A metallurgist working in his own laboratory developed the first and still the most important commercially practical method of producing ductile titanium; the process was neglected for years by the leading metallurgical and chemical corporations. The helicopter was the result of the enthusiasm of individual inventors; up to 1938 only one large aircraft manufacturer had taken much interest in it, and even that only as the result of the personal interest of the head of the firm. The groundwork for the successful Kodachrome process was laid by two young musicians whose ideas were later taken up by a large photographic firm. The safety razor came from two individuals, one a salesman in crown corks, who struggled through financial and technical doldrums before finally meeting with success. Two engineers are responsible for the zip fastener, which was not taken up for large-scale production until many years later. A British watch repairer invented the self-winding wrist watch, and Swiss watch manufacturers were slow to see its importance. A patent attorney invented xerography, which was ignored for years by the large photographic firms.

Small and medium-size companies have continued to be another important source of invention. A one-man effort in a then small American firm was responsible for the development of cellophane. A medium-size firm in the English cotton industry invented the crease-resisting process. The continuous hot-strip rolling of steel was conceived by a company official who might be considered an individual inventor and was perfected in a medium-size American steel company. A firm that had no direct interest in the production of new fibers was responsible for the invention of the synthetic fiber Terylene.

A third group of inventions, including the cyclotron, penicillin, streptomycin, insulin, electric precipitation, and chromium plating, came from university laboratories. Still another group consists of cases that, in Jewkes's words, "seem to defy classification." Among these he cites the long-playing record, which was invented by an engineer of the Columbia Broadcasting System in charge of a completely different line of activity, color television experiments. Important discoveries relating to stainless steel were made almost simultaneously by an individual inventor and one working in a company's research laboratory. Radar emerged from the combined work of government research stations, radio companies, and scientists in the universities.

Of the 61 inventions on Jewkes's original list, only 16 can be attributed directly to organized research by large corporations. These are acrylic fibers (such as orlon), DDT, the diesel-electric locomotive, Duco lacquers, fluorescent light-

ing, Freon refrigerants, Krilium, methyl methacrylate polymers, neoprene, nylon, polyethylene, silicones, synthetic detergents, television, tetraethyl lead, and transistors. Even some of these contributions were built upon the prior work of independent scientists and inventors.[27] Summing up the evidence the study concludes:

More than half of the cases can be ranked as individual invention in the sense that much of the pioneering work was carried through by men who were working on their own behalf without the backing of research institutions and usually with limited resources and assistance or, where the inventors were employed in institutions, these institutions were, as in the case of Universities, of such a kind that the individuals were autonomous—free to follow their own idea without hindrance.[28]

THE COSTS OF R.&D.

The invention-innovation rationale rests in no small part upon the assumption that because of today's complex and costly technologies, the ability to carry on research and development work tends to be a function of a company's size and resources. And from this assumption it would logically follow that those concerns best able to carry the financial burden would have the best records in making scientific and technological advances. The empirical knowledge gained through the historical studies of the history of inventions permits an examination of both propositions.

It is true that a few extremely costly types of equipment, such as giant atom smashers and huge radio telescopes, are far beyond the resources of independent inventors, and small firms. But such items are also beyond the resources of large firms and therefore are necessarily financed directly or indirectly by the government. Moreover, in analyzing the cost of research, the customary distinction between invention and innovation must again be made. Since the former, as Novick pointed out, is a thinking process, its costs are usually modest; a number of typical case examples were cited before the Senate Antitrust Subcommittee by Richard Stillerman, co-author of the Jewkes study:

In this century, scores of inventions have been conceived with simple equipment and advanced with modest expenditures. Chester Carlson used crude equipment to prove out his ideas for xerography. Farnworth, in his television experiments, expressed a preference for simple tools. The newness of the field forced him to improvise his own research and measuring instruments. Julius Hyman and his group, working on a small scale, discovered the insecticides chlordane, aldrin, and dieldrin. Not only did the Wright brothers build their own wind tunnel for testing wing shapes, but also their historic airplane. Nicholas Christofilos, the self-trained nuclear physicist, formulated mathematically his idea for strong-focusing, which simplified the construction of large accelerators; and Ernest O. Lawrence's first cyclotron was a combination of window glass, sealing wax, brass, and wire. The basis for Kodachrome blossomed from experiments in a kitchen sink. When John Bardeen and Walter Brattain invented the transistor, their most costly piece of equipment was an osciloscope. Charles H. Townes' prepared mind received the inspiration for the maser while he sat on a park bench; experimental verification of the idea did not involve high costs. Robert Goddard made fundamental progress in rocketry with his own handmade rockets; parallel work by the early German rocket enthusiasts proceeded with limited funds and primitive tools. The record of modern invention demonstrates that it is the quality of the researcher not the elaborateness of his equipment that determines success. Inventors who place increased reliance on specialized tools and less on thinking power and personal observation may get caught up in the machines and miss solutions lying near the surface of things.[29]

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[27] About half of this group of 16 are in the general field of chemicals. Commenting on this "intriguing" phenomenon, Jewkes observes: "Individual chemical invention was not unknown in the 19th century—Goodyear, Perkin, Mercer and Cross are famous in that connection. It is still to be found in industries which may be regarded as peripheral to the chemical industry such as photography, metallurgy, textile finishing and chemotherapeutics. And at least some of the great chemical inventions of recent years, such as those of Carothers, Whinfield and Midgley, although made in industrial research laboratories, were produced by small groups operating with relatively inexpensive equipment." (Ibid., p. 89.)

[28] Jewkes, Sawyers, Stillerman, op. cit., p. 82.

[29] Hearings on Economic Concentration, Pt. 3, pp. 1081–83, testimony of Richard Stillerman.

In contrast to the cost of inventing, the cost of development may on occasion be quite large. It is perfectly evident that no small company—and few large ones for that matter—could match the expenditures by Du Pont of $27 million for the development of nylon, $25 million for Corfam synthetic leather, and $50 million for Delrin plastic. But these are extreme cases. For most innovations the development costs are not beyond the reach of medium-size and even many small firms. This is particularly true if, as there is reason to believe, the small firm can make its development dollar go farther than the large company.

In testimony before the Subcommittee on Antitrust and Monopoly, Arnold C. Cooper presented the results of a study of the development costs of large and small companies, from which he concluded that "a large company typically spends from 3 to 10 times as much as a small one to develop a particular product." [30] This remarkable conclusion was based partly upon 25 interviews in the New England area, principally with men who had managed development in *both* large and small companies, and partly upon cost comparisons of "parallel development projects" in which both a large and a small company had independently developed the *same* product. With respect to the former, Cooper stated:

"Those men I have talked to who have managed development in both large and small companies are, on the whole, extremely outspoken in their belief that substantial differences exist in the efficiency of development activities between large and small companies. (The typical man in this category had been a section head or department head in the development organizations of one or more large companies, usually with at least several thousand employees, before leaving to go with a newly founded small firm, often in the same field.)"

Moreover, this inverse relationship was held to be true not only in a comparison of large versus small companies but *within* any company as it grew in size:

"Most of these men believed their development organizations to have become less efficient as their companies grew. * * *

Some of these men were most vivid as they spoke of the problems of inspiring and controlling their growing research organizations. The president of a firm which does contract development said, 'We're less efficient now than when we had only 50 employees, but I'm afraid we're not as inefficient as we're going to be when we grow even larger."

The director of research of a firm in the semiconductor industry spoke of the changes in the atmosphere he had observed as the firm grew from total personnel of about 20 to over 4,000.

He said, 'I wish I knew what to do to create the same kind of atmosphere we had when we were small. No one really cares as much anymore.'"

Interviews were also held with officials who had worked only for large companies: "Most of these men considered their own companies to be less efficient than smaller competitors in developing new products." The same conclusion was reached in studies of parallel product development projects, particularly one involving the independent development of a new protective coating by a small and a large company.[31] The former was one of the smallest firms in its segment of the chemical industry, with about 50 employees and a research department consisting of 2 chemists. The large company had over 20,000 employees, with over 500 (including some 50 chemists and technicians) in its protective-coating division alone. For the small company the total direct cost was estimated at $1,400 and the time involved at less than 12 months. For the large company, which, incidentally, started its project after the small firm had put its product on the market, total direct costs were nearly 8 times as much ($11,000), and the time consumed was 38 months.

Cooper attributed the better showings of the smaller firms primarily to their ability to attract people who were technically competent and creative, who had the ability to see "the core of a problem," and who were motivated by an intense personal drive to achieve solutions:

"In many small companies, the technical staff consists of only a handful of engineers, all of whom might be described as 'highly visible.' The president of one small research-based firm said, 'we're so close to each other, it's hard not to know what each individual engineer is doing.' In addition, the managers of many small companies, particularly if the situation is a bit precarious, often feel they cannot afford to have people on the payroll who are poor or barely average. Thus, in the interviews held with many small company R & D managers, in-

[30] Ibid., pp. 1296–1304, testimony of Arnold C. Cooper.
[31] In order to protect the companies, the product was described only in general terms.

stances came to light of technical people having been fired simply because they were not quite good enough."

A second and related factor is that the technical employees in a small company tend to be more "cost-anxious." The company is not some vast amorphous organization whose earnings are not affected significantly by the cost of its R&D organization. Excessive expenditures on technical development in the small company can mean the end not only of its R&D effort but of the company itself. Neither the resources nor the opportunities are available for the ostentatious display of status. As Cooper observed,

"The small company is less likely than the large company to suffer from the propensity of engineers to order laboratory equipment they really could get along without and from the effort of individuals to obtain laboratory assistants or secretaries, more to demonstrate their status than because of a real need. An executive of one large electronics firm ruefully remarked, 'People often have the attitude, "there's more where that came from," so that every engineer wants his own oscilloscope, and every section head wants two filing cabinets.'"

Finally, problems of communication and coordination tend to be more serious in the large company. In the field of product development the competent technical man must be sensitive simultaneously to the needs of the market for which the product is being developed and to the production facilities available to manufacture it. The difficulties of trying to secure such awareness within the large company were described by one R&D director as "monumental." The differences between large and small companies were illustrated in Cooper's testimony by the example of protective coatings:

"In the small firm, the chief chemist worked about 10 feet from the door to the plant and usually had samples made up by production personnel who would use temporarily idle production facilities. If there were production problems, he often worked with the plant superintendent to help solve them. In the sales area, he was in frequent contact both with company salesmen and with customers, inasmuch as a great deal of his time was spent in devising special formulations to meet the needs of particular customers. He also spent a great deal of time in customers' plants, helping them to use these formulations.

"In the large company, the project chemist had his samples made up by laboratory technicians on special laboratory equipment. Although he had been in the company's and in customers' plants, his principal duties centered on the development of new products in the company's research center.

"The difference in familiarity with sales and production problems was an important factor in the great disparity in development costs incurred by the two companies. In the small company, there were absolutely no problems in "transferring the new product to production," since even the earliest samples had been made by production personnel on production equipment. The chief chemist, with his great sensitivity to market preferences, developed only a limited number of formulations (each of which could be modified). He actually turned down requests to develop certain special formulations for which he thought the market would be inadequate.

"In the large firm, the transfer of the product to production was extremely difficult, inasmuch as the chemist had utilized processing methods which were unrealistic under factory conditions; many months had to be devoted to solving this problem. In addition, the project chemist had developed a large number of formulations, each in response to a request from some prospective customer. Management later simplified the line (to about the same number of formulations as had been developed by the smaller firm) because of lack of potential for the other formulations."

INVENTION IN THE MOST CONCENTRATED INDUSTRIES

If smaller companies are barred from conducting research and development by its expense, the leaders in conceiving and adopting new processes and products should logically be the large corporations in the most concentrated industries. To quote Richard Stillerman, "If monopoly power gives a firm the stability, financial resources and ability to retain the benefits of its research, then we should find that the more concentrated industries are the most reserach oriented and technically progressive." There is little in the evidence, however, to support such a presumption. As Stillerman noted,

In the United States, the most concentrated industries are aircraft propellers, primary aluminum, locomotives and parts, cyclic (coal tar) crudes, flat glass, electric lamps (bulbs), telephone and telegraph equipment, safes and vaults, soap and glycerin, gypsum products, chewing gum, carbon and graphite products, re-

claimed rubber, primary copper and steam engines and turbines. Not all of these industries are regarded commonly as pacemakers in technology; some spent little on research. If we rank certain major industry groups from highest to lowest concentration, it is difficult to argue that they retain the same ranking in terms of their interest and accomplishments in research. Clearly particular industries of low concentration such as apparel and furniture are not research conscious, but neither are such concentrated industries as tobacco and dairy products. Some industries of relatively low concentration, notably scientific instruments, insecticides and fungicides, and plastics materials are technically active."

Citing reports of the Monopolies and Restrictive Practices Commisson, Stillerman pointed to the laggard's pace set by the more concentrated industries in Great Britain. For example, although the British Oxygen Company Ltd. long held a near monopoly on oxygen and acetylene, it had no research department until 1945 and pioneered none of the major inventions in its field.[32] Among the most concentrated of the British industries is matchmaking, which still uses the conventional process adopted in the nineteenth century and whose leading firm, British Match Corps Ltd., not only does not conduct research but has discouraged it among other machinery makers.[33]

In the United States the performance of our single most concentrated major industry—primary aluminum—also constitutes a striking refutation of the argument. Although a few producers were added after World War II, primarily through the disposition of government-built surplus plants, the industry now numbers only 7 producers, and its 4 largest firms account for over 95 percent of its value of shipments.[34] Many new processes and products involving aluminum have been developed, but according to a study by Merton J. Peck, few have come from the primary-aluminum producers.[35] Of 52 inventions that he recorded relating to the joining, or welding, of aluminum, only 6 came from the aluminum producers. The largest source was equipment manufacturers—a far less concentrated area—which were responsible for 26. When the analysis is limited to "major" inventions, the conclusion remains the same: "The origin of these apparently more major inventions corresponds roughly with the results obtained from the counting of the inventions, with one each coming from a British equipment maker, a domestic equipment maker, an end-product manufacturer and one jointly from an end-product manufacturer and a primary producer."

The idea for the "most significant" invention in this area, the Koldweld process, came from a Royal Air Force officer who, upon observing that a weld sometimes occurs between two sheets of copper cut with dull sheers, sought to establish the conditions under which such a weld would regularly take place. Peck recorded 76 inventions in the conversion of the aluminum ingot into semifinished forms for use by the end-product manufacturers; only 10 of these came from the primary-aluminum producers. Again the equipment makers were the most important source, with 37 of the inventions, followed by independent fabricators with 13. The 3 major inventions in fabricating technique originated abroad during World War II. Johannes Croning, a German engineer, was responsible for the most important, shell molding, which utilizes a plastic shell rather than the more expensive metal die or mold. Also during the war, German aircraft firms built 4 extremely large forging presses, which could form entire aircraft subassemblies, thereby reducing the number of parts while simplifying and increasing structural strength. An Italian engineer invented a continuous casting process for aluminum, which permits a single machine to convert aluminum ingot directly into redrawn rod, eliminating a number of intermediate steps (and the equipment for them): 'None of these inventions were introduced in the United States by the primary producers, which is consistent with the relatively limited role of these firms in the invention of fabricating techniques." [36]

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[32] London, Monopolies and Restrictive Practices Commission, Report on the Supply of Certain Industrial and Medical Gases, 1956.

[33] London, Monopolies and Restrictive Practices Commission, Report on the Supply and Export of Matches and the Supply of Matchmaking Machinery, 1958.

[34] "Concentration Ratios in Manufacturing Industry," 1963, p. 25.

[35] Hearings on Economic Concentration, Pt. 3, pp. 1438–50, testimony of Merton J. Peck.

[36] In addition Peck recorded inventions in the finishing of aluminum and in aluminum alloys. The primary producers played an even less important role in the former but were responsible for most of the new alloys. Both, however, were special cases. Finishing is of importance primarily to the aircraft industry and is therefore "a less valid test for the relative role of different classes of invention," while in the development of new alloys, firms other than the primary producers "do not have access to the technology and cannot realize direct and immediate gains from such inventions."

Finally, Peck examined inventions relating to new product uses for aluminum, which "are too numerous for listing" but include such items as low-tension electrical wire, store fronts, lighting fixtures, window frames, wall panels, shelving, refrigerator shelves, and irrigation pipe. While important in expanding the use of aluminum and occasionally calling for the solution of difficult technical problems, these developments represent "less of an advance in the state of the arts." And, although the primary producers have been "important contributors to this kind of technical change," nonetheless "the end-product manufacturers are the major sources of these inventions."

RECENT INVENTIONS

As a depiction of the present-day inventive process, the Jewkes study has been criticized on the grounds that by including inventions made in the early years in this century, it gives undue weight to the era predating organized scientific research. C. Freeman has contended that if the study had been confined to a more recent era, the discoveries made by the large corporations would form a larger proportion of the total.[37] After surveying more recent studies and adding 10 additional case histories of new discoveries, Jewkes, in the second edition of his study, rejects the argument:

"* * * the most recent evidence does not support Freeman's suggestions. Hamberg, in his study of inventions emanating between 1946 and 1955, finds that of a total of twenty-seven, twelve originated in the work of independent inventors. Among the case histories which we have added to this volume there are a number of the more important—oxygen steel-making, the Hovercraft, Computers, the Wankel engine, the prevention of Rhesus Halmalytic Disease, chlordane and associated chemicals, Photo-typesetting—which cannot be attributed mainly to large institutions. We think this is also the correct interpretation with other recent innovations: the Maser and Laser, the Tunnel Diode, the Fuel Cell, certain of the tranquilizer drugs and the Auto-Analyses."[38]

In addition to Jewkes's new case histories, Hamberg's study for the 1946–55 period,[39] and studies for individual industries, the record of the Senate Antitrust Subcommittee contains a considerable body of information relating to the sources of invention and innovation. Included in this material are case histories of important inventions of fairly recent origin—the "wonder drugs," aircraft, the turbojet engine, rocketry, xerography, the mercury dry-cell battery, and the "continuous mix" baking process. In these cases, which are summarized below, the role of the large corporation was, at best, that of providing financial assistance to university-based scientists and aiding in the later stages of development work; at worst, it was a record of indifference and even hostility.

"Wonder drugs"

A voluminous body of information relating to the discovery of new products was secured in the investigation of the drug industry conducted by the Subcommittee. It is a little-recognized fact that most of the truly original breakthroughs in drugs—discoveries that have led to the creation of the whole classes of new drugs— have come from the work of individual scientists who were *not* staff employees of any private company. In the three classes of so-called wonder drugs that were examined by the Subcommittee (corticosteroids, tranquilizers, and antibiotics), the original breakthroughs came from creative individuals and not from organized or group research.[40] This is true even in those cases where the research was conducted in universities or clinics but financed by major drug companies, which, in addition, often provided other forms of assistance.

Corticosteroids, used in the treatment of rheumatoid arthritis and many other ailments, stem from the discovery of the use of cortisone by Philip S. Hench of the Mayo Clinic, who was aided by financial and other assistance from Merck & Company. As is usually the case in drugs, once the original discovery had been made,

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[37] Thus Freeman's argument is that if the line of 61 inventions studied in the original Jewkes study are divided into two groups—those before and those after 1928—the very large organizations show a better performance record in the later than in the earlier period (see C. Freeman, "Research and Development in Electronic Capital Goods," National Institute Economic Review, November 1965).

[38] Jewkes, Sawers, Stillerman, op. cit. (rev. ed.), pp. 208–209.

[39] See footnote 26.

[40] With respect to the fourth category, oral antidiabetics, not enough is known concerning the sources of discovery of the most important product in this group, tolbutamide, which was first marketed and patented by the Hoechst Co. of Germany.

modifications were soon made by a number of manufacturers. Eminent medical authorities appearing before the Subcommittee agreed that some of the early modifications, notably prednisone, were distinct therapeutic improvements over the original product, but they were skeptical as to whether the later variants represented any further advance.[41]

The Subcommittee examined the origins of both the potent and the mild tranquilizers, as well as the closely related product reserpine. A French anesthetist, Laborit, had the original idea that led to the development of the potent tranquilizers. He had observed that certain antihistamines (which are drugs used in the treatment of hay fever, hives, and other allergic diseases) had the undesirable side effect of inducing drowsiness. Acting on the idea that what was undesirable in an antihistamine could be useful in an anesthetic, he commissioned the French drug manufacturing company Rhone-Poulenc to develop a phenothiazine compound in which the antihistaminic properties would be reduced to a minimum and the sedative properties maximized. The product Rhone-Poulenc came up with was chloropromazine, sold in this country as Thorazine. Laborit used it in anesthetizing, and a short while later two French psychiatrists, Delay and Denicker, at the University of Paris, as well as Heinz Lehmann at the Verdun Protestant Hospital in Montreal, used it to calm or "tranquilize" the mentally ill. Although many modifications were subsequently introduced, both here and abroad, Lehmann, author of the first publication in the English language on tranquilizers, testified: "There hasn't been a very much better one than the very first ones that came out in the six or seven years of frantic research since then."

The widely used mild tranquilizer meprobamate (sold principally under the trade names of Miltown and Equanil) is the discovery of Frank M. Berger, who became vice president of Carter Products. Born in Czechoslovakia, Berger found refuge during World War II in Great Britain. While searching for a preservative for penicillin, he noted that a mouse injected with one of the compounds would, if placed on its back, be unable to right itself for over an hour. Either the mouse was too relaxed to care, or its muscles were too relaxed to move. He then began an intensive examination of muscle relaxants and hit upon mephenesin in 1946. Coming to the United States after the war, he joined the staff of Wallace Laboratories Division of Carter Products and continued his work on muscle relaxants, the result of which was meprobamate, a derivative of mephenesin. Berger held it to be superior to mephenesin in that it had a more intense effect, induced effects of longer duration, and had fewer side effects.

The discovery of reserpine, used as a tranquilizer and in the treatment of hypertension, represents an amalgam of long usage, independent research by Indian scientists, and organized research in an international drug company. Reserpine is a derivative of the rauwolfia root, which has been used for centuries in India for ailments ranging from insomnia and headaches to fevers and snakebite. In the early 1930's the active ingredients were isolated by two Indian chemists, and evidence was published in 1933 by an Indian physician demonstrating that crude rauwolfia had remarkable abilities to produce sedation and lower blood pressure. As a result of work they had been conducting off and on for several years, the laboratory staff of the Swiss drug firm CIBA isolated serpentine in 1950, something the Indians had already achieved, and a year later succeeded in extracting reserpine from the brown muddy fraction that remained.

The discovery, early development, and initial testing of penicillin represent the very antithesis of purposeful, directed, organized research.[42] Modern antibiotics had their origin in a classic example of serendipity—a chance and perspicacious observation in September, 1928, by Alexander Fleming in St. Mary's Hospital of London. In Fleming's own words:

"While working with staphylococcus variants a number of culture plates were set aside on the laboratory bench and examined from time to time. In the examinations these plates were necessarily exposed to the air and they became contaminated with various micro-organisms. It was noticed that around a large colony of a contaminating mould the staphylococcus colonies became transparent. * * * It was found that broth in which the mold had been grown at room

[41] Hearings on Administered Prices, Pt. 16, pp. 9024–34, 9040–89, testimony of Heinz Lehmann; ibid., pp. 9034–38, 9049–89, testimony of Fritz Freyhan.

[42] See Federal Trade Commission, "Economic Report on Antibiotics Manufacture," 1958, App. 2, "Discovery and Development of Penicillin," pp. 302–54.

temperature for 1 or 2 weeks had acquired marked inhibitory, bactericidal and bacteriolytic properties to many of the more common pathogenic bacteria." [43]

For the next decade little was done to develop the implications of the original observation. In the 1930's H. W. Florey, professor of pathology at Oxford University, became interested in another Fleming discovery, known as lysozyme, but soon concentrated his research on penicillin. Aided by a grant of $5,000 from the Natural Science Division of the Rockefeller Foundation, Florey and Chain were successful in establishing in 1940 the remarkable therapeutic properties of penicillin in mice and other animals. They were able to show that penicillin was not toxic, that the white blood cells were unaffected, that the activity of penicillin was not affected by pus, blood, or the number of bacteria present, and that it was absorbed after injection. In later writings Florey has emphasized that this early scientific work antedated any thought of large-scale usage:

"Although in the application [to the Rockefeller Foundation] the possible practical results were brought forward, the research was conceived of as an academic study with possibilities of wide theoretical interest, both chemical and biological. Statements have appeared from time to time that the work on penicillin was started as an attempt to contribute to the treatment of septic wounds in World War II. This is quite erroneous, as the work was planned well before the outbreak of war, and in any case there was then no idea that penicillin could play the important part which it has done in the treatment of war injuries." [44]

Despite the promising results of their animal testing, Florey and his associates continued to be beset with difficulties. With their own resources and existing methods they were unable to produce enough penicillin to make possible adequate clinical testing in man, and without the results of such clinical tests they were unable to obtain the assistance of drug companies. Referring to further animal tests carried out in May and June, 1940, Florey stated, "The enthusiasm of the Oxford workers was believed by many to be premature and though an approach was made to a commercial firm, this firm and others who might otherwise have helped in the project were overburdened with war work." [45] Armed with the results of a few tests on humans as well as their animal investigations and aided by a second grant of $5,000 from the Rockefeller Foundation, Florey came to the United States to secure assistance in finding ways and means of increasing production:

"Florey * * * visited a number of drug firms in the United States and Canada with a request which now looks modest but at the time seemed formidable—to brew 10,000 liters of culture fluid and extract the pencillin, so that more clinical trials might be made at Oxford. None of the information which had been accumulated at Oxford was withheld. Though certain of the firms thought the matter worth attention, a number of them showed little interest, and some none at all. Amongst the first to tackle the problem seriously were Merck & Co., Inc., E. R. Squibb & Sons, and Chas. Pfizer & Co., Inc." [46]

But the greatest assistance came from experts with long experience in mold fermentation stationed at the Northern Regional Research Laboratory of the U.S. Department of Agriculture at Peoria, Illinois. These experts contributed the ideas that made possible the subsequent great expansion in penicillin output, principally the idea of using cornsteep liquor as the medium of fermentation and the idea of producing penicillin in deep culture in the revolving drums used for gluconic acid and other fermentations. From this point on, most of the work on penicillin consisted of refining and improving the application of these methods of production and of accumulating additional information concerning the drug's behavior in man. In this developmental stage important contributions were made not only by the Northern Regional Research Laboratory but by drug companies in both the United States and Great Britain. By May 1944, production of penicillin in the United States was sufficiently great not only to meet the needs of the armed forces of the Allies but to permit limited sale through hospitals. For a few years following the war the discoveries of new antibiotics came thick

[43] Quoted in ibid., p. 303.
[44] Quoted in ibid., p. 308.
[45] Quoted in ibid., p. 310. Some idea of the straits to which they were reduced in their efforts to increase production is provided by their reliance for fermentation vessels upon old-style bed pans. But even here their efforts to obtain 600 of these vessels were frustrated when it was found that they had been replaced by a more modern streamlined structure without the lid that was necessary for fermentation.
[46] Quoted in ibid., pp. 314–15.

and fast as the recognition grew that nature provided a multitude of molds. Following penicillin came the discovery of streptomycin by Selman Waksman at Rutgers University, with the assistance of Merck & Company, and of chloramphenicol (Chloromycetin) by Paul Burkholder at Yale University, with the aid of Parke, Davis. These were followed by the tetracycline family—chlortetracycline (Aureomycin), oxytetracycline (Terramycin) and tetracycline, each of which came from the laboratories of the large U.S. drug companies. Although their importance cannot be minimized, the discovery of new molds in nature, while undoubtedly time consuming and costly to the companies in terms of laboratory and clinical testing, hardly falls in the same creative category as the pioneering work of the Oxford scientists and the Peoria Laboratory.

Aircraft

In their recent book Ronald Miller and David Sawers, after surveying the history of invention in aircraft, conclude:

"Invention within the aircraft industry is most noticeable for its absence. Of all the major inventions made in the past half-century, only those of two types of flap can wholly be credited to the employees of aircraft manufacturers. The institutions that have been most productive of inventions are the universities and government-financed research institutes—especially in Germany—while about a quarter of the inventions have come from inventors with no institutional backing."[47]

In view of the vast sums that reportedly are spent on aircraft research and development, such a conclusion seems startling. But, in the view of Miller and Sawers, these amounts are spent mostly on development and production, while very little goes to research. Moreover, much of what is spent on development comes from government agencies, such as the National Advisory Committee for Aeronautics, whose primary function since World War II appears to have been pursuing development work on ideas originated before and during the war by German scientists. As Sawers testified,

The result was by the end of the war in 1945 German designers had built or were testing nearly all the ideas that have been incorporated in American aircraft in the past 20 years; these included the swept-back wing, the delta wing, the wing with variable sweepback, the area rule and forged wings spars. The contribution of the National Advisory Committee for Aeronautics was to develop many of these ideas, notably the area rule and variable sweepback until they could easily be applied by manufacturers.[48]

The fountainhead of German aerodynamics knowledge was the research center at Göttingen University, long headed by Ludwig Prandtl. This center "provided a unifying influence as well as scientific inspiration, for most [German] designers had studied there."[49] Its purpose was to achieve an understanding of the laws of aerodynamics and to create aircraft designs that were in accord with this developing body of scientific knowledge. Speaking of the accomplishments that flowed out of Göttingen, Miller and Sawers observe:

"later in the decade [of the 1930's] a new generation of designers came to the fore in Germany, products of Gottingen and the gliding movement. These men better appreciated the lessons they could learn from science than their predecessors or designers in Britain and the United States, who remained practical men in the tradition of the industry. So Germany quickly attained a lead in design when understanding of recent aerodynamic research—mostly done in Germany—because essential to the designer, as it did in the development of transonic and supersonic airplanes during the war. Only the military defeat of Germany in 1945 prevented the German industry from becoming as dominant as the American industry is today."[50]

In their listing of important aircraft inventions, the two most recent are the swept-back wing and the variable-sweepback wing. At an international conference on aircraft design in 1935, Adolph Busemann of Göttingen suggested that sweeping back the wing would ease the problem of drag encountered at speeds

[47] Ronald Miller and David Sawers, "The Technical Development of Modern Aviation," Routledge and Kegan Paul, 1968, p. 246. Emphasis added. For a summary of their work see the statement by David Sawers in Hearings on Economic Concentration, Pt. 3, pp. 1505–08.

[48] Hearings on Economic Concentration, Pt. 3, p. 1505.

[49] Miller and Sawers, op. cit., p. 169.

[50] Ibid., p. 247.

near or above the speed of sound. A further contribution was made in 1939 by Albert Betz, also of Göttingen, who pointed out that the really significant reduction in drag comes when the wing is swept back enough to maintain subsonic flow over the leading edge.[51]

In endeavoring to develop designs for supersonic speeds the Germans were not inhibited, as were British and American scientists, by wind tunnel tests which seemed to indicate that drag would increase so sharply with rising speed as to prevent an airplane from reaching the speed of sound. In a wind tunnel the model of an airplane must of course be mounted on a support; it was the manner in which the model was mounted that gave rise to the rapid increase in drag. As the Germans had learned, the problem disappears when the model and its support are properly mounted.[52]

The most recent invention listed by Miller and Sawers, the variable-sweepback wing, is also of German origin. Alexander Lippisch received a secret German patent in 1941 for a swept-back wing that could be moved forward for lower speeds and backward for supersonic speeds. Such a wing would gain the advantages of a swept-back wing at high speeds, while overcoming its poor handling qualities at low speeds. Because of its obvious conceptual advantages such a wing was incorporated in Boeing's winning design for the American supersonic transport plane, but because of mechanical problems it subsequently had to be abandoned in favor of a fixed wing.

Regardless of how far back one goes in the listing of aircraft inventions, the contributions of the large enterprises remain conspicuous by their infrequency. In the words of Miller and Sawers, "For a science-based industry the aircraft manufacturers—especially in Europe—show surprisingly little interest in research." [53]

The turbojet engine

Although not the first to conceive of a turbojet engine, Frank Whittle of Great Britain supplied much of the scientific knowledge and engineering skill required to transpose the idea into a working mechanism.[54] The idea first appeared to Whittle in 1930, when he was a junior officer in the Royal Air Force. But his initial efforts to interest the large manufacturers of aircraft engines and industrial steam turbines were completely unsuccessful. Their reasons for rejection were the absence of sufficient knowledge in the underlying sciences of metallurgy and engine design plus the inability of existing airframes to use such a high-speed mechanism. Whittle dropped his idea and even let his basic patent lapse.

It was not until 5 years later, when Whittle was studying engineering at Cambridge University, that an old acquaintance heard of the turbojet and became convinced of its merits. Through this friend limited financing was obtained, and a new company, Power Jets Ltd., was founded in 1935 with about $10,000 in cash. In his study of the history of the turbojet, Robert Schlaifer credits Whittle with having been largely responsible "for setting the sound general management policies in regard to development which were followed by Power Jets Ltd. and without which no amount of scientific ability could have brought success."

Despite the growing menace of Hitler's Germany during the late 1930's, the British government gave the project only the most nominal assistance.[55] During this period the total amount raised by Power Jets was only some $83,000 from private sources, supplemented by about $16,000 from the government. It was not until the middle of 1939 that, on the basis of the work done by Power Jets, the government became convinced of the practicality of the turbojet and only then did the project begin to receive adequate financial assistance. Summarizing the history of this development Schlaifer states:

"There can be no question but that, if the new firm of Power Jets had not been formed and financed with funds no part of which came from the aircraft indus-

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[51] Ibid., pp. 24, 167.
[52] Ibid., p. 168.
[53] Ibid., p. 249.
[54] Hearings on Economic Concentration, Pt. 3, pp. 1230–39, testimony of Robert Schlaifer. See also his "Big Business and Small Business," Harvard Business Review, July 1950.
[55] During this same period the German government was seeking to promote work on the jet engine. According to Schlaifer, "In Germany the earliest development was begun in 1936, just about the date at which development began in Britain, and was due to two manufacturers of airframes. At least one of the regular producers of engines had considered jet propulsion as early as 1930 but had rejected it for the same reason that the British engine producer mentioned above rejected it in that same year. As late as 1938–39 it required considerable pressure from the German Government to persuade the engine manufacturers to enter the new field."

try, the development of turbojets in Great Britain would have been delayed by at least five years. The same delay would have occurred in the United States, both because the first flyable turbojets produced in this country were almost exact duplicates of an imported Power Jets engine and even more because the spark which set off the intensive development of powerjets of native American design was the knowledge that such engines had actually flown in Britain."

Interestingly, the frustrations encountered by Whittle had their historical parallel a quarter of a century earlier in the difficulties faced by the developer of the air-cooled aircraft engine—a small American firm, Lawrence Aero Engine Corporation. Founded in 1917 with a capitalization of only $50,000, it had neither production experience nor manufacturing facilities. What it did have was vision, ability, and persistence in the person of its founder, president, and chief engineer, Charles L. Lawrence. Only 2 years after its formation, the firm had brought out a design for a 3-cylinder engine of about 60 horsepower and obtained backing from the Navy Department to finance the development of a 9-cylinder engine of around 200 horsepower. Only 3 years later the Navy, which had become convinced of the superiority of air cooling over liquid cooling, began putting the larger engine into actual service.

As is generally true of procurement agencies, the Navy preferred to deal with one of the large established companies, which in this industry consisted only of the Curtiss Aeroplane & Motor Company and the Wright Aeronautical Corporation. However, to quote Robert Schlaifer, "From 1919 to 1922 the Navy's efforts to interest these two companies in the project failed completely." Preoccupied with its efforts to build a high-powered version of the old liquid-cooled engine, Curtiss's management "flatly refused to divert any time to a side issue which might delay the attainment of the major goal." If Schlaifer's words, "There can be no doubt that if the Navy had been forced to rely on the two large firms in the industry, the development of this type of engine would have been delayed by 5 years at least."

Rocketry

The space ships of today and their military counterpart, guided missiles, can be traced directly to the work of one man, Robert H. Goddard. In 1935, a 22-foot rocket he had designed, engineered, and personally built reached a height of 7,500 feet. What is remarkable is not so much the height attained as the nature of the vehicle that reached it. In the words of Goddard's biographer, Milton Lehman, the discoveries incorporated in this rocket "led the way to virtually every modern rocket—from V–2 to sputnik to Gemini to the ionized and nuclear and solar propelled rockets of tomorrow." [56]

It is well recognized that today's space ships and guided missiles represent refinements, elaborations, and improvements of the German V–2 rocket of World War II. What is not so well known is the extent to which the German missile was itself a product of Goddard's earlier work. On this point Lehman testified:

"In Germany Goddard's work stimulated Herman Oberth, and led us directly as an arrow to the technological accomplishments of Dr. Wernher von Braun at Peenemunde and years later at Huntsville, Alabama. It led far more directly to Dr. von Braun's work than Americans—almost all of us have been informed or are likely to be informed by the German expatriates. For Goddard's work did underlie the German's rocket development in World War II—entirely and fully."

Remarkably similar to the smaller German V–1 rocket was a Goddard patent that had been published in the German aviation journal *Flugsport* on January 4, 1939—5 years before the first buzz bomb fell on London.[57] A diagrammatic comparison between the 46-foot German V–2 of 1943 and the 22-foot Goddard rocket of 1939 also reveals striking similarities.[58] On inspecting a captured V–2 in March, 1945, one of Goddard's crew was quoted by Lehman as saying, "Of course it was more elaborate and much larger than the rockets we'd wokred on, but it seemed extremely familiar—the injection feeding system, the pump assembly, the general layout. The only thing that looked at all new to me was the German design of their turbine."

For over 30 years Goddard had been making public his work through patents and scientific papers. He was awarded over 200 patents on rockets, each of which

[56] Hearings on Economic Concentration, Pt. 3, pp. 1311–33, testimony of Milton Lehman. See also his This High Man, The Life of Robert H. Goddard, Farrar, Straus, 1963.
[57] Ibid., p. 1519, exhibit by Milton Lehman.
[58] Ibid., p. 1523, exhibit by Milton Lehman.

contained a description of the invention. Among his scientific writings one of the most interesting is a monograph, *A Method of Reaching Extreme Altitudes*, published in 1919 by the Smithsonian Institution. Here he asserted in a footnote that it was mathematically possible for a rocket, light in weight and heavy in fuel, to reach the moon. Two of his patents, issued in 1914, introduced features basic to all future rocket development: the use of a combustion chamber with a nozzle; the feeding of propellants, liquid or solid, into the combustion chamber; and the principle of the multiple-stage or step rocket. With respect to the last, he asserted in his patent: "What I do claim is * * * in a rocket apparatus, in combination, a primary rocket, comprising a combustion chamber and a firing tube, a secondary rocket mounted in said firing tube, and means for firing said secondary rocket when the explosive in the primary rocket is substantially consumed." [59]

Goddard combined in one person research scientist, inventor, and innovator. He conceived the ideas of the essentials of rocket flight, invented the necessary items of hardware, and put them together in a workable vehicle. In addition to the design of the combustion chamber, the method of feeding propellants, and the principle of the multiple-stage rocket, other essential features of modern rocketry that originated with Goddard include the use of liquid fuel in the form of hydrogen or oxygen, movable vanes worked by gyroscope to control the flight, the cooling of the combustion chamber by the circulation of a liquid around the inside of the chamber (curtain cooling), and the design of a pump to force-feed the liquid fuel and oxygen into the combustion chamber. Where he could not purchase a necessary item, Goddard made it in his own workshop. Over a 40-year period the total amount available to him was only $250,000, out of which had to come the salary of his crew, the cost of his hardware, and the fees for his patents, as well as the maintenance of his household. The sources of these funds were his salary as a professor plus small grants from the Smithsonian Institution and the Guggenheim Foundation. Not only did the armed services fail to provide any financial assistance; they repeatedly rejected Goddard's efforts to interest them in rockets as an instrument of warfare.

The record of support by industry was no better. Although the Linde Air Products Company had a plant in Goddard's home town of Worcester, Massachusetts, it refused to sell him the small quantities of liquid oxygen he needed at a price he could afford to pay. His requests to Ingersoll-Rand and Worthington Pump for a powerful miniature pump were turned down on the grounds that the cost was too great and that there was no ready market for such a device. At a conference of Du Pont engineers arranged by Goddard's supporter Charles A. Lindbergh, the idea of a rocket was dismissed as impractical: "A rocket, however used, would generate such enormous heat and pressure that its combustion chamber would require a heavy lining of fire brick. To elevate a load of fire brick into the atmosphere—this, of course, was impossible." As Lehman commented, "While U.S. industry gave Goddard few assists, the inventor assuredly gave many to industry. His creative vision, reduced to sound and workable patents, became the basic foundation of every corporate and missile manufacturer in the country today, who tend to pay their respects to the inventor through stuffy industrial rocket banquets from time to time."

Xerography [60]

The inventor of electrophotography, or "xerography," was a patent attorney, Chester Carlson. His interest in better methods of copying was aroused by the very nature of his work; patent attorneys are in constant need of copies of documents and drawings. In his words, "There was no convenient method for obtaining them. It involved completely retyping a manuscript, or sending a drawing out to a photocopy firm. I thought how fine it would be if one could feed an original into a small machine, just push a button, and get out a copy." [61]

Like many other inventors, he made a deliberate decision to ignore existing technology—as he put it himself, "Who was I to compete with Eastman Kodak?" In a relatively short period of time he hit upon the approach of using electrostatics and photoconductive materials. The idea, as he perfected it, called for a plate consisting of a conductive base covered by a layer of photoconductive insulation. Upon the insulation, he would first place an electrostatic charge.

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[59] Quoted by Lehman in ibid., p. 1316.
[60] Hearings on Economic Concentration, Pt. 3, pp. 1108–11, testimony of Daniel V. DeSimone.
[61] Quoted by Daniel V. DeSimone in ibid., p. 1109.

Then the positive image of whatever was to be reproduced would be projected on the charged plate. Wherever the light impinged, the charge would drain off. Next, the plate would be dusted with a special powder and gently blown so that the only dust remaining was that which adhered to those areas of the plate that still retained the electrostatic charge. This dust would then be affixed to paper and the paper heated, resulting in a permanent copy of the original. On October 22, 1938, in a room behind a beauty parlor in Astoria, Long Island, he transferred the words "10–22–38 Astoria" from one piece of paper onto another.

Seeking aid to develop his invention, Carlson went to more than 20 companies and, as he puts it, "was met with an enthusiastic lack of interest." He was turned down by IMB, among others, who felt that the idea was not worth the risks. In 1944 the Battelle Memorial Institute agreed to take on the development work, for which they were to receive 60 percent of the proceeds from the invention. Battelle in turn located a businessman who manifested real interest in the invention—Joseph C. Wilson, who had just become president of the Haloid Company, a small concern with a yearly net income of only $100,000. In Wilson's words, "We were able to convince Battelle that we would run with it and not put it on the back burner. They were soured on big companies and had about decided to give it to a small company, even if it looked like the wrong choice on paper." [62]

Wilson brought to the project that indispensable ingredient of entrepreneurial enthusiasm without which many inventions might still be languishing. As is the case with most radical new departures, the road from success in the laboratory to profits in the market was long and arduous. On more than one occasion Haloid came close to the abyss. It was not until 1960 that the first xerographic copier was marketed for office use, 25 years after Carlson had "reduced his idea to practice." It has been estimated that by mid-1966 Battelle had received some $60 million (in cash and stock) under its agreements with the Xerox Corporation. Carlson's share of Battelle's receipts had accumulated to roughly $24 million.

The mercury dry-cell battery [63]

The importance of the mercury dry cell lies in the small but numerous changes it has brought about in lifestyles. It is the source of power for portable radios and similar devices, for hearing aids, for electronic watches and cameras, for synchronizing devices that pulse the heart, and for numerous other items. It was the creation of an independent inventor, Samuel Ruben, who has also been responsible for many other inventions, including the solid-state rectifier and the dry electrolytic capacitator—both items of widespread use.

Its predecessor, the zinc-carbon dry battery, suffered from a number of serious disadvantages—most notably, a relatively short "shelf life," particularly in hot, humid weather. What was needed to power portable radio receivers, transmitters, and the like was a long-life cell, capable of discharging high currents. During World War II the military demand for portable communications and mine-detecting equipment accentuated the need. Two weeks after Pearl Harbor, Ruben informed the Army Signal Corps through the National Inventors Council—which had made known the need for a cold-resistant dry cell—that he had the answer in the form of a low-ambient-temperature cell, which obviated the low-temperature problem.

But there remained the need for a high-current battery with a long shelf life that would operate in conditions of high as well as low temperature and humidity. The relatively rapid deterioration of the dry cells then available was the result of chemical reaction; gas would expand with rising temperature, quickly destroying the cells in hot climates. Opening the cells would let in moisture, corroding the electrodes. On the other hand, hermetically sealing them would cause the rising gas pressure to rupture the container.

Ruben's mercury dry cell solved the gas and other problems. Among its features were long shelf life over a wide temperature range, very low internal gas pressure, and a very high ratio of output capacity to cell volume, which is essential to the miniaturization of batteries (e.g., in hearing aids and electronic watches). The invention has had the effect of broadening greatly the range and uses of battery-powered products.

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[62] Quoted by Daniel V. DeSimone in ibid., p. 1110.

[63] Hearings on Economic Concentration, Pt. 3, pp. 1106–08, testimony of Daniel V. DeSimone.

The "continuous-mix" process

Since time immemorial the process of bread making has defied substantial change.[64] It was only with the introduction of the "continuous mix" process that the long-embedded methods of the past gave way to technological progress. The history of this new process was described before the Subcommittee by Joseph P. Duchaine, president of Quality Bakers of America (QBA) and one of the nation's largest independent, single-plant bakers:

"For many years, Dr. John C. Baker, of Wallace & Tiernan, a noted cereal chemist, dreamed of a way to revolutionize this process. For many years he sought a way of accomplishing all of this which required from 5 to 6 hours or more, in a matter of minutes. He dreamed of a "continuous" mix process in which the ingredients would flow in a steady even stream into a mechanism which would properly and quickly blend and develop them into dough in small continuous amounts and result, therefore, in a continuous flow of dough ready for the pans." [65]

By the early 1950's Wallace & Tiernan had made sufficient progress in developing the process to announce that it planned to build a number of field models for experimental purposes. Among the large bakery corporations, Continental, General, American, and National each contracted for a unit. In addition, one was contracted for by the management cooperative of the independent bakers (QBA) and installed in Duchaine's plant in Massachusetts. As is usually the case with a new process, numerous "bugs" developed between the pilot-plant stage and commercial production. Although the large companies soon lost patience with the process and discontinued their experimental work, Duchaine persisted. In recounting his experience, he revealed that quality of dogged, stubborn persistence which seems to be unique to the small enterpriser and the individual inventor:

"It became a matter of personal pride with me and while my agreement with QBA covered only the cost of the equipment if unsuccessful, I spent a small fortune on my own in literally hundreds of experiments, wasted and destroyed dough, and upsets of my working force.

By fall of 1953, we really began to make progress and in the spring of 1954 we converted all of our white bread production to the new process.

* * * * * * *

"Despite the initial investment which today represents some $150,000 plus an equal amount for advertising, some 30 QBA members have installed the equipment, plus others who have the equipment on order, and it is my opinion that QBA members alone have risked a total of $8 or $10 million in the process.

I feel that this is an excellent illustration of the fact that smaller corporations are neither unwilling, incapable, nor undesirous of venturing into research and taking the risks involved."

The new process not only reduced the cost and time of manufacture but, according to Duchaine, produced a superior product: "Its uniformity and fine grain is noticeable and we advertise: 'Compare. No holes, no streaks, no poor end slices in Sunbeam Bread.'"

Today the continuous-mix process is widely used throughout the United States in the production of white bread. In addition to the Wallace & Tiernan process, a somewhat comparable method, the Amflow process, has been developed more recently by American Machine & Foundry and adopted extensively by chain-store and other bakeries. According to George Graf, general manager of QBA, the reduction of costs and uniformity of product made possible by these continuous processes have enabled many independent bakers to survive, and in some cases to expand their operations.

Mr. Duchaine went on to offer a few general observations concerning the contributions of large versus small bakeries to technological progress:

"* * * I can honestly say I know of no major or revolutionary research contributions to the industry by the large corporations. I am aware of the fact that Continental Baking Co. [the industry's largest producer] has a sizable research

[64] The historical method of bread making involves several separate and distinct stages. First a "sponge" is made containing the primary ingredients—flour, yeast, water, etc. This is allowed to ferment for several hours and then remixed with the balance of the ingredients. It is then passed through a series of machines to be divided and rounded. From there it goes to a complicated apparatus known as a "proofer," then to a molder, then to the steam proofer and finally to the oven.

[65] Hearings on Administered Prices, Pt. 12, 6527–31, testimony of Joseph P. Duchaine.

budget * * * I understand it averages over a half million dollars annually. I must presume, however, that the output of this department is devoted primarily to research on cutting costs and strengthening themselves in competition, for I know of no important direct industry contribution which has come from their research."

Instead, he held, it is the smaller firms, sometimes with the help of machinery manufacturers, who have been primarily responsible for innovations. For example, he cited the "brown 'n serve" process of baking, which has added new markets and increased the industry's sales; the process, according to Duchaine, "was developed by a very small bakery and promoted by General Mills." The slicing of bread was "first developed and exploited by smaller bakers before the big corporations took over." Other examples he cited were "the process known as hot sponges for better bread flavor"; the process known as "loose molding," which made possible the achievement of better grain and texture; new methods of truck loading; and new processes of packaging, registration, and wrapping.

Senator NELSON. Our final witness today is Professor Seymour Melman, Department of Industrial and Management Engineering, Columbia University, New York.

STATEMENT OF PROF. SEYMOUR MELMAN, DEPARTMENT OF INDUSTRIAL AND MANAGEMENT ENGINEERING, COLUMBIA UNIVERSITY, NEW YORK, N.Y.

Professor MELMAN. Mr. Chairman, due to the hour, I will summarize the statement which I would like to present for the record.

Senator NELSON. Your statement will be printed in full in the record. You may present it however you desire.

Professor MELMAN. The constitutional injunction that underlies the patent system is the one that permits the Congress to give special privilege to inventors and authors; special privileges which are to be given in the name of promoting science and the useful arts, and my remarks in the statement are addressed to this letter requirement.

For the application of science and the useful arts to the production technology, the consequent level of productivity and rate of productivity growth is a controlling aspect of any modern industrial economy.

The rate of productivity and rate of growth is a controlling aspect of any modern industrial economy.

The rate of productivity growth constitutes both the capability of a society for advancing the material well-being of its people, and also the limit on that capability.

There are well-defined requirements for advancing industrial productivity, in the form of resources, and decision process.

The controlling resources are the availability of capital and research and development, and the controlling decision process is one that drives the industrial firm to introduce new technology and design of products, and to production processes.

The reason for addressing these matters, Mr. Chairman, is that American industrial productivity which once operated at an annual growth rate of about 3 percent from 1965 to 1970, has altered sharply, and the rate of growth of industrial productivity from 1965 to 1970 was 2.1 percent, and became only 1.8 percent average annual rate of growth from 1970 to 1975, so in the period after 1965, the annual rate of growth of U.S. industrial productivity was not only the lowest ever recorded within the United States, it was also the lowest rate of productivity growth of any western industrial country during those periods.

What happened to the underpinnings of the productivity process in the United States?

First, with respect to the crucial resources, capital available for the advancement of productivity diminished sharply in the United States, from 1951 to the present day.

The after tax profits left in the hands of all U.S. corporations were a lesser sum than the annual new capital made available each year by the Congress to one agency of the Federal Government alone; namely, the Department of Defense, and by that continuing allocation of capital, the Federal Government, and one single agency of the Federal Government, became in fact the controller of the largest single block of capital in the American economy.

The disposition of capital in the United States is also revealed by examining the relation of capital use in the United States, with that of other countries, thus for the late 1960's, a U.N. study showed that military budget expenditure, the percentage of gross fixed investment was 52.8 percent in the United States, but only 14 percent in the Federal Republic of Germany, and 2.3 percent in Japan, so capital, the capital funds of Germany and Japan were and are overwhelmingly available in the service of the civilian economy, hence the production of consumer goods and services, and the production of further means of production should be underscored, Mr. Chairman, in whatever utility or political or military form, that the military enterprise may have, its products do not constitute a product of the ordinarily understood level of living, and neither can they be used for further production, hence the military enterprise produces an output that does not possess economic use value in the ordinarily understood meaning of those terms.

With respect to R. & D., here again, if the United States has devoted a lion's share of its resources to the military enterprise, hence the nonproductive economical products.

This is revealed in numerous forms of data contained in my formal statement, and it is noteworthy that the American performance is in stark contrast to that of Japan and of Western Europe, where the predominant research activity is on behalf of civilian products, civilian service.

I think it is noteworthy since previous testimony has given substantial attention to the steel industry, to take note of the position of the steel industry as shown in exhibit 2(a) of my formal statement, Mr. Chairman.

The second column of that table shows the employment of sciences and technicians in R. & D., as a percentage of production workers.

For the year 1970, in all manufacturing industry, there were 3 R. & D. people for every 100 production workers.

The second column, marked B, shows in 1970, in all manufacturing industries for every 100 production workers, there were 3 R. & D. people.

In the ordnance and missiles industry serving the military, there were 24 per 100.

Now, I call your attention to the data in the lower part of that column.

Item 8a, primary metals, so when the primary metals industry, in that industry we have seven-tenths of 1 percent per 100 production

workers in the R. & D. factor, hence there is no mystery why the steel industry of the United States has been lacking in technological knowledge, and even in capital with which to make new productive investment.

Mr. Chairman, there is a second part of the mechanism defined here underlying the productive process, and that is the internal decision process.

It needs underscoring that from its very inception, the United States was a high-wage economy, and American industry could and did produce salable, satisfactory goods, while paying the highest wages in the world, and this was made possible by the offset given by the application of technology, and the consequent high and advancing level of industrial productivity.

Mr. GORDON. Are you saying, Professor Melman, the cost of labor, the unit of output in the United States, was actually lower in many industries, even though wages were high?

Professor MELMAN. That is precisely correct. It is possible to pay a high hourly wage, and to have a low unit labor cost.

That combination is made possible by efficient use of the manpower of all classes, so with appropriate efficiency, in the utilization of labor and of capital, it is possible to pay a high wage.

At the same time, it is even possible to offset, not only a high wage, but also other costs.

Indeed, it was this cost offsetting capability of U.S. industry for the century, 1865 to 1965, that made possible the condition of the payment of high wages, the highest in the world, while the production of goods is competitively priced.

That involved the operation throughout the manufacturing industry of a cost minimizing internal mechanism, this is to say, in order to maximize profit, the firms not only dealt in the marketplace, but they also saw to minimize internal costs.

Now, that minimizing was made possible by the availability of capital and the availability of new technology from research.

From 1965 on, the accumulated preemption of capital and technology resources on behalf of the military establishment, shortcircuited that century-long capability of U.S. industry.

The capacity for cost minimizing becoming defective was replaced by an internal mechanism of costs passed along, in response to increase in costs, in production, and many American production firms sought refuge repeatedly in passing these costs along as price.

The consequence of cost was persistent rise of prices throughout the industrial system, even during the times of declining market demand for products.

Needless to say, as the ability to offset cost increases through the traditional methods diminished, hence as capacity for improving productivity diminished, they are the one and the same thing.

Inflation became the characteristic pattern of the U.S. economy. Moreover, persistence of that price inflation made U.S. firms vulnerable to competition from abroad as never before, and the consequence has been the diminution of markets, for a great array of U.S. industries.

The collapse of competitiveness of the U.S. steel industry is important not only in its own right, it is a major signal of a condition of depletion at the root of the whole American industrial system.

By depletion, I mean the presence of a market, and the parallel inability of many parts of an industry to serve that market.

May I call your attention, Mr. Chairman, to exhibit 4, it is the last table in my prepared testimony.

The data of this table are based upon a measure of productivity carried out for each establishment, that is for each factory in numerous industries.

The measure of productivity output to input is gauged here in terms of value added per employee.

What the Bureau of the Census did was measure value added per employee in each of the factories, for example, of the blast furnaces, and steel mills in industry, noted here as industry number 3312, that is the SIC Code.

Having these data for each individual plant, it was then possible to arrange these plants in diminishing order of ranking, thus highest productivity at the top, lowest productivity below.

When the plants were arranged in this fashion and the upper quartile of the plants were compared with the lowest quartile then the results for 1967 appears in the far right column, and so for the blast furnaces and steel mills of the country, the top quartile of plants were 2.3 times as productive as the lowest quartile of plants.

This points, Mr. Chairman, to an internal condition of the steel industry, and it could be noted of many other industries, marking off a dramatic gap in productive between the most productive, and the least productive enterprises and factory of the industry.

That difference of 2.3 times of productivity is far greater than any price differential between the average of American steel prices, and the average of imported steel prices, hence, the noncompetitiveness condition of the steel and of other industries can be redefined from the data of this table as follows:

The problem is how to effectuate a sharp improvement in productivity of the lowest quartile, or the lowest half better yet of each industry.

It is such that these plants become as productive as the top quartile of these plants. It should be noted, Mr. Chairman, that such a process draws upon already available and already implemented technology.

Such a process does not require formally any new research and development, but it does require free availability of available technology to all of the plants and all of the firms of a given industry.

This has bearing, Mr. Chairman, on one of the particular interests of this committee: namely, the patent law and its administration.

Clearly, from the standpoint of improving average productivity of the U.S. industry, and from the standpoint of requirement of sharply increasing productivity, of the least productive enterprises of many industries, one of the key requirements is the free availability of knowledge, the free availability of technology, throughout the industry; hence, I suggest, Mr. Chairman, that this requirement is an eminently important criterion to be utilized by this committee in

considering the particulars of its legislative proposals with regard to patents and similar matters. Thank you.

Senator NELSON. When you say free availability of technology, you are referring to patents, also?

Professor MELMAN. Yes, Mr. Chairman.

Mr. GORDON. How would you characterize the status of technology in the United States today—not just in the steel industry but in many other industries?

Professor MELMAN. You have to differentiate between the military economy and the civilian economy.

The military economy is rich in technology. It is elaborately served, and by comparison with other military economies and military systems, it tends to be a world leader, no question about that, and that follows clearly and logically from the massive resources made available; thus, the Federal Government, as was noted in previous testimony today, is far and away the largest agency of the society making research and development expenditures.

Within the Federal Government, the expenditure system, for about a quarter century, about two-thirds of the R. & D. Federal funds has gone to the military and closely allied enterprises of the Federal Government.

Accordingly, it is perfectly reasonable to expect that in countries that have given priority attention to their R. & D. spending to civilian technology, that there would be more rapid pace of new development, and that indeed has been the case.

Please notice that that is completely consistent with the testimony given previously by Professor Adams, but there is a second factor involved here, and that is the nature of the decision process within the U.S. industry, having an important bearing on technology, installed technology, technology utilization, not simply on technology potential; thus, under the whip of a cost minimizing process, being the common one, U.S. industry, there was a pervasive pressure to introduce new technology in production, in new product design.

As the cost minimizing process gives way to cost passable, there is less of that decision process pressure; accordingly, it is to be expected that firms and industries finding themselves in that kind of condition of depletion already described, will increasingly seek out, not internal measures to offset costs, and improve competitive position, but will instead turn to seeking subsidies and similar assistance from the Federal Government.

Again, the action of the steel industry is crucial. If a few industries or firms of less importance in the whole system seek out subsidy, then this may be regarded by some as a particular action deserving to be taken and readily supported in the economy as a whole; but when industries of the importance of the steel industry seek out subsidies, then it becomes impossible to take that same view, because then the root part of the economy, as a whole, as a total industrial system, finding itself defective, and turning for subsidy, develops a condition from which there is no longer a subsidy to be paid, and there is then a diminishing pool of resources in the whole economy, from which to draw on subsidy for a particular section; therefore, the diminition of civilian technology capability in the form of less capital and less R. & D. for

these purposes, and the diminishing of the decision process, that until now has crushed the introduction of new technology, constitutes warning signals of deterioration in U.S. civilian technology and productivity.

Senator NELSON. You made reference some time back to the inflationary factor involved in the reduced productivity.

As you well know, it is commonly claimed that the inflation is caused by "excessive spending." Is the productivity question, in your judgment, the most important factor in the inflationary spiral that runs contrary to what we have seen in the past with high unemployment and also high inflation?

Professor MELMAN. Yes; I do, Mr. Chairman.

Until now the array of economic fears across the spectrum has examined market behavior as the primary arena of decision with respect to price, hence with respect to inflation.

One of the common assumptions of all economic fears has been the assumption that the firm within its own microeconomy operates the way to minimize costs in the name of maximizing profit. It is precisely that mechanism of maximizing costs which has been giving way to a process of costs.

I expect, Mr. Chairman, that research now in process at the Department of Engineering at Columbia University will within the next months produce the full statistical statement of the strength of relationship between the change of the internal decision process of firms as reflected by the decline of productivity, and the consequent pattern of inflation since 1965.

Senator NELSON. You made reference a moment or two ago to maximizing costs. Do you mean maximizing or minimizing costs?

Professor MELMAN. Within the classic U.S. civilian economy, the industrial firm has been oriented to minimizing costs as part of the maximization of profit.

Within the military industry firms, the pattern is one of maximizing costs, and maximizing subsidies from the Federal Government.

The presence of that military economy, and its sustained operation, has served as a partial model for an alternative to the internal mechanism of minimizing costs.

Indeed, there has been a substantial amount of infection of civilian industry and the economy by the cost pass along and cost maximizing process, for which the military economy has been a model.

Plainly, with a microeconomy, that maximizes costs, in the presence of opportunity to maximize subsidy, what we have understood as the productivity process of U.S. industry is sharply abridged.

Shall I give an example?

Where there is no need to compete in a marketplace, any marketplace, and when there is no internal mechanism of cost, it is possible to produce a product as the B–1 bomber, of which four have thus far been produced, and to do that as a total estimated cost that makes the B–1 bombers produced exceed their equivalent weight in gold.

Senator NELSON. Did you compute that out yourself?

Professor MELMAN. Yes.

Senator NELSON. What is the weight of the bomber, and what were you paying for gold at the moment?

Professor MELMAN. The detailed calculation goes into some detail.

Senator NELSON. You do have it?

Professor MELMAN. The gross takeoff weight is 255,000 pounds. I can give you the full data on that. Two gross maximum takeoff weight of the bomber, let me correct that, please, it was, unless my memory fails me, about 295,000 pounds. Allowance has to be made for its possible bomb load, and for possible fuel, when I made such allowances, then the stripped aircraft was estimated at having a weight of about 255,000 pounds of net weight per aircraft.

Four aircraft were produced. The estimated cost for these four aircraft would be $4.500 million.

As you do the arithmetic, that would emerge to be about somewhat more than $4,000 per pound of aircraft, and the price of gold over on the London exchange when I last checked the figures was $164.75, that was 2 weeks ago, and that produced a calculation that the B–1 bomber cost approximately 1.6 times its equivalent of weight in gold.

Senator NELSON. That is the best argument I have heard against it. It is a fine substitute for the argument I have been using.

Professor MELMAN. It might be a very dramatic thing, if a piece of the B–1 were offered in the way of a special artifact in the way of jewelry, but as industrial firms, Mr. Chairman, undertake to function in the civilian economy, by modes of decisionmaking, and internal rules that even remotely resemble the ones that generate the B–1 bomber, then those firms and industries will necessarily become noncompetitive in regard, or in relation to any outside firm or industry, that wishes to operate in the same market, and that is the essential mechanism by which many U.S. industries have become noncompetitive, thus not only the steel industry, 20 percent of the auto industry, now has finished products and parts supplied from abroad, about 40 percent of the shoes sold in the United States are supplied from abroad.

Virtually all of the 75 millimeter cameras and a visit to any hi-fi store will disclose that the consumer electronics there are reasonably of sophisticated sort are overwhelmingly imported, once made in the United States, of course.

Senator NELSON. But those items were produced here and were competitive at one time.

What happened to make them noncompetitive?

Is there a wage differential?

Professor MELMAN. The wage differential argument will not stand.

U.S. industry has always paid a high wage, in fact the highest wage in the world until recently.

Let me note as a footnote that in recent years, certain industries in Sweden and in Germany, and in Switzerland now pay higher hourly wages than do equivalent industries in the United States, but for the historic, until recent past, the United States did pay the highest wages in the world.

Let us take a case from a real industry of importance, the auto industry.

During the 1950's, that industry clearly paid the highest in the world, two to three times that of Western Europe and more than that of Japan, but they produced the cheapest cars in the world in terms of price per pound, of produced vehicle, so that was made possible by high productivity, by appropriate organization and mechanization of work, which in turn produced a high level of productivity of labor and of capital.

The same possibilities are present for the electronic industries, thus many opportunities for improving productivity of operations, by standardization of components, by standardization of certain production processes, were foregone in the United States, and the result was that production was moved abroad because it became cost advantageous to do that, but there is no inherent technological limit that makes impossible a reduction of unit cost, so as to make U.S.-based production possible in that industry.

Mr. GORDON. You have done considerable research on problems of industrial productivity and industrial operations.

You testified before this subcommittee almost 20 years ago. You stated that the possibility of securing patents has very little relevance to stimulating research.

Do you recall that?

Professor MELMAN. Yes.

Mr. GORDON. Now, is this still your opinion?

Professor MELMAN. The record of the last 20 years is a monument in support of that opinion.

The stimulation of research has proceeded dramatically in this country, as the Federal Government proceeded to do just that stimulating, by allocating substantial resources, and by making research enterprise in many fields important in the society, and that applied not only in the military field, it has applied in many fields of basic research and basic sciences.

Mr. GORDON. Do you see any benefits at all for the Government and the public to grant monopoly rights to the contractors for inventions resulting from Government-financed research and development?

Professor MELMAN. I do not.

On the contrary, the weight of evidence is very strong in the direction of supporting the proposition that it is the widest of availability, whether in its pure form, or embodied as technology, that is an indispensable requirement for widest application of knowledge, and I take it that though not necessarily repeatedly stated is an underlying concern of this committee.

Senator NELSON. Thank you very much.

We stand adjourned until tomorrow morning at 10 a.m. in room 6202.

[Whereupon, the subcommittee was recessed at 1:05 p.m.]

[The prepared statement of Professor Melman follows:]

STATEMENT BY SEYMOUR MELMAN, PROFESSOR OF INDUSTRIAL ENGINEERING, COLUMBIA UNIVERSITY, NEW YORK, N.Y.

THE PRODUCTIVITY PROBLEM IN AMERICAN INDUSTRY

For two centuries American law and industrial practice have included the patent system and its operation. Therefore the patent system has operated through a period of sustained growth in U.S. industrial productivity, as well as during the period of crisis in which American productivity growth has fallen well behind the rate of change in productivity in other countries. The following paper indicates that a major decline in the rate of U.S. productivity growth, and of allied technological competance, are a consequence of a transformation in the internal character of the American industrial firm that is associated with a long period of concentration of capital and technology in military as against civilian economy.

1. For a century until 1965 the average annual rate of growth of labor poductivity in the manufacturing industries of the United States was about 3% per year.[1] Indeed, so persistent was this pattern that economists began to regard this as a virtual "constant" in the operation of the U.S. economy. That per-

Footnotes at end of article.

formance altered sharply after 1965. From 1965 to 1970 the average annual rate of change in U.S. productivity was 2.1 percent in manufacturing. As the appended (Exhibit 1) table shows this was the lowest rate of productivity growth of any industrialized country in the western world. This marked downturn in U.S. manufacturing productivity occurred well before the various price upheavals associated with rising costs of energy after 1973. From 1970 to 1975 there was a further downturn in the U.S. rate of productivity growth to 1.8 percent per year, and again the U.S. performance was at the lowest level of any western industrialized economy.

The growth of productivity has a controlling effect on the ability of industrial managers to offset various costs. Accordingly, productivity growth at a satisfactory level made possible a century of high U.S. wages and other costs while allowing the firms of the United States to produce acceptable products at saleable prices. As productivity growth declines, the ability of a firm to offset costs is diminished and there is a built-in pressure to turn to cost pass-along rather than cost minimizing as a strategy for achieving acceptable profits.

2. In the cost-minimizing firm, of the form that had been characteristic of U.S. industry for a century, there is a well defined mechanism of cost- off-setting which has produced mechanization of work and consequent productivity growth. The essential character of this mechanism can be summarized, as follows: as the hourly wages of industrial workers have risen, managers and manufacturing firms found that the prices of machinery did not tend to rise to the same degree; machinery prices rose less than wages of labor as the manufacturers of machinery themselves mechanized their own work and thereby off-set important parts of their own wage increases; as industrial managements were generally confronted with increasingly attractive prices of machinery as a way of performing work previously done manually, they undertook to replace manual work with machinery; the consequent purchase and installation of new types of manufacturing machinery had the effect of raising the average level of out-put per worker.[3] In this way the growing alternative cost of labor to machinery had the effect of inducing mechanization and consequent productivity growth. This mechanism, operating in manufacturing industries in many countries, accounted for 78 percent of the observed variation in productivity during the first half of the 20th century.[3]

The operation of this mechanism critically requires the functioning of a cost-minimizing pattern within the industrial firm. Other necessary conditions include available capital, available technology and the availability of competent machinery producing industries.

Since the Second World War, major changes in these necessary conditions for productivity growth have been induced in the manufacturing industries of the United States as a consequence of the operation of a permanent war economy.

3. In military industry cost-minimizing has been replaced by a combination of cost-maximizing and subsidy-maximizing. The data describing the new type of internal mechanism in the industrial firm has been elaborately described.[4] Under cost-maximizing conditions there is little or no encouragement to off-set cost increases and great encouragement to enlarge costs as a way of enlarging subsidies and thereby profits. This pattern of operation has not been restricted to military economy. There is evidence of infection of the civilian economy by this type of enterprise micro-economy. As this infection proceeds the primary casual mechanism that has been responsible for U.S. productivity growth is abridged. Critical evidence for the occurrence of this abridgment of the traditional productivity inducing process is found in the tendency of many machinery prices to rise as rapidly as, or more rapidly than, the wages of labor.[5]

As a consequence of the diminution of the alternative cost incentive to mechanize, there is evidence of an aging stock of production machinery in critical industries. Thus, by 1973 67 percent of the metal working machinery used in American industry was 10 years old or over. This was the oldest stock of metal working machinery to be found in any major industrial country and marks a continuation of machinery aging process that was visible from the end of the Second World War to the present time.[6]

As the rate of productivity growth in the United States diminished there was an associated deficiency in the ability of U.S. industrial firms to off-set cost increases. The following shows the contrast between productivity actually developed in the United States from 1966 to 1971 as compared to the productivity rates that would have been necessary to off-set major cost increases.

Footnotes at end of article.

From basic data on U.S. wages and productivity in manufacturing industry we can gauge the deficit in productivity during the 1960s which contributed to an increase in the unit labor cost.

From 1960 to 1965 U.S. productivity in manufacturing increased more rapidly than hourly compensation to employees. Any price increases during that period were not due to higher unit labor cost. After 1965 unit labor cost rose sharply because productivity did not increase enough to offset the rise in hourly pay. Here are the actual increases in productivity for 1966 to 1971: 1966, 1.22 percent; 1967, .10 percent; 1968, 4.70 percent; 1969, 1.43 percent; 1970, 1.51 percent; 1971, 3.43 percent.

The following are the productivity increases that did not occur and that would have been additionally necessary to offset the increases in hourly pay: 1966, 3.16 percent; 1967, 4.83 percent; 1968, 2.50 percent; 1969, 5.01 percent; 1970, 5.06 percent; 1971, 2.74 percent.

This productivity growth that was foregone was a price that this country paid for assigning to the military economy the technology resources that were essential for achieving the additional productivity. For this crucial period the total U.S. productivity gap was 28 percent. Actually, the productivity changes that would have been required year by year to achieve a stable unit labor cost (the sum of the two figures for each year) are well within the range of performance of other economies during the same period. The nations of Western Europe showed yearly productivity increases of 5.5 to 7.5 percent from 1966 to 1971, and in Japan the productivity growth was 7 to 16 percent per year.[7]

4. The operation of military economy was associated not only with a major alteration in the micro-economy of the U.S. manufacturing. There was an associated concentration of capital and technology resources in the military as against the civilian economy.

From 1951 until the present day the fresh military funds alloted by the Congress each year have exceeded the total after tax profits of all U.S. corporations.[8] Plainly, the government of the United States and the military establishment in particular have become the prime controllers of the principal capital resources in the American economy.

The American performance in this respect is very different from that of other major industrial countries. From 1967 to 1969, a United Nations study reports that military budget expenditure as a percentage of gross domestic, fixed investment, was 52.8 in the United States; 14 in the Federal Republic of Germany; and 2.3 in Japan.[9] This means that compared with Germany and Japan the United States devoted a much larger part of available fresh capital funds for the economically non-productive military economy rather than to the civilian economy taken as a whole.

Similar patterns emerge with respect to the deployment of technology resources.

Technology resources are critically represented by the manpower and the money expended for research and development purposes. For the last quarter century, the United States has concentrated its research and development expenditures in the military sphere. By 1974 the Department of Defense and the Space Agency accounted for 65 percent of all federally funded research activity.[10] A further view of the significance of technology resource concentration in the military sphere is seen from a detailed examination of R. & D. expenditures in the military as compared to other manufacturing industries. This is shown in the accompanying tables prepared by Dr. Michael Boretsky of the U.S. Department of Commerce.[11]

With respect to both R. & D. expenditures and the employment of scientists and engineers, it is clear that the ordnance and missile industry dominated the scene as against other manufacturing industries, and in relation to the average for manufacturing as a whole. Thus, in 1970 R. & D. expenditures in ordnance and missiles comprised 36 percent of "value added by manufacturers," but only 5.8 percent of "value added" in manufacturing as a whole. Also in 1970, the ordnance and missile industries employed 24 scientists, engineers and technicians in R. & D. for every hundred production workers, as compared to 3 per hundred in manufacturing industry as a whole. A further examination of the accompanying tables shows the considerable range of industries, including primary metals, in which the employment of R. & D. personnel was a third and less of the average for manufacturing industry as a whole. (Exhibits 2a, b, c.)

Footnotes at end of article.

The manufacturing industries of the United States have been clearly disadvantaged in relation to the manufacturing industries of other countries with respect to the availability of research and development resources. Independent examinations of U.S. R. & D. activity compared with that of other countries discloses a persistent pattern of developing disadvantage for the United States. The following summary data are exercepted from a recent Department of Commerce Draft Study on U.S. Technology Policy.

In recent years, the total expenditure for R. & D. in the United States has shown a steady decline. This is in sharp contrast to the steady (and in one case dramatic) increases found in many industrialized foreign nations. For instance, in the period 1969–1973:

Percent change during 1969–73 in total R. & D. expenditures in 1969 dollars:

United States	−3
U.S.S.R.	+43
West Germany	+40
Japan	+74
France	+11

Moreover, since World War II, most of the R. & D. effort in European countries and Japan has been oriented toward civilian economic development whereas in the U.S. the major emphasis has been on defense and space objectives.

Percent of GNP for Civilian R. & D. in the 1960's:

United States	1.2
West German	1.7
France	1.6
Japan	1.5

Source: U.S. Department of Commerce, National Technical Information Service, "U.S. Technology Policy, A Draft Study"; Betsy Ancker-Johnson, Ph. D., Assistant Secretary of Commerce for Science and Technology and David B. Chang, Ph. D., Deputy Assistant Secretary of Commerce for Science and Technology, March 1977.

Clearly, U.S. R. & D. expenditures as a whole have been diminishing while those of other countries have been substantially enlarged. Most impressive is the pattern of use of R. & D. funds for civilian economy in the United States compared to that of other countries. Thus West Germany, France and Japan use substantially larger porportions of the total R. & D. activity for civilian industrial purposes.

There is, accordingly, no mystery with respect to the growing competitiveness of industrial products from those economies. Diverse investigators have independently developed the conclusion that "the opportunity cost of federal R. & D. contracts in defense-space programs has been the slower growth, reduced productivity, and lower quality of output in the civilian sector." [12]

5. There is a further vital feature of productivity development in the United States: the development of large internal productivity gaps within U.S. industries. From August to October, 1977, a series of massive layoffs and plant closings were carried out in many U.S. steel factories. These occured in Pennsylvania, New York, Ohio, Indiana, Illinois and California. As many as 60,000 steel industry employees have been directly involved. (See the appended news reports on steel industry shutdowns. (Exhibits 3a, b.)

Characteristically, the discussion of American steel industry layoffs has proceeded in terms of average conditions in the industry and problems of price competition between U.S. and Japanese steel making firms. Little or no attention has been given to the size of the productivity differences among factories in the U.S. steel industry. The U.S. Bureau of the Census has prepared special industrial tabulations in response to the initiative of Dr. Michael Boretsky of the U.S. Department of Commerce. The data for the steel industry are based upon a calculation of productivity (output in relation to input) for each factory ("establishment") in the industry. The factories of the steel and other industries were ranked according to value added per employee. The data from the census of 1967 show the average productivity for the top quartile of firms, ranked by productivity, as against the average for the industry. In these terms, in 1967 the most productive quarter of steel industry factories were one and a half times more productive than the average for the industry as a whole. However, for the same year, we are also informed that the top quartile of steel industry factories were 2.3 times as productive as the lowest quartile of steel industry factories, ranked by productivity.

These differences in productivity between that most productive quartile and the least productive quartile of steel industry factories within the United States exceeds by far the difference in price between Japanese produced and American produced steel products. The reasonable inference is that there is a competitive difficulty for the least productive of U.S. steel industry factories.

The problem of non-competitiveness that has diminished employment and output in a host of U.S. industries is clearly linked to the large differences that obtain between technology and production methods in the most productive as against the least productive establishments of a given industry. (See the Table of Internal Industry Productivity Differences that is appended. Exhibit 4.)

The steel industry, like many other manufacturing industries of the United States, has been pressed by the relative shortage of capital and shortage of fresh technology resources owing to the quarter century pre-emption of capital and technology by the federal government's military establishment. As a consequence of the withdrawal of these resources the steel industry has been rendered less capable of responding to cost increases by cost offsetting devices based upon productivity improvement. The failure of productivity improvement and consequent price rise has led to hopelessly noncompetitive situations, especially for the older and least productive factories and firms.

CONCLUSION

The development of U.S. productivity at a lower annual rate compared with other countries derives from the abridgment of the long standing cost-minimizing mechanism that drove American productivity. The shortage of capital and technology for civilian industry, coupled with the revision of the internal economy of firms from cost-minimizing to cost-pass-along and cost-maximizing, is responsible for the breakdown of the productivity process. In this perspective patent policy can play a part to the extent that it makes more difficult, or eases, the diffusion of new technology for possible use. But that diffusion is clearly not the sufficient factor to account for variation in productivity. That effect is traceable primarily to the nature of the micro-economy of industrial firms and to the availability of capital and technology resources in the civilian economy.

FOOTNOTES

[1] U.S. Department of Labor, Bureau of Labor Statistics, "Trends in Output Per Man-Hours Per Unit of Output-Manufacturing, 1939–53," BLS Report No. 100, 1955.
[2] S. Melman, "Dynamic Factors in Industrial Productivity," John Wiley, Basil Blackwell, 1956.
[3] Ibid., ch. 16.
[4] J. R. Fox, "Arming America," Harvard School of Business Administration, 1976. Fox was an Assistant Secretary of the Army and this volume incorporates massive detail describing cost-maximizing behavior in the Department of Defense and in military-industry firms. For additional bibliography on this topic see S. Melman, "The Permanent War Economy," Simon and Schuster, 1974.
[5] See data in S. Melman, "The Permanent War Economy," app. 1.
[6] American Machinist, Oct. 19, 1973, p. 143.
[7] S. Melman, "The Permanent War Economy," p. 96.
[8] See the Annual Economic Reports of the President, appendix tables.
[9] United Nations, "Economic and Social Consequences of the Arms Race," Oct. 22, 1971.
[10] U.S. National Science Foundation, "Federal Funds for Research, Development, and Other Scientific Activities," for fiscal year 1974, 1975 and 1976, NSF 75–334, 1975, p. 6.
[11] M. Boretsky, "U.S. Technology: Trends and Policy," The George Washington University, October 1973.
[12] W. N. Leonard, "Research and Development in Industrial Growth," Journal of Political Economy, March–April 1971.

EXHIBIT 1

RATES OF CHANGE OF PRODUCTIVITY IN MANUFACTURING

Country	Average annual percentage change in output per man-hour	
	1965–70	1970–75
Belgium	6.8	8.2
Canada	3.5	3.0
France	6.6	3.4
Germany	5.3	5.4
Italy	5.1	6.0
Japan	14.2	5.4
Netherlands	8.5	5.8
Sweden	7.9	4.4
Switzerland	6.2	3.5
United Kingdom	3.6	3.0
United States	2.1	1.8

Source: U.S. Department of Labor, Bureau of Labor Statistics, "Productivity and the Economy," Bulletin 1710, Washington, D.C., U.S. Government Printing Office, 1971, p. 30; 1970–75 data by special communication from the Bureau of Labor Statistics.

EXHIBIT 2A

RELATIVE INTENSITY IN USE OF TECHNICAL INPUTS IN U.S. MANUFACTURING INDUSTRIES, SELECTED YEARS, 1960–70

Industry	A. Expenditures on R. & D. as percent of value added originated in the industry		B. Employment of scientists, engineers, and technicians in R. & D. as percent of production workers		C. Employment of scientists, engineers, and technicians in functions other than R. & D. as percent of production workers		D. Employment of craftsmen as percent of "operatives and laborers"	
	1961	1970	1961	1970	1961	1970	1960	1970
All manufacturing industries	6.6	5.8	3.0	3.0	4.4	5.9	39.0	39.3
1. Ordnance and missiles	75.9	37.7	28.1	24.1	23.9	28.2	(1)	46.4
2. Chemicals and related products	7.4	6.5	10.3	11.0	12.5	14.5	42.0	43.5
2a. Drugs and medicines	7.4	9.3	14.9	18.5	17.9	16.2	34.8	(1)
2b. All other chemicals	7.5	5.8	9.7	10.0	11.8	14.3	67.6	(1)
3. Nonelectrical machinery	6.3	5.4	4.7	3.8	7.7	9.4	71.6	57.9
3a. Office and computing machinery	25.4	18.5	(1)	15.8	(1)	23.8	50.3	(1)
3b. All other nonelectrical machinery	3.5	2.9	(1)	2.2	(1)	7.7	73.9	(1)
4. Electrical machinery and equipment	17.2	15.6	10.8	9.3	10.7	12.3	35.3	31.0
4a. Radios, TV, commo. equipment and electronics	21.9	18.0	14.5	12.0	12.2	13.2	(1)	(1)
4b. All other electrical machinery and equipment	13.5	13.0	6.6	5.9	9.0	10.1	(1)	(1)
5. Transportation equipment	27.3	23.0	6.8	6.7	6.4	8.5	66.9	61.5
5a. Aircraft and parts	38.0	38.4	9.8	9.6	7.1	9.1	87.3	82.2
5b. Motor vehicles and equipment	5.5	7.0	2.1	2.7	3.8	5.5	43.0	40.1
6. Instruments and related products	8.3	8.8	9.4	7.9	11.8	14.1	50.9	(1)
7. Sum of No. 2 to 6	14.8	12.2	7.9	7.4	9.1	11.2	55.7	49.2
8. All other manufacturing industries	1.2	1.1	.9	1.0	2.3	2.3	32.2	34.9
8a. Primary metals	1.4	1.2	1.1	.7	4.0	4.1	69.5	63.7
8b. Fabricated metal products	1.3	.9	1.6	1.4	4.4	4.0	52.5	47.6
8c. Rubber products	3.5	2.8	1.5	1.1	2.8	3.6	24.5	25.5
8d. Textiles and apparel	.2	.3	.1	.2	.2	.3	10.9	14.4
8e. Paper and allied products	.9	1.0	1.0	1.3	2.8	2.8	30.0	32.4
8f. Food and kindred products	.6	.6	.3	.3	.6	.9	25.5	23.9

[1] Not available.

Source: Michael Boretsky, "U.S. Technology: Trends and Policy Issues," U.S. Department of Commerce, October 1973.

EXHIBIT 2B

COMPARATIVE CIVILIAN EQUIVALENT R. & D. EFFORT FOR PURPOSES OF ECONOMIC DEVELOPMENT IN THE 1960's: UNITED STATES VERSUS SELECTED INDUSTRIALIZED COUNTRIES

Country	Expenditures (average for 1963–67)			Employment of professional manpower (1967)		
	United States cost equivalent (millions)	Percent of United States (United States=100)	Per dollar worth of GNP (United States=$1)	Full time equivalent (thousands)	Percent of United States (United States=100)	Per dollar worth of GNP (United States=$1)
United States	$7,992	100	$1.00	342.5	100	$1.00
France	1,750	22	1.35	78.5	23	1.37
West Germany	2,098	26	1.44	100.7	29	1.61
Belgium	195	2	.69	10.8	3	1.00
Netherlands	482	6	1.82	26.9	8	2.42
Italy	420	5	.50	27.3	8	.79
Common Market	4,945	62	1.22	244.2	71	1.38
United Kingdom	2,132	27	1.69	116.3	34	2.17
Western Europe (total)	7,972	100	1.14	402.5	118	1.34
Canada	406	5	.64	24.2	7	.88
Japan	1,667	21	1.21	197.9	58	2.86
Western Europe, Canada, and Japan (total)	10,045	126	1.12	624.6	182	1.56

EXHIBIT 2C

COMPARATIVE GROWTH IN TOTAL INTRAMURAL R. & D. EFFORT[1] PERFORMED IN THE BUSINESS ENTERPRISE SECTOR OF SELECTED COUNTRIES, 1963–69

Country	Percent per year growth of R. & D. expenditures (current prices)	Growth in employment of professional R. & D. manpower
United States	5.6	3.5
France	16.0	6.6
West Germany	[3] 15.0	[3] 6.6
Belgium	8.0	2.5
Netherlands	[3] 14.7	[3] 13.2
Italy	13.1	6.2
Common Market (total)	14.9	6.7
United Kingdom	[3] 6.2	[4] 1
Sweden	[3] 6.1	[3] 3.2
Norway	13.4	8.6
Austria	20.5	13.2
Canada	12.7	4.9
Japan	20.0	5.3

[1] All sources of funding, including capital expenditures in the case of foreign countries and depreciation in the United States.
[2] Scientists, engineers, and technicians.
[3] 1964–69.
[4] 1965–68.

Sources: OECD, "A Study of Resources Devoted to R. & D. in OECD Member Countries in 1963/64," vol. 2, Statistical Tables and Notes, Paris, 1968; and OECD, "International Survey of the Resources Devoted to R. & D. in 1969 by OECD Member Countries," vol. 1, Business Enterprise Sector, Paris, 1972.

EXHIBIT 3A

[From U.S. News & World Report, October 10, 1977]

STEEL INDUSTRY'S WOES HIT CLOSE TO HOME

Troubles in the steel industry keep hitting closer to home, affecting the lives of more and more steelworkers and their families and spreading gloom in dozens of communities.

Just in recent days, layoffs and plant closings have thrown some 10,000 steel-mill employees out of work.

Big names in the steel industry are involved. U.S. Steel is laying off people at Chicago, Gary, Youngstown and Pittsburgh; Armco in Houston and at Middletown, Ohio. Bethlehem has had big cuts at Lackawanna, N.Y., and Johnstown, Pa.

Youngstown Sheet & Tube is shutting down its Youngstown plant and putting 5,000 employes out of work between now and the end of the year.

All this is on top of thousands of layoffs by steel companies earlier this year and in 1976. Chief cause: sales lost as a result of steel imports from mills in Europe and Japan at prices lower than those for domestic products.

As shown on the map below, job losses have been concentrated in a few sections of the East and Midwest where the bulk of the country's steel is produced. Five States—Pennsylvania, Ohio, Illinois, Indiana and Michigan—account for almost three quarters of the steel output of the U.S.

President Carter at his news conference on September 29 described the steelmakers' problems as both "chronic" and "complicated," and said that the White House is studying them. But he appeared to rule out any immediate changes in import policy, noting that the Government already provides job retraining and economic assistance for steelworkers laid off their jobs.

Emergency financial aid has gone to some 45,000 steelworkers in recent months under the Trade Readjustment Act, which applies when an individual loses a job because of competition from imported goods. On September 28, the latest approval of such assistance was announced for the 5,000 Youngstown Sheet & Tube workers who will lose their jobs by the end of 1977.

The issue of import competition, mostly from Japan, has been building up for years and now seems to be approaching the crisis point.

In August alone, imports accounted for 20 per cent of the entire U.S. steel supply—the highest proportion in 32 months.

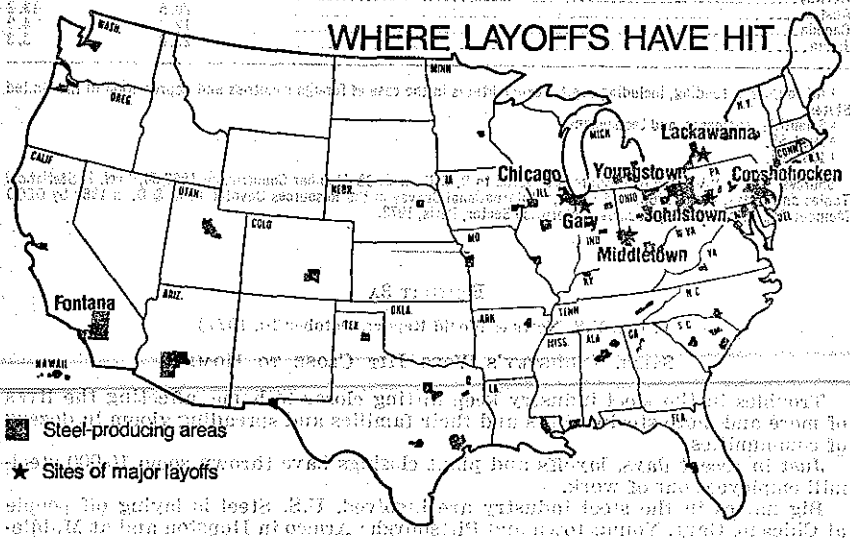
Many steel users find they can buy such items as plates, structural steel, pipe and nails from importers at lower prices than those charged by American steelmakers for similar products.

STEEL FOR FORD

Even Ford Motor Company, which manufactures much of the steel for its cars in its own plants, has indicated it may buy some foreign steel in the coming year, because it sells for $50 a ton less than steel made here.

U.S. Steel Corporation filed a petition late in September with the Treasury Department, charging "dumping" by Japanese steel mills. The company asked that special duties be applied on a range of products. If the Government accepts the dumping charge, which is denied by the Japanese, duties would be imposed to offset the price advantage.

A top Administration official predicted on September 30 that an agreement for "orderly marketing" of both Japanese and German steel in the United States may be worked out within the next few months. Otherwise, he said, "Congress will act, and nobody will like the consequences."



U.S. NEWS & WORLD REPORT, Oct. 10, 1977

EXHIBIT 3B

[From the New York Times, September 20, 1977]

YOUNGSTOWN STEEL TO PARE OPERATIONS

OHIO PRODUCER SCHEDULES 5,000 LAYOFFS IN MOVE TO CHICAGO AREA

(By Gene Smith)

Citing import competition and environmental restraints, the Youngstown Sheet and Tube Company announced yesterday a major cutback in its steel operations at Youngstown, Ohio, at a cost of 5,000 jobs.

R. C. Rieder, chairman of Youngstown Sheet, a subsidiary of the Lykes Corporation, said some of the operations would be relocated from the old Campbell Works to the newer, more modern Indiana Harbor Works on Lake Michigan near Chicago.

Youngstown's headquarters will also be moved to the Chicago area, Mr. Rieder said.

The layoffs and cutbacks affect 5,000 of the company's 22,000 workers in the Youngstown area. In addition, the United States Steel Corporation, the nation's largest producer, has said it is planning to consolidate its Youngstown area operations with severe cuts in a work force that ranges between 5,400 and 6,400.

Yesterday's announcement confirms that shakeout and shrinkage now underway in one of the nation's most basic industries.

Bethlehem Steel, the No. 2 producer, has announced plans to cut back its Lackawanna, N.Y. operation, cut its dividened in half and forecast a substantial loss.

United States Steel has announced major cutbacks at its massive South Works near Chicago. Profits of the major companies have sagged badly. Capital investment has sagged.

The industry attributes its troubles to Japan, costly Federal requirements in and slack demand from major markets, particularly capital equipment.

The announcement came on the heels of a decision by the United States Court of Appeals for the Third District that invalidated a March 1976 decision of the Environmental Protection Agency to exempt eight steel mills in the Mahoning River Valley of Ohio from Federal clearwater standards.

Youngstown Sheet and Tube's Campbell Works was one of those affected by the decision. Other companies with plants involved were the United States Steel Corporation and the Republic Steel Corporation, the nation's first and fourth largest steelmakers.

When the original decision was handed down in 1976, the steel companies said the plants involved, all sited on the Mahoning River, were not profitable enough to justify outlays of some $140 million for pollution controls to meet Federal standards.

POLLUTION IS DESCRIBED

The Mahoning River has been described as "a near-stagnant collection of grease, oil and metallic particles, all suspended in heated water that sometimes reaches 90 degrees." But attacks on its pollution have been opposed by regional church, civic and other groups all intent on protecting the jobs of the 160,000 local inhabitants.

Yesterday, William A. Sullivan Jr., president of the Western Reserve Economic Development Agency, said he was "not surprised" at the Youngstown news.

"We can always hope, until the furnaces can't be lit up again," he added "but if the Carter Administration is relying on standards set by the Council on Wage and Price Stability, this will be a day of mourning that will be repeated in many other steel cities."

This was an obvious reference to criticism of recent price increases by the steel industry that have been challenged by the Wage and Price Council.

Mr. Sullivan said a meeting was scheduled for next Friday with Commerce Department officials but he added that he felt that "what is happening in Youngstown is even worse than what happened in New York City and will be repeated in those areas that are dependent on steel."

Specifically, Youngstown Sheet and Tube plans to discontinue production of hot-rolled sheets and plates, cold-rolled sheets, some steel-bar products and continuous weld pipes at the Campbell Works. This work will be transferred to the Indiana Harbor works at East Chicago, Ill., but production will clearly shrink in the process.

Youngstown Sheet and Tube pointed out that the operations scheduled for suspension "have not been profitable in recent years (and) demand for the hot-rolled and cold-rolled sheets, which are the largest tonnages produced at the Campbell Works, have been severely depressed during much of the past two and a half years."

Youngstown Sheet and Tube cited low-priced foreign steel as one principal reason for the decision to eliminate its high-cost production facilities. It reiterated the industry's contention that "prices of these foreign steels do not fairly reflect the cost of production in those countries, as these foreign producers are either owned, subsidized or supported by their governments as an instrument of national policy."

Coincidentally, the Department of Commerce reported that last July, steel imports accounted for nearly 19 percent of the nation's steel supply—the highest percentage to date. This occurred even though July imports were lower than June's level. July production by domestic mills fell by a greater percentage.

Through the first seven months, the nation's trade deficit in steel mill products stood at nearly $2.2 billion.

Steel imports vary by products but the greatest impact is on specialty steel—stainless and tool grade—and on heavy structural steel on the West and Gulf Coasts.

In a related development, the weekly steel production figures of the American Iron and Steel Institute continued to show weakening demand for steel.

The industry poured only 2.28 million tons of steel in the week ended Sept. 17, down 0.5 percent from the previous week, meaning the industry was putting to use only 74.9 percent of its total available capability.

The Youngstown cutbacks are the severest to date, but by no means an isolated event. In mid-August, the Bethlehem Steel Corporation said it was laying off 3,500 of its employees, at its Lackawanna, N.Y., plant and would severely restrict future operations at its flood-ravaged Johnstown, Pa., works.

In addition, some 4,000 workers in the Chicago area have been laid off by U.S. Steel and Inland. Over the past weekend the Jones & Laughlin Steel Corporation said it had laid off about 30 members of its research and engineeering staffs in a cost-cutting effort.

EXHIBIT 4

DATA HEADING ON CURRENT DISPARITIES IN THE LEVEL OF PRODUCTIVITY IN SELECTED U.S. MANUFACTURING INDUSTRIES, 1958, 1963, AND 1967

SIC code	Industry	Ration of value added per employee in 25 percent highest productivity establishments (plants) to the average of the respective industry			Ratio of value added per employee in 25 percent highest productivity establishments to the value added per employee in 25 percent worst performing establishments		
		1958	1963	1967	1958	1963	1967
2211	Broad woven fabric mills, cotton	1.6	1.6	1.4	2.8	2.0	1.9
2621	Papermills, except building papermills	1.6	1.5	1.4	2.4	2.2	2.2
2812	Alkalies and chlorine	(1)	2.3	2.3	(1)	3.7	3.2
2815	Intermediate coal tar products	1.8	1.5	1.7	2.7	2.8	2.9
2821	Plastics materials and reins	1.9	1.8	1.8	3.2	3.1	3.6
2911	Petroleum refining	2.2	1.4	1.5	7.8	3.2	4.8
3211	Flat glass	1.2	1.4	1.2	1.5	1.9	2.4
3312	Blast furnances and steelmills	1.7	1.6	1.5	2.2	2.3	2.3
3323	Steel foundries	1.3	1.3	1.5	1.5	1.6	1.8
3334	Primary products af aluminum	1.3	1.1	1.1	1.9	1.7	1.7
3391	Iron and steel forgings	1.7	1.7	1.4	1.8	2.0	1.9
3461	Metal stampings	1.5	1.3	1.3	1.9	1.5	1.7
3519	Internal combustion engines, n.e.c	1.3	1.4	1.6	1.7	2.0	2.3
3522	Farm machinery and equipment	1.7	1.5	1.4	2.4	2.1	2.1
.3541	Machine tools, metal cutting	1.6	1.5	1.3	1.8	1.9	1.9
3561	Pumps and compressors	1.7	1.7	1.6	1.9	2.1	2.1
3621	Motors and generators	1.5	1.4	1.4	2.0	1.5	1.8
3632	Household refrigerators and freezers	1.1	1.0	1.4	2.1	2.4	1.6
3717	Motor vehicles and parts	1.8	1.6	1.4	2.5	2.8	2.5
.3722	Aircraft engines and parts	1.3	1.2	1.4	1.4	1.2	1.8
	Average	1.6	1.5	1.5	2.2	2.2	2.4

(1) Not available.

Source: Michael Boretsky, "U.S. Technology: Trends and Policy Issues," U.S. Department of Commerce, October 1973.

Based on special tabulations of census schedules in regular census years by the Department of Commerce, Bureau of the Census.

GOVERNMENT PATENT POLICIES

TUESDAY, DECEMBER 20, 1977

U.S. SENATE,
SUBCOMMITTEE ON MONOPOLY AND
ANTICOMPETITIVE ACTIVITIES,
SELECT COMMITTEE ON SMALL BUSINESS,
Washington, D.C.

The subcommittee met, pursuant to recess, at 10 a.m., in room 6202, Dirksen Senate Office Building, Hon. Gaylord Nelson, chairman, presiding.

Present: Senator Nelson.

Also present: Benjamin Gordon, consultant to the Committee on Small Business; and Karen Young, research assistant.

Senator NELSON. The subcommittee will please come to order.

Our first witness this morning is Mr. John H. Shenefield, Assistant Attorney General, Antitrust Division, Department of Justice.

Mr. Shenefield, we are very happy to have you here this morning.

Your statement will be printed in full in the record.

You may present it however you desire.

STATEMENT OF JOHN H. SHENEFIELD, ASSISTANT ATTORNEY GENERAL, ANTITRUST DIVISION, DEPARTMENT OF JUSTICE

Mr. SHENEFIELD. Thank you, Senator, very much.

I appreciate the opportunity to testify today on behalf of the Department of Justice on Federal Government policies with respect to patent rights in inventions resulting from federally funded research and development. I understand these hearings to be on the general subject, and not on any particular legislation. At the outset I would like to point out that the Administration is currently reviewing its position regarding the ownership, control, and use of patentable inventions resulting from federally funded R. & D. contracts and grants. We expect that the Department of Justice will participate in that review. Until an administration position on this issue is decided, it is premature for me to state any administration position. We would like, however, to mention some of the factors that will be considered in the review, and to outline the positions the Department of Justice has and will continue to advocate.

For over 30 years a controversy has existed between the advocates of the so-called title and license policies regarding the disposition of rights in inventions made under federally funded R. & D. Under the "title" policy, the Government takes title to the rights in these inventions (that is, patents), and private interests may utilize the inventions through the Government's licensing or dedication of the patents or

other rights. Under the "license" policy, the contractor is given title to the rights in these inventions, with a royalty-free license retained by the Government, but there is no obligation on the part of the contractor to let other qualified applicants have access to the products of Government-funded research.

Presently there is no general legislation that controls all Federal agencies in the disposition of rights to inventions stemming from federally funded R. & D. Congress has acted, however, in a number of instances with respect to particular agencies or subject matter. In these cases, the particular legislation has generally provided that title to inventions resulting from such R. & D. is normally to be retained by the Government. Waiver of title is permitted in some situations after evaluation of various factors, including the invention's importance to public health, welfare, and safety, and the effect of waiver on promoting commercial utilization of the invention. The recent Federal Nonnuclear Energy Research and Development Act of 1974 contains such provisions. No statutes provide that title should be given directly to the contractor.

Prior to 1963, the disposition of contractor inventions was a matter of individual agency policy. The agencies followed a variety of practices. In 1963, President Kennedy issued a statement of Government patent policy, which took the approach that one single policy was not required, and represented a middle ground, a compromise position perhaps, describing in general terms those conditions under which Government would take title, and those conditions under which contractors would take title.

The 1971 Presidential statement, which was really only a slightly modified version of the 1963 statement, and now governs Federal patent policy, and is implemented by the various agencies.

Senator NELSON. What is the 1963 policy, and what was the 1963 policy as modified by the 1971 policy?

Mr. SHENEFIELD. I think it could best be summarized as a compromise between the extreme positions on either side in an effort to achieve some kind of flexibility, and to allow, in effect, agencies to make some sort of determination on more or less an ad hoc basis.

Senator NELSON. What does that mean?

Mr. SHENEFIELD. It means what I said.

Senator NELSON. I know, but it does not mean anything to my ear. What does it mean? That they can give some away and keep some?

Mr. SHENEFIELD. That is correct.

Senator NELSON. If they have flexibility, are there any guidelines or any other controls?

Mr. SHENEFIELD. The guidelines depend on the statutes that govern particular agencies—and there are a variety of them, as you know—and regulations implemented by those agencies pursuant to the particular Presidential statements, and they would vary somewhat by agency. I am not familiar with the particular agencies' regulations.

Senator NELSON. Well, do you have a copy of the statement of Government patent policy made by President Kennedy in 1961?

Mr. SHENEFIELD. In the 1961 statement?

Senator NELSON. Yes.

Mr. SHENEFIELD. No, I do not have that with me right here.

Senator NELSON. From what I heard you say, it sounds totally meaningless: They do not give it all away; they do not keep it; they maintain flexibility. You might as well not have policy at all.

Mr. SHENEFIELD. If I may be permitted to comment on that from a slightly different angle, it is not entirely meaningless—it represents a vague policy. The policy is currently quite vague.

I agree with you it is not precise, it does not articulate standards that either you or I can look at and have any probability quotient, but it is not meaningless, because it is an important piece of information that the Congress or the Administration, in formulating a position, ought to be utilizing. If you want a precise and specific set of standards, and that is perhaps what the Department of Justice would like, the Presidential policies under which we are operating are really not sufficient.

Mr. GORDON. Mr. Shenefield, you might mention that the President's patent policy statement deals only with those areas not covered by statutes. Is that not correct?

Mr. SHENEFIELD. That is generally correct.

Mr. GORDON. So that would deal with, say, the Department of Defense and a few other agencies, but with respect to the Atomic Energy Act, saline water, and things like that, they are already covered by statute, and the President's policy really does not apply.

Mr. SHENEFIELD. That is correct.

Obviously where there is a statute, such a policy would have no effect.

Senator NELSON. In reference to the President's statement of Government patent policy, President Kennedy's patent policy, indeed it adopted a sort of middle ground, describing in general terms those conditions, under which the Government would take title, and those under which it would take only a license.

And then you state that the 1971 Presidential statement of Government patent policy, which is a slightly modified version of the 1963 statement, now governs Federal policy, and is supplemented by the regulations of various agencies.

As I understand it, the Presidential statements of patent policy are just sort of general statements, and each agency makes the decision wholly on its own, without review from the Justice Department, without review by the President?

Mr. SHENEFIELD. As to review by the Justice Department, the answer is "Yes."

Senator NELSON. There is or there is not review?

Mr. SHENEFIELD. Without review by the Justice Department. There is no review so far as I am aware.

Senator NELSON. So if there were a very important antitrust implication, monopoly implications, none of these agencies of the Government discuss it, or clear it with the Justice Department?

Mr. SHENEFIELD. That is my understanding.

I would say, and I cannot represent this to be a fact, and I will check it, and let you know if it is a fact, but I would say that our intellectual property section is probably very familiar with these agency policies. If not, they should be, and if there are represented in those regulations, loopholes of kinds that we ought to be dealing with, my hope

would have been that the section would have brought that to the attention of the Assistant Attorney General, and there could have been something done about it.

Senator NELSON. But to get the record clear, these general statements of Presidential patent policy still leave the decision and authority to make the decision, respecting the flexibility, whether to license, keep it, what-have-you, to the agency itself?

Mr. SHENEFIELD. That is correct.

Senator NELSON. And there is no general clearinghouse in the Federal Government, the Justice Department level, the Capitol level, the Presidential level on these various decisions by the various agencies?

Mr. SHENEFIELD. There is none in the Justice Department insofar as I am aware of.

Certainly not in the Antitrust Division. As to somewhere else, I am not precisely sure.

Senator NELSON. The Pentagon, the Defense Department, spends about $13 billion a year, about 50 percent of the $26 billion in R. & D. is spent by the Defense Department. So far as you know, there is no centralized governmental review by the executive branch, or the Justice Department of their decisions, and their various contracts and agreements respecting discoveries of patents that might come about through the expenditure of public moneys?

Mr. SHENEFIELD. So far as I know, that is true.

Senator NELSON. All right.

Mr. SHENEFIELD. The Department of Justice has traditionally supported a "title" policy. This was the Department's position, in the 1947 Attorney General's Report on Investigation of Government Patent Policy, his 1956 Report Under the Defense Production Act, and numerous appearances before congressional committees. Most recently, in 1974, the Department urged use of a "title" policy when Congress was considering patent provisions for legislation to promote crucial research and development in the energy area. That is still the Department's view.

There are several arguments in support of this policy. When public moneys are spent, the public as a whole should benefit, as it would from the availability of nonexclusive, nondiscriminatory licenses to qualified applicants, resulting in maximum availability of the invention. Inventions produced by expenditures of public funds should inure to the benefit of the public. Government control of inventions deriving from such expenditures assures that they will be used to promote the public interests, rather than the not necessarily synonymous interests of private parties.

In our view—that is, in the view of the Department of Justice—no purpose would be served by taxing the public for research and development and then turning the very results sought by that research and development over to the contractor along with a right to exclude its competitors from the use of those results. Such rights seem to be in the nature of a windfall, at public expense, to the contractor. What the Government is purchasing is the contractor's research and development effort, often on a cost-plus basis. The contractor does not lower his contract price because of the Government's agreement to grant him patent rights. His contract price does not take account of speculative invention and patent possibilities.

The expenditure of public funds for R. & D. is in effect a Government underwriting of the risk of the research effort. For privately funded research, the patent system supplies an incentive to undertake these risks because it offers the reward of a limited right to exclude competitors from the fruits of the research. When the Government underwrites R. & D. risks, the Government—that is, the public—should be entitled to the full rewards of any invention. A "title" policy in our view best guarantees such rewards to the public. On the other hand, under a "license" policy, the public would pay the contractor twice—first through the governmental research support, and then again through the patent monopoly surcharge in the marketplace, which is reflected in the price the public pays for goods subject to that surcharge.

We are not aware of any convincing showing that exclusive rights in Government-financed inventions need be granted to contractors in order to induce them to accept Government R. & D. contracts, which themselves confer many benefits beyond the simple contract price. Among these benefits are the opportunity to train key personnel, expand research facilities, develop know-how—all with Government aid—and apply these assets to further the contractors' own commercial objectives. These contractors may also receive Government data and know-how inaccessible to their competitors. As a result, contractors participating in Government-funding research programs can acquire a long and significant lead over their actual or potential competitors.

As the role of Government-financed R. & D. expands—as it generally has since World World II—the competitive significance of Government research contracts also grows. Even a company with a firmly established commercial position in a particular technology must think twice before refusing to bid for a Government research contract, since the likely consequences of such a decision may well be to create new competitors or to strengthen old ones. In addition, during slow times contractors may be eager to utilize their personnel and plant assets productively with Government contracts.

The competitive risk to the public in transferring title to the contractor may be especially high where transfer carries a danger of further entrenching the already strong market positions of many Government contractors. The Government may want to use a certain dominant firm for certain R. & D. because of, for example, its R. & D. capability in its field. An exclusive grant of Government-financed patent rights to that firm, however, may raise the barriers to competition in that field by increasing the firm's technological lead.

Mr. GORDON. May I interrupt for a second.

Some Government agencies have the statutory authority to waive title to an invention when they think it is in the public interest to do so. Where a corporation already holds a dominant position in a field with a sufficient portfolio of patents to make it difficult for other people to compete effectively, both because of its economic dominance and its patent position, would you deem it to be in the national interest to waive patent rights that would further strengthen that dominant position?

Mr. SHENEFIELD. Other things being equal, I would certainly not think it in the public interest.

That is precisely the kind of factor which, according to the ERDA Act, which describes the matters the Administrator must take into account in considering whether to waive, ought to be weighed carefully.

That is precisely a situation in which small businesses that are endeavoring to enter, or have already entered into, the field, could be benefited by the general availability of the know-how and of the technology.

Mr. GORDON. Well, do you think before a waiver is granted, the Department of Justice or the Federal Trade Commission should have an opportunity to analyze its economic, especially competitive, implications?

Mr. SHENEFIELD. That is a complicated question, Mr. Gordon. I would like to say in general two things about it.

First of all, we are hesitant, and by we, I mean the Department of Justice, to take on a kind of automatic review process for a large number of transactions, no matter how large or how small, and to obligate ourselves to review them just automatically without any preassessment of competitive significance. But that is sort of a bureaucratic answer to the problem.

The more important answer it seems to me is that somehow there ought to be a way of assessing the competitive significance on the record, before the waiver is granted. It is apparent that at least in a couple or in a number of circumstances, we have not gotten there yet.

There is, as I understand it, no way to know in advance, there is no way that the Department of Justice or the Federal Trade Commission can exercise any kind of review of the competitive significance of a proposed waiver.

Second, as I understand it, the 1974 ERDA Act, if that is a model, does not apparently require, or at least the language does not explicitly require, an explication of the Administrator's decision, and the grounds for that decision, in the competitive area, so there is no way even to assess what sort of factors went through his or her mind in making the determination. Third, there is no way in retrospect, at least as near as one can tell from the statute, to go back after the decision, and say you made the wrong decision, we should do something about it.

I would like to be able to see some measure of the competitive significance of a proposed waiver in advance, on a discretionary basis.

How precisely that is done, it seems to me is still open, but the problem that you have raised seems to be very important.

Senator NELSON. Well, does not the position of the Justice Department, as you stated it here, militate against giving away any patents except in the most exceptional case?

You argue the position of the Department, that contractors do not take the contract in anticipation of discovering something new. They do not reduce their price because they might discover something new. They are paid a contract price, frequently cost plus. Therefore, the Department's position argues for the proposition that you do not give any exclusive licenses or patents away to anybody unless it is an exceptional case. You say the Justice Department would not want to be loaded down with all kinds of decisions. The Justice Department should not have to be loaded down because these cases should be exceptions and relatively rare.

The contracting agency ought to have to say that it has a compelling reason in special circumstances for an exception, with a particular contract, with a particular contractor. It should set forth the reasons, and it ought to be a rare, rare case. Is not that the position of Justice?

Mr. SHENEFIELD. I think that is exactly right, although currently the statute in the ERDA area, which spells out a slightly different procedure than what I am suggesting, might be able to be refined or modified in order to give us and the Federal Trade Commission a kind of advanced look.

If my memory serves me correctly, in the years 1968–72, there were approximately 1,700 or 1,800 requests for a grant of patent rights made of all agencies in the Federal Government.

Senator NELSON. Requests from whom to whom?

Mr. SHENEFIELD. From contractors to the Federal Government for waiver, or a larger patent concessions than would have been forthcoming otherwise.

This is in the 1972 or 1973 Report on Government Patent Policy, and if it is that many, my only point is that even if waivers should only be permitted in a small number of circumstances, somebody has to review that number, and whether the Department of Justice, or the Federal Trade Commission can currently usefully review 1,500 applications, and make any sense of them, absent a fairly searching market analysis, I am not at all certain.

Senator NELSON. How many requests and between which years?

Mr. SHENEFIELD. I looked at a report, as I recall on Government Patent Policy.

Senator NELSON. And these were requests from the contractor?

Mr. SHENEFIELD. Requests from the contractor for a waiver or in some sense a larger concession of patent rights than the Government agency was inclined to grant.

Senator NELSON. Why did you not just say "no?" Why not say: "If you have a case, make it, otherwise, do not bother us." Those requests were probably just routine stuff for something that nobody was entitled to get.

In the ERDA regulations that Admiral Rickover read yesterday, it is almost specifically suggested to the contractor that he ask for an exception.

Well, any contractor with any sense—I would think—would say, yes, I see that, let us ask for the exception.

The answer to that is simply to say "no," and to tell the contractor: "If you have a special case, file a brief telling us what reason there is for this great exception, and we will send it to Justice for review."

The 1,600 or 1,700 requests for waiver probably does not mean anything, except they want everything they can get their hands on, but if all of the agencies deal like ERDA, and say, everytime we give you a contract, we want to remind you that you ought to ask for some kind of exception for patents, and so forth, well, of course, they will do so.

As soon as you tell them, we will not give you any exception unless there is a very special reason for it, and we do not know, we cannot think of any special reasons, you give us a special reason, then you would not have a big problem reviewing them, because you would not be giving any away.

Mr. SHENEFIELD. I am not so sure that is correct.

My guess is there could just as easily be ginned up a sort of form brief supporting concession of patent rights, as could be ginned up a form of application.

Senator NELSON. Once you sign the contract, you simply say, here is the contract. Any patents are ours.

Any request for an exception, the answer is no, and that is it.

I do not know why the people in the Federal agencies keep trying to give the Federal Government's money away.

Mr. SHENEFIELD. Nobody is trying to do that.

Senator NELSON. Sure they are.

Mr. SHENEFIELD. We cannot review, as he suggested we ought to be able to do, every request that comes along without devoting some resources to the task, and we ought to be counting the resources we are devoting in some assessment of the benefits we are getting.

That is all I am saying.

Senator NELSON. I am not blaming you. All I am saying is the Justice Department does not have any guts, and never has had in this area. The Defense Department wants to give everything away, and we get a lot of problems from all of the other agencies on this issue. I would hope under this Administration there would be somebody in Justice that would have the guts to stand up and say let us quit giving this money away.

I understand you are not the Attorney General, but it gets pretty wearysome listening to all of the excuses that we cannot do this, we do not have this authority, and so on.

At least Justice ought to go to the President, and say, "Look, we have been giving the country away long enough."

Here is what we would suggest, and take your lumps if the President wants to continue to give the public's money away. But what a way to do business!

Mr. SHENEFIELD. All I think—the only final statement I would be willing to make is that in answer to Mr. Gordon's question, would it not be a good idea, the answer is yes. No. 2, I suggested a variety of ways that it might be facilitated, but No. 3, I do not think automatic review is one of them. If Congress writes an act that requires the Department of Justice to offer its opinion, we would be happy to comply with the provisions of that statute.

Senator NELSON. The Justice Department has enormous legal resources. I have been reading from previous reports of the Attorney General, such as the 1956 report. The Department of Justice has been writing reports for half a century. Somebody over in Justice ought to just come out with a good tough memo, give it to the President, and show a little guts. A speech at the American Bar Association every decade does not mean a damn thing. You have all of the resources. We do not have them over here. You have them, including an antitrust division, and I do not know what you do with it, but——

Mr. SHENEFIELD. I will have a chance to show you. You will have a chance to find out. I understand you are holding hearings on the Antitrust Division, and we are looking forward to that, because I want to tell you what we do.

Senator NELSON. You are going to be there to tell us?

Mr. SHENEFIELD. I hope so.

Mr. GORDON. Mr. Shenefield, I am not finished yet.

Now, in order to analyze the economic, especially the competitive, implications of this giveaway, you have to know what you are giving away, right?

Mr. SHENEFIELD. That would seem plausible.

Mr. GORDON. In other words, intelligent judgment requires that the Government know at the time that it abandons or waives title, what the inventions are, and what purposes they serve. Is that correct?

Mr. SHENEFIELD. If the point of the question is, would we prefer a waiver only at the point the invention is identified, the answer is yes, we would.

In general, it would seem to be a bad idea to waive rights before anybody knows what the inventions we are waiving have to do with.

Mr. GORDON. But, as you are aware, the DOD and other Government agencies and departments routinely allow contractors to retain title at the time of contracting, so the Government does not know what it is giving up or what the contractor is acquiring, is that not correct?

Mr. SHENEFIELD. I would agree with that. I would agree with that, and that is obviously a lamentable circumstance.

A major rationale for a license policy is allegedly to facilitate commercialization of these inventions. We do not believe that a factual basis exists for the belief that giving title to a contractor will generally achieve commercialization of Government-financed inventions more rapidly than leaving title in the Government. The only clearly discernible general effect of giving such rights to private parties would be to confer a substantial private benefit without compensating public gain. There are no studies, statistics, or experiences that have demonstrated to our satisfaction the thesis that such an allocation of rights will protect the public investment in research and development by promoting the widespread utilization of inventions.

In fact, we believe that available evidence is to the contrary. The question of patent rights as an incentive to commercial utilization of inventions—as well as other issues—was the subject of study by Harbridge House, Inc. The study identifies categories of firms to which patent rights are not a significant factor, either in inducing participation in Government work, or fostering commercial utilization of such patents, as well as categories of firms to which ownership of a patent is a secondary or incidental factor in the decision to commercialize an invention, compared to market considerations and investment requirements. Many Government contractors, it appears, make marketing decisions without serious regard to patent ownership.

Exceptional circumstances—and I emphasize that word—may on occasion arise when the public interest warrants a waiver of principal or exclusive rights by the Government in particular inventions. Consideration of such a waiver, however, should occur only after identification and analysis of the invention concerned and its market setting, for only then can a reasonably informed assessment be made of all factors having an impact on the public interest.

Senator NELSON. That position is precisely what I have been saying—exceptional cases—and you say the consideration of waiver should occur only after identification and analysis of the invention concerned and its market setting.

What is Justice doing about this?

It is drafting some recommendation to the President, or some recommendation for legislation, or is this another repeated statement of policy that has been made by Justice for, well—I remember a 1924 statement—so it is over 50 years.

Is Justice doing something about it? Is it going to come out with a recommendation to the President for legislation, or are we just going to continue to lather and never shave?

Mr. SHENEFIELD. There is, as you would expect, a struggle going on within the administration with the participants on either side of the issue, that have been the same, probably since 1924.

We are in that struggle and the position we advocate is the one that you see before you in the statement; how that is to be resolved, I cannot answer and I cannot predict.

Senator NELSON. You mean the Commerce Department wants to continue to give the country away, and Justice does not?

Mr. SHENEFIELD. The Commerce Department takes a different view than we do.

Senator NELSON. Well, I must say it is discouraging that the struggle is still going on for a half a century, with nothing happening.

Mr. SHENEFIELD. There is a new administration, as you know, and I am told that within 2 or 3 weeks, there will be a position of this administration.

I must say that I anticipate that our view will probably prevail, but there is no way to predict that, and a lot of people more important than I am will make that decision.

We will strongly advocate this position.

Senator NELSON. You say that you are expecting that a position by Justice, or position by the administration on this question will be taken when?

Mr. SHENEFIELD. Within a few weeks.

Senator NELSON. Within a few weeks?

Mr. SHENEFIELD. Yes.

Senator NELSON. That means by the end of January?

Mr. SHENEFIELD. I would certainly say so.

Mr. GORDON. Can you describe an exceptional circumstance which would justify a giveaway of patent rights?

Mr. SHENEFIELD. Giveaway patent rights?

Mr. GORDON. Yes.

Mr. SHENEFIELD. Are you talking about waiver?

Mr. GORDON. A waiver, or abandoning without even knowing what we are giving away.

What exceptional circumstances can you envisage that would justify a waiver of principal or exclusive rights?

Mr. SHENEFIELD. It would have to be, in my view, an extraordinary situation, perhaps involving national security or wartime, or some sort of very pressing circumstance.

Short of that, it seems to be difficult to justify.

Mr. GORDON. Now, if there is a good reason for it, what safeguards will you provide to protect the public in the face of granting a monopoly?

Mr. SHENEFIELD. After the monopoly is granted?

Mr. GORDON. No; at the time of giving a monopoly, assuming there are good reasons for giving it.

What can we do to protect the public against the abuses of it?

Mr. SHENEFIELD. It seems to me you have got to do a couple of things.

You have got to assure yourself that the grantee will be in a position to and will actually commercially utilize the invention, and make in that sense the fruits available to the public, in the public interest.

It seems to me you have to limit the term, and you have to obviously preserve the option of the Government to go back in at anytime that it views the grantee is not carrying out its obligations.

Mr. GORDON. And selling it at a reasonable price too, not exploiting the public?

Mr. SHENEFIELD. Yes.

Mr. GORDON. Can you conceive a case of an important product or process which people need and for which there is a demand, not being commercialized because of absence of monopoly rights?

Mr. SHENEFIELD. It seems as a matter of economics very unlikely.

Mr. GORDON. So you would not give the patent away just to commercialize a product. If it is important, if it is needed, it will be produced. Is that right?

Mr. SHENEFIELD. If it is needed, presumably the market will take care of its development quite apart from the question of granting a monopoly.

If you decided on perfectly good grounds that we discussed earlier to waive the Government rights at the time the invention was identified it seems to me the thing you most of all want to assure is that the invention is then developed and made commercially utilizable.

Mr. GORDON. If it is not needed, if it is not that important, and the market could not take care of it, why give the monopoly rights to anybody?

Mr. SHENEFIELD. That goes to the question of what original standards are, and I thought your question was after you determined on the basis of those original standards to waive the rights, what safeguards do you write in, and I am suggesting the safeguards.

Mr. GORDON. I am referring to the point when you give out the rights.

Senator NELSON. Please proceed.

Mr. SHENEFIELD. All right.

Rational assessment of the value of what the Government may be giving up, and what the resulting effect on the public may be, cannot be made, however, when title to inventions yet unmade is conferred on the contractor at time of contracting.

Moreover, when promotion of utilization is to be a basic concern, it would seem especially important that the effect of Government or private ownership be reviewed. Only in these circumstances can proper evaluation be made of the need, if any, to place title in private hands and of the terms and conditions to attach should such an allocation of rights appear warranted.

Rather than wholesale turning over to private firms the title to all Government-financed inventions, even those not needing the inducement of the full 17-year monopoly for full commercialization, the problems posed by exceptional circumstances should be handled indi-

vidually. Any problems posed by a few instances should not be solved at the public expense in the majority of cases.

Sections 9 and 10 of the Federal Nonnuclear Energy Research and Development Act of 1974, sections 5809 and 5908 of title 42, United States Code, represent the most recent major congressional action dealing with patent policy. These provisions basically provide for title in the Government at time of contracting, with provision for waiver under stated conditions, retention of rights in the Government to revoke the waiver if necessary—"march-in" rights—and exclusive or partially exclusive licenses under Government-owned patents in specific circumstances. These provisions were arrived at after considerable study of the subject on the part of both Congress—with the aid of extensive hearings—and the executive branch. The flexible title-waiver policy they contain recognizes the importance of fostering commercialization of inventions, while generally permitting access to Government-sponsored technology and fostering competition. Provisions such as these appropriately entrust to public authorities rather than private parties the responsibility of seeing to it that the public receives full measure for its investment in research and development activities.

Mr. Chairman, this concludes my prepared statement, I would be happy to answer any questions the committee may have.

Mr. GORDON. How effective are the so-called march-in rights in protecting the public?

Mr. SHENEFIELD. I am not sure what the empirical answer to that question is.

It seems like to me that the answer is that they are not terrifically effective.

My guess is by virtue of the way Government tends to operate and the energy of private firms in this area, that march-in rights would not be very frequently exercised, and as a result it is probably largely an empty provision.

Mr. GORDON. One argument to justify a grant of a patent monopoly on the results of Government-financed research is that it will promote the maximum use of a product or process. That is the theme that runs through all of the arguments.

How can you assure maximum utilization where the contractor is entitled to exclusive commercial rights which permit him to exclude other citizens, other members of the public, from practicing the invention?

Mr. SHENEFIELD. I think the answer to that is you probably cannot in most circumstances.

The only exception to that general rule would seem to be when in the absence of such granting of monopoly rights, as you put it, there would be likely little or no development whatever in that or succeeding stages of invention, but in general, I would think the answer to your question is that you cannot do it as well.

Mr. GORDON. The patent, the whole idea of a patent is to restrict the use.

If you restrict the use, you can control the prices and the profits.

If you are interested in the maximum and prompt dissemination of scientific and technological information, is it not clear that rather than granting monopoly rights to a contractor, we should provide for

Government retention of rights or for dedication or publication of the invention, that is, if our objective is the most rapid dissemination?

Mr. SHENEFIELD. I would agree with that statement in general.

Mr. GORDON. And from the standpoint of technological progress and economic growth, it is true, is it not, that it is desirable to have the most rapid dissemination of this new knowledge?

Mr. SHENEFIELD. It is true.

Senator NELSON. Yesterday Admiral Rickover testified that the Defense Department spends $1 billion a year in what is called independent research and development.

Admiral Rickover's testimony was that these grants of money are made to private corporations, mostly large ones.

It is not targeted research according to Admiral Rickover.

Are you familiar with that program?

Mr. SHENEFIELD. I am not.

Senator NELSON. I will not pursue that.

Thank you very much. We appreciate your presentation.

Mr. SHENEFIELD. Thank you very much.

[The prepared statement of Mr. Shenefield follows:]

STATEMENT OF JOHN H. SHENEFIELD, ASSISTANT ATTORNEY GENERAL, ANTITRUST DIVISION, DEPARTMENT OF JUSTICE

I appreciate the opportunity to testify today on behalf of the Department of Justice on federal government policies with respect to patent rights in inventions resulting from federally funded research and development. I understand these hearings to be on the general subject, and not on any particular legislation. At the outset I would like to point out that the Administration is currently reviewing its position regarding the ownership, control, and use of patentable inventions resulting from federally funded R&D contracts and grants. We expect that the Department of Justice will participate in that review. Until an Administration position on this issue is decided, it is premature for me to state any Administration position. We would like, however, to mention some of the factors that will be considered in the review, and to outline the positions the Department of Justice has and will continue to advocate.

For over thirty years a controversy has existed between the advocates of the so-called "title" and "license" policies regarding the disposition of rights in inventions made under federally funded R&D. Under the "title" policy, the government takes title to the rights in these inventions (i.e., patents), and private interests may utilize the inventions through the government's licensing or dedication of the patents or other rights. Under the "license" policy, the contractor is given title to the rights in these inventions, with a royalty-free license retained by the government, but there is no obligation on the part of the contractor to let other qualified applicants have access to the products of government-funded research.

Presently there is no general legislation that controls all federal agencies in the disposition of rights to inventions stemming from federally funded R&D. Congress has acted, however, in a number of instances with respect to particular agencies or subject matter. In these cases, the particular legislation has generally provided that title to inventions resulting from such R&D is normally to be retained by the government. Waiver of title is permitted in some situations after evaluation of various factors, including the invention's importance to public health, welfare, and safety, and the effect of waiver on promoting commercial utilization of the invention. The recent Federal Nonnuclear Energy Research and Development Act of 1974[1] contains such provisions. No statutes provide that title should be given directly to the contractor.

Prior to 1963 the disposition of contractor inventions was a matter of individual agency policy unless the agency was subject to a specific statute. Some

[1] 42 U.S.C. 5901, 5908.

agencies followed a "title" policy and some a "license" policy. In 1963 President Kennedy issued a Statement of Government Patent Policy. This statement took the approach that one single policy was not required, and did not adopt either a "license" or "title" policy. Instead it adopted a sort of middle ground and described in general terms those conditions under which the government would take title and those under which it would take only a license. The 1971 Presidential Statement of Government Patent Policy, a slightly modified version of the 1963 statement, now governs federal patent policy and is implemented by the regulations of various agencies.

The Department of Justice has traditionally supported a "title" policy. This was the Department's position, in the 1947 Attorney General's Report on Investigation of Government Patent Policy, his 1956 Report Under the Defense Production Act, and numerous appearances before congressional committees. Most recently, in 1974, the Department urged use of a "title" policy when Congress was considering patent provisions for legislation to promote crucial research and development in the energy area.[2] That is still the Department's view.

There are several arguments in support of this policy. When public monies are spent, the public as a whole should benefit, as it would from the availability of nonexclusive, nondiscriminatory licenses to qualified applicants, resulting in maximum availability of the invention. Inventions produced by expenditures of public funds should inure to the benefit of the public. Government control of inventions deriving from such expenditures assures that they will be used to promote the public interests, rather than the not necessarily synonymous interests of private parties.

In our view no purpose would be served by taxing the public for research and development and then turning the very results sought by the research and development over to the contractor along with a right to exclude its competitors from the use of those results. Such rights seem to be in the nature of a windfall, at public expense, to the contractor. What the government is purchasing is the contractor's research and development effort, often on a cost-plus basis. The contractor does not lower his contract price because of the government's agreement to grant him patent rights. His contract price does not take account of speculative invention and patent possibilities.

The expenditure of public funds for R&D is in effect a government underwriting of the risk of the research effort. For privately funded research, the patent system supplies an incentive to undertake these risks because it offers the reward of a limited right to exclude competitors from the fruits of the research. When the government underwrites R&D risks, the government—that is the public—should be entitled to the full rewards of any invention. A "title" policy in our view best guarantees such rewards to the public. On the other hand, under a "license" policy, the public would pay the contractor twice—first through the governmental research support, and then again through the patent monopoly surcharge in the marketplace, which is reflected in the price the public pays for goods subject to that surcharge.

We are not aware of any convincing showing that exclusive rights in government-financed inventions need be granted to contractors in order to induce them to accept government R&D contracts which themselves confer many benefits beyond the simple contract price. Among these benefits are the opportunity to train key personnel, expand research facilities, develop know-how—all with government aid—and apply these assets to further the contractors' own commercial objectives. These contractors may also receive government data and know-how inaccessible to their competitors. As a result, contractors participating in government-funded research programs can acquire a long and significant lead over their actual or potential competitors.

As the role of government-financed R&D expands—as it generally has since World War II—the competitive significance of government research contracts also grows. Even a company with a firmly established commercial position in a particular technology must think twice before refusing to bid for a government research contract, since the likely consequences of such a decision may well be to create new competitors or to strengthen old ones. In addition, during slow times contractors may be eager to utilize their personnel and plant assets productively with government contracts.

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[2] Statement of then Assistant Attorney General Kauper on H.R. 6602 before the Subcomm. on the Environment of the House Comm. on Interior and Insular Affairs, 93rd Cong. (February 1, 1974).

The competitive risk to the public in transferring title to the contractor may be especially high where transfer carries a danger of further entrenching the already strong market positions of many government contractors. The government may want to use a certain dominant firm for certain R&D because of, for example, its R&D capability in its field. An exclusive grant of government-financed patent rights to that firm, however, may raise the barriers to competition in that field by increasing the firm's technological lead.

A major rationale for a "license" policy is allegedly to facilitate commercialization of these inventions. We do not believe that a factual basis exists for the belief that giving title to a contractor will generally achieve commercialization of government-financed inventions more rapidly than leaving title in the government. The only clearly discernible general effect of giving such rights to private parties would be to confer a substantial private benefit without compensating public gain. There are no studies, statistics, or experiences that have demonstrated to our satisfaction the thesis that such an allocation of rights will protect the public investment in research and development by promoting the widespread utilization of inventions.

In fact, we believe that available evidence is to the contrary. The question of patent rights as an incentive to commercial utilization of inventions (as well as other issues) was the subject of study by Harbridge House, Inc.[3] The study identifies categories of firms to which patent rights are not a significant factor, either in inducing participation in government work, or fostering commercial utilization of such patents, as well as categories of firms to which ownership of a patent is a secondary or incidental factor in the decision to commercialize an invention, compared to market considerations and investment requirements. Many government contractors, it appears, make marketing decisions without serious regard to patent ownership.

Exceptional circumstances may on occasion arise when the public interest warrants a waiver of principal or exclusive rights by the government in particular inventions. Consideration of such a waiver, however, should occur only after identification and analysis of the invention concerned and its market setting, for only then can a reasonably informed assessment be made of all factors having an impact on the public interest. Rational assessment of the value of what the government may be giving up, and what the resulting effect on the public may be, cannot be made, however, when title to inventions yet unmade is conferred on the contractor at time of contracting.

Moreover, when promotion of utilization is to be a basic concern, it would seem especially important that the effect of government or private ownership be reviewed. Only in these circumstances can proper evaluation be made of the need, if any, to place title in private hands and of the terms and conditions to attach should such an allocation of rights appear warranted.

Rather than wholesale turning over to private firms the title to all government-financed inventions, even those not needing the inducement of the full 17-year monopoly for full commercialization, the problems posed by exceptional circumstances should be handled individually. Any problems posed by a few instances should not be solved at the public expense in the majority of cases.

Sections 9 and 10 of the Federal Nonnuclear Energy Research and Development Act of 1974 (42 U.S.C. §§ 5908, 5809) represent the most recent major congressional action dealing with patent policy. These provisions basically provide for title in the government at time of contracting, with provision for waiver under stated conditions, retention of rights in the government to revoke the waiver if necessary ("march-in" rights), and exclusive or partially eclusive licenses under government-owned patents in specific circumstances. These provisions were arrived at after considerable study of the subject on the part of both Congress (with the aid of extensive hearings) and the Executive Branch. The flexible title-waiver policy they contain recognizes the importance of fostering commercialization of inventions, while generally permitting access to government-sponsored technology and fostering competition. Provisions such as these appropriately entrust to public authorities rather than private parties the responsibility of seeing to it that the public receives full measure for its investment in research and development activities.

Mr. Chairman, this concludes my prepared statement. I would be happy to answer any questions the Committee may have.

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[3] Harbridge House, Inc., "Government Patent Policy Study" (1968).

Senator NELSON. Our next witness is Mr. Merton H. Douthitt, corporate patent counsel, of SCM Corp., Cleveland, Ohio.

STATEMENT OF MERTON H. DOUTHITT, CORPORATE PATENT COUNSEL, SCM CORPS., CLEVELAND, OHIO

Mr. DOUTHITT. Thank you, Mr. Chairman.

Senator NELSON. Your statement will be printed in full in the record. You may present it however you desire.

Mr. DOUTHITT. I appreciate the time you are affording me here.

I have submitted a detailed statement, and I would like to summarize this and speak from notes and develop some collateral history, collateral to your opening statement of yesterday.

Mr. Chairman, you pointed out these hearings are in an initial phase of an extensive study of policies of the Department of Justice and related agencies with respect to disposition of rights and results from publicly financed research, and that it would be more accurate to say that the hearings are a resumption of those held earlier in 1959, 1962, and 1963.

More on that in a minute. I think I should say why I am here and more about my company.

My company is SCM Corp., and more specifically, it has been hurt and its organic chemicals division, which I will refer to as SCM Corp., it has been hurt by the foreign patent policies and practices of the U.S. Department of Agriculture.

I propose to discuss this injury, and suggest some corrective measures.

Now, there is a typographical error in my statement, on page 2, line 5, in the detailed written statement.

It says that SCM's Organic Chemical Division's sales were approximately $136 million of turpentine based chemicals.

That is an error by $100 million. The number should be $36 million, not 136.

I hope that qualifies the business as being small enough to have this committee pay attention to.

SCM Organics is one of six major divisions of the SCM Corp.

The corporation itself has about 1½ billion of annual sales. I am corporate patent counsel as you noted.

Now, each division in this company has a president, each has a fair degree of autonomy, and they must compete for corporate funding.

Now, I would like to go back to a little bit of history for a minute relative to your opening statement.

Immediately after World War II, T. Clark, then Attorney General, made a detailed study, very similar to the one I think you proposed to do, and he reported those conclusions to President Truman.

Now, a copy of that study is in the library of the Department of Justice, and another one in the Department of Interior library, and on page 2, I quote, "Inventions financed with public funds should enure to the benefit of the public, and should not become a purely private monopoly under which the public may be charged for or even denied the use of technology which it has financed."

That was his conclusion.

Mr. GORDON. What is the date of that?

Mr. DOUTHITT. That was right after the war.

I believe it was around 1947, 1946, I am not sure.

Those basic premises, I do not think they were ever effectively challenged.

I believe they were sound and valid in 1947, and I think they are valid today.

Now, after President Truman received that report, he issued Executive Orders 9865 and 10096, based on that report.

These dealt with domestic U.S. patents, and domestic and foreign patents, to be obtained by various agencies, as a result of their research progress.

Now, these orders created a Government Patent Board, and its chairman was empowered to issue administrative orders, consistent with the Executive orders.

Perhaps the most important order he issued came down, was Administrative Order No. 6, and we get into what happened there.

Now, in spite of the multimillion dollars research and development budgets of the Government departments and the aggregate Government agencies, there seemed to be a resistance to getting patents, especially foreign patents on inventions made by employees of these departments.

The Administrative Order No. 6 permitted the agencies to elect that they could get foreign patent protection if they felt like it at times.

The next step in this, as I see it, was that some of the agencies, including the Department of Agriculture then began to release the foreign rights to Government employee inventors who then could sell them to a private industrial party.

Such private party could finance procurement of foreign patents in return for an assignment of those rights, a total ownership, or possibly a license.

Mr. GORDON. Is this routine, or are they special cases when they allow employees to retain the title?

Mr. DOUTHITT. Well, it was routine to the extent that it was written into the regulations, as I understand it.

Mr. GORDON. How about the law, is it in the statute at all?

Mr. DOUTHITT. I do not recall anything in the law.

It took myself and especially my counsel a great deal of time to find all this out.

It was not easy to find out what the policies were, or what the interpretations of the written word was once you would read it.

It took about 2 months of digging. As far as you are asking about routine, I believe that question, anytime the employee inventor asks for this, he can ask for the release routinely.

Whether he gets it or not, I am not sure. It is in the Department of Agriculture, there is no statute on this, and in the Department of Agriculture, it seems to be routine at least, at least there.

Does that answer your question, sir?

Mr. GORDON. Yes.

Mr. DOUTHITT. Now, back in 1965, an employee inventor, that is in the Department of Agriculture, and several coworkers were trying

to stimulate the flow of resins and olio-resins from pine trees that were gathering turpentine from resin.

They wounded a tree by scraping the bark, and applying a very delicate solution of a herbicide and several other chemical cousins, and they did not get more flow, but low and behold, after a few months, the tree became loaded with rosin in its interior, and I show here, I will leave these with the committee, this is a tree that has been wounded, or injected with a very little solution of this herbicide, and you can see that it is just saturated with these byproducts of wood pulp resin, turpentine, oleoresins generally.

This goes generally up the tree from the point of the wound and the application of the herbicide.

That is called light wood. I believe the term comes because if you take that kind of saturated wood, and splinters, and light a match to it, it lights and becomes excellent kindling.

It burns like a torch. It contains maybe 10 times as much, 4 to 10 times as much of these resins as ordinary pulp wood.

Now, a little bit about the business of SCM Organics, and that will help us a little bit here.

It is based in Jacksonville, Fla., and processes almost 7 million pounds of sulphate turpentine per month, and this is a byproduct of craft papermaking, and this is the raw material, the basic raw material to make intermediate products, and final products for perfumery, flavorings, pharmaceuticals, and even vitamins A and E, disinfectants and some herbicides.

Organics primarily domestic competitors in this field are Hercules, Inc., Rayco Gold, Inc., Arizona Chemical Co., and Union Chem Corp.

There are many other indirect. Those are direct.

Now, many turpentine based, or so-called turpentine products compete with petrochemicals, and because of the rising cost of petroleum based raw materials, turpentine products have grown rapidly.

In fiscal 1977, I think we have seen from as far back as 15 years, maybe a growth of 10 times, tenfold.

Now, the supply of this turpentine is limited.

U.S. production is quite fully exploited. The output is committed to various users well in advance of its production.

As a result, perhaps most of the expansion will be for people to look to foreign sources for an adequate supply to keep the business growing and healthy.

In our case, as much as 10 percent comes from foreign sources.

Now, given the short supply of this value resource, scientists have had a dream of increasing the yield of turpentine from pine trees, and once this invaluable discovery was made, the use was obvious.

There is maybe 4 to 10 times as much resin here as there would be in the ordinary wood. By 1973, the Department of Agriculture began to realize they had quite an invention on their hands, and I think it was apparent that somebody could make a lot of money, as you could tie up this process, at least in foreign markets.

Now, the question I ask, is it possible to use Government-sponsored research for the enrichment of Government scientists and a company they favor?

I believe the answer today is yes, at least for the Department of Agriculture.

Now, let me say immediately that I believe that employed scientists and inventors should get reasonable compensation and recognition.

I believe there are many ways to recognize them, and many ways to compensate them, besides having them crapshoot on what inventions they are going to make, and how they can get them exploited.

The thing that bothers me terribly here is that there seems to be a possibility of getting unreasonable favoring of a single competitor within an industry, by these employee inventors, and excluding or preventing other citizens from equivalent participation.

Now, domestically, there is no problem. This invention is available for a domestic license from the Department of Agriculture, on routine application, and my own company has one.

Now, what about foreign?

Well, we tried, for example, to put together a group of big forestry people in New Zealand, because New Zealand has maybe enough by-products, for turpentine, and things like that to justify one plant.

We were rebuffed in our efforts finally, and the main reason that was given to us by one of the potential partners was that the New Zealand patent rights were already sewed up by Hercules, and so we were sort of late.

Now, in the history of this particular case here, the Department of Agriculture released the rights to use this process in foreign countries to the departmental employees who shared in this invention.

They in turn sold their interest very promptly to Hercules. The patent application was made by the U.S. Department of Agriculture I believe in August 1973, about the last few days, within a month, they applied for their release or waiver, the employees did, and it was granted, maybe a month or two.

I want to say to his credit, the Chief of the Foreign Service in approving this release urged the inventors, to see that other concerned U.S. companies are aware of the possible availability of such rights.

This admonition was not heeded, and instead there seemed to be an extreme haste to give this one company the exclusive overseas rights.

Since that time, Hercules has obtained patent rights, I will call it a paraquat process in more than 20 countries.

Now, a subsequent application for license by SCM Organics, and perhaps others to practice the invention in foreign countries was denied by USDA.

If the USDA is upheld, and we are suing them frankly on this point, the injury would be significant.

I have already told you about the problem in New Zealand. There are several other countries that are prime candidates for use of this process, specifically Brazil, possibly Canada, maybe Chile.

Now, I do not think it was the intention of either Congress or the Department of Agriculture to create this unusual, and what I believe unfair situation, and I would like to recommend some fairly simple procedures that might prevent a repetition of this inequity.

Now, these apply immediately to employee inventors. I would say first the procedure for releasing foreign rights should be made more open and fair and uniform.

Now, you remember in this case, there was no public hearing or open bidding, no other procedures designed to see that the public rights were protected.

No other comparable value is given away by the Government without such elemental safeguards, as far as I know.

Second, I would say that as a general rule, nonexclusive licenses should be generally available to any U.S. citizen who wants to undertake the foreign development of an invention made by employee inventors of the Department, using these employees who have used public funds as a general rule.

And, third, there may be cases where an exclusive license is necessary to insure adequate or prompt development, and I can think of a few.

Now, that is not the case I described. Where there is a reasonable case made for exclusivity, I would say the burden should be on the applicant seeking such privilege.

In the foreign, I think there should best be a public hearing as I suggested earlier.

Now, I would be grateful to answer any questions that I can deal with.

Senator NELSON. Is this process patented?

Mr. DOUTHITT. Yes, sir. It is patented in the United States.

I cannot think of the number of patents issued about 1974.

Basically, it says you will wound a tree, apply a sublethal dose of this paraquat, or one of its chemical cousins, and then you stand back and let the tree do the rest.

At some point, say 6 months later, you harvest the tree, and the trunk in a sector where you wounded it, you apply it, the sector upward from there is loaded something like this.

Senator NELSON. You have to cut down the tree to extract it?

Mr. DOUTHITT. Yes, you are going to harvest the tree anyway to pulp it, and that is where you get sulfate turpentine and rosin, the main products.

Senator NELSON. And is the pulp then used for something else?

Mr. DOUTHITT. The pulp is used for making bags and things like that, wrappings.

Senator NELSON. You are a patent attorney?

Mr. DOUTHITT. Yes, sir.

I am one of those Admiral Rickover speaks of as the patent lobby.

Senator NELSON. I do not know anything about patent law, but what is patented in this case?

This is just simply a process, anybody could just buy the herbicide and apply it.

What is patented?

Mr. DOUTHITT. Well, you infringe the patent if you do that.

Senator NELSON. What has been patented here?

Mr. DOUTHITT. The process of increasing, I think the exact words are increasing the light wood, or the richness of the light wood in the tree.

It is a discovery really. It is not a complicated manufacturing process. It is taking advantage of some previously weird and unknown thing in nature, and this is a real breakthrough.

People have been treating pine trees with everything in sulfuric acid to increase the flow of resins, I cannot think of all of the things.

My counsel says, and I will quote, and he is right, the process is, one, wounding the tree, two, applying paraquat to the wound.

Those are the two essential steps.

Senator NELSON. Well, I did not know you could patent that kind of thing.

Mr. DOUTHITT. Well, it is I would say one of the biological breakthroughs of the century.

If it continues to be as good in the future, as it has been in the last few years, it will be quite significant.

It will increase the turpentine and rosin available maybe by a factor of two or more.

Now, there is some expense to going through the woods and hitting each tree, and as far as I know, that can be recovered by what more the tree will do in 3 months, and by 6 months, you made a profit, and maybe by a year, if the tree is not dead, you have really increased the light wood. residue. or the reserve rosin or turpentine.

Senator NELSON. Are you familiar with the practices in the Department of Agriculture, other than this particular case?

Mr. DOUTHITT. Well, from this case, and from working in it, I believe I have become quite well acquainted with the practice of it, the patent practices of the Department of Agriculture.

Senator NELSON. Is it the practice to grant patent rights on request rather routinely, to inventions, or discoveries, by employees in the Department of Agriculture?

Mr. DOUTHITT. Yes, sir.

That is my belief, it is done routinely.

Mr. GORDON. As I understand it, you feel that since you contributed to development of this invention as a taxpayer, that you and your company should be able to use it, like anybody else; is that correct?

Mr. DOUTHITT. Well, I would not even go that far, sir.

I will say that we should have had a chance to bid, and maybe we could have had a chance. Certainly I do not want to hurt these inventors. I do not want to hurt them.

Mr. GORDON. In private industry, an inventor, when he invents, has to give title, has to assign title to the employer; is not that correct?

Mr. DOUTHITT. Ordinarily that is the case, especially if he has a contract.

It is very common to have contracts to that effect these days.

Mr. GORDON. Is not the common law that an employee who gets paid to invent or who uses his employers facilities——

Mr. DOUTHITT. At the risk of the patent lobby, and especially those behind me, jumping all over my back, I will tell you what I believe the common law is, as you put it, the law, that if you are in the absence of a contract, if you are hired to do that, and you do so invent, yes, there is an implication that you should assign the rights to the person who hired you.

But if there is any kind of argument about whether you were hired to invent or not, or whether or not there was really here a part of your duty, about the best the employer can get from you, your employer, is what they call a shop right, which is a nonexclusive license to use that invention in his own facilities, and you have as the inventor, you have all of the rest of the rights.

Senator NELSON. You defined it rather narrowly.

You say if the employee was hired for the specific purpose of inventing.

Supposing he is simply hired as a design engineer, and in the process of working on some design, say to make a machine run more efficiently, he stumbles upon an idea for an invention. He was not hired to invent, he was just a design engineer.

Mr. DOUTHITT. Mr. Chairman, I do not pose to be an expert on this, but I would say it would not bother me very much, since you ask a design engineer who was hired to make designs, to assign his inventions to me as an employer.

If it were a janitor, or somebody like that, I would say undoubtedly you would have to have a contract.

Now, some place, where you get, where there is an interface, where you have problems, and you have to decide these on a case by case basis, but there is no problem here in the Department of Agriculture, because each employee accepts employment, and he promises to live up to the Department's regulations.

I think they are called ARS, and one of the ARS, at least one of them, and further down the Forestry Service manual, says that he will assign his inventions to the Department of Agriculture, the Secretary of Agriculture, and they even have a form to that effect, and I have shown that, I think that is No. 7, yes, No. 7, is the assignment form that is used by the Department of Agriculture, it is in this exhibit book that accompanies my statement.

Senator NELSON. You made some study of this.

When did the Department start this policy of rather routinely granting exclusive license to the inventor?

Mr. DOUTHITT. 1964.

Senator NELSON. 1964?

Mr. DOUTHITT. Yes, sir.

Senator NELSON. And prior to that, they did not do it routinely?

Mr. DOUTHITT. As far as I know, no.

Senator NELSON. But it has been the general practice since then?

Mr. DOUTHITT. Yes, sir.

Senator NELSON. All right.

Mr. GORDON. Can we say this is a case where the disposition of the rights resulting from publicly financed research actually undermined the competitive condition of your company?

Mr DOUTHITT. Indeed.

Turpentine, sulphate turpentine is the only basic raw material of this little division, I am talking about, that sells $36 million worth of goods a year, and would like to sell a lot more based on turpentine chemicals.

It is a renewable resource.

We have great hopes for it. When oil is running out, I think pine trees will still be growing.

Senator NELSON. Thank you very much. We appreciate your taking the time to come to testify today.

Mr. DOUTHITT. Thank you.

[The prepared statement and attachments of Mr. Douthitt follow:]

STATEMENT BY MERTON H. DOUTHITT, CORPORATE PATENT COUNSEL, SCM CORP., CLEVELAND, OHIO

I am corporate patent counsel for SCM Corporation. I have been employed by SCM for approximately ten years. SCM is comprised of six domestic divisions and various related foreign enterprises. SCM's Organic Chemicals Division, one of my clients, has been adversely impacted by the patent policy of the United

States Department of Agriculture. Pursuant to this policy, without public notice or hearing, title to foreign patent rights in publicly-financed research conducted by the Department is allegedly "released" to and thus vested in the Department's employee-inventors. These employees then negotiate financially advantageous exclusive arrangements with private industry. This procedure has resulted in the alleged acquisition by a major competitor of SCM's Organic Chemicals Division of exclusive foreign patent rights in one of the most important inventions to result in many years from the Department's publicly-financed research.

SCM's Organic Chemicals Division uses crude sulfate turpentine, a by-product from the pulping of wood, almost exclusively as its raw material. Its primary domestic competitors include Hercules, Inc., Reichhold, Inc., Arizona Chemical Company, and Union Camp Corporation. The Organic Chemicals Division and its competitors convert turpentine into a wide variety of chemical products used in perfume, flavorings, pharmaceuticals and herbicides. Specific products made by or derived from intermediate chemicals manufactured by these companies include synthetic menthol for lotions, tobacco and shaving creams, perfume ingredients for soaps, etc. and intermediates for making vitamin A and vitamin E. This important domestic industry has grown markedly in the last fifteen years, possibly ten-fold and perhaps more. In its 1976 fiscal year, SCM's Organic Chemicals Division's sales were approximately $136,000,000 of turpentine based chemicals.

The supply of sulfate turpentine is limited. The Organic Chemical Division purchases the maximum amount possible from United States sources, particularly in the southeast. For the most part, available United States production already is committed to various users or is otherwise quite completely exploited. SCM, accordingly, makes substantial purchases of foreign turpentine, specifically from Canada, Portugal, France, and Scandanavia. Such foreign purchases represent at times as much as ten percent of SCM's turpentine acquisitions. Projected future increases in the need for this raw material must be primarily satisfied from foreign sources.

The Department of Agriculture carries on extensive, tax-financed research.[1] One of the most significant results consequent in recent years from that massive research effort was the discovery by Thaddeus A. Harrington and coworkers, all members of the Department's Forest Service, at the Olustee, Florida Experimental Station, of a process for substantially enhancing the yield of turpentine and rosin from pine trees. This process entails application of a dilute water solution of a commercial herbicide called "paraquat" (or a closely-related herbicide "diquat") to a small area on a pine tree trunk from which the bark has been removed. Such application stimulates the rapid formation of significant quantities of "lightwood" from which turpentine and rosin are derived. This process is referred to as the "paraquat invention".

By 1973, the Forest Service of the Department of Agriculture was convinced that the observation of Mr. Harrington and his coworkers was, in fact, a most commercially significant and valuable invention. In April 1973, the Department published USDA Forest Service Research Note SE–191, entiitled "Inducing Lightwood in Pine Trees by Paraquat Treatment" (Exhibit 2). This article concludes that "This method has great potential as an efficient way to boost the world supply of critically needed chemicals by nonpolluting means. . . ."

Even before this article was published, representatives of SCM's competitor Hercules, Inc. had learned privately of the paraquat invention. In the summer of 1973, Hercules approached the Government employee-inventors in an attempt to obtain exclusive foreign rights.

On August 20, 1973, the Government employee-inventors addressed a letter (Exhibit 3) to John R. McGuire, Chief of the Forest Service, requesting a "release" of the foreign rights in the paraquat invention. As one reason for the requested release, the letter states:

"3. We plan to assign our foreign rights to a U.S. company [*i.e.*, Hercules] capable of immediately using the method for naval stores production in many countries thereby promoting U.S. interests."

On September 7, 1973, the Department filed application Serial No. 395,025 (now U.S. patent 3,839,823) for the paraquat invention.

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[1] The Department's research budget for fiscal 1978 is approximately $239,000,000. See the publication entitled "U. S. Department of Agriculture, 1978 Budget, General Budgetary Statements". A copy of the cover page and pages reflecting the Department's research budget compromise Exhibit 1.

Five days later, on September 12, 1973, without any public hearing or any notice to the public of any kind, the Department of Agriculture, acting through John R. McGuire, Chief of the Forest Service, purported to grant the requested release of the Government's interest in the foreign patent rights to the paraquat invention. In approving the request, this release (Exhibit 4) remarkably states:

". . . This approval is based on the following primary considerations:

"2. Publication in April 1973 has allowed expressions of interest to surface in much the way that the domestic patent normally would.[2]

"I understand that at least one U.S. company [*i.e.*, Hercules] in the naval stores and pulp chemicals field has shown strong interest in purchasing foreign patent rights from the inventors. In approving the inventors' request to relinquish these rights, I urge them to see that other concerned U.S. companies are aware of the possible availability of such rights." [3]

With respect to patent matters, at all relevant times, Mr. Harrington and his coworkers in the Forest Service were subject, as a condition of their employment, to the Administrative Regulations of the Department of Agriculture and to the provisions of the Forest Service Manual. Under these regulations, which defined the patent policy for all employees of the Department, (i) domestic patent rights were assignable to the Government and (ii) foreign patent rights were retained by the employees in accordance with Executive Order 9865 and Administrative Order No. 6, *subject, however,* to a mandatory obligation that the employee grant to Government (a) a royalty-free license in any foreign patent, and (b) the power to grant sublicenses to practice the invention royalty-free in any foreign country to members of the United States industry who were also licensees under the corresponding United States patent.[4]

For at least a decade—and until the spring of 1974 when the problem with which this statement is concerned arose—the Department of Agriculutre routinely obtained assignment and license agreement from its employee-inventors with respect to inventions for which a patent application was filed. A standard "OGC Form 24" [5] implementing both the foreign and domestic aspects of AR 1.893 and Section 1345.4 of the Forest Service Manual was used for this purpose. During the same decade, the Department routinely, and on request, exercised the power vested in it by such assignment and license agreements to grant a royalty-free nonexclusive license "throughout the world" to domestic industry licensed under the corresponding U.S. patent. A standard form designated "AS Form 54" (Exhibit 6) was adopted by the Department and used for this purpose.

In October 1973, each of the five alleged inventors named on the application which became patent 3,839,823 signed an assignment form OGC 24. See Exhibit 7. As appears from inspection, this assignment *includes* the *express grant* to the

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[2] An apparent reference to Research Note SE–191 (Exhibit 2).

Notably, SE–191 contains no hint that the inventors might be "released" to sell, without public noitce, exclusive foreign patent rights to only one of the U. S. companies comprising the relevant industry.

[3] An admonition which was not heeded.

[4] AR 1.878 provided: "The purpose of these regulations, which are a condition of employment of all employees of the Department, is, in general, to provide a patent policy relative to inventions of employees and to prescribe procedural rules for implementing and effectuating such policy, and for the administration of inventions subject to Department control."

AR 1.893 provided: "Where the domestic patent rights are assignable to the Government, but the foreign patent rights are retained by an employee in accordance with Executive Order 9865 and Administrative Order No. 6, the employee *shall* grant to the Government a nonexclusive, irrevocable, royalty-free license in any patent which may issue thereon in any foreign country, including the power to issue sublicenses for use in behalf of the Government, *and said license shall also include the power to sublicense American licensees under Government-owned United States patents to practice the invention without payment of royalty or other restriction in any foreign country wherein a corresponding patent may issue to the employee or his foreign assignee.*"

Insofar as herein relevant, Section 1345.4 of the Forest Service Manual provided in identical language for the mandatory grant to the Government of a power to grant royalty-free sublicenses to American industry under foreign patents issuing on inventions made by Department employees.

While the matter is beyond the scope of this statement, it is SCM's view that Executive Order 9865 and Administrative Order No. 6 do not permit and, in fact, preclude the purported "release" of foreign patent rights in the paraquat invention to the Department's employee-inventors.

[5] Exhibit 5 is a copy of "OGC Form 24". The letters "OGC" refer to the "Office of the General Counsel" of the Department of Agriculture.

Note that the initial provisions of OGC Form 24 constitute an asignment of the United States patent rights in an employee invention to the Goverment, whereas the final paragraph of the form, as required by the Department's regulations, grants to the Government (i) a royalty-free foreign license and (ii) power to grant royalty-free foreign licenses to American industry.

Government of the power to issue foreign sublicenses to qualified applicants such as SCM—all as mandated by AR 1.893.

On November 8, 1973, *after* execution of this assignment and license agreement, the Government employee-inventors with the knowledge and approval of the Department of Agriculture and its then patent counsel, M. Howard Silverstein, entered into an agreement with SCM's competitor Hercules, Inc.

By this agreement, the inventors purport to " * * * assign, sell and transfer to HERCULES their entire right, title and interest in and to The Invention, including patent rights, in every country of the world outside the United States, its territories and possessions." [6]

As consideration for this purported assignment of foreign rights, Hercules agreed to pay each individual inventor $10,000 plus an additional $20,000 or a running royalty "for the practice of The Invention in the countries where the patent has issued". Hercules has since filed appropriate patent applications in more than twenty foreign countries.

In April of 1974, each inventor executed a second assignment and license agreement (Exhiibt 8) identical in its terms with the first assignment and license agreement executed in October 1973 before the Hercules contract was signed.

On March 6, 1974, SCM filed with the United States Department of Agriculture a request (Exhibit 9) for a domestic and a foreign royalty-free license to practice the invention disclosed in U.S. patent 3,839,823. SCM was ultimately granted a license (Exhibit 10) under the United States patent—*and thus qualified* for the grant of a royalty-free foreign license as specified in the assignment and license agreements which the employee-inventors had twice executed as mandated by the controlling Department regulations.

Nevertheless, SCM's request for a license to practice the invention royalty-free in countries foreign to the United States was denied. The Department refused—apparently for the first time in more than ten years—to exercise, upon the request of a qualified member of the United States industry, to exercise its unquestioned power to grant royalty-free sublicenses on an invention resulting from publicly-financed research.

The only apparent "reason" for this switch in position to accommodate SCM's competitor Hercules is that M. Howard Silverstein, who replaced the Department's prior patent attorney, Rubin Hoffman, in July of 1973, apparently disagreed personally with the Department's policy as set forth in its regulations and as had been applied by the Department and its former counsel, Mr. Rubin Hoffman, since 1964. Accordingly, Mr. Silverstein induced the Department to reject SCM's foreign license application.[7]

In an *ex post facto* attempt to justify this departure from established Department procedure, Mr. Silverstein, in the spring of 1974, without any public notice or hearing of any kind, took the initiative to amend the Department's regulations in a manner consistent with his philosophy and which would purport to justify a refusal by the Department to grant licenses to United States industry to practice the invention in countries foreign to the United States consequent from the Department's massive research effort.

The Organic Chemicals Division of SCM has been harmed by this conduct of the Department of Agriculture. For example, crude sulfate turpentine from New Zealand is of high quality but the volume is modest. Paraquat stimulation of New Zealand's pine trees appears necessary to provide a supply of crude turpentine of sufficient quantity to justify a processing plant of economic size. SCM was rebuffed last year in its efforts to join the main New Zealand producers in an arrangement for the construction of a turpentine separating plant. One such New Zealand producer indicated that SCM's unsuccessful effort was attributable to the fact that Hercules owned the New Zealand patent rights in the paraquat invention.

In 1947, the Attorney General of the United States submitted to the President a three-volume report of an extensive study of the patent and ownership policies

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[6] The rights, if any, allegedly acquired by Hercules under this contract are necessarily subject to the "power" vested in the Government by the October 1973 assignment and license agreement (Exhibit 7) to grant a royalty-free foreign sublicense to qualified applicants such as SCM on the Department's standard "AS Form 54" (Exhibit 6).

[7] The refusal of the Department to grant SCM's request for a royalty-free license has resulted in the litigation first instituted in the District of Columbia and now pending in the U.S. District Court for the Middle District of Florida, as Civil Action No. 75–759–Civ–J–S. In such litigation, SCM is named as the plaintiff and the Department of Agriculture, Hercules, Inc. and the five individual inventors are named as defendants. The relief sought includes, *inter alia*, a declaration that the contract between the inventors and Hercules is void.

Subsequent to the initiation of such litigation by SCM, a like suit was filed by Reichhold, Inc. as plaintiff and is also now pending in the Middle District of Florida.

of Government agencies.[8] This report spawned Executive Orders 9865 and 10096 which define the procedures to be followed by the departments of the executive branch with respect to the disposition of Government employee inventions. The key conclusion reached by the Attorney General with respect to inventions made by Government employees was that:

"Inventions financed with public funds should inure to the benefit of the public, and should not become a purely private monopoly under which the public may be charged for, or even denied, the use of technology which it has financed * * *." (p. 2)

Had the Department of Agriculture been guided by this philosophy, as it should have been, Hercules, a major competitor of the Organic Chemicals Division would not now be in alleged exclusive possession of the entirety of the foreign patent rights in the paraquat invention.

Legislation is urgently required to insure that inventions financed with public funds, in fact, inure to the benefit of the public. The legislation should guarantee that no private rights of any kind will be granted in publicly-financed inventions in the absence of an opportunity for all interested parties to be heard. As a matter of basic principle, any private rights granted to practice Government-financed inventions should be nonexclusive and royalty-free. Exclusive rights in the publicly-financed inventions should not be awarded to private enterprise except under the most unusual and compelling circumstances.

EXHIBIT 1

U.S. DEPARTMENT OF AGRICULTURE 1978 BUDGET—GENERAL BUDGETARY STATEMENTS

TABLE 1.—NEW BUDGET (OBLIGATIONAL) AUTHORITY—BUDGET ESTIMATES, 1978 COMPARED WITH 1977

Agency or item	1977 enacted to date	1977 adjusted	1978 budget estimates	Budget estimates compared with— 1977 enacted to date	Budget estimates compared with— 1977 adjusted
Office of the Secretary	$2,267,000	$2,337,000	$2,496,000	+$229,000	+$159,000
Departmental administration	14,145,000	13,723,000	14,292,000	+147,000	+568,000
Economic Management Support Center	2,802,000	2,923,000	3,006,000	+204,000	+83,000
Office of the Inspector General	18,434,000	19,130,000	28,058,000	+9,624,000	+8,928,000
Transfer from food stamp program	(7,932,000)	(8,231,000)		(−7,932,000)	(−8,231,000)
Total, Office of the Inspector General	(26,366,000)	(27,361,000)	(28,059,000)	(+1,692,000)	(+697,000)
Office of the General Counsel	8,708,000	9,165,000	9,461,000	+753,000	+296,000
Federal Grain Inspection Service: Salaries and expenses		8,874,000	13,595,000	+13,595,000	+4,721,000
Agricultural Research Service:					
Research	270,576,000	280,589,000	319,719,000	−49,143,000	+39,130,000
Special fund (reappropriation)	1,000,000	1,000,000	(2,000,000)	−1,000,000	−1,000,000
Scientific activities overseas (Special foreign currency program)	7,500,000	7,500,000	7,500,000		
Total, Agricultural Research Service	279,076,000	289,089,000	327,219,000	+48,143,000	+38,130,000
Animal and Plant Health Inspection Service	403,667,000	416,057,000	431,319,000	+27,652,000	15,262,000
Cooperative State Research Service	126,652,000	126,765,000	136,687,000	+10,035,000	+9,922,000
Extension Service	240,208,000	240,495,000	242,471,000	+2,263,000	+1,976,000
National Agricultural Library	6,026,000	6,193,000	6,880,000	+854,000	+687,000
Statistical Reporting Service	33,827,000	35,324,000	37,508,000	+3,681,000	+2,184,000
Economic Research Service	26,080,000	27,274,000	29,405,000	+3,325,000	+2,131,000
Agricultural Marketing Service:					
Marketing services	52,734,000	45,563,000	50,927,000	−1,807,000	+5,364,000
Payments to States and possessions	1,600,000	1,600,000		−1,600,000	−1,600,000
Total, Agricultural Marketing Service	54,334,000	47,163,000	50,927,000	−3,407,000	+3,764,000
Packers and Stockyards Administration	5,226,000	5,460,000	6,152,000	+926,000	+692,000
Farmer Cooperative Service	2,589,000	2,724,000	2,920,000	+331,000	+196,000

Note: Amounts in the "1977 adjusted" column include supplemental appropriations to date and proposed supplementals for pay costs and are adjusted for comparability with the appropriation structure proposed in the 1978 budget estimates. Amounts in parentheses are not included in the totals.

[8] See generally *Kaplan* v. *Corcoran*, 545 F.2d 1073, 1076–1077 (7 Cir. 1976).

TABLE 2.—NEW BUDGET (OBLIGATIONAL) AUTHORITY BY SUBAPPROPRIATION AND APPROPRIATION, 1976, 1977, AND 1978 BUDGET ESTIMATES

Agency or item	1976 actual	1977 adjusted	Budget estimates, 1978	Change, 1978 budget estimates compared with 1977 adjusted
Office of the Secretary	2,342,100	2,337,000	2,496,000	+159,000
Departmental administration	12,552,900	13,724,000	14,292,000	+568,000
Economic Management Support Center	2,802,000	2,923,000	3,006,000	+83,000
Office of the Inspector General	17,588,000	19,130,000	28,058,000	+8,928,000
Transfer from food stamp program	(6,635,000)	(8,231,000)		(−8,231,000)
Total, Office of the Inspector General	(24,233,000)	(27,361,000)	(28,058,000)	(+697,000)
Office of the General Counsel	8,517,000	9,165,000	9,461,000	+296,000
Federal Grain Inspection Service:[1] Salaries and expenses	6,193,000	8,874,000	13,595,000	+4,721,000
Agricultural Research Service:				
Research	281,839,000	280,589,000	319,719,000	+39,130,000
Special fund (reappropriation)	1,000,000	1,000,000	(2,000,000)	−1,000,000
Scientific activities overseas (special foreign currency program)	7,500,000	7,500,000	7,500,000	
Total, Agricultural Research Service	290,339,000	289,089,000	327,219,000	+38,130,000
Animal and Plant Health Inspection Service	377,646,000	416,057,000	431,319,000	+15,262,000
Cooperative State Research Service:				
Payments to agricultural experiment stations and penalty mail	84,934,000	97,973,000	106,066,000	+8,093,000
Cooperative forestry research	7,462,000	8,212,000	8,212,000	
Contracts and grants for scientific research	19,546,000	17,852,000	19,213,000	+1,361,000
Rural development	1,500,000	1,500,000	1,500,000	
Federal administration (direct appropriation)	1,018,000	1,228,000	1,696,000	+468,000
Total, Cooperative State Research Service	114,460,000	126,765,000	136,687,000	+9,922,000

Note: Amounts for 1976 and 1977 include all supplemental appropriations and rescissions to date and proposed supplementals for pay costs and are adjusted for comparability with the appropriation structure proposed in the 1978 budget estimates. Amounts in parentheses are not included in totals.

EXHIBIT 2

[USDA Forest Service Research Note SE–191, April 1973]

Inducing Lightwood in Pine Trees by Paraquat Treatment

Abstract.—Naval stores researchers at Olustee have discovered that paraquat, a herbicide, can be used to induce lightwood formation (resin-soaking) many feet above the treatment level in slash and longleaf pines. This lightwood extends to the pith and contains 40 percent oleoresin (by weight) which can be recovered by extraction processes. The new method has great potential for boosting production per man-day of woods labor and would help overcome a worldwide shortage of valuable chemical raw materials.

Naval stores researchers at Olustee, Florida, have discovered that applications of paraquat will induce lightwood formation (resin-soaking) in slash and longleaf pines. Lightwood formation is not a new phenomenon. Varying amounts are formed naturally in the heartwood of many conifers, especially pines. Wounds caused by mechanical, chemical, or biological agents are also known to cause lightwood formation in sapwood. Wood naval stores is based on the use of lightwood from old-growth pine stumps containing 20 to 25 percent extractives. Anderson [1] reported a process of limited resin-soaking as a result of mechanical wounding which would be augmented with chemicals. Resin-soaking by this process was limited to the area immediately around the mechanical wound. Hepting [2] and Clapper [3] also showed that inoculations of pine trees with suspensions of pitch canker fungus, *Fusarium lateritium* f. *pini*, caused resin-

[1] Anderson, A. B. Extract stimulation for wood rosin production—increasing extractive content ponderosa pine. For. Prod. J. 5 : 417–420, 1955.
[2] Hepting, George H. Gum flow and pitch-soak in Virginia pine following Fusarium inoculation. USDA For. Serv. Southeast. For. Exp. Stn. Pap. 40, 9 pp. 1954.
[3] Clapper, R. B. Stimulation of pine oleoresin flow by fungus inoculation. Econ. Bot. 8 : 260–284, 1954.

soaking. Potential for wood extractives or fence-post production was investigated, but the extent of resin-soaking with these methods was not sufficient to make it commercially feasible.

Recent research at Olustee has revealed that resin-soaking can be induced in the tree by treating a 1-inch-square wound with an 8-percent solution of paraquat, a herbicide. In some slash pines, lightwood formation was found 17.5 feet above the wounded area and extended to the pith radially with little lateral effect (fig. 1). In other slash pines, the effect was not as extensive, and weaker concentrations induced less lightwood formation. In longleaf pine, the 8-percent treatment induced resin-soaking to a height of 30 feet above the wound.

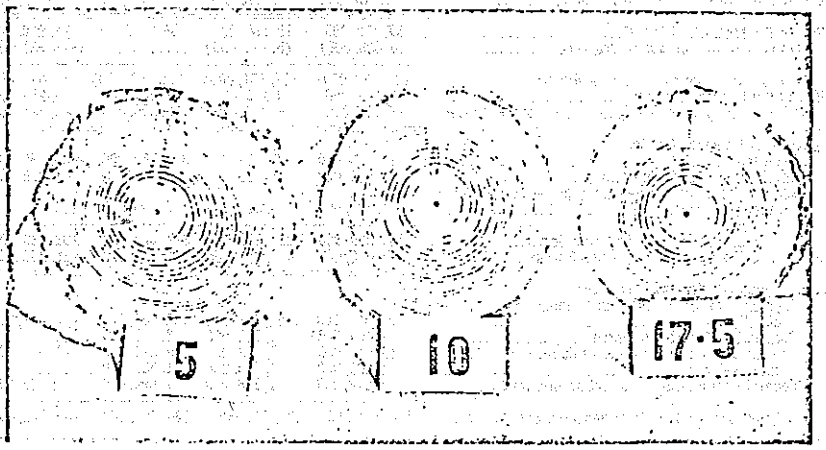

FIGURE 1.—Lightwood formation in stem sections taken from a slash pine tree at 5, 10, and 17.5 feet above the point of wounding with paraquat. The treatments consisted of removing 1-inch-square sections of bark to the wood surface and treating by spraying to runoff with 0.5-, 1-, 2-, 4-, and 8-percent solutions of paraquat. Only the 2-, 4-, and 8-percent concentrations induced resin-soaking to a height of 5 feet above the treatment. The 8-percent concentration induced some resin-soaking to the pith at 17.5 feet above the 1-inch-wide treatment in this tree.

The depth of resin-soaking caused by biweekly treatment with 0.1-percent paraquat was compared with 50-percent aqueous, sulfuric acid on the opposite side of a slash pine tree 12 inches d.b.h. The paraquat treatment induced resin saturation to the pith, but resin-soaking caused by acid was less than 0.5 inch deep (fig. 2).

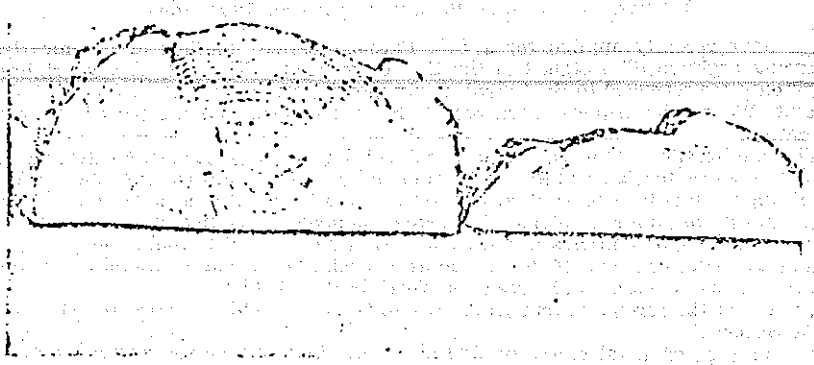

FIGURE. 2.—These trunk sections were taken a few inches above the treated areas on the opposite sides of the same slash pine tree. One sixth of its circumference on one side (left section) was treated with 0.1-percent paraquat; on the opposite side (right section), an equal area was treated with 50-percent solution of sulfuric acid to induce gum (oleoresin) flow. The paraquat treatment induced resin-soaking along radial lines to the pith. Resin-soaking caused by acid treatment was less than 0.5 inch deep.

These examples show that lightwood can be induced to substantial height in sample trees by one treatment on a small area with high concentrations of paraquat. Alternatively, intense resin saturation to the pith for more than 1.5 feet up the bole can be induced by repeated application of low concentrations of paraquat. Thus, it is probable that resin saturation of half the volume of a tree stem at least to 15 feet is possible from one or two well-timed applications of the proper concentration and amount of paraquat solution. This stem section would contain more resin and turpentine than can be obtained from the gum exuded from the same tree worked for gum naval stores over a 4-year period. Four years of gum production requires 60 or more visits to each tree. If only one or two visits to the tree will produce the same amount of gum, production per man-day of woods labor will be increased many-fold.

The potential for resin and turpentine production from paraquat-induced lightwood formation in a volume of pine roundwood equal to that now going to southern pulpmills is tremendous. Conservative estimates based on the assumption that half of each tree is resin-soaked to 15 feet indicate that production 20 times greater than current production from all three segments of the naval stores industry is possible.

With this method, it may soon be technically and economically feasible to produce resin-saturated wood to replace stumpwood as a superior raw material for the production of wood naval stores. It is equally applicable to the production of pulp chemicals either by pre-extraction of the pulp chips or for increasing the production of turpentine and tall oil rosin by enriching the woods-run chips with chips from resin-soaked wood. A patent which outlines tihs method of extractives production has been applied for.

Further research is needed to answer the following questions: How does paraquat induce lightwood formation? What other chemicals are effective? In which pine species can resin saturation be induced? What are the optimum concentrations and amounts of solutions to apply? What is the best method of application? When should the chemicals be applied to be most effective?

This method has great potential as an efficient way to boost the world supply of critically needed chemicals by nonpolluting means. The supply is readily renewable as long as pine trees are planted.

EXHIBIT 3

To: John R. McGuire, Chief, Forest Service. AUGUST 20, 1973.

RELEASE OF FOREIGN PATENT RIGHTS TO INVENTORS

We have recently applied for a U.S. Patent entitled "Method of Chemically Inducing Lightwood" assigned to the U.S. Government. Normally foreign rights to patents are returned to the inventors six months after application for the U.S. Patent. We hereby request a waiver of this six months waiting period on our invention.

The publication of Research Note SE–191 has already prevented getting a patent in some foreign countries. Further delay will jeopardize the chances of obtaining patents in several other countries which have different laws concerning patentability of published ideas. This request is made so the inventors can pursue patents in foreign countries in which Research Note SE–191 would constitute a patent bar before the end of the six-month period. Such a waiver would be in the interest of the inventor-employees as set forth in FSM 1345.03.

Waiver of the foreign patent rights would be in the public interest for at least three reasons.

1. This type of naval stores production would help relieve the current worldwide rosin shortage making more available for use in this country and lowering consumer prices of the final products.

2. Greater worldwide production and lower production costs would allow rosin and turpentine to sell at a price competitive with petroleum products as chemical intermediates and release petroleum to help relieve the energy crisis.

3. We plan to assign our foreign rights to a U.S. company capable of immediately using the method for naval stores production in many countries thereby promoting U.S. interests.

DONALD R. ROBERTS,
Plant Physiologist,
THADDEUS A. HARRINGTON,
Research Forester (Adm.)
ERNEST R. CREWS,
Forestry Research Technician,
WILLIAM J. PETERS,
Biological Laboratory Technician,
JUNIOR BROOMFIELD,
Forestry Aid.

EXHIBIT 4

To: General Counsel. SEPTEMBER 12, 1973.

RELEASE OF FOREIGN PATENT RIGHTS TO INVENTORS

Two of our scientists and three of their support staff in their research at Olustee, Florida, discovered a method of inducing lightwod in pine by treatment with paraquat, a herbicide. This substantially increases oleoresin production in the tree. The five men involved have applied for a patent on the process. The patent application (No. 5836) was filed in the Patent Office on September 4, 1973. The process was also described in Research Note SE–191, "Inducing Lightwood Formation in Pine Trees by Paraquat Treatment," which was published in April 1973.

The attached August 20, 1973, letter from the inventors requests waiver of the usual six-month government option on foreign patent rights.

Their request is approved. This approval is based on the following primary considerations:

1. Insofar as we can determine, there is no interest or need for obtaining foreign patent rights on the process for government purposes.

2. Publication in April 1973 has allowed expressions of interest to surface in much the way that the domestic patent normally would.

I understand that at least one U.S. company in the naval stores and pulp chemicals field has shown strong interest in purchasing foreign patent rights

from the inventors. In approving the inventors' request to relinquish those rights, I urge them to see that the other concerned U.S. companies are aware of the possible availability of such rights.

JOHN R. MCGUIRE,
Chief.

EXHIBIT 5

ASSIGNMENT

Whereas, I (we), _____
_____
residing at _____
_____
_____
have invented an improvement in _____
_____
as described in the United States patent application on said invention executed by me (us) on the _____ day _____, 19__, the United States patent rights in said invention being assignable to the United States by virtue of my (our) having made the invention while in the employ of the United States Department of Agriculture under applicable law and regulations of the United States Department of Agriculture which render the patent rights so assignable; and

Whereas, the United States, as represented by the Secretary of Agriculture, is desirous of acquiring an assignment of said patent rights;

Now, therefore, in consideration of these premises, and for other consideration, receipt of which on the part of the undersigned is hereby acknowledged, I (we) hereby assign said patent rights to the United States of America, as represented by the Secretary of Agriculture;

I (we) further grant to the Government of the United States a nonexclusive, irrevocable, royalty-free license in any patent which may issue on said invention in any foreign country, including the power to issue sublicenses for use in behalf of the Government and/or in furtherance of the foreign policies of the Government, and said license also includes the power to sublicense American licensees under any Government-owned United States patents on said invention to practice the same without payment of royalty or other restriction in any foreign country wherein a corresponding patent may issue to me (us) or my (our) foreign assignee.

Executed _____, 19__. _____
Executed _____, 19__. _____

EXHIBIT 6

LICENSE

Whereas, United States patent No. _____, issued to _____
_____
for _____
_____, is assigned to the United States of America as represented by the Secretary of Agriculture, hereinafter referred to as Licensor, and it is desirable in the public interest to have the invention covered by the patent practiced; and

Whereas, _____
_____
_____
hereinafter referred to as Licensee, desires to practice the said invention;

Now, therefore, in consideration of these premises, a royalty-free, nonexclusive and non-transferrable license is hereby granted to Licensee to practice the invention within the territory of the United States of America,* it being understood that Licensor neither assumes any responsiiblity if Licensee in prac-

*And throughout the world where a patent may issue on the said invention to the inventor(s) or his (their) assignees.

ticing the invention should infringe any other patent, nor assumes any responsibility due to the practicing of the invention, that Licensee will not use this license to indicate that the Government sponsors, or recommends any particular products of Licensee; that this license does not relieve Licensee from compliance with requirements of law; that Licensee may terminate this license upon notice to Licensor, and that Licensor may revoke it upon notice to Licensee with the reason for such revocation and giving Licensee opportunity to be heard in the matter.

UNITED STATES OF AMERICA,

Date executed:

By_____
Administrator, Agricultural Research Service,
U.S. Department of Agriculture.

EXHIBIT 7

ASSIGNMENT

Whereas, (we),_____
_____
_____
_____
_____
_____

having invented an improvement in Lightwood Formation in Pine Trees, for which (we) have made application for Letters Patent of the United States, executed concurrently herewith and further identified as Department of Agriculture Case No. 5836; and

Whereas, the United States patent rights in said invention are assignable to the United States by virtue of (our) having made the invention while in the employ of the United States Department of Agriculture under applicable law and regulations of the United States Department of Agriculture which render the patent rights so assignable; and

Whereas, the United States, as represented by the Secretary of Agriculture is desirous of acquiring an assignment of said patent rights;

NOW, THEREFORE, in consideration of these premises, and for other consideration, receipt of which on the part of the undersigned is hereby acknowledged, (we) hereby assign said patent rights to the United States of America, as represented by the Secretary of Agriculture;

I (we) further grant to the Government of the United States a nonexclusive irrevocable, royalty-free license in any patent which may issue on said invention in any foreign country, including the power to issue sublicenses for use in behalf of the Government and/or in furtherance of the foreign policies of the Government, and said license also includes the power to sublicense American licensees under any Government-owned United States patents on said invention to practice the same without payment of royalty or other restriction in any foreign country where a corresponding patent may issue to (us) or (our) foreign assignee.

Executed October 9, 1973. _____
Executed October 9, 1973. _____
Executed October 15, 1973. _____
Executed October 9, 1973. _____

EXHIBIT 8

ASSIGNMENT

Whereas, (we)_____ residing at_____
_____ respectively, have invented an improvement in _____ as described in United States patent application on said invention Serial No. 395,025, filed by (us) on the 7th day of Sept. 1973, the United States patent rights in said invention being assignable to the United States by virtue of (our) having made the invention while in the employ of the United States Department of Agriculture under

applicable law and regulations of the United States Department of Agriculture which render the patent rights so assignable; and

Whereas, the United States, as represented by the Secretary of Agriculture, is desirous of acquiring an assignment of said patent rights;

Now, therefore, in consideration of these premises, and for other consideration, receipt of which on the part of the undersigned is hereby acknowledged, (we) hereby assign said patent rights to the United States of America, as represented by the Secretary of Agriculture;

I (we) further grant to the Government of the United States a nonexclusive, irrevocable, royalty-free license in any patent which may issue on said invention in any foreign country, including the power to issue sublicenses for use in behalf of the Government and/or in furtherance of the foreign policies of the Government, and said license also includes the power to sublicense American licensees under any Government-owned United States patents on said invention to practice the same without payment of royalty or other restriction in any foreign country wherein a corresponding patent may issue to us or our foreign assignee.

Executed March 28, 1974. _____
Executed March 27, 1974. _____
Executed April 1, 1974. _____
Executed March 27, 1974. _____
Executed March 27, 1974. _____

EXHIBIT 9

MARCH 6, 1974.

MR. WAYNE T. THRUSH,
General Services Division,
Agricultural Research Service,
Hyattsville, Md.

DEAR MR. THRUSH: Pursuant to our telephone conversation, this letter constitutes a formal request for issuance of a world-wide, royalty-free, nonexclusive license to SCM Corporation, 900 Union Commerce Building, Cleveland, Ohio, 44115, and its subsidiaries and affiliates under any U.S. patent that may issue from the pending application identified below, or any continuation, continuation in part, division or reissue thereof, and any and all foreign counterparts thereof and their continuing cases of any nature, including patents of addition, if any.

Method of Chemically Inducing Lightwood Formation in Pine Trees
Serial No.: 395,025
Filed: September 7, 1973
Inventors: Roberts et al.

SCM is a diversified United States corporation having domestic and foreign corporations, subsidiaries and affiliates. One area of its commercial involvement is in the processing and sale of naval stores products, such as rosin and turpentine, and the synthesis of derivatives therefrom including flavors, fragrances, vitamin components, solvents, resins, pressure sensitive adhesives, rubber tackifiers, insecticides, and the like. Since the identified patent application relates to a method for increasing the yield of naval stores products from raw materials, SCM considers the requested license important to the maintenance and growth of its commercial endeavors as above described.

We have reviewed 37 C.F.R. 101.8 with care, and we understand that its provisions afford the government a six-month period from the filing of a U.S. patent application within which to decide whether to release foreign rights to inventors and that the decision, whether by affirmative written or oral release or by administrative inaction, does not become effective until after the six-month period has expired. It is accordingly a purpose of this letter to make SCM's formal request for a license of record before the expiration of that six-month period.

We further understand that under the provisions of 1 AR 893, the U.S.D.A., in any event, retains the right to practice the invention in the U.S. and foreign countries and the right to sub-license U.S. companies to practice the invention without payment of royalty or other restriction in the U.S. and in any foreign country wherein a corresponding application may issue, as a condition to any release that may become effective upon expiration of the six months.

We are informed in this instance that a written document purporting to constitute a release of foreign rights has been conveyed, prior to expiration of the

six-month period, to the inventors. One purpose of this letter is to make of record the position of SCM that any construction of that document as adversely affecting SCM's right to obtain the license herein formally requested will, in our view, render the document null and void and outside the authority of the government to grant, and will force SCM to take action to fully protect its rights in the premises.

While we understand that the regulations pertaining to the procedure for licensing of government inventions is currently suspended by order of February 12, 1974, we request that prompt attention be given to the present request and that it be processed now to the extent possible. We also request early notification in writing addressed to the undersigned of intent to convey a license to SCM Corporation promptly upon issuance of implementing regulations.

Please let me know if additional information is necessary to complete the application. I thank you for your attention to this matter.

Yours very truly,

WILLIAM J. MASON.

EXHIBIT 10

LICENSE

Whereas, U.S. patent rights are assigned to the United States of America, as represented by the Secretary of Agriculture (hereinafter referred to as GOVERNMENT), to the invention set forth in:

U.S. patent application Serial No. ------, filed ------

U.S. Patent No. 3,839,823

Title: "Method of Chemically Inducing Lightwood Formation in Pine Trees"

Inventor(s): Donald R. Roberts, William J. Peters, Thaddeus A. Harrington, Junior Broomfield, and Ernest Crews

Whereas, Government desires that said invention be practiced in the United States, its territories, or possessions;

Whereas, SCM Corporation, principal place of business, Cleveland, Ohio, incorporated in the State of New York,

hereinafter referred to as LICENSEE, desires to practice said invention in the United States, its territories or possessions;

Now, therefore, in consideration of these premises, GOVERNMENT grants to LICENSEE a royalty-free, nonexclusive license, in the United States, its territories or possessions, to practice the invention claimed in said Patent No. 3,839,823, or in any patent which may issue on said patent application Serial No. ------ or on any division or continuation thereof, including the right to grant royalty-free sublicenses to others to practice said claimed invention on behalf of LICENSEE or to produce materials for LICENSEE or to employ materials supplied by Licensee.

Furthermore, it is understood that GOVERNMENT assumes no responsibility for licensee or others in the practice of the claimed invention under this license, such as responsibility for LICENSEE's possible infringement of another's property rights; LICENSEE will not use this license to indicate that GOVERNMENT sponsors or recommends any particular products of LICENSEE; this license does not relieve LICENSEE from compliance with requirements of law; LICENSEE may terminate this license upon notice to GOVERNMENT; GOVERNMENT may revoke this license upon notice to LICENSEE with the reason for such revocation and giving LICENSEE opportunity to be heard in the matter; and LICENSEE shall submit annual reports on LICENSEE's efforts to practice said claimed invention, which reports shall contain information within LICENSEE's knowledge, or which LICENSEE may acquire under normal business practices, pertaining to the commercial use being made of said claimed invention, including a list of sublicenses.

Date Executed: November 7, 1974.

UNITED STATES OF AMERICA,

By ——— ———,

Acting Administrator,
Agricultural Research Service,
U.S. Department of Agriculture.

Senator NELSON. Our next witness is Mr. Stanley M. Clark, patent lawyer.

Mr. Clark, your statement will be printed in full in the record.

You may present it however you wish.

STATEMENT OF STANLEY M. CLARK, CHIEF PATENT COUNSEL, FIRESTONE TIRE AND RUBBER CO.

Mr. CLARK. Thank you, Senator. I am glad to be here.

My testimony is based upon more than 35 years of practice as a patent lawyer, the last 20 years as chief patent counsel of the Firestone Tire and Rubber Co.

I must emphasize that these remarks reflect my personal views, not those of my employer.

My remarks are directed generally to the question of whether the Government should retain full title to patents resulting from Government-financed research and development work conducted by private contractors or whether, as some propose, research contractors should acquire title to such patents with the Government retaining only nonexclusive rights for governmental purposes.

My view can be summed up very simply: I believe that the Government should get what it pays for. Before I expand on that, I would like to make a few preliminary remarks on any views.

I believe in free enterprise and in a competitive system. But the proposal that the Government spend large sums of money for research and development and then hand the patents stemming from such research over to the private contractors is not consistent with free enterprise.

In operation, such a proposal will favor the Government research contractor over his competitors, and at Government expense. This is not a free enterprise system. Even worse, it is the use of the taxpayers' money to impair the free enterprise competitive system.

I firmly believe that, in most circumstances, the Government should retain full title to all such patents and make nonexclusive, royalty-free licenses under them freely and openly available to the public without interposing any bureaucratic obstacles to the obtaining of such licenses.

I recognize, however, that there may be circumstances when it may be in the public interest to make exceptions to this general policy. Such circumstances may occur, for example, in the fields of pharmaceuticals, pesticides, agrichemicals, and the like. In such circumstances, I believe that a policy consistent with provisions for waiver such as those incorporated in 42 U.S.C.A. 5908 would give the Government sufficient latitude to deal with any exceptions that might arise.

Senator NELSON. You state that such circumstances may occur in the field of pharmaceuticals, pesticides, agrichemicals, and the like.

What is special about them?

Mr. CLARK. What I perceive is special about them, and this is not my field, and I have no direct experience in it, but from my readings and thoughts, I think there is a great deal more development effort required in the field of pharmaceuticals.

I think in the pharmaceutical field, the patent may come first, and that a great deal of work comes after the patent. A great deal of sub-

sequent development work and effort far more so than in other applications, and that stems from the Government requirement that pharmaceuticals be safe in the human body. That requires a lot of money to prove, and a lot of years to prove, and I think that in order to make that kind of effort, the company, the pharmaceutical company would require some protection, some exclusive rights. Otherwise they could put all of that investment in the development, and at the end find that their competitors could move in without making a corresponding investment, without any risk, and share the market almost immediately.

I would say this is something in which I am not all that qualified to discuss, but I can see a problem there, and I think that problem ought to be looked into.

Senator NELSON. Just so I understand you, you say that it may be in the public interest to make exceptions, and such an exception may be a case in which it may take a substantial amount of effort in resources by a private company in order to utilize it, whatever the discovery was?

Mr. CLARK. That is right.

Pharmaceuticals may require more than the usual investment than is required in other fields, and what I am proposing is that there may be justification for waivers in such cases.

I think if there is going to be a waiver of the Government's exclusive rights, there ought to be a public notice that such waiver is to be granted; all of the proceedings, or all of the communications relating to the waivers should be a matter of public record, and there should be an opportunity for members of the public and competitors of a particular company to protest. I agree there should be compelling reasons before such a waiver should even be considered, but there may be some instances in which that is possible.

I do not like to close the door. I think that ought to be looked into.

Mr. GORDON. In the case of a drug which may be very important from the standpoint of health—perhaps it is a breakthrough in the field of cancer or heart disease—if additional testing, or if additional development work is needed, what do you think about the Government itself going further with it?

Mr. CLARK. If the Government does it, then the Government ought to have the rights.

If the Government pays for it, I come back to what some call a simplistic view, I think the Government ought to get what it pays for, and not give it away.

Now, you will hear some criticism of such a program. Some have told you and will tell you that unless the research contractors are given title to patents which are produced at Government expense, the contractors will not accept Government research and development contracts. Don't you believe it. They want those Government funds and the rewards and advantages that come with such contracts and they won't turn them down. What they get, in many instances, can be very rewarding even without the patents; and in any event there are no risks involved, the Government assumes all of those.

What do they—the research contractors—get? They get a share of their research overhead paid for by the Government. Often they can

train a staff of valued research personnel and, in effect, hold them in reserve for the time when they employ them on their own private research projects. In addition, the research staff and the records of the contractor constitute a body of "know-how" which inevitably remains the property of the contractor and may be a valuable asset. These are not trivial benefits as I shall point out by reference to an actual example.

The example I turn to is a synthetic rubber industry.

It is a unique occurrence in American history. I think it is the only significant example where the Government owned an entire industry, created it, operated it for a period of years, and then sold it to private industry.

The reason for this is historical, it came out of the emergency of the early months of 1942, when the Japanese cut natural rubber off from the United States, and we had to build a synthetic rubber industry from nothing.

It was done in less than 2 years, and in retrospect, it was a miracle of engineering.

Thirty-five years ago the U.S. Government, in cooperation with a number of private companies, created a synthetic rubber industry in an incredibly short period of time at a cost of about $750,000,000 which, I might add, was a bargain-basement price. It was a tremendous technical feat, made possible by the pooling of existing technology.

The project can be equated to the development of the atomic bomb.

The industry was sustained by an extensive and continuing research and development program totally financed by the U.S. Government. In 1955 the Government-owned rubber plants were sold to private industry. One of the conditions imposed by Congress upon the sale of the plants was that the Government be succeeded by a free and openly competitive synthetic rubber industry. The purchasers of the plants were given nonexclusive licenses under all of the patents arising directly or indirectly out of the Government-financed research and development work. All purchasers were placed on an equal footing. So far as patents were concerned, no one purchaser had a competitive advantage over the others. Or so it seemed at the time.

However, some years later, the General Tire & Rubber Co. sued four of its major competitors for infringement of its so-called oil-extended rubber patent. My employer, the Firestone Tire & Rubber Co., was one of the defendants and, as it turned out, was the only company to test the patent license which it had acquired from the Government in the courts. Ultimately, an appellate court held that the U.S. Government was entitled to patent rights under General Tire's patent and that Firestone also had a valid license under the patent as a derivative right from the Government. This decision saved Firestone from an adverse judgment in the order of $100 million, and to a major degree affirmed and preserved the competitive nature of the synthetic rubber industry.

Mr. GORDON. Could you elaborate on that, the fact that Firestone had a valid license of the patent, as a derivative right from the Government?

Mr. CLARK. What happened is that the Government assigned certain development contracts to all of the operators of the Government plants, and some others, universities, and other companies.

There were I think perhaps 40 research contractors, private contractors, using Government funds in the field of synthetic rubber.

As a condition for those contracts, the Government required the right to all inventions resulting from that program, and the right to grant royalty-free licenses to anybody the Government wished.

In fact, the Government, while it did not have title to the patents, had all of the attributes of ownership, in effect it had a royalty-free right to license, and the right to grant such royalty-free licenses to the others.

They were called nominees of the Government. Firestone when it bought the synthetic rubber plant became a nominee of the Government, and acquired a license from the Government, under all of the patents and inventions resulting from this extensive program of Government-financed research and development.

Every other purchaser of a Government plant acquired the same kind of license. The intent was then, and except for this lawsuit, was to put each of the purchasers in a freely competitive position, and not be at a disadvantage, and it worked. It worked only because we chose to test that fully in the courts at great risk.

Now, let me explain something about this know-how that I referred to earlier.

General Tire & Rubber had operated a synthetic rubber plant for the Government at Baytown, Tex. throughout the period 1943–55 and throughout that period had engaged in Government-financed R. & D. in the synthetic rubber field. When the rubber plants were sold in 1955, General Tire's bid to purchase the Baytown plant was rejected by the Government as being much too low. Several years later, General decided to build a new rubber plant and it did so. But the only reason it was able to do so was because General had a core of technical personnel—technicians, process engineers and the like—who possessed a large body of unpatented know-how relating to the design and operation of a synthetic rubber plant and to the production, testing, and use of various synthetic rubbers. This know-how existed in the records of the company and in the minds and hands of its trained people and all of it was acquired at Government expense. It was in large part unpatented technology.

It was used in building this plant. I do not say there was anything improper about it, but I do say that acquiring such know-how is a natural consequence of the inevitable educational process which results from an extensive program of research work.

It is done at Government expense. It is acquired free. All such know-how is a valuable asset.

Possession of such "know-how" was worth at least $1 million in 1955 values to General Tire and that is a conservative figure; it may have been worth much more than that.

The reason I say that is the value is because after 1955, various companies in this country granted licenses abroad to produce such synthetic rubber. Licenses were granted in Japan, Germany, England, and Brazil.

These licenses were essentially licenses for the know-how which these companies possessed in the design and operation of a synthetic rubber plant, and the fees for such licenses were within the order of $1 million or more for each such license.

The General Tire Co., if they had not had this know-how, they would have had to turn to somebody who did have it, and would have had to pay this kind of money, that is, $1 million or more in order to get it.

Thus, to a varying degree, a Government R. & D. contractor always acquires the benefit of unpatented know-how. There is always a body of unpatented know-how resulting from such work and it may be quite valuable. Possession of such know-how may give a considerable edge to the contractor over his competitors. That is enough of an advantage. It should not be compounded by a give-away of patent rights as well.

To repeat, such know-how may give a considerable edge to a contractor. It should not be compounded by giving away patent rights as well, and I think that is sufficient incentive to engage in Government research work. The Government contractors understand this.

I should add one more comment to the General Tire story. Before it built its private synthetic rubber plant it asked for and received a royalty-free license from the Government under all the Government's patent rights in the rubber field. General Tire was free to enter the market and to compete with those already established in the market without facing any patent barriers created by Government funds. The Government policy of retaining full patent rights operated in this case for a free market. That would not have occurred if the Government had granted total title to the patents to the research contractors who engaged in Government-financed work.

If the Government had not acquired this kind of sublicensing rights, and passed licenses to all comers, there would have been conflicts over patents, and people might have been barred from the synthetic rubber field for years to come. So we see that the Government patent policy of retaining the basic rights to the patents was used to create and preserve a competitive synthetic rubber system, and it was competitive and has remained so. That has been to the benefit of the American people.

The Government patent policy which prevailed then, at least in the synthetic rubber field, thus operated to create a freely competitive synthetic rubber industry, all to the benefit of the public. I advocate essentially the same policy today for all areas except where there may be a compelling need for exceptions to the policy and those exceptions should be very few in number.

In conclusion, based upon my personal experience, I am convinced that Government funds should be expended to preserve free competition, not to create private monopolies; to place members of an industry on equal footing, not to favor one member over another; to place the fruits of the taxpayers' money directly to the benefit of the taxpayers and not to enable a private company to extract royalties from the taxpayers who had paid for the patent in the first place.

Mr. GORDON. Why do private companies say they need patents?

Mr. CLARK. They need patents, those that say the need them, there are many industries in which patents do not play an important role, but a patent, if it is a valid patent, may enable a holder to pay off the investment, time and money and effort they expended upon the development, which led to the patent.

I think it is an incentive and a proper incentive to research work, but most of the goods in this world are unpatented goods, made by unpatented processes.

Very often the patents come too early in the development in any event, and people who had created the invention, and obtained the patent, are never able to exploit it, because it often takes more than 17 years for industry to catch up to a particular invention.

I think if a company spends $5, $6 or $10 million on the development of, say, a new synthetic rubber, they are entitled to have patents protecting that invention, providing it is their own funds that create it and not Government funds.

Mr. GORDON. The courts have found that most patents are not valid; they are really not inventions. For example, I think about 70 percent of the patents that are litigated have been found to be invalid, perhaps even more, I don't know. A lot of them are not even litigated, not because people think they are valid, but because they do not want to go through the litigation.

For example, Mr. Fortas, when he was a judge stated that most justices rightly or wrongfully are inclined to think a strong well-financed applicant has a pretty good chance of getting some patent claims allowed somewhere along the line, and they do not have much confidence in the process or respect for the result. Judge Will in several court cases stated that: "The presumption of validity of an issued patent as far as I am concerned is a myth."

The value of patent is really, well, the strength of a patent is really not assumed anymore.

What do you think about that?

Mr. CLARK. Personally, I believe that the presumption of validity 99 percent of the time is a myth.

Senator NELSON. Is a myth?

Mr. CLARK. Is a myth.

I do not think there should be a presumption of validity, or if there is, you should be able to break it like a bubble, and burst it pretty easily.

The problem is essentially the patent office does not have the resources to examine a patent application to the same degree that a defendant in a Federal court can defend against an issued patent.

I think a patent examiner may have, and I would have to guess at this, 6 hours total to read a patent application, to analyze it, to search the prior art, and apply the prior art.

A defendant in the Federal courts might spend, have skilled lawyers, spend 1,000 hours, and they will have access to information, and to prior art, and to interpretation of prior art that is economically beyond the capabilities of the patent office.

What I think is required is that, and I think it is happening, is that the burden be placed upon the patent applicant to be scrupulously fair with the Patent Office, to lay all of its cards before the examiner, so that the examiner will be at least as well informed as the applicant, and as the applicant's lawyer.

That would give, I think a higher percentage of valid patents.

Yours is a long and involved question. I have tried to sum up one aspect of the problem. There are many others.

Mr. GORDON. The trouble of these invalid patents—and there are perhaps hundreds or thousands of invalid patents around—is that they serve as roadblocks for small competitive businesses to get into various areas.

They do not have the wherewithall to test these patents in court.

Mr. CLARK. I think that is true, and I think an issued patent has intimidating force, even if in the minds of those who are sure it is invalid, because it does cost a lot of money to defend against even an invalid patent.

In the General Tire case, to which I referred, we spent several millions of dollars. I would hate to tell you how much was spent to defend our position, and a small company cannot do that.

I think a part of the answer is that we ought to have a more honest, I think and hope we are getting there very rapidly, a more honest, frank dealing with the Patent Office.

I think an applicant should be totally, completely, and thoroughly honest with the examiner, and not hide anything from him including the motives of the applicant.

Senator NELSON. What is happening? You said we are getting there rapidly.

Mr. CLARK. I think there is a recognition by the Patent Office and Patent Bar stemming largely from many of the recent court decisions based upon fraud in the Patent Office which carries some rather severe penalties for lack of candor and honesty with the Patent Office. I am certain that the morality, or rather lack of morality, that existed in the prosecution of a patent application 30 years ago is gone.

I think there is a much more frank, honest approach to the problem of obtaining a patent.

I think there should be.

Senator NELSON. Thank you very much, Mr. Clark, for coming to present your very thoughtful testimony this morning.

The hearing will resume tomorrow in room 1318.

[Whereupon, the subcommittee was recessed at 11:50 a.m.]

[The prepared statement of Mr. Clark follows:]

STATEMENT BY STANLEY M. CLARK, CHIEF PATENT COUNSEL, FIRESTONE TIRE AND RUBBER CO.

My testimony is based upon more than thirty years of practice as a patent lawyer, the last twenty years as chief patent counsel of The Firestone Tire & Rubber Company.

I must emphasize that these remarks reflect my personal views, not those of my employer.

My remarks are directed generally to the question of whether the government should retain full title to patents resulting from government-financed research and development work conducted by private contractors or whether, as some propose, research contractors should require title to such patents with the government retaining only non-exclusive rights for governmental purposes.

My view can be summed up very simply: I believe that the government should get what it pays for. Before I expand on that, I would like to make a few preliminary remarks.

I believe in free enterprise and in a competitive system. But the proposal that the government spend large sums of money for research and development and then hand the patents stemming from such research over to the private contractors is not consistent with free enterprise.

In operation, such a proposal will favor the government research contractor over his competitors, and at government expense. This is not a free enterprise system. Even worse, it is the use of the taxpayers' money to impair the free enterprise system.

I firmly believe that, in most circumstances, the government should retain full title to all such patents and make non-exclusive, royalty-free licenses under them freely and openly available to the public without interposing any bureaucratic obstacles to the obtaining of such licenses.

I recognize, however, that there may be circumstances when it may be in the public interest to make exceptions to this general policy. Such circumstances may occur, for example, in the fields of pharmaceuticals, pesticides, agri-chemicals, and the like. In such circumstances, I believe that a policy consistent with provisions for waiver such as those incorporated in 42 U.S.C.A. 5908 would give the government sufficient latitude to deal with any exceptions that might arise.

Now you will hear criticisms of such a program. Some have told you and will tell you that unless the research contractors are given title to patents which are produced at government expense, the contractors will not accept government research and development contracts. Don't you believe it. They want those government funds and the rewards and advantages that come with such contracts and they won't turn them down. What they get, in many instances, can be very rewarding even without the patents; and in any event there are no risks involved, the government assumes all of those.

What do they get? They get a share of their research overhead paid for by the government. Often they can train a staff of valued research personnel and, in effect, hold them in reserve for the time when they employ them on their own private research projects. In addition, the research staff and the records of the contractor constitute a body of "know-how" which inevitably remains the property of the contractor and may be a paluable asset. These are trivial benefits as I shall point out by reference to an actual example.

GOVERNMENT PROGRAM—THE SYNTHETIC RUBBER INDUSTRY

Thirty-five years ago the United States Government, in cooperation with a number of private companies, created a synthetic rubber industry in an incredibly short period of time at a cost of about $750,000,000 which, I might add, was a bargain-basement price. It was a tremendous technical feat, made possible by the pooling of existing technology. The industry was sustained by an extensive and continuing research and development program totally financed by the U.S. Government. In 1955 the government-owned rubber plants were sold to private industry. One of the conditions imposed by Congress upon the sale of the plants was that the government be succeeded by a free and openly competitive synthetic rubber industry. The purchasers of the plants were given non-exclusive licenses under all of the patents arising directly or indirectly out of the government-financed research and development work. All purchasers were placed on an equal footing. So far as patents were concerned, no one purchaser had a competitive advantage over the others. Or so it seemed at the time.

However, some years later, the General Tire & Rubber Company sued four of its major competitors for infringement of its so-called oil-extended rubber patent. My employer, The Firestone Tire & Rubber Company, was one of the defendants and, as it turned out, was the only company to test the patent license which it had acquired from the government in the courts. Ultimately, an appellate court held that the United States Government was entitled to patent rights under General Tire's patent and that Firestone also had a valid license under the patent as a derivative right from the government. This decision saved Firestone from an adverse judgment in the order of $100,000,000, and to a major degree affirmed and preserved the competitive nature of the synthetic rubber industry.

Let me refer again to the synthetic rubber program to illustrate one of the real rewards which accrue to a contractor who receives government research and development.

General Tire & Rubber had operated a synthetic rubber plant for the government at Baytown, Texas throughout the period 1943–1955 and throughout that period had engaged in government-financed R&D in the synthetic rubber field. When the rubber plants were sold in 1955 General Tire's bid to purchase the Baytown plant was rejected by the government as being much too low. Several years later, General decided to build a new rubber plant and it did so. But the only reason it was able to do so was because General had a core of technical personnel who possessed a large body of unpatented know-how relating to the design and operation of a synthetic rubber plant and to the production, testing and use of various synthetic rubbers. This know-how existed in the records of the company and in the minds and hands of its trained people and all of it was acquired at government expense. It was in large part unpatented technology.

Now there was and is nothing improper about this. It is the natural consequence of the inevitable educational process which results from an extensive

program of research work. Possession of such "know-how" was worth at least a $1,000,000 (in 1955 values) to General Tire and that is a conservative figure; it may have been worth much more than that.

Thus, to a varying degree, a government R&D contractor always acquires the benefit of unpatented know-how. There is always a body of unpatented know-how resulting from such work and it may be quite valuable. Possession of such know-how may give a considerable edge to the contractor over his competitors. That is enough of an advantage. It should not be compounded by a give-away of patent rights as well.

I should add one more comment to the General Tire story. Before it built its private synthetic rubber plant it asked for and received a royalty-free license from the government under all the government's patent rights in the rubber field. General Tire was free to enter the market and to compete with those already established in the market without facing any patent barriers created by government funds.

The government patent policy which prevailed then, at least in the synthetic rubber field, thus operated to create a freely competitive synthetic rubber industry, all to the benefit of the public. I advocate essentially the same policy today.

In conlusion, based upon my personal experience, I am convinced that government funds should be expended to preserve free competition, not to create private monopolies; to place members of an industry on equal footing, not to favor one member over another; to place the fruits of the taxpayers' money directly to the benefits of the taxpayers and not to enable a private company to extract royalties from the taxpayers who had paid for the patent in the first place.

progress of research work. Possession of such "know-how" was worth at least a $1,000,000 (in 1958 values) to General Tire and that is a conservative figure; it may have been worth much more than that.

Thus, in a varying degree, a government R&D contractor always acquires the benefit of unpatented know-how. There is always a body of unpatented know-how resulting from such work and it may be quite valuable. Possession of such know-how may give a considerable edge to the contractor over his competitors; that is enough of an advantage. It should not be compounded by a giveaway of patent rights as well.

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The government's patent policy which prevailed then, at least in the synthetic rubber field, thus operated to create a freely competitive synthetic rubber industry, all to the benefit of the public. I advocate essentially the same policy today.

In conclusion, based upon my personal experience, I am convinced that Government funds should be expended to preserve free competition, not to create private monopolies; to place members of an industry on equal footing, not to favor one member over another; to place the fruits of the taxpayers' money directly to the benefit of the taxpayers and not to enable a private company to exact royalties from the taxpayers who had paid for the patent in the first place.

GOVERNMENT PATENT POLICIES

WEDNESDAY, DECEMBER 21, 1977

U.S. SENATE,
SUBCOMMITTEE ON MONOPOLY AND
ANTICOMPETITIVE ACTIVITIES,
SELECT COMMITTEE ON SMALL BUSINESS,
Washington, D.C.

The subcommittee met, pursuant to recess, at 10 a.m., in room 1318, Dirksen Senate Office Building, Hon. Gaylord Nelson, chairman, presiding.

Present: Senator Nelson.

Also present: Benjamin Gordon, consultant to the Committee on Small Business; and Karen Young, research assistant.

Senator NELSON. The subcommittee will please come to order.

Our first witness this morning is Senator Russell B. Long. As a member of your Finance Committee, of which you are the chairman, you are always the first one there for hearings, and I noticed you were the first one here this morning.

STATEMENT OF HON. RUSSELL B. LONG, A U.S. SENATOR FROM THE STATE OF LOUISIANA

Senator LONG. Mr. Chairman, I was also late today, so do not worry. I beat you here by 30 seconds.

Senator NELSON. I was just going to say if it is not, it ought to be, a violation of Senatorial courtesy for you to get here ahead of me at my hearings as well as ahead of me at your own.

I know you are familiar with the subject, and that you conducted hearings on it 12, 13 years ago; that you have introduced and gotten some legislation adopted, 13 bills, as a matter of fact, on the question of Government patent policy. Nevertheless, as you well know, the debate goes on, as it has for half a century, and we do not have an overall Government policy respecting the disposition and handling of inventions and patents developed through the expenditure of the public's money. A substantial amount of money is spent on research by various agencies and the developer who got the money very frequently is allowed to retain a patent monopoly on the publicly financed development.

We were assured by the Attorney General's representative yesterday that this Administration was going to propose some comprehensive policy within the next month or 6 weeks, and I hope that they will propose an overall policy that pursues the general line that you have advocated for many years here in the U.S. Senate, and

previously as chairman of this Subcommittee on Monopoly of the Small Business Committee.

Senator Long, please go ahead and present your statement however you desire.

Senator LONG. I will try to abbreviate it some, Mr. Chairman.

I really think that we have both been very fortunate in having Ben Gordon to help us in this matter.

He is a good economist. He has studied this patent problem, and he has worked on every Senator's conscience around here to do what ought to be done in the public's interest and to protect the public's investment in research. In addition, I applaud you, Senator Nelson, for the fine work you have done as chairman of this subcommittee, and as chairman of the full committee, to try to assure the taxpayers that they are, in fact, getting what they paid for.

Mr. Chairman, it seems to me that if you do what you ought to be doing, and I do what I ought to be doing during the next year or so, we have a chance to get a Government patent policy, the like of which it should be.

I doubt that the President understands this problem as much as you or I do, or some of the able people working with you in this area. The President of the United States, if he takes the attitude that we would like to see him take to stop all of this mischief of using billions of dollars of public funds to pay for research, and then permit the one who has the good fortune of getting the guaranteed contract—since he is assured a profit on his research—to own what he finds.

I would like to suggest that this is like giving a person the right to go out to see how much land is in the public domain, and whatever he finds is his, and this is what we have been doing.

Mr. Chairman, I want to work with you and with all of the other Senators interested in doing something about this matter.

Mr. Chairman, I appreciate the opportunity to be here and discuss Government patent policy. As you know, when I was chairman of this very subcommittee, I spent many years studying this subject.

Since the end of World War II there has been a phenomenal increase in the amount of research and development, and there has been a tremendous growth in the application of science to industry. The changes going on in the areas of electronics, atomic energy and automation are in many respects different in kind from any that occurred before, and will change the world much more.

The needs of World War II stimulated organized scientific research. We made an atomic bomb; we replaced natural rubber; and we made great technological achievements in radar and antibiotics.

Many new products, the results of research, helped push the economy upward during the first decade after World War II. Transistors, power steering, power brakes, antibiotics, polyethylene, styrene plastics and resins, vitamins, synthetic detergents, grew more than 40 percent per year during that decade. Synthetic fibers, room air-conditioners, tape recorders, grew from 30 to 40 percent per year. This list can be expanded indefinitely. The impact of research and development is obvious. Technological progress has been playing a major role in propelling the economy forward, especially since the middle of the 18th century. The new element in our society is the growing recognition that new

products and new processes are the key to a company's growth, an industry's growth, a nation's growth—and these are dependent on the continuous development of innovations to keep the economic system expanding. As research has grown, its influence on profitability has also grown to the point where it now either determines or strongly influences the profit performance of many segments of industry.

GOVERNMENT RESEARCH AND DEVELOPMENT

At the present time, the Federal Government is spending at the rate of $26 billion annually on research and development. This constitutes about 65 percent of the research in the United States. This percentage figure tells only part of the story, for in certain industries the Government pays for the major part of the research performed.

The size of these expenditures is a new phenomenon. In 1940 they were less than $7.5 million; by 1950 they were about $1 billion; by 1958 they were nearly $5 billion; in 1969 $15 billion; and from then on they increased rapidly year by year.

Senator NELSON. I have not seen that 1940 figure.

It seems almost unbelievable. Are you saying that in 1940, the total Federal Government outlay for research and development was $7.5 million, that is all?

Senator LONG. You see, back at that time, we were pursuing the theory that inventors and people doing research for the most part paid for it themselves, and their reward would be a private patent, so anything that came out of that investment would be theirs.

They had a monopoly right for 17 years to the invention that they could develop.

Since that date, the Government, in moving ahead in research, has undertaken to pay for most of what is being done.

Now, if the Government is going to pay for it, then all of the people in this country ought to have an equal right to it.

It ought to belong to all of the people who paid for it, rather than be a monopoly right of just the one person who had the good fortune to grab off a Government contract, on which it had an assured profit to begin with.

He already had his reward, he has been paid for the research.

He does not have the right to maintain a monopoly against the public when the Government paid for it.

It is a matter of paying him twice, and that is the type of thing that is contrary to everything that we believe should be as part of our constitutional government.

In Louisiana many years ago, there was a situation where some people sold a building to the State, and later on they sold the furniture. They were prosecuted on the theory that the initial sale included the furniture. Those men had to go to the penitentiary.

There was some legal doubt about it. It always seemed to me you could argue about whether the sale included the furniture, but assuming that the sale did include the furniture in the first instance, and those men knew it, then obviously, when they sold the furniture the second time, they belonged in the penitentiary, and that is where they went. But here it is a Government policy that would undertake to say

that someone had been paid to do the research, and after paying to do the research, what you find with it is his, which of course is contrary to every concept of democracy. It amounts to public expenditure for private gain, and what the Nation gets out of it is very little, compared to what you put into it. The present figure of $26 billion for Government R. & D. may increase markedly in the coming years. It is expected for example, that Government R. & D. expenditures to develop new sources of energy will rise rapidly, and, as other natural resources—particularly metals such as copper and tin—become depleted, we may face even greater needs for Federal expenditures for research for substitute materials and new methods involving more economical processing.

ROLE OF GOVERNMENT R. & D. IN THE CIVILIAN SECTOR

Government expenditures for research and development have an important impact on the creation, development, and allocation of our national resources. Military and space research and development, which in dollar terms is 70 to 80 percent of all Government-financed research, is concerned—like all other research—with obtaining new knowledge and producing new techniques and products. Although these are concerned with military needs, these actions have civilian applications.

We must recognize the degree to which military research and development is applied to civilian enterprise, and the degree to which it affects the country's resources and its economic development. Throughout the years, many civilian products and techniques have been the direct result of military and space expenditures. Some well-known and often-cited examples are yellow-fever eradication, chlorination of water, nuclear power, modern aircraft, helicopters, space communications, new high temperature alloys, aircraft engines, silicon transistors, new automobile power steering and suspension systems, anti-icing equipment, battery-powered handtools, chemical processing equipment and so on. In those cases where large sums of money are needed and where private industry will not willingly gamble in the absence of the prospect of a short-run payoff, the Government plays a very important role in bringing about innovations much earlier than might normally be the case.

Since the U.S. Government finances a very large part of all research and development performed by industry and since a large part of Government-financed research is devoted to pushing forward the frontiers of knowledge, it can be seen that Government activities in this field have an exceedingly important and direct impact on the growth of our economy and its market structure. The channeling of research and development funds into an industry can insure its expansion and prosperity; the withholding of such funds can stifle or retard its growth.

Similarly, the awarding of research contracts to particular corporations, especially in trail-blazing developments, confers incalculable advantages in know-how which generally presages the growth, domination, or competitive superiority in these or related fields.

DISPOSITION OF GOVERNMENT RIGHTS

The disposition of rights resulting from Government research and development can increase monopoly and the concentration of economic power or, alternatively, can spread the resulting benefits to the maintenance of a competitive free enterprise system and more rapid economic growth. The Congress has always recognized these principles and whenever it has spoken, has always provided that the U.S. Government should acquire title and full right of use and disposition of scientific and technical information obtained and inventions made at its direction and its expense, and in some cases subject to waiver of Government title when the equities of the situation so require. The basic premise is that inventions should belong to those who pay to have them created, and Congress has stated on numerous occasions that title should be taken by the United States for the benefit of all the people of the United States if made in the performance of a Government contract. Despite the vigorous opposition from industry groups and from the organized patent bar, Congress has applied this principle to the following agencies of Government:

The Atomic Energy Commission, the Department of Agriculture, the Tennessee Valley Authority, the National Aeronautics and Space Administration, the Office of Coal Research and Development, the Department of Health, Education, and Welfare, the Veterans' Administration. In addition, what came to be known as the Long Amendment is an integral part of a host of laws, such as the Federal Coal Mine Health and Safety Act of 1969, the National Traffic and Motor Vehicle Safety Act, the Helium Act Amendment of 1960, the Solid Waste Disposal Act, the Disarmament Act, the Saline Water Act, the Solar Energy Act, and others. The purpose was to insure that no research would be contracted for, sponsored, cosponsored, or authorized under authority of a particular piece of legislation unless all information, uses, products, processes, patents, and other developments resulting from such research will be available to the general public. Only a few years ago, the late Senator Hart, you, Mr. Chairman, and I convinced the Senate that such a provision should be included in the Energy Research and Development Act. Although the subject of these hearings has been advertised as Government patent policy, it should be recognized that it is a misnomer. It is not a patent problem at all. It is not concerned with the administration of the Patent Office. The subject we are dealing with involves the disposition of the public's property rights arising out of the huge expenditures of public funds.

DEPARTMENT OF COMMERCE STUDY

It is dismaying therefore, to find that a Department of Commerce Report, "U.S. Technology," issued in draft form in March 1977, makes the same old, tired, discredited claims we heard years ago to justify the giving away of Government owned rights.

I might say, Mr. Chairman, although I am disappointed to see this type of thing come out of the Commerce Department under the new Administration, that some policy has been advocated by the Commerce Department as far back as I can recall.

I can recall back before Congress was able to establish a policy to the extent it has, I asked the Secretary of Commerce to come down and defend his department's policy. He declined to appear before this committee.

The only way I could have gotten him was to have subpenaed him, have him arrested and brought up here to defend his policy.

That Secretary of Commerce also came from North Carolina, Mr. Chairman. I admire North Carolina, except they have not been able to provide much leadership in the patent policy area.

The report I referred to includes the same old statement that used to come out of the Department of Commerce:

> The great variety of existing Federal patent policies with their emphasis on Government ownership of inventions is a hindrance to the commercialization of technology developed with Government funds. (Page 13.)

No supporting evidence is given. In fact, in 1963, the National Aeronautics and Space Administration (NASA) gave this same reason to try to justify a more liberal waiver policy. When the then Administrator James Webb was asked at hearings of this subcommittee: "Can you give this subcommittee any figures, studies, or facts of any kind which can reasonably support your statement? We would like to have them." He was unable to do so at that time and not since that time.

The Commerce Department study also complains that the Federal Government's antitrust activities hampers innovation—without any supporting evidence; that Federal patent policy discourages private firms from engaging in R. & D. projects with the Government with no supporting evidence offered. The recommendation is that a bill should be introduced that will provide for contractors to retain ownership of inventions resulting from federally sponsored research if they wish to do so.

PROPOSED LEGISLATION

One month later—April 1977—such a bill was introduced in the other body (H.R. 6249) and, I must confess, it is a "beaut." This is what a real giveaway should be like. It gives everything away; it doesn't leave even a sliver of meat on the bone. It doesn't apply only to those areas uncovered by legislation but it repeals every law on the books which reserves for the public the results of the research it pays for.

It proposes the repeal of the provisions of the Atomic Energy Act.

It proposes the repeal of the provisions of the National Aeronautics and Space Act.

It proposes the repeal of the provisions of the Department of Agriculture, of TVA, of Department of Interior, in the National Science Foundation, Disarmament Agency, Energy Research and Development Agency, Consumer Product Safety Agency and every other piece of legislation enacted by the Congress to protect the public.

When I was first told about this bill, I did not believe what I heard. I had to look at it myself to get its full flavor. The bill supposedly includes a narrowly limited right for the Government to "march-in" and disrupt the existing business arrangements of an established agency contractor. Although Government agencies have had this power for over 14 years, oddly enough, they have never used it. In fact, the De-

partment of Justice, in draft comments on H.R. 6249 to Congressman Rodino, chairman of the House Judiciary Committee, stated that:

Moreover, we do not believe that "march-in," provisions along the lines of those contained in H.R. 6249 can be relied upon to protect the public interest for purposes of accepting a generalized "license" policy. The exercise of such rights by agencies would not be a simple matter, particularly where administrative hearings and de novo judicial review would be involved. For example, trying to show that exclusive rights to an invention in the contracts have tended substantially to lessen competition or to result in undue market concentration in any section of the United States in any line of commerce to which the technology relates would be tantamount to getting involved in a miniature Clayton Act—section 7 trial.

An agency would have no real assurance of the outcome of its attempted exercise of "march-in rights, nor indeed, the potential investment of time and resources that such would entail. Given the costs involved, the numbers of patents that might be involved, and the varying interests and expertise of the many Federal agencies in the area of public interest described in the "march-in" provisions, we think it unrealistic to assume that the public interest would be adequately protected, assuming even the highest motivation on the part of all concerned.

Finally, the time delays inherent in any ultimately successful exercise of "march-in" rights in a really important case could well be intolerable.

The Department of Justice for the last 30 years has vigorously supported the view that the results of publicly financed research and development should benefit the public. The basic reasons given are:

First, when public moneys are expended the public as a whole should benefit, as it would from the availability of nonexclusive, nondiscriminatory licenses to qualified applicants, resulting in maximization of the invention's use and implementation.

Second, there is serious question as to whether any worthwhile purpose would be served by giving a contractor the right to exclude competitors from patentable inventions arising out of Government financed research. Rather, such rights may be in the nature of a windfall, at public expense, to a contractor whose contract price does not, and may not be able to take account of speculative invention and patent possibilities. When the Government underwrites R. & D. risks, the Government—that is the public—should be entitled to any invention rewards.

Third, there has been no convincing showing that exclusive rights in Government financed inventions need be granted to contracteors in order to induce them to accept Government R. & D. contracts, which themselves confer many benefits beyond the simple contract price.

(Draft letter from Department of Justice to Congressman Peter Rodino, chairman, House Judiciary Committee, opposing H.R. 6249).

In the House this bill was referred jointly to the Judiciary and to the Science and Technology Committees. In the Senate—if it ever gets here—it would come presumably to the Committee on Commerce, Science, and Transportation, and to the Committee on the Judiciary. This proposed legislation is one of the most radical, far-reaching and blatant giveaways that I have seen in the many years that I have been a Member of the U.S. Senate.

As a member of the Commerce Subcommittee on Science and Space, I will vigorously oppose this bill.

Senator NELSON. In fact, there is a good deal of testimony that we have had—and there are statements in the past—that very frequently the retention of the patent by the private owner inhibits expansion, production and distribution of the technology, because there may be special interest, special reasons, for withholding of that technology from the market by the owner of it, whereas, if the Government makes

it available to the whole public, that more likely assures a very broad distribution of the technology and its utilization.

Senator LONG. Mr. Chairman, you and I know that those who have tried to uphold my position in debate in the U.S. Senate, have always been victorious.

About the only way these patent giveaways can be accomplished is through the lobbying power of the big industries. The large corporations and their lobbyists put pressure on people, and then they might manage to muster enough votes, but they never win the debate. I just challenge any debating coach or any economic professor to read a debate on this subject and pass judgment on it. It is hard to get anybody on the Senate floor to even uphold that side of the argument, so it is the kind of thing that they try to do by indirect maneuver, by obtaining some muscle somewhere behind the scene, because there is no justification for what they are advocating. In fact, their arguments are ridiculous.

In other words, if you assume that any person in this room were a dedicated worker in any one of these laboratories, when he is doing the research to develop something new for the benefit of all humanity, he is not going to get the patent if he finds it. He will get an annual salary. He might get a little recognition somewhere. He will get a watch or something to indicate the good work he did, but if he is sophisticated, he knows that the big corporation is not paying for his efforts. The Government is paying. That big corporation is a contractor interposed between him and his Government. He is doing it to support that Government, the same as that corporation is doing.

Now, let us assume he finds something that is very good. That corporation takes the patent on it, and it is then in a position to sit there and deny him, the man that discovered it, the man that made the breakthrough, the right to put to use what he himself developed for the good of all humanity.

They can sit there on that thing for 17 years. Under the kind of patent policy the Commerce Department is advocating here, I would assume they would be sufficiently generous to permit the Government to have the contract with someone to produce something the Government paid for to begin with, the Government buying the product.

It is a very generous concession from their point of view that the Government that paid for the research be permitted to use the results for its own use, but this type of thing is just absolutely indefensible.

Mr. GORDON. Senator, do you recall that in 1962 you held hearings on weather modification and control, and you found that the Government was paying a lot of money to get some developments in that field, and that the patents were given away in that particular field which is so important to everybody; do you recall that?

Senator LONG. Sure, and I think the argument in that case was that the Government could use the invention if it was limited to something that would just benefit the Government, but if it would be something that would benefit the public in general, the Government could not use it, which left us wondering, if it is weather control you are talking about, what possible benefit could it be, except something that would benefit the public in general.

It is pretty hard to figure out how to make the rain fall on a Government installation without falling outside the fence, but even so, we

heard the same type of rather silly arguments made to defend an unwise policy.

Now, I am dismayed to see that with the encouragement of some of those who are in the Commerce Department—who were probably there before I came to the Senate, and I guess they would be there after we are all gone, and probably will still be there when we are in our graces—this same type of patent giveaway is being urged.

We have seen legislation introduced on the House side proposing to give away what the Government has, and getting nothing for it, and I am encouraged to believe that the Attorney General and the Justice Department would speak out against this kind of thing. Whether they do or do not, I want to assure you Mr. Chairman, and members of your committee, that I will be doing everything in my power, not only to prevent that type of thing from happening, but to see that we can educate the new President of the United States about this matter, so that everyone can benefit, and benefit in short order.

When something is discovered that is of great value to all, rather than lock it up, and lock up 50,000 other technical breakthroughs behind patent laws, we should insure that anyone who wants to manufacture something, or produce something for the benefit of humanity, is not precluded from doing so. We try to encourage the free-enterprise system, yet when somebody starts a business, if he is going to produce some new technical breakthough, even though produced by Government funds, he is risking patent suits and other barriers erected by his Government to prevent him from producing products or using knowledge developed by his taxes.

Now, that type of thing should not be permitted. All this knowledge and this information developed with $26 billion of annual expenditure of Federal funds ought to be something all Americans should be able to use freely and competitively to make this economy grow.

Furthermore, Mr. Chairman, by providing this kind of advantage by allowing someone to get a private monopoly over a thing paid for and developed at Government expense, you slow technical knowledge.

For example, let us say in one of these laboratories, some fellow discovers something that is new that could be used to improve all electronic equipment, all radios, all television sets, all telephones throughout the entire country, perhaps a new type transister or something of that sort that would make better electronic products for everyone, and make possible tremendous energy savings.

Can you expect those people to say, look, this is a great breakthrough, let us make it avaliable to all other scientists so they can go from here to develop something better?

No, under the present policy advocated by the Department of Commerce, the attitude would be: Don't let General Motors find out about it, don't let Westinghouse find out about it, don't let anyone find out about this. This is something that might make us rich. Under those circumstances, we must see to it that this is something that is kept quiet among our group, and do not even apply for a patent on it, not now. Let us just have some evidence we found this out. Let us just keep this close to our chest, like a good poker player, and wait until the opportune time when we are ready to commence that 17 years monopoly period.

Now, the patent laws need straightening out and somebody ought to do something about it. It seems unreasonable that between two people who are going to get the monopoly, you do not reward the one who first makes the knowledge available to society.

The fellow who gets the monopoly is the guy who found it, even though he may be holding out for many reasons for himself separately.

Admiral Rickover who testified here—I do not want to steal some of his subject—has told the story many times about the doctors who first discovered the forceps to help in delivery of a child, and how those people kept that a family secret for generations, because it enabled them to be pre-eminent in the field, while mothers died in child birth, and suffered needless pain for generations.

Now, under the patent system you have here in this country, those Viennese doctors, if they had developed it, and kept it a secret for 3 generations, when someone else came out and developed the same thing, if it were a patentable invention, they would have the right then having denied it to the public for 3 generations and have the patent on it, in deference to making the knowledge to the public when they first found out about it.

That kind of mischief thrown in by nonelected public officials is very difficult to explain, and I guess one reason it is difficult to explain is that a lot of it is something that elected public officials did not do directly.

There is no law that states outright that the Government give away what is developed with public funds.

You just find a law that somebody can give it away, and then they proceed to have some appointed official give it away.

I must say, however, that the generality of that statement is contradicted by this bill sponsored by the Commerce Department, and introduced on the House side, which would say, not only can we, but we must give away that which belongs to 230 million people, and I do not think it will pass.

I do think we all ought to know what an outrage this is. We should zero in and concentrate on the matter, and I think we have a chance now.

Senator NELSON. Usually from what I have looked at in those cases where they state that there would be circumstances in which the public interest is served, and the invention is going to be commercialized if you give the patent to the contractor; those are supposed to be exceptional cases. If, in the exceptional case, there might be a compelling reason for doing it for the benefit of the public, you may give the patent to the contractor.

They take that exceptional case and end up making it the rule. Admiral Rickover testified 2 days ago, that the Department of Energy has authority to waive the Government's patent rights.

In all the contracts a waiver has always been possible if it serves the public interest, but the waiver becmes the rule, and the retention becomes the exception.

Admiral Rickover stated that: "The Government patent lawyers have prepared a regulation which actually invites contractors to re-

quest waivers, and urges the agency to approve them." The Admiral quoted the proposed regulation as follows:

> To accomplish its mission, ERDA must work in cooperation with industry in the development of new energy sources and in achieving the ultimate goal of widespread commercial use. * * * An important incentive in commercializing technology is that provided by the patent system. As set forth in these Regulations, patent incentives, including ERDA's authority to waive the Government's patent rights to the extent provided for by statute, will be utilized in appropriate situations at the time of contracting to encourage industrial participation, foster commercial utilization and competition, and make the benefits of ERDA's activities widely available to the public.

That is from the proposed regulation. Admiral Rickover comments:

> This regulation also states that each potential contractor should be notified at the time of bid solicitation that he may request the Government to waive its patent rights, and that the request for waiver will not be considered as an adverse factor in evaluating the bids.

So what they are really doing here is saying for heaven's sake, request the waiver as soon as you make the contract bid, and we are well disposed to grant it as often as we can get away with it, so they actually turn the whole business upside down, and make it the rule to give it away rather than the exception.

Senator LONG. It seems to me that if you are going to do something like that in the law, you ought to say that one who would like to bid on the contract and have monopoly rights to that which he finds, be permitted to bid for the business on that condition, and then you want to be just fair to him, you go on to say that they would state in their presentation why they are so much better qualified than everybody else—and they might be—that only they could do this job the way it ought to be done. The presumption would be that they are not that well qualified, but let them prove it, but if they can overcome it beyond a reasonable doubt, then you ought to overcome it by the preponderance of the evidence.

If they could make a convincing case that could stand up on appeal, then they would get the business.

Now, you have all kinds of groups in his country who are permitted to challenge the decision of an administrator for various and sundry reasons, and it would seem to me you would want to do that. It would be fair to give someone the right to challenge the decision of whatever Government officials saw fit to say, and to take them to court, and then let them back it up before a judge, to say that this company is so much better qualified, that it ought to have the business in preference to the others and I would be glad to give them an expedited legal process in court, and there may be cases, I assume, when a fair court would give it to them.

It may be that a company like Exxon, for example, with huge research programs, might very well be far enough ahead than everybody else in certain types of fuels. If they wanted to develop something similar to something they developed previously, they would be best qualified to do it, and perhaps you ought to give them the contract and let them keep the patent rights. But if you are going to do that, it ought to be subject to a challenge by somebody who would like to compete for the business, and let them have a chance to go in and say I do not think they are better qualified.

For example, suppose the other firm happened to have the lead in research, happened to have people who worked for Exxon, who had been their best people, a team of researchers bidding for the business. In the case of doubt, it seems to me you ought to give the break to the people who want to make something available, or who would be willing to make something available to the public in general, rather than those who want to hoard all of that information for themselves.

Now, there is another thing involved here, Mr. Chairman. You are paying for so much waste, just fabulous waste in the type of policy that Commerce is advocating. It is hard to find what you are really looking for.

Let us say that a process is found that will make a better product. Meanwhile the decision had been made—and it is already made at the top corporate level—if you find something that could be the subject of a good patent, do not let anybody know anything about it.

It might require three or four different things you discovered to be put together and make a patentable product. But the instructions from the top on down is if you find something, do not let anybody know about it until you find out everything you need to know for the finished product. So if you have to overcome five technical problems in order to arrive at a patentable product, the instructions are to keep all that information in the privacy of the fraternity, just a small little group of people, until you have made the whole thing into a patentable product. In the meantime, the public has been deprived of a vast amount of knowledge. Another device to retard scientific and technological progress is "fencing in."

Fencing in is to try to figure out every way to overcome the same technical problem, and apply for a patent to all those things too, so if you invent a better mousetrap by using a principle different from the one before, you must then go to work and try to figure out, at public expense by the way, every conceivable way you could invent a mousetrap that might not be quite that good, using the same principles, so nobody can build the same thing without violating your patent. You then wind up not only paying to keep all of the information from being made available to the public who have paid for it and who may need its benefits, but you have also given people a cash incentive to hold it up, even though they have developed a whole lot of inferior things to go to apply for patents on those too.

One of our great corporations had about 15,000 patents. Now, those 15,000 patents are not to keep people just from making the products the corporation is making. They are there to keep people from some competing product, even though it is not identical, but something similar that might use some of the same principles that they use.

The policy that this bill advocates would give the right to prevent somebody from making it at all, or competing to provide a better service at a more reasonable price to the public.

How do they justify to the public, which pays for these inventions, that a contractor is being given not only the right to get a big price and to make it and sell it for 10 times what it is worth, but to deny it to the public entirely at any price? How do they justify that?

They would spend our money in such a way that the fellow they give it to has a right to guarantee that we would never get any benefit out of it.

That type of thing cannot stand up today. The only thing that one can say for it is that it has the benefit of mass ignorance to defend it, because the injustice, the inequity, the unfairness, the favoritism involved when people who do not develop something, do not pay for it, just get an advantage to get a contract in the first instance, are permitted to reap the benefits and the public pays twice for something it should not have been required to pay for more than once. It is contrary to every concept of democracy, as I understand it, Mr. Chairman, and as you understand it.

Senator NELSON. We heard different aspects of that in the testimony yesterday concerning the Agricultural Department employees discovering a new process, which would double, quadruple the production of rosins and turpentine in trees, applying for and rather quickly getting the rights to patents from the Department, and then turning around immediately and selling it to a corporation, which now has the rights in 20 other countries, with the corporation having contributed nothing. All the research had been done by paid employees of the Department of Agriculture with public moneys, and then they turned it over with no competitor in sight anyplace, so it has a number of important aspects in addition to the prime contractor ending up being the beneficiary after having received a cost-plus contract to do the work which they were happy to do.

Senator LONG. Guaranteed profit to begin with just in case he does not find anything. He is guaranteed the profit if he does.

Senator NELSON. Thank you very much, Senator Long.

We appreciate your taking the time to come.

Senator LONG. thank you.

[The prepared statement of Senator Long follows:]

STATEMENT OF HON. RUSSELL B. LONG

Mr. Chairman, I appreciate the opportunity to be here and discuss government patent policy. As you know, when I was Chairman of this very subcommittee, I spent many years studying this subject.

Since the end of World War II there has been a phenomenal increase in the amount of research and development, and there has been a tremendous growth in the application of science to industry. The changes going on in the areas of electronics, atomic energy and automation are in many respects different in kind from any that occurred before, and will change the world much more.

The needs of World War II stimulated organized scientific research. We made an atomic bomb; we replaced natural rubber; and we made great technological achievements in radar and antibiotics. Many new products, the results of research, helped push the economy upward during the first decade after World War II. Transistors, power steering, power brakes, antibiotics, polyethylene, styrene plastics and resins, vitamins, synthetic detergents, grew more than 40 percent per year during that decade. Synthetic fibers, room air conditioners, tape recorders, grew from 30 to 40 percent per year. This list can be expanded indefinitely. The impact of research and development is obvious. Technological progress has been playing a major role in propelling the economy forward, especially since the middle of the 18th century. The new element in our society is the growing recognition that new products and new processes are the key to a company's growth, an industry's growth, a nation's growth—and these are dependent on the continuous development of innovations to keep the economic system expanding. As research has grown, its influence on profitability has also grown to the point where it now either determines or strongly influences the profit performance of many segments of industry.

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The size of these expenditues is a new phenomenon. In 1940, they were less than $7.5 million; by 1950 they were about $1 billion; by 1958 they were nearly $5 billion; in 1969 $15 billion; and from then on they increased rapidly year by year.

The present figure of $26 billion for Government R. & D. may increase markedly in the coming years. It is expected for example, that Government R. & D. expenditures to develop new sources of energy will rise rapidly, and, as other natural resources—particularly metals such as copper and tin—become depleted, we may face even greater needs for Federal expenditures for research for substitute materials and new methods involving more economical processing.

ROLE OF GOVERNMENT RESEARCH AND DEVELOPMENT IN THE CIVILIAN SECTOR

Government expenditures for research and development have an important impact on the creation, development, and allocation of our national resources. Military and space research and development, which in dollar terms is 70 to 80 percent of all Government-financed reserach, is concerned—like all other research—with obtaining new knowledge and producing new techniques and products. Although these are concerned with military needs, these actions have civilian applications.

We must recognize the degree to which military research and development is applied to civilian enterprise, and the degree to which it affects the country's resources and its economic development. Throughout the years, many civilian products and techniques have been the direct result of military and space expenditures. Some well-known and often-cited examples are yellow-fever eradication, chlorination of water, nuclear power, modern aircraft, helicopters, space communications, new high temperature alloys, aircraft engines, silicon transistors, new automobile power-steering and suspension systems, anti-icing equipment, battery-powered hand tools, chemical processing equipment and so on. In those cases where large sums of money are needed and where private industry will not willingly gamble in the absence of the prospect of a short-run payoff, the Government plays a very important role in bringing about innovations much earlier than might normally be the case.

Since the U.S. Government finances a very large part of all research and development performed by industry and since a large part of Government-financed research is devoted to pushing forward the frontiers of knowledge, it can be seen that Government activities in this field have an exceedingly important and direct impact on the growth of our economy and its market structure. The channeling of research and development funds into an industry can insure its expansion and prosperity; the withholding of such funds can stifle or retard its growth.

Similarly, the awarding of research contracts to particular corporations, especially in trail-blazing developments, confers incalculable advantages in know-how which generally presages the growth, domination, or competitive superiority in these or related fields.

DISPOSITION OF GOVERNMENT RIGHTS

The disposition of rights resulting from Government research and development can increase monopoly and the concentration of economic power or, alternatively, can spread the resulting benefits throughout our society with consequent benefit to the maintenance of a competitive free enterprise system and more rapid economic growth. The Congress has always recognized these principles and whenever it has spoken, has always provided that the United States Government should acquire title and full right of use and disposition of scientific and technical information obtained and inventions made at its direction and its expense, and in some cases subject to waiver of Government title when the equities of the situation so require. The basic premise is that inventions should belong to those who pay to have them created, and Congress has stated on numerous occasions that title should be taken by the United States for the benefit of all the people of the United States if made in the performance of a government contract. Despite the vigorous opposition from industry groups and

from the organized patent bar, Congress has applied this principle to the following agencies of Government:

The Atomic Energy Commission, the Department of Agriculture, the Tennessee Valley Authority, the National Aeronautics and Space Administration, the Office of Coal Research and Development, the Department of Health, Education and Welfare, the Veterans Administration. In addition, what came to be known as the Long Amendment is an integral part of a host of laws, such as the Federal Coal Mine Health and Safety Act of 1969, the National Traffic and Motor Vehicle Safety Act, the Helium Act Amendment of 1960; the Solid Waste Disposal Act; the Disarmament Act; the Saline Water Act; the Solar Energy Act, and others. The purpose was to insure that no research would be contracted for, sponsored, cosponsored, or authorized under authority of a particular piece of legislation unless all information, uses, products, processes, patents, and other developments resulting from such research will be available to the general public. Only a few years ago, the late Senator Hart, you, Mr. Chairman, and I convinced the Senate that such a provision should be included in the Energy Research and Development Act. Although the subject of these hearings has been advertised as Government patent policy, it should be recognized that it is a misnomer. It is not a patent problem at all. It is not concerned with the administration of the Patent Office. The subject we are dealing with involves the disposition of the public's property rights arising out of the huge expenditures of public funds.

DEPARTMENT OF COMMERCE STUDY

It is dismaying therefore, to find that a Department of Commerce Report, "U.S. Technology," issued in draft form in March, 1977, makes the same old, tired, discredited claims we heard years ago to justify the giving away of Government owned rights. For example, the report states that:

"The great variety of existing Federal patent policies with their emphasis on Government ownership of inventions is a hindrance to the commercialization of technology developed with Government funds." (Page 18)

No supporting evidence is given. In fact, in 1963, the National Aeronautics and Space Administration (NASA) gave this same reason to try to justify a more liberal waiver policy. When the then Administrator James Webb was asked at hearings of this subcommittee: "Can you give this Subcommittee any figures, studies, or facts of any kind which can reasonably support your statement? We would like to have them." He was unable to do so at that time and not since that time.

The Commerce Department study also complains that the Federal Government's antitrust activities hampers innovation—without any supporting evidence; that Federal patent policy discourages private firms from engaging in R & D projects with the Government with no supporting evidence offered. The recommendation is that a bill should be introduced that will provide for contractors to retain ownership of inventions resulting from federally-sponsored research if they wish to do so.

PROPOSED LEGISLATION

One month later—April 1977—such a bill was introduced in the other body (H.R. 6249) and, I must confess, it is a beaut." This is what a real giveaway should be like. It gives everything away; it doesn't leave even a sliver of meat on the bone. It doesn't apply only to those areas uncovered by legislation but it repeals every law on the books which reserves for the public the results of the research it pays for.

It proposes the repeal of the provisions of the Atomic Energy Act.

It proposes the repeal of the provisions of the National Aeronautics and Space Act.

It proposes the repeal of the provisions of the Department of Agriculture, of TVA, of Department of Interior, in the National Science Foundation, Disarmament Agency, Energy Research and Development Agency, Consumer Product Safety Agency and every other piece of legislation enacted by the Congress to protect the public.

When I was first told about this bill, I did not believe what I heard. I had to look at it myself to get its full flavor. The bill supposedly includes a narrowly lim-

ited right for the government to "march-in" and disrupt the existing business arrangements of an established agency contractor. Although government agencies have had this power for over 14 years, oddly enough, they have never used it. In fact, the Department of Justice, in draft comments on H.R. 6249 to Congressman Rodino, chairman of the House Judiciary Committee, stated that:

"Moreover, we do not believe that 'march-in', provisions along the lines of those contained in H.R. 6249 can be relied upon to protect the public interest for purposes of accepting a generalized 'license' policy. The exercise of such rights by agencies would not be a simple matter, particularly where administrative hearings and de novo judicial review would be involved. For example, trying to show that exclusive rights to an invention in the contracts have tended substantially to lessen competition or to result in undue market concentration in any section of the United States in any line of commerce to which the technology relates' would be tantamount to getting involved in a miniature Clayton Act—Section 7 trial.

"An agency would have no real assurance of the outcome of its attempted exercise of 'march-in' rights, nor indeed, the potential investment of time and resources that such would entail. Given the costs involved, the numbers of patents that might be involved, and the varying interests and expertise of the many Federal agencies in the areas of public interest described in the 'march-in' provisions, we think it unrealistic to assume that the public interest would be adequately protected, assuming even the highest motivation on the part of all concerned.

"Finally, the time delays inherent in any ultimately successful exercise of 'march-in' rights in a really important case could well be intolerable."

The Department of Justice for the last 30 years has vigorously supported the view that the results of publicly financed research and development should benefit the public. The basic reasons given area:

"First, when public monies are expended the public as a whole should benefit, as it would from the availability of nonexclusive, non-discriminatory licenses to qualified applicants, resulting in maximization of the invention's use and implementation.

"Second, there is serious question as to whether any worthwhile purpose would be served by giving a contractor the right to exclude competitors from patentable inventions arising out of government-financed research. Rather, such rights may be in the nature of a windfall, at public expense, to a contractor whose contract price does not (and may not be able to) take account of speculative invention and patent possibilities. When the Government underwrites R & D risks, the Government—that is the public—should be entitled to any invention rewards.

"Third, there has been no convincing showing that exclusive rights in Government-financed inventions need be granted to contractors in order to induce them to accept goverment R & D contracts, which themselves confer many benefits beyond the simple contract price."

(Letter from Department of Justice to Congressman Peter Rodino, Chairman, House Judiciary Committee, opposing H.R. 6249).

In the House this bill was referred jointly to the Judiciary and to the Science and Technology Committees. In the Senate—if it ever gets here—it would come presumably to the Committeee on Commerce, Science and Transportation, and to the Committee on the Judiciary. This proposed legislation is one of the most radical, far-reaching and blatant giveaways that I have seen in the many years that I have been a member of the United States Senate.

As a member of the Commerce Subcommittee on Science and Space, I will vigorously oppose this bill.

Senator NELSON. Our next witness is the Honorable Michael Pertschuk, Chairman of the Federal Trade Commission.

STATEMENT OF HON. MICHAEL PERTSCHUK, CHAIRMAN, FEDERAL TRADE COMMISSION

Chairman PERTSCHUK. Thank you, Mr. Chairman.

Senator NELSON. Senator Long, if you wish, you may sit up here and listen to Chairman Pertschuk's testimony.

As former chairman of this subcommittee, we welcome you back for a temporary stint.

Senator LONG. I am glad to be back on.

Chairman PERTSCHUK. Mr. Chairman, Senator Long, the usual form I have discovered since I have gone downtown, is by saying I am delighted to be here, which is usually a lie, but in this case, it is really true, partly because I think you are dead right in the concerns you have expressed, and we share them at the Commission.

Also, if you will forgive me a moment of sentiment, I came to work in the Senate in 1962, and the first project I got involved in was the battle against the communications satellite bill in which I met Ben Gordon, who was my tutor, and had lectures in filibustering techniques from you, Senator Long, which I have never forgotten.

If I may note for the record, I believe this may be Ben's last hearing, and I just want to express as a former colleague, to add my sentiments to Senator Long, that Ben really is a model of a staff man committed to the public interest, so it is a pleasure to be here.

Senator NELSON. I want to say he said it is his last hearing.

If so, it is to the relief of a good many corporations in this country.

Chairman PERTSCHUK. Yes, unfortunately.

Thank you, Mr. Chairman, for your invitation to appear here today and to testify concerning Government policy with respect to ownership of inventions developed in the course of federally funded research and development work. The basic question with which I understand these hearings are concerned—and which my testimony will address—is whether patent rights to such inventions presumptively should be granted to the private contractor involved or to the Government.

The fact that Federal spending policies exert an enormous influence on the economy is hardly a startling proposition. Nor should it be surprising that Government spending affects the competitive structure and performance of the private sector. Thus, with the Federal Government spending roughly $26 billion annually on research and development—of which more than half goes to private industry—concern over the competitive impact of those expenditures is justified. And where Federal R. & D. expenditures result in patents, which in effect confer legal monopolies, that concern is heightened. So it is appropriate that these hearings consider the competitive implications of Federal patent and R. & D. policy.

After spending several months formulating "new directions" for the Federal Trade Commission, it is a pleasure for me to deal with a topic that underscores the continuity of purpose and principle within the FTC. Nearly 15 years ago Commissioner Paul Rand Dixon, who was then Chairman of the Commission, addressed this same subcommittee on this very same topic,[1] and his statement bears repeating. Commissioner Dixon said:

> If the logic behind the granting of private patents is accepted without reservation—they are a reward [and incentive] for the application of thought, time and effort to inventive activity—the inference with respect to government-sponsored research is clear: Since the public finances such research, any resulting discoveries should be a part of the public domain. As such, they should be made

[1] Statement of Paul Rand Dixon, March 8, 1963.

available to all potential competitors so that the public may benefit from the broadest possible dissemination and exploitation of these discoveries. This safeguard is especially vital when the bulk of all Governmental research expenditures is concentrated among a relatively few firms.

Commissioner Dixon's observations retain their validity today. The legally protected monopoly which is conferred by a patent can create a formidable barrier to entry, raising substantially the cost to new entrants who seek to compete with the patent holder. Where the patent is owned by a large, well-financed firm—the type of firm often relied upon to perform major Government R. & D. work—smaller businesses may experience significant difficulty in competing. Because of this serious anticompetitive potential we must closely examine the need for patent protection.

In the case of Government-financed R. & D. that need is far from clear. As Commissioner Dixon noted, the purpose of the patent grant is to create incentives to innovation by offering a reward to the successful inventor. But, as he also stated, the firm which performs research for the Government is typically well rewarded even in the absence of a patent. Not only is the firm paid for its effort—often on a cost-plus basis—but, in addition, it winds up with technical know-how, specialized research facilities and a pool of highly trained scientific personnel, all as a result of the Government contract. Thus, even absent a patent, the contractor may be expected to have significant advantages over potential competitors in the field in question. I am aware of no evidence that the Government has gone begging for customers for its R. & D. contracts even when no patent rights are available.

Let me focus on the energy area by way of example. Technological innovation is perceived by many as one of the paths to solution of the Nation's energy problems. And in large part it is Federal money which is fueling this search for new technologies. Energy development and conservation is the leading growth area in Federal R. & D. funding. This fiscal year, in fact, the Department of Energy will surpass NASA as the Government's second largest R. & D. contractor, spending $2.2 billion on energy-related R. & D. And a principal purpose of this nonnuclear energy research and development is to spin off commercially usable technologies and products.

DOE's R. & D. and patent policies thus will be a significant force in shaping emerging industries such as the solar energy industry, which was the focus of a symposium held just last week by the FTC's Bureau of Competition. The Federal Trade Commission is concerned about the possibility that those policies could lead to further concentration within the energy sector. Because a very large portion of DOE's R. & D. funding goes to giants of the energy industry, a system which gives all patent rights to the contractor—rather than making new products, processes and know-how equally available to all who wish to enter the commercial market—would raise substantially the likelihood of higher concentration.

Senator NELSON. May I ask what do you believe the guidelines should be in order to permit a Government agency to grant a waiver?

Chairman PERTSCHUK. Senator, I do not think we—the FTC— are capable of setting forth guidelines, because we really are not expert in the areas of public benefit, which may accrue from the granting of a

patent, but we would place a heavy burden on the contractor and on the agency is granting the waiver.

The presumption must always be that the waiver should not be granted, so we would require a very clear showing of public benefit, a clear showing before that waiver was granted.

Senator NELSON. Do I take it that you would say that the grant of a waiver would be the exceptional case rather than the rule?

Chairman PERTSCHUK. Yes, it should be the exceptional case. It is interesting, I noted, as you read the instructions——

Senator NELSON. The proposed regulations?

Chairman PERTSCHUK. That the presumption appeared to be that the waiver would be granted as a matter of course, and I would not consider that to be a proper presumption.

Senator NELSON. One of the witnesses—I do not recall whether it was Admiral Rickover or not—made a proposal, and some part of the testimony of Senator Long as well as yourself deals with it—and that was when anybody wanted a waiver, the agency would be required to post that request in the Federal Register, and then allow commentary so that others, as Senator Long suggested, who may very well feel that they are qualified, or better qualified, or equally qualified, may make their comments on it, and make their protests. Any individual on behalf of themselves, or any individual group on behalf of the public, may also make their input, so that it is not a kind of in-house agreement between agencies with varying standards to make that decision without the public even knowing about it.

Would you agree that some kind of public disclosure of this kind and opportunity for the public to comment on it should be there?

Chairman PERTSCHUK. It strikes me at first instance as an excellent idea, because you have got two populations which have an interest in that waiver.

You have the public interest groups, which are concerned about the spread of technology, if it is energy conservation, for example, assuring that the benefits are widely shared, and you have potential competitors which may be disadvantaged by the granting of a waiver, and you have groups with incentive to comment, and that is certainly worth exploring.

Senator LONG. It seems to me that is a good idea that it would be best to say two things, one that, of course, when someone is bidding for a contract, and he wanted it on a monopoly basis, that ought to be flagged, have an asterisk on those bids, so they could be flagged for what they are, and it also ought to be the law making liable for conspiracy under the antitrust laws if the contractor should try to get other people to follow his lead to bid only on monopoly rights basis, because I would think that one who is trying to get the contract on a monopoly basis would be very much tempted to try to persuade any other contractor not to bid on the basis where the public would enjoy the full benefit of it.

Chairman PERTSCHUK. As you know, Justice has an active program on collusive bidding, and this would certainly be one antisocial form of collusive bidding.

Senator LONG. Yes.

Mr. GORDON. Mr. Pertschuk, when a contractor has a dominant position in a particular field, or has a large portfolio of patents, or if concentration is very high in that field, would you consider it to be in the national interest to waive patent rights that would further strengthen the contractor's economic power?

Chairman PERTSCHUK. No.

Mr. GORDON. Would you say that before any waiver of the public's rights is given by any agency, the Department of Justice or the Federal Trade Commission should first analyze the waiver for its economic—especially the competitive—implications?

Chairman PERTSCHUK. I think somebody ought to analyze it for its competitive implications.

I do not know whether we are really the Agency set up with the personnel or expertise to do it.

It seems to me the opportunity for public comment is certainly one way of drawing attention, though it does not really amount to a review.

I would have to think about that. There ought to be some kind of review mechanism, but I am not sure that we or Justice ought to be doing it in every instance.

Mr. GORDON. But in order to be able to review it, you have to know what you are waiving, is not that correct?

Chairman PERTSCHUK. Yes.

Mr. GORDON. So can we conclude, then, that waiver of the public's rights at the time of contracting is undesirable, and potentially deleterious to the national interest?

Chairman PERTSCHUK. Unless I can be shown some reasons why it ought to be done at the time of contract, I know of none.

Mr. GORDON. Yes, but you do not know what is going to be found. You may be waiving something that is extremely valuable.

Chairman PERTSCHUK. Also, I guess the thrust of the rest of my testimony is that there is no evidence that DOE has not got a long line standing outside its door waiting to sign these contracts.

The need to waive these patent protections as an incentive to draw people into the market for the research and development contracts just does not exist. And I do not know of any other reason to offer a waiver as an incentive, other than if you do not get any takers at all for a given research project. But there is no evidence that I know of that such an incentive is needed.

Fortunately, from a procompetitive viewpoint, DOE's patent policies are controlled by a statute which presumes retention by the Government of patent rights from federally funded R. & D. The Federal Nonnuclear Energy Research and Development Act of 1974 [1] vests title to any such inventions in the United States, unless the Department waives all or any part of the rights of the Government; and the statute sets out numerous factors which must be considered before such a waiver is permissible.

DOE issues over 2,000 major R. & D. contracts annually; and since ERDA began operating in 1974, fewer than 130 waivers have been granted, including only 20—out of 59 requests—involving specific in-

[1] 42 U.S.C. Sec. 5901 et seq.

ventions developed under contract. I might note also that many of these waivers have been limited either in time, in geography, or in other respects. Has private industry been inhibited from accepting ERDA R. & D. contracts because patents are not routinely granted to contractors? The available evidence makes it quite clear that this has not occurred.

This answer is supported by a recent report in Business Week on energy-related R. & D., which asserted that "[c]orporate competition for Government funding is keen" and, in particular, that "ERDA contracts for R. & D. are profitable. * * *"[2] Why have the normally patentless ERDA contracts been so popular? Business Week continued, quoting one corporate executive, as follows: "Such contracts entail little risk, and 'there's no investment to speak of—just bright people'. * * *"[3] Business Week added that a big attraction of Government funding is that it offers recipients the chance to build a major new business at taxpayer expense.[4]

What can we conclude from the ERDA example? Well, we find that ERDA R. & D. grants are regarded as profitable, require little investment by the contractor, and can lead to competitive advantages—even if the contractor is denied patent rights to inventions developed under the contract. Thus it appears that granting patent rights to Government R. & D. contractors often is not needed as an incentive for having such research performed; and granting such rights to large firms who perform R. & D. for the Government would provide a windfall to those least in need of such help and might create significant obstacles to competition with such firms.

There may be specific circumstances in which exceptions are justified. I certainly do not have all the answers with respect to this issue. But I believe that any such exceptions should be reluctantly granted and narrowly limited; the burden should be on the proponent of the exception to demonstrate on the basis of an analysis of the invention and the market involved that there is a public benefit in granting a private patent monopoly. For, absent a strong showing to the contrary, Government retention of patent rights resulting from Government-funded R. & D. seems clearly appropriate. The presumption should always be that more competition is preferable to more monopoly power or concentration.

That concludes my prepared statement, Mr. Chairman. I would be happy to answer any questions.

Mr. GORDON. Mr. Pertschuk, if it is not necessary to give away title in order to get contracts to do the work, why do some Government agencies give them away?

Chairman PERTSCHUK. I guess that is the purpose of this inquiry, Ben, and I would like to answer by stating that I do not know the answer.

Mr. GORDON. A frequently used argument to justify giving away patent monopolies on Government-financed research is that exclusive rights, that is, patent monopolies, will bring about maximum utilization of the invention.

[2] Business Week, "Energy Conservation's Impact on R. & D.", June 27, 1977, at 53.
[3] Id. at 53–54.
[4] Id. at 54.

That is the argument that we always hear.

How can you maximize utilization if the contractor is put in a position to exclude other citizens, other members of the public, from practicing the invention?

Chairman PERTSCHUK. Our presumption would be the greater the access to the invention, by potential competitors, the greater the competition, rather than the opposite.

Mr. GORDON. And the greater maximization?

Chairman PERTSCHUK. Greater maximization of the invention, yes.

Mr. GORDON. In other words, I have always felt, and I understand the whole idea of a patent is that it is a restrictive device; is that correct?

Chairman PERTSCHUK. The incentive, as I understand it, is involved with a question of stimulating inventions, rather than stimulating widespread use of inventions, once it has been developed.

Mr. GORDON. Do you know of any cases of a product or process for which there was a need or a demand that was not marketed or used because of lack of monopoly rights?

Chairman PERTSCHUK. No, nor can I claim expertise or wisdom in this field.

Mr. GORDON. Now, small business gets only a very small amount of R. & D. dollars. It is a tiny amount, maybe 3 to 5 percent at the most.

When the Government gives the contractor a patent monopoly on publicly-financed R. & D., is not the Government actually shutting small businesses out of some of the most dynamic areas of our economy?

Chairman PERTSCHUK. Yes. In our solar competition symposium last week, one of the areas of concern was that R. & D. funding policies in the solar field—which by its nature shows more promise that smaller, decentralized entities will be able to make a profitable contribution to development—tended to favor larger firms, and the more centralized technologies. This tendency is an area of concern to us, as an Agency with responsibilities for encouraging competition, and we intend to play an active role in advocating greater concern about the competitive impact of the R. & D. policies of DOE.

Senator NELSON. Thank you very much, Mr. Pertschuk.

We appreciate your taking the time to come to testify.

Chairman PERTSCHUK. Thank you, Mr. Chairman.

Senator NELSON. The subcommittee stands adjourned.

[Whereupon, the subcommittee was adjourned at 11:10 a.m.]

[The prepared statement of Chairman Pertschuk follows:]

STATEMENT OF MICHAEL PERTSCHUK, CHAIRMAN, FEDERAL TRADE COMMISSION

Thank you, Mr. Chairman, for your invitation to appear here today and to testify concerning government policy with respect to ownership of inventions developed in the course of federally funded research and development work. The basic question with which I understand these hearings are concerned—and which my testimony will address—is whether patent rights to such inventions presumptively should be granted to the private contractor involved or to the Government.

The fact that federal spending policies exert an enormous influence on the economy is hardly a startling proposition. Nor should it be surprising that government spending affects the competitive structure and performance of the private sector. Thus, with the federal government spending roughly $23.5 bil-

lion annually on research and development—of which more than half goes to private sector. Thus, with the federal government spending roughly $23.5 bil- justified. And where federal R. & D. expenditures result in patents, which in ef- fect confer legal monopolies, that concern is heightened. So it is appropriate that these hearings consider the competitive implications of federal patent and R. & D. policy.

After spending several months formulating "new directions" for the Federal Trade Commission, it is a pleasure for me to deal with a topic that underscores the continuity of purpose and principle within the FTC. Nearly fifteen years ago Commissioner Paul Rand Dixon, who was then Chairman of the Commission, addressed this same subcommittee on this very same topic,[1] and his statement bears repeating. Commissioner Dixon said:

"If the logic behind the granting of private patents is accepted without reser- vation—they are a reward [and incentive] for the application of thought, time and effort to inventive activity—the inference with respect to government-spon- sored research is clear: Since the public finances such research, any resulting discoveries should be a part of the public domain. As such, they should be made available to all potential competitors so that the public may benefit from the broadest possible dissemination and exploitation of these discoveries. This safe- guard is especially vital when the bulk of all Government research expenditures is concentrated among a relatively few firms."

Commissioner Dixon's observations retain their validity today. The legally pro- tected monopoly which is conferred by a patent can create a formidable barrier to entry, raising substantially the cost to new entrants who seek to compete with the patent holder. Where the patent is owned by a large, well-financed firm—the type of firm often relied upon to perform major government R&D work—smaller businesses may experience significant difficulty in competing. Because of this serious anticompetitive potential we must closely examine the need for patent protection.

In the case of government-financed R&D that need is far from clear. As Com- missioner Dixon noted, the purpose of the patent grant is to create incentives to innovation by offering a reward to the successful inventor. But, as he also stated, the firm which performs research for the government is typically well rewarded even in the absence of a patent. Not only is the firm paid for its efforts—often on a cost-plus basis—but, in addition, it winds up with technical know-how, special- ized research facilities and a pool of highly trained scientific personnel, all as a result of the government contract. Thus, even absent a patent, the contractor may be expected to have significant advantages over potential competitors in the field in question. I am aware of no evidence that the government has gone begging for customers for its R&D contracts even when no patent rights are available.

Let me focus on the energy area by way of example. Technological innovation is perceived by many as one of the paths to solution of the nation's energy prob- lems. And in large part it is federal money which is fueling this search for new technologies. Energy development and conservation is the leading growth area in federal R&D funding. This fiscal year, in fact, the Department of Energy will surpass NASA as the government's second largest R&D contractor, spending $2.2 billion on energy-related R&D. And a principal purpose of this non-nuclear energy research and development is to spin off commercially usable technologies and products.

DOE's R&D and patent policies thus will be a significant force in shaping emerging industries such as the solar energy industry, which was the focus of a symposium held just last week by the FTC's Bureau of Competition. The Federal Trade Commission is concerned about the possibility that those policies could lead to further concentration within the energy sector. Because a very large por- tion of DOE's R&D funding goes to giants of the energy industry, a system which gives all patent rights to the contractor—rather than making new products, processes and know-how equally available to all who wish to enter the com- mercial market—would raise substantially the likelihood of higher concentration.

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[1] Statement of Paul Rand Dixon, March 8, 1963.
[2] 42 U.S.C. Sec. 5901 et seq.

unless the Department waives all or any part of the rights of the government; and the statute sets out numerous factors which must be considered before such a waiver is permissible.

DOE issues over 2000 major R&D contracts annually; and since ERDA began operating in 1974, fewer than 130 waivers have been granted, including only 20—out of 59 requests—involving specific inventions developed under contract. I might note also that many of these waivers have been limited either in time, in geography, or in other respects. Has private industry been inhibited from accepting ERDA R&D contracts because patents are not routinely granted to contractors? The available evidence makes it quite clear that this has not occurred.

This answer is supported by a recent report in Business Week on energy-related R&D, which asserted that "[c]orporate competition for government funding is keen" and, in particular, that "ERDA contracts for R&D are profitable * * *"[3] Why have the normally patentless ERDA contracts been so popular? Business Week continued, quoting one corporate executive, as follows: "Such contracts entail little risk, and 'there's no investment to speak of—just bright people', * * *"[4] Business Week added that a big attraction of government funding is that it offers recipients the chance to build a major new business at taxpayer expense.[5]

What can we conclude from the ERDA example? Well, we find that ERDA R&D grants are regarded as profitable, require little investment by the contractor, and can lead to competitive advantages—even if the contractor is denied patent rights to inventions developed under the contract. Thus it appears that granting patent rights to government R&D contractors often is not needed as an incentive for having such research performed; and granting such rights to large firms who perform R&D for the government would provide a windfall to those least in need of such help and might create significant obstacles to competition with such firms.

There may be specific circumstances in which exceptions are justified. I certainly do not have all the answers with respect to this issue. But I believe that any such exceptions should be reluctantly granted and narrowly limited; the burden should be on the proponent of the exception to demonstrate on the basis of an analysis of the invention and the market involved that there is a public benefit in granting a private patent monopoly. For absent a strong showing to the contrary, government retention of patent rights resulting from government-funded R&D seems clearly appropriate. The presumption should always be that more competition is preferable to more monopoly power or concentration.

That concludes my prepared statement, Mr. Chairman. I would be happy to answer any questions.

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[3] Business Week, "Energy Conservation's Impact on R. & D.," June 27, 1977, at 53.
[4] Id. at 53–54.
[5] Id. at 54.

APPENDIX

RUSH-PRESBYTERIAN-ST. LUKES MEDICAL CENTER,
Chicago, Ill., December 16, 1977.

HON. GAYLORD NELSON,
Chairman, Senate Monopoly Subcommittee, Senate Select Committee on Small Business, Russell Senate Office Building, Washington, D.C.

DEAR SENATOR NELSON: I am writing to object to the concepts implied in the press releases from your office dated December 9th and December 13th, 1977 concerning ownership of patent rights resulting from government sponsored research. In the private not-for-profit sector, as in the private industry sector, the government purchases research because these sectors possess the capability, expertise, and frequently the equipment to carry out the research. The government does not possess this capability, and it would be foolishly extravagant to try to duplicate the expensive private (non-private and industrial) research resources which now exist; indeed it would probably be impossible to duplicate such resources, at any cost. The ownership of patent rights resulting from such research is essential for the prompt movement of a technical invention to the market place.

In the health care sector most inventions developed involve highly complex technology or complicated medicinal materials. Following the reduction to practice of such inventions, millions of dollars of additional development are frequently required before a marketable product can be made available. These expenditures are necessary for further testing and manufacturing development. In those cases where a device or chemical is to be used in human treatment, the expense may be as high as ten million dollars to complete all necessary development and testing procedures. If, as suggested by the then-Atty. Gen. Rogers in 1958, the government were to undertake these expenses in order to preserve a non-exclusive license situation, there would be a significant negative effect on the amount of money for research itself. Such an undertaking would not only lead to this reduction in research money, but would place the government in an adversary position of competing with private enterprise.

It is important to bear in mind that the U.S. Government is construed as an instrument of, and a representative for, the people, not as an adversary to the people. The group known as the people is dependent upon all the elements which make up the group for continued healthy survival.

The institutional patent agreement which organizations such as this one have with the Department of Health, Education, and Welfare allows for prompt development of a marketplace product in the best interests of the public. The royalties from such inventions under this agreement go, in small part, to the inventor, and, in large part, to the institution for further investment in research and education. The capability of granting an exclusive license under the institutional patent agreement makes possible the prompt development of marketable products which is essential for the royalties which make possible further research.

In summary, this institution would like to voice support for the present patents policy as carried out by the Department of Health, Education and Welfare and to emphasize the adverse consequences which the suggested changes in the federal patents policy would lead to.

Sincerely,

W. RANDOLPH TUCKER, M.D.,
Director, Research Administration.

WASHINGTON UNIVERSITY,
St. Louis, Mo., December 20, 1977.

HON. GAYLORD NELSON,
Chairman, Select Committee on Small Business,
U.S. Senate, Russell Senate Office Building, Washington, D.C.

DEAR SENATOR NELSON: I note with great interest releases 77–167 and 77–168 from your office announcing that the Monopoly Subcommittee is holding hearings on the federal government's patent policies. I would hope that your subcommittee will air the subject fully and not be limited by the short and selective testimony of the few witnesses announced in release 77–168. Many other viewpoints and facts on this subject are essential for a full understanding by the public of how its interests would best be served in the management of inventions arising during performance of government sponsored research.

From my personal experience in this area I would offer the following for your subcommittee's consideration:

(a) The overriding consideration in invention management is availability of the invention in the form of products which requires the voluntary investment and support of the commercial sector. No government agency can deliver the benefits of such inventions to the public—only the private enterprise system can do this.

(b) Our Constitution established our patent system to avoid suppression of technological advances so that they would become available to the public. This patent system provides the basic incentive, property rights, for the operation of the free enterprise system in this area. Failure to establish at least limited ownership in the hands of industry is a renouncement of the value of our patent system as well as the similar systems which every advanced nation in the world maintains.

(c) Inventions derived from government sponsored research are minute fraction of inventions being developed daily by industry for public sale. Widespread abuse of patent rights is not in evidence and we have adequate laws to attack such abuse should it develop. Special restrictive controls on government inventions have no positive benefit to the public in any way and instead act to suppress such inventions from reaching the public through the commercial sector.

(d) A careful study of inventions on which the government holds title and those which the government has refused to secure or allow others to secure patent protection will show a dismal record of any subsequent development and public availability in product form.

(e) Patent protection for a company is essential to provide the incentives for such a company to take the high risk investment in development, testing and clearance with regulatory agencies of new products. Within the last two years we have licensed several "sure" new inventions to industrial concerns. In one case the company invested (and lost) $2 million in development work before proving that insurmountable technical problems made a practical product infeasible. In another case a second company lost $1 million in development work before being forced to abandon the project by the problems of converting concepts to the reality of a product safe for consumer use.

(f) Rarely does a patent convey any practical sustaining monopoly to its owner but rather simply excites others to improve competitive products, develop new non-infringing products, "get around" these patent rights by cleverness, etc. Such is the vitality of our free enterprise system and the value of our patent system.

(g) The primary purpose of government sponsored research is expansion of scientific knowledge, not the creation of patent rights, for the government or others. If, in fact, knowledge is expanded and disseminated full value to the public has been achieved in the expenditure of their money. Inventions are generally a by-product bonus to be managed in such a manner that they too benefit the public as available products from industry.

(h) Experience has shown that universities which produce inventions under government research contracts and grants can be encouraged by liberal agency patent policies to seek patent protection, search for responsible industrial licensees and to manage these patent rights for public benefit. The alternative is disinterest in commercialization, publication in scientific journals and technical reports to the sponsoring agency, but not public availability of the invention in usable (product) form.

There are many who are better informed than I on this subject such as Mr. Raymond Woodrow of Princeton University and president of the Society of

University Patent Administrators; officials of the Licensing Executives Society; officials of the Patent and Trademark Office; and especially executives of high technology industries. I would hope that your subcommittee would give these informed individuals "equal time" in front of the subcommittee.

In summary, the greatest service a government agency can render to the public in the invention management area is to provide the necessary positive incentives, i.e. the essential patent protection, to industry so that the risk investment will, in fact, be taken and new products will, in fact, be delivered to the public under our free enterprise system. If abuses should arise I am confident our Justice Department will pursue them vigorously and successfully.

Respectfully yours,

EDWARD L. MACCORDY,
Associate Vice Chancellor for Research.

AEROSPACE INDUSTRIES ASSOCIATION OF AMERICA, INC.,
Washington, D.C., December 22, 1977.

HON. GAYLORD NELSON,
Chairman, Subcommittee on Monopoly and Anticompetitive Activities, Select Committee on Small Business, U.S. Senate, Russell Senate Office Building, Washington, D.C.

DEAR MR. CHAIRMAN: It is apparent from discussions and testimony at the hearings on December 19, 20 and 21, 1977, before the Subcommittee on Monopoly and Anticompetitive Activities, Senate Select Committee on Small Business, that there exist serious misunderstandings of the nature of independent research and development.

The term Independent Research and Development (IR&D) was probably first generated in 1959 for use in the Cost Principles of the Armed Services Procurement Regulation to distinguish between company research and development (R&D) costs that are allocated through overhead and R&D performed by a company paid for by a grant or contract. Thus, by definition, IR&D is "* * * that technical effort which is not sponsored by or required in performance of a contract or grant * * *" (ASPR 15-205.35). Manifestly, therefore, IR&D cannot be a grant as alleged at the hearings, but rather is company-funded R&D.

As to the historical background of company-funded R&D (IR&D), such technical effort is as old as the history of industry, not only in the United States but in the world. Any company, to maintain its technical competence and hence its competitive position in its selected marketplaces, must conduct research and development and, to stay in business, must recover the costs of such efforts in the prices of goods and services sold to its customers, whether such customers are government, other segments of industry, or the general public.

As to the expenditures for research and development in the United States, the latest figures of the National Science Foundation indicate that in 1975 (the last year for which figures are complete) total R&D (expressed in millions of dollars) was $34,558; of which $18,307 was provided by the Government; $15,002 by Industry; $741 by Universities and $508 by other non-profits. Copy attached Tab 1. Thus, non-government funds expended for research and development totaled $16,025, or about 47% of the total.

Contrary to allegations at the hearings, Congress does indeed receive reports on IR&D. P.L. 91-441, Sec. 203 (sponsored by Senator Proxmire), requires the Department of Defense (DoD) to render an annual report to the Congress as to contractor IR&D costs. The latest annual report was transmitted to the Vice President on March 15, 1977. Copy attached, Tab 2.

The report shows that in 1975 major defense contractors incurred total IR&D costs of (in millions) $1,235, of which $1,015 was accepted by the government, i.e., was decided to have a potential military relationship, and the DoD's share was $501. Thus, in 1975 DoD's share of total IR&D costs incurred by the contractors was 41%. In 1976, the major contractors' total IR&D costs was $1,323, the government accepted $1,061 and DoD's share was $543, or 41% of total contractor IR&D effort.

In regard to the above figures, it should be borne in mind that IR&D is an overhead cost and is equitably allocated to all company efforts. Thus, a company having 40% government work and 60% commercial, will allocate only 40% of its IR&D costs to government contracts. Moreover, under P.L. 91-441, a company that has received $2 million in IR&D from the DoD in the previous year

must enter into an advance agreement with that agency as to the amount of IR&D that will be accepted for reimbursement under DoD contracts. Generally, DoD accepts only about 80% of a contractor's IR&D costs which would otherwise be allocable, as reasonable, to DoD contracts. In short, the DoD enjoys a preferred customer status, to the benefit of the national defense.

A statement was made at the hearings that small business rarely obtains IR&D monies. To the contrary, most small business firms sell on a fixed price basis and unless their costs are subject to audit by the government, no question is raised as to the amount of IR&D included in the prices of the goods or services sold by such firms. Accordingly, as a general rule, small business recovers 100% of its expenditures for IR&D.

To further clarify the nature of IR&D, enclosed is "A Position Paper on Independent Research and Development and Bid and Proposal Efforts" prepared by three industrial associations, namely, Aerospace Industries Association of America, Inc., Electronic Industries Association and National Security Industrial Association. We will be pleased to answer any question you or your staff may have on this matter.

It is requested that this letter and its attachments be included in the record of the hearings before this Subcommittee.

In view of the interest of the Subcommittee on Research and Development of the Senate Armed Services Committee in the subject of IR&D, a copy of this letter is being transmitted to Senator Thomas McIntyre as Chairman of that Subcommittee.

Very truly yours,

KARL G. HARR, JR.

U.S. RESEARCH AND DEVELOPMENT SOURCES OF FUNDS BY SECTOR, 1968–77

[In millions of dollars]

Year	Total	Federal Government	Industry	Universities and colleges	Other nonprofit[1]
1968	24,604	14,926	9,005	391	282
1969	25,626	14,890	10,010	420	309
1970	25,905	14,668	10,439	461	337
1971	26,595	14,892	10,813	529	361
1972	28,257	15,795	11,502	575	385
1973	30,303	16,389	12,886	615	413
1974	32,260	16,874	14,266	671	449
1975	34,558	18,307	15,002	741	509
1976 (estimate)	37,363	19,755	16,243	808	557
1977 (estimate)	40,800	21,789	17,508	883	611

Source: National Science Foundation No. 77–310, p. 30.

U.S. RESEARCH AND DEVELOPMENT PERFORMANCE BY SECTOR, 1968–77

[In millions of dollars]

Year	Total	Federal Government	Industry[1]	Universities and colleges	FFRDC's	Other nonprofit[1]
1968	24,604	3,494	17,429	2,149	719	814
1969	25,626	3,503	18,303	2,220	725	870
1970	25,905	3,855	18,062	2,335	737	916
1971	26,595	4,156	18,311	2,500	716	912
1972	28,257	4,482	19,383	2,676	764	952
1973	30,303	4,619	20,921	2,940	817	1,006
1974	32,260	4,815	22,399	3,017	865	1,164
1975	34,558	5,395	23,540	3,393	987	1,243
1976 estimate	37,363	5,800	25,500	3,660	1,080	1,323
1977 estimate	40,800	6,500	27,750	3,956	1,177	1,417

[1] Expenditures for federally funded research and development centers (FFRDC's) administered by both industry and by nonprofit institutions are included in the totals of the respective sectors.

Source: National Science Foundation No. 77–310, pp. 22–23.

[From the Congressional Record, July 15, 1977]

Department of Defense Annual Report on Independent Research and Development

Mr. McIntyre. Mr. President, section 203, paragraph (c) of Public Law 91–441 requires the Department of Defense to submit an annual report to the Congress on independent research and development, I.R. & D.; and bid and propose, B. & P., costs. The report for 1976 has been received and I ask unanimous consent to have the report entered into the Record at the conclusion of my remarks. In the interest of brevity, I shall refer to the categories of cost as I.R. & D.

The Presiding Officer. Without objection, it is so ordered. (See exhibit 1.)

Mr. McIntyre. Mr. President, I would like to summarize the financial data and comment on its significance. Last year it was estimated that the payments to contractors by the Department of Defense for I.R. & D. in 1975 would be $811 million. The actual data provided this year shows that indeed $811 million was paid by the Department of Defense. But let me point out that the total DOD share of I.R. & D. costs was greater than expected, but this was offset by an equal increase in the amount absorbed by sales to foreign governments.

The estimate for I.R. & D. costs to DOD for 1976 is $845.2 million, an increase of $34.2 million or about 4 percent over 1975. Considering the impact of inflation, this must be viewed as a real decrease. However, this estimate assumes that $112.8 million will be recovered from sales to foreign governments and its is not clear at this time that that amount will be realized.

Mr. President, the costs for I.R. & D. are high but I believe that the present system strikes a good balance between controlling these costs and giving our defense industry sufficient flexibility to maintain a strong technological base. The purpose of I.R. & D. funds is to make sure there are qualified bidders to propose on DOD programs. It is the price we pay to make sure we have companies that are on the forefront of technology and prepared to bid on new projects.

There have been concerns expressed in the past that the Congress does not have adequate control of I.R. & D. funds. I do not share that view.

It is clear that the process now used by DOD to control the amount spent for I.R. & D. is not allowing wild increases, in fact, there is probably a decline in real value. If Congress were to become more involved in allocating these funds, it would mean that Congress would soon have to deal with choices as to which company should be proficient in which technology. Clearly, those decisions must be left to the individual companies. In my judgment the present system strikes a good balance between control and flexibility.

Mr. President, in summary, I am convinced that the investment we make in independent research and development is not only prudent but essential. It is one part of the total investment to preserve our technological leadership and is one that has paid rich dividends.

Exhibit 1

Assistant Secretary of Defense,
Washington, D.C., March 15, 1977.

Hon. Walter F. Mondale,
President of the Senate,
Washington, D.C.

Dear Mr. President: The Secretary of Defense has requested that I prepare and submit to you the report of Independent Research and Development and Bid and Proposal costs required under Section 203, paragraph (c) of the 1971 Department of Defense Appropriation Authorization Act (PL 91–441). This section requires the submittal of an annual report to the Congress on or before March 15th each year setting forth—

"(1) those companies with which negotiations were held pursuant to subsection (a)(1) of this Section prior to or during the preceding fiscal year of the Federal Government, together with the results of those negotiations;

"(2) the latest available Defense Contract Audit Agency statistics, estimated to the extent necessary, on the independent research and development or bid and proposal payments made to major defense contractors, whether or not covered by subsection (a)(1) of this section during the preceding calendar year; and

"(3) the manner of his compliance with the provisions of this Section, and any major policy changes proposed to be made by the Department of Defense in the administration of its contractors' independent research and development and bid and proposal programs."

The report is in three parts corresponding to the three items quoted above. Parts I and II were compiled from detailed data pertaining to individual companies. This detailed company information is very sensitive and is not included in the report; however, it will be made available for review.

Sincerely,

_____,
Acting Assistant Secretary of Defense,
(Installations and Logistics).

Enclosures.

REPORT TO THE CONGRESS ON INDEPENDENT RESEARCH AND DEVELOPMENT COSTS AND BID AND PROPOSAL COSTS

This report covers the fiscal year ended 30 June 1976 and transition quarter ended 30 September 1976.

Furnished in compliance with Section 203, paragraph (c) of the Department of Defense Appropriation Authorization Act of 1971 (PL 91-441), March 1977.

PART I

Companies with which negotiations were held pursuant to Section 203 prior to or during the preceding fiscal year of the Federal Government and the results of those negotiations.

In accordance with the above requirement the attached Schedule A provides data pertaining to the negotiations conducted in the Government's fiscal year 1976 and Schedule B provides data pertaining to the negotiations conducted in the Government fiscal year 197T.

SCHEDULE A

I.R. & D./B. & P. REPORT, PT. 1—NEGOTIATIONS COMPLETED IN FISCAL YEAR 1976 AND RESULTS OF THOSE NEGOTIATIONS

[Dollars amounts in thousands]

	Number of companies	Total program dollars proposed by contractors			Total advance agreement ceiling dollars negotiated by DOD			Estimated DOD share of ceiling dollars negotiated		
		I.R. & D.	B. & P.	Total	I.R. & D.	B. & P.	Total	I.R. & D.	B. & P.	Total
Contractors' fiscal year:										
1975	15	$247,481	$93,849	[1] $340,361	$184,434	$74,338	$258,772	$87,200	$46,807	[1] $134,008
1976	46	703,306	316,739	1,020,045	555,632	264,482	820,114	310,392	182,905	493,297
1977	14	335,613	173,346	508,959	252,160	151,610	403,770	147,063	101,734	248,797
1978	3	251,209	61,890	313,099	198,300	51,070	249,370	35,010	28,972	63,982

[1] Discrepancies in totals represent rounding off of DCAS submissions.

SCHEDULE B

I.R. & D./B. & P. REPORT, PT. 1—NEGOTIATIONS COMPLETED IN FISCAL YEAR 197T AND RESULTS OF THOSE NEGOTIATIONS

[Dollars amounts in thousands]

	Number of companies	Total program dollars proposed by contractors			Total advance agreement ceiling dollars negotiated by DOD			Estimated DOD share of ceiling dollars negotiated		
		I.R. & D.	B. & P.	Total	I.R. & D.	B. & P.	Total	I.R. & D.	B. & P.	Total
Contrators' fiscal year:										
1976	2	$4,588	$3,029	$7,617	$4,421	$2,079	$6,500	$4,421	$2,079	$6,500
1977	3	4,865	5,465	10,330	4,400	4,960	9,360	3,866	3,402	6,268
1978	1	2,450	3,900	6,350	2,350	3,590	5,940	1,669	2,549	4,218

PART II

Latest available Defense Contract Audit Agency statistics, estimated to the extent necessary, on the Independent Research and Development (IR&D) or Bid and Proposal (B&P) payments made to major defense contractors, whether or not covered by Subsection (a) (1) of this Section [203, PL 91-441] during the preceding calendar years.

The statistics required are provided in the attached DCAA report. The report shows total IR&D and total B&P cost incurred by the contractors reviewed, the amount accepted or recognized by the Department of Defense and the DoD share. In addition, total sales of the contractors are shown along with the portion representing DoD sales.

The amount listed on Page 1 under the column heading "Amount Accepted by Government" represents the sum of the ceilings negotiated with individual contractors as well as the sum of amounts recognized for other contractors who had no advance agreements. These accepted amounts are not the costs reimbursed by the DoD but are the amounts that the DoD recognizes for allocation to all the contractors' business. The DoD portion is shown under the column headed "DoD share."

On pages 2 and 3 of the report the totals shown on page 1 are broken down to show, respectively, the portions applicable to contractors for which advance agreements were required, and the portion applicable to contractors for which advance agreements were not required. The foreword appearing in the DCAA report explains the basis for the cost data reported, but we would like to call particular attention to note A on page 1 regarding foreign military sales. These sales and IR&D/B&P costs hould be subtracted from the amounts shown in the report to determine the amounts applicable to the Department of Defense. This adjustment is as follows (all figures are in millions) :

	1975	1976
Sales to DOD per report	$24,751.0	$27,181.0
Less foreign military sales	2,158.7	3,364.6
Net sales to DOD	22,592.3	23,816.4
DOD share of I.R. & D./B. & P. per report	882.0	958.0
Less amount absorbed by sales to foreign governments	71.0	112.8
Net costs charged to DOD	811.0	845.2

It will be noted that data for both 1975 and 1976 are furnished. It has been the practice to update data previously furnished because the latest year figures include significant amounts of estimated information. The 1975 figures presented here have had most of the estimated data replaced with actual data. The report furnished next year will similarly update the 1976 data furnished herewith.

PART III

The mannner of his compliance with the provisions of this section, and any major policy changes proposed to be made by the Department of Defense in the administration of its contractors' Independent Research and Development and Bid and Proposal Programs.

During the past year, we believe our implementation of Section 203, PL 91-441, has been in full compliance with that section. We have not revised any of our major policies for administration of contractors' Independent Research and Development and Bid and Proposal programs.

SUMMARY OF INDEPENDENT RESEARCH AND DEVELOPMENT AND BID AND PROPOSAL COSTS INCURRED BY MAJOR DEFENSE CONTRACTORS IN THE YEARS 1975 AND 1976

(Prepared by Defense Contract Audit Agency, March 1977)

FOREWORD

This summary report presents the latest available Defense Contract Audit Agency (DCAA) statistics on the independent research and development (IR&D)

and bid and proposal (B&P) payments to defense contractors. The statistical data are to be included in the Secretary of Defense's annual report to the Congress on or before 15 March 1977, accordance with paragraph (c), Section 203, Public Law 91–441. The data in this summary report are similar to that previously furnished to the Office of the Assistant Secretary of Defense (Installations and Logistics) (OASD) (I&L)), for contractor fiscal years 1974 and 1975.

Page 1 shows the overall IR&D and B&P costs incurred by 99 defense contractors during their fiscal years 1975 and 1976, amounts accepted by the Government, and the Department of Defense (DoD) share of amounts accepted. The amounts accepted by the Government are allowable and allocable to all contractor work performed—Government and commercial. The DoD share of the costs accepted each year is the contractors' allocation of such costs to DoD work. In addition, this summary shows related sales achieved by the 99 contractors, comprising 258 reporting divisions and/or operating groups.

The major defense contractors in this summary are those which had an annual auditable volume of costs incurred of $30 million or required 5,000 or more man-hours of DCAA's direct audit work a year. In previous DCAA reports, a major defense contractor was identified as having an annual auditable volume of costs incurred in excess of $15 million or requiring annually 4,000 or more man-hours of direct audit effort. Since these standards were no longer realistic, they were changed. The impact of this change on the IR&D/B&P reporting requirement is not significant because it affected nine contractors only, with the DoD share of IR&D/B&P totalling approximately $6 million, or 0.6 percent of the total DoD share of IR&D/B&P costs. This summary also includes other contractors which, although not meeting the above criteria, negotiated IR&D/B&P advance agreements so that the summary on page 2 will be compatible with the advance agreement reports prepared by Army, Navy, Air Force, and the Defense Logistics Agency. Contractors specifically excluded from this summary are construction Companies; educational institutions; foreign contractors and overseas operations of U.S. contractors; insurance companies; marine transport contractors; and military medicare contractors. These contracting activities incurred nominal or no IR&D/B&P costs.

DCAA obtained the IR&D/B&P cost and sales data from contractors' records, but such data do not necessarily represent audited amounts. Included in the costs shown are amounts accepted by the Government in overhead negotiations and through advance agreements. Where actual cost and sales data were not available, as in the case of contractors which had not closed their books for 1976, DCAA auditors obtained reasonable estimates.

Page 2 shows the extent of advance agreements in effect during 1975 and 1976. Page 3 shows costs not subject to advance agreements.

SUMMARY OF INDEPENDENT RESEARCH AND DEVELOPMENT AND BID AND PROPOSAL COSTS INCURRED AND SALES ACHIEVED BY MAYOR CONTRACTORS FOR CONTACTOR FISCAL YEARS 1975 AND 1976

[In millions of dollars]

	1975			1976		
	Costs incurred	Amount accepted by Government	DOD share	Costs incurred	Amount accepted by Government	DOD share
Independent research and development (I.R. & D.)	1,235	1,015	501	1,323	1,061	543
Bid and proposal (B. & P.)	604	539	381	677	590	415
Total I.R. & D. and B. & P. costs	1,839	1,554	[1] 882	2,000	1,651	[1] 958
Sales:						
Total Government and commercial		[1] 46,024			[1] 48,962	
Total DOD			[1] 24,751			[1] 27,181

[1] Included in the data are the sales to foreign governments placed through DOD contracts and reimbursed to DOD by such foreign governments in the amounts of $2,158,700,000 and $3,364,600,000 for 1975 and 1976, respectively, as well as the applicable I.R. & D. and B. & P. costs allocable to these sales in the amounts of $71,000,000 and $112,800,000 for 1975 and 1976, respectively.

SUMMARY OF INDEPENDENT RESEARCH AND DEVELOPMENT AND BID AND PROPOSAL COSTS INCURRED BY MAJOR DEFENSE CONTRACTORS FOR CONTRACTOR FISCAL YEARS 1975 AND 1976

[In millions of dollars]

	1975				1976			
	Costs incurred	Amount accepted by Government	DOD share	Number of contractor divisions	Costs incurred	Amount accepted by Government	DOD share	Number of contractor divisions
WITH ADVANCE AGREEMENTS								
Independent research and development (I.R. & D.)	1,204	993	489	212	1,300	1,046	535	207
Bid and proposal (B. & P.)	581	518	367	212	656	570	402	207
Total I.R. & D. and B. & P. costs	1,785	1,511	856	----------	1,956	1,616	937	----------
WITHOUT ADVANCE AGREEMENTS								
Independent research and development (I.R. & D.)	31	22	12	46	23	15	8	51
Bid and proposal (B. & P.)	23	21	14	46	21	20	13	51
Total I.R. & D. and B. & P. costs	54	43	26	----------	44	35	21	----------

A Position Paper on Independent Research and Development and Bid and Proposal Efforts

AEROSPACE INDUSTRIES ASSOCIATION OF AMERICA, INC.
1725 DeSales Street, N.W., Washington, D. C. 20036

ELECTRONIC INDUSTRIES ASSOCIATION
2001 Eye Street, N. W., Washington, D. C. 20006

NATIONAL SECURITY INDUSTRIAL ASSOCIATION
740 - 15th Street, N. W., Washington, D. C. 20005

A Position Paper on Independent Research and Development and Bid and Proposal Efforts

This paper was prepared by the Tri-Association Ad Hoc Committee on IR&D and B&P under the auspices of the Aerospace Industries Association of America, Inc. (AIA), Electronic Industries Association (EIA), and National Security Industrial Association (NSIA).

MARCH 22, 1974

CONTENTS

I. INTRODUCTION

The subject of Independent Research and Development (IR&D) and Bid and Proposal (B&P) effort is undoubtedly going to be debated in the U.S. Congress again this year. The vital importance of IR&D and B&P to American industry and to the U.S. Government requires the timely, clear articulation of the issues. In particular, industry bears the responsibility for making its voice heard in support of those Government agencies currently trying to evaluate objectively the critical issues for the Congress.[1]

It is important to understand what IR&D and B&P efforts really are, why they are absolutely essential, and how they differ.

Independent Research and Development (IR&D) is a term devised by the Department of Defense (DOD) and used by Federal agencies to differentiate between a contractor's research and development technical effort performed under a contract, grant, or other arrangement (R&D) and that which is self-initiated and self-funded (IR&D).

Bid and Proposal (B&P) is a term devised by DOD and used by Federal agencies to describe a contractor's technical and supporting effort directed at preparing and submitting proposals (solicited or unsolicited) to a customer to meet an identified customer requirement.

The limited similarity in content and objectives of IR&D and B&P should be understood, primarily to prevent the mistaken tendency to group them together. It would be a great tragedy if sincere and dedicated Senators and Congressmen were to lack understanding of the true nature of IR&D and B&P efforts, and consequently act to the detriment of our country. It is the purpose of this paper to explain the vital nature of IR&D and B&P, and to present the industry viewpoint in support of Government recognition of the costs incurred in pursuing strong, aggressive IR&D and B&P efforts to retain U.S. leadership in the world.

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[1]This paper summarizes a number of technical papers prepared under the auspices of the Aerospace Industries Association of America, Inc., Electronic Industries Association, and National Security Industrial Association. These papers cover the following subjects:

1. Economic Considerations Regarding IR&D and B&P Expense
2. Alternative Methods of IR&D and B&P Cost Reimbursement
3. Benefits Derived from IR&D Effort
4. Benefits Derived from B&P Effort
5. U.S. & Foreign Nation Support of Industrial Technical Effort
6. Industry Response to 22 Proxmire-McIntyre Questions

The above papers have been published under separate cover and entitled "Technical Papers on IR&D/B&P." This "position paper" will reference the individual papers cited above from time to time.

The controversy over IR&D and B&P is not new. The subject has been debated in Government and industry circles for more than thirty years, dating back to World War II. Many studies have been made, much has been said and written, regulations have been issued and legislation enacted, and a greater degree of understanding has evolved. Nevertheless, we stand today at another crossroads. IR&D and B&P efforts, essential in doing business and of great benefit to national defense and the economic well-being of the United States, are gravely endangered.

Recent activities within the Senate[2] could lead to precipitate actions that would seriously weaken the ability of American industry to maintain our technological leadership.

The challenge of U.S. technological leadership by foreign countries is strong and increasing every year ("U.S. & Foreign Nation Support of Industrial Technical Effort" - see Footnote 1). IR&D and B&P efforts by American industry are critical to the stimulation of competition, which not only greatly benefits all customers including the Government, but also strengthens our nation in the expanding competition with other countries.

II. THE VITAL NATURE OF IR&D AND B&P

IR&D and B&P exist because private firms doing business with the Government must develop advanced technologies necessary for future products and services (IR&D), and must incur the costs of bidding and proposing these products and services (B&P). All private firms must recover all their costs from their sales, including the costs of company-initiated research and development and the costs of bids and proposals. All sales should share the allocation of these costs. In the private sector, these costs are never identified to the customer and they are never questioned. The customer simply wants the best product at the best price, and each private firm strives to supply this ideal by judicious management of research and development, and marketing. The competitive market controls the proper level - too much or too little expenditures in either area can have adverse consequences. Accordingly, very close and constant attention is afforded to these costs by all successful business firms. Only judicious establishment of the level of these activities permits a firm to survive in a competitive environment. It is important that customers do not have any direct control over these expenditures, for if they do they would impact (and maybe even control) the destiny of the private firm.

The current and future economic health of the United States is linked directly to the economic health and growth prospects of industry.

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[2]Congressional Record - Senate, dated May 8, 1973, pages S-8570 through S-8583, and September 24, 1973, pages S-17516 through S-17519, and October 11, 1973, pages S-19051, S-19052.

One of the fundamental requirements for corporate profitability and growth is expenditure for the development of future products and services, through company-initiated research and development. No corporation can continue to exist in our economy without ongoing self-initiated research and development. It is an essential ingredient for maintaining its business vitality.

The United States will gain by preserving the independent or contractor-initiated nature of independent research and development, particularly when the Government is the customer. It permits a contractor to apply his resources selectively to those technologies in which his capabilities are highest, and which from his broad experience and objective perspective will benefit the customer most. At the same time, independence insures that only those companies which exercise good business judgment survive in our competitive free enterprise economy.

Although specific data is not available to compare the concept of IR&D in the United States and its equivalent in other countries, data exists on the general subject of R&D trends in other countries which is relevant to the discussion at hand. The United States has, certainly since World War II, had a positive balance of trade due in large measure to high technology exports. This advantageous position has eroded and in recent years shown a deficit. U.S. Department of Commerce data reported by the National Science Foundation shows that the favorable balance of trade on technology intensive manufactured products increased from $5.85 billion in 1960 to $11.6 billion in 1971. During the same period, nontechnology intensive products showed a deficit growing from $88 million in 1960 to $11.07 billion in 1971. Unfortunately, for the past few years, the surplus in technology intensive manufactured products has increased only slightly while the deficit in nontechnology intensive products has grown markedly, becoming a significant factor in the recent overall unfavorable balance of trade. ("U.S. & Foreign Nation Support of Industrial Technical Effort" - see Footnote 1, p. 1). The net result is vividly portrayed in Figure 1, showing the composite balance of trade for all manufactured products. From this, one can readily appreciate the growing competitive challenge from abroad.

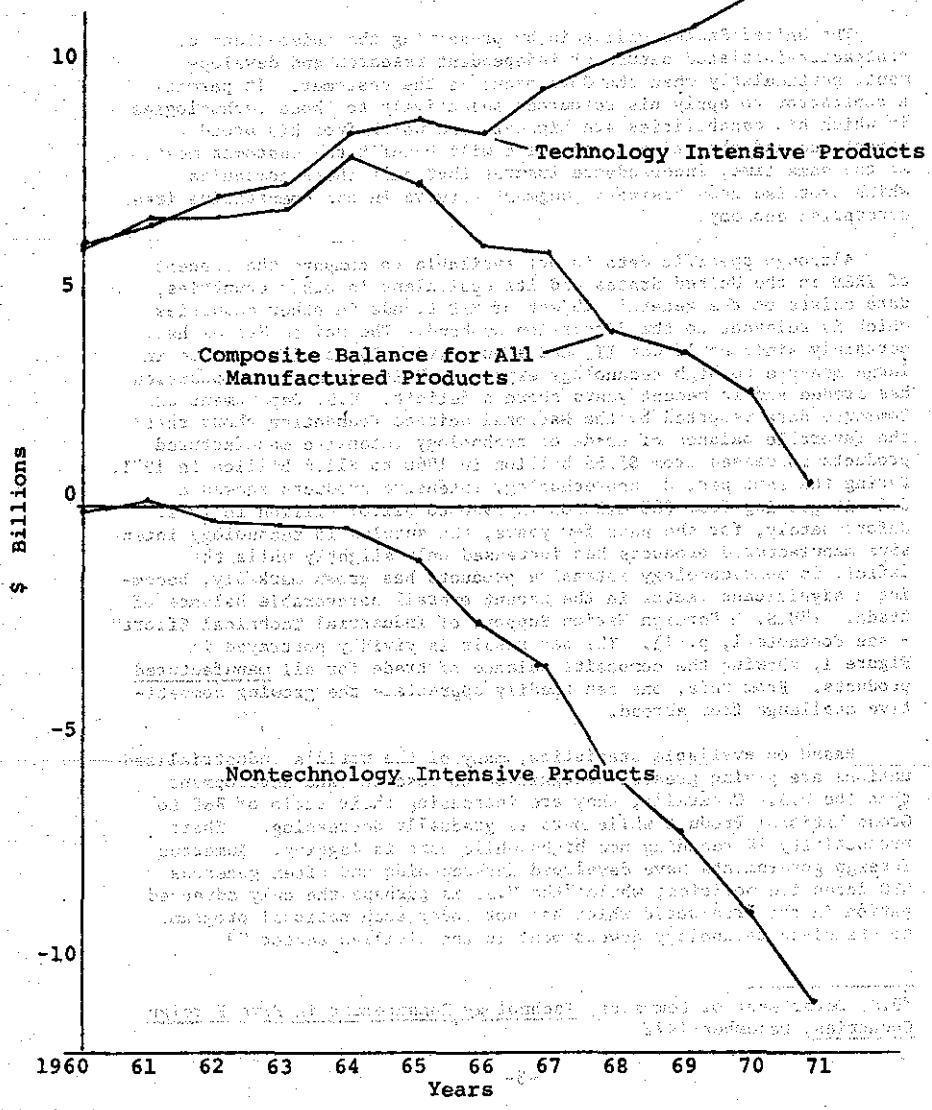
Based on available statistics, many of the world's industrialized nations are giving greater recognition to research and development than the U.S. Generally, they are increasing their ratio of R&D to Gross National Product while ours is gradually decreasing. Their productivity is reaching new highs while ours is lagging. Numerous foreign governments have developed far-reaching and often generous R&D incentive policies, while "the U.S. is perhaps the only advanced nation in the free world which has not undertaken national programs to stimulate technology development in the civilian sector."[3]

[3]U.S. Department of Commerce, Technology Enhancement in Five Foreign Countries, December 1972

FIGURE 1

Balance of Trade

Manufactured Products



Two counteracting forces contribute to this. First, the economies of western Europe, Canada and Japan have recovered from World War II and are now capable of supporting significant R&D efforts. These efforts, coupled with labor costs lower than the U.S., have created price-competitive products. Conversely, the U.S. has retrenched from the aggressive federally funded R&D policies of the early 1960s to a more recent practice of limiting federal support to levels below increases in the inflation index, i.e., a declining level of real effort.

The important thing to note from this review of international trends in R&D is the greater aggressiveness of most industrialized foreign countries compared to the U.S. Having seen the U.S. attain a position of world leadership through military and industrial strength based upon superior technological capability, other nations have reacted with vigorous support of R&D. These governments have recognized the need to encourage industry to conduct research and development in order to provide a necessary technological base to compete in the international marketplace. In many cases, such encouragement is in the form of direct subsidies. U.S. companies neither seek nor believe that subsidies or direct payments of any kind are desirable.

Inasmuch as IR&D has as its primary characteristic the stimulation of new ideas and concepts for advancing technology and applying it to the solution of current and future problems, the need for continued strong support of IR&D by American industry is obvious. Clearly it is in the Government's best interest to fully recognize IR&D and B&P costs allocated to Government contracts.

B&P efforts differ markedly from IR&D. B&P is that activity undertaken by a company to respond to specific Government requirements by the application of its particular technological expertise. Preparation of proposals, whether solicited by the Government or unsolicited, involves major technical effort on the part of a company to set forth to the procuring agency the details, feasibility and superiority of its proposed approach. Government encourages competition among private companies and this can only be effective if industry is in a position to respond with vigorous B&P activity. Competition is encouraged not only on standard products (catalog items) and price proposals (build to print, or production programs), but also on cost-reimbursement type contracts where technical approach, price, schedules and performance are all factors.

While there is much B&P technical effort involved in the preparation of complex proposals for major Government programs, the nature of this effort is very specifically directed toward the technical requirements spelled out in detail in the request for proposal. This effort is primarily involved in the application of a company's technical capability and expertise to the problem at hand. Exploratory IR&D-type efforts are usually not then appropriate, because there is insufficient time for them after receipt of the RFP. The results of IR&D efforts conducted long before are what is needed in the proposal, which is often a good indicator of the quality of previous IR&D work.

Thus, it is evident that while both IR&D and B&P involve technical effort by scientists and engineers, they are really two distinctly different activities, directed toward different objectives. IR&D is exploring the future, seeking a better answer to problems or a better way to perform a function, whereas B&P is defining the present capability, describing clearly and concisely, in a formal proposal, a solution that is already reasonably well understood and tested or an approach to a solution that has a very high probability of success (often demonstrated as a result of previous IR&D).

In the Government procurement process (DOD and NASA), contracts are not awarded solely on the basis of a company's cost proposal and demonstration of resources to be applied to a contract, coupled with prior accomplishments. Rather, a company's proposal must demonstrate a complete understanding of all technical problems, to the point of describing therein a substantially finished design of a viable version of the system to be furnished, and discussing the merits of the chosen design versus possible alternatives. The associated technical effort, ranging from studies, computer modeling and design calculations to, in many cases, the construction of prototypes, represents the technical effort required for B&P.

From the foregoing, the vital nature of both IR&D and B&P to industry should be very clear. In industry's view it should also be clear to the people in Government that IR&D and B&P are absolutely essential activities which should be encouraged, and strongly and consistently supported. Although those in Government most closely associated with IR&D and B&P have consistently argued the indispensable nature of these efforts[4,5,6,7], certain Congressional critics have apparently not been convinced concerning the value of IR&D and B&P, and the appropriateness of full Government recognition and reimbursement of these necessary and legitimate costs.

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[4]Dr. John S. Foster, Jr., Director of Defense Research and Engineering, DOD, Testimony before House and Senate Subcommittees on Research and Development, 1970.

[5]Dr. Malcolm R. Currie, Director of Defense Research and Engineering, DOD, Testimony before the House Defense Appropriations Subcommittee, September 24, 1973.

[6]Report of the Commission on Government Procurement, December 1972, Volume II, Part B, Page 31.

[7]Report of Blue Ribbon Defense Panel.

III. THE IR&D/B&P CONTROVERSY - ITS EVOLUTION

Dr. Vannevar Bush, Chief of the Office of Scientific Research and Development for Defense during World War II, observed in 1946[8] that "World War II was the first war in human history to be affected decisively by weapons unknown at the outbreak of hostilities. This is the most significant military fact of our decade - that upon the current evolution of the instrumentalities of war, the strategy and tactics of warfare must now be conditioned."

Fortunately, a large community of scientists and engineers did exist in the United States and their efforts were largely responsible for the remarkable scientific advances of this country during World War II.

Dr. Bush, however, has noted that little of this energy was devoted in the decade preceding World War II to development of new weapons for the military, even though Congress appropriated every cent requested by the agencies for R&D - which was not much. Even when larger R&D amounts were finally requested by the military and made available, there was no corresponding increase in vision as to how these R&D funds might be used for the development of new and more effective weapons. Our country was pathetically unprepared from the standpoint of new weapons - even though we believed ourselves to be a nation quite advanced in technology and science.

What we did with the outbreak of World War II was to "pull all stops" and win a war by developing a new arsenal of weapons while we fought. During the few short years from 1940 to 1945, the adaptation of scientific technology to new weapons was supported by a massive industrial base which used and applied the most advanced technology of that time at tremendous expense. We, of course, will never again enjoy the luxury of the time necessary for catching up. Today's warfare technology is such that total preparedness is an unquestioned necessity. National strategy is based on prevention of total war, or rather, defense against aggression based on demonstrable military superiority, which in turn can stem only from technological strength.

Thus, a new partnership between a loosely knit scientific community and a highly formalized military group was formed together with the powerful industrial structure upon which both relied. Dr. Bush also observed in 1946 that a "great source of the fundamental strength of the United States was in the very high proportion of its scientific and engineering talent devoted to the ordinary economy of peacetime. Previous efforts to bring civilian science into the program of weapon development were based on the theory that the Services would know

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[8] Organizing Scientific Research for War, Dr. Vannevar Bush, et al., 1946, Atlantic Monthly Press.

what they needed and would ask the scientists to aid in its development... The times (of World War II) called for a reversal of the situation, namely letting men who knew the latest advancement in science become more familiar with the needs of the military in order that they might tell the military what was possible in science so that together they might assess what should be done."

The experience of World War II, and the continuing cold war pressures and the ongoing efforts to realize a true detente, have made it abundantly clear that this country must have the strong, continuous involvement of all of our developed technical talents to survive. We were able to respond to the challenge of World War II because self-initiated research and development had been conducted by private industry in many fields relating to their specific business interests.

Recognizing the cost of this company-initiated, or independent research and development, as an element of overhead is a long-standing accounting practice. In one form or another and under whatever name, contractual recognition of IR&D has been in effect since the cost-reimbursement contracting days of World War II. The 1940 Treasury Decision 5000[9] included cost principles that recognized indirect engineering expenses related to manufacturing operations as an allowable cost. Although not strictly defined as IR&D, this was the first official recognition by the Government that related technical effort was a proper cost in a defense contract.

The earliest reference to what we now call IR&D is found in a document published in April 1942 (known as the "Green Book") entitled, Explanation of Principles for Determination of Costs under Government Contracts.[10] In this statement of "Engineering and Development", the following appears:

> "32. Distinction has previously been made between engineering services related immediately to manufacturing operations (shop engineering expense) and research, experimental and development costs not related to current manufacture but devoted to future improvement in and application of products. The cost of the latter research and experimental development work may be absorbed in manufacturing cost on a regular basis by means of absorption rates, on the principle that these activities are usually maintained under a consistent program independently and apart from current manufacturing operations, and that their benefit relates to products on a uniform scale

[9] U.S. Treasury, Department Regulation 5000, August 7, 1940, Sec. 26.9.

[10] War Department and Navy Department, Explanation of Principles for Determination of Costs under Government Contracts, April 1942, U.S. Government Printing Office, Washington, D. C.

over a period of years more properly than according to actual expenditures in any given year. When these costs are deferred or capitalized in conformity with a consistent plan, reasonable allocation may be treated as a cost of performing a contract.

33. Alternatively, when it is the policy to charge off actual research, experimental and development expenses currently in each year rather than to use stabilized absorption rates, a reasonable portion thereof may be allocated to the cost of performing the contract."

B&P costs were allowed just as any other indirect cost.

This governing principle which was followed until 1949 provided guidance developed around the determination of whether the work was research - hence, general in nature - or development and pertinent only to a specific contract. This guidance did not attempt to define the terms research and development. Interpretation was left to the contract-negotiation process. The provisions of these cost principles applied to supply and research contracts with commercial organizations, in which it was stated that research and development specifically applicable to the supplies or services covered by the contract were allowable costs without regard to whether they were treated as direct or indirect costs.

From 1949 forward, with the Government Defense R&D Budget covering Government laboratories and contracted R&D, there has been a constant erosion of the concept of Independent Research and Development performed by contractors. Interestingly, during World War II we find little evidence that the Government sought to assert unique rights to patents or data except in the field of nuclear energy.

In 1949 the Armed Services Procurement Regulation (ASPR)[11] Cost Principles were issued, and provided that "research and development specifically applicable to the supplies and services covered by the contract" was an allowable cost but "general research, unless specifically provided for elsewhere in the contract" was unallowable. Accordingly, independent general research could be, and frequently was, allowed as a cost under cost reimbursement contracts only if it were specifically provided for in the individual contracts. However, these former regulations applied only to cost reimbursement contracts; recognition of independent general research cost was always permitted in the pricing of other contracts (fixed-price, incentive and price re-determinable).

[11] U.S. Department of Defense, Armed Services Procurement Regulation, Washington, D. C., U.S. Government Printing Office, 1949.

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It is noteworthy to observe the cyclical pattern of change in the IR&D and B&P controversy. It started with full recognition of IR&D under the Green Book as a normal cost of the products and services produced during World War II, and these policies continued after the close of the war in 1945, at which time a period of retrenchment set in. This attitude of retrenchment was reflected in the Armed Services Procurement Regulation Cost Principles of 1949 which reversed all previous policies and made allowable only those development costs directly related to a specific contract. General research was determined to be unallowable unless specifically allowed in the contract. This characteristic has been repeatedly observed, IR&D being strongly supported in times of crisis but sharply attacked in times of retrenchment. Oddly, the Korean War had little effect on further liberalizing these IR&D regulations, and during the 1950s there was much confusion in their implementation as to what technical effort was allowed since there was no definition of "development", "general research", or "IR&D." The regulation was silent on bid and proposal costs, which were generally allowable as part of normal overhead.

In the late 1950s, it became apparent that the force of retrenchment had once again jeopardized our national security and leadership. As a result of this, pressures for revision were intensified after the Sputnik launch focused new emphasis on science and engineering to catch up and pass the Soviets in the space race. The 1959 Revision of the Armed Services Procurement Regulation[12] reflected in part this new mood and finally recognized IR&D as a legitimate cost of doing Government business; contractors costs for this effort were allowable. Although these new regulations were more liberal, not all the features were consistent with strengthening IR&D and B&P efforts.

a. IR&D development costs were still only allowable if directly related to product lines for which the Government had contracts.

b. Research was allowable if "reasonable."

c. Advance agreements for IR&D were recommended but not mandatory.

d. Cost sharing was suggested to provide an "incentive" to contractors.

e. Bid and proposal costs were allowed just as any other indirect cost.

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[12]U.S. Department of Defense, Armed Services Procurement Regulation, Section XV, November 2, 1959, Washington, D. C., U.S. Government Printing Office.

Failure on the part of Government negotiators to interpret these regulations uniformly led to problems and the formulation of Government and industry study groups in the mid-1960s. Their objective was to develop methods for equitable treatment of IR&D and B&P, both for the Government and industry. The CWAS, or Contractors' Weighted Average Share, method for determination of degree of risk was undertaken along with other concepts for establishing a fair and reasonable ceiling for IR&D and B&P. DOD set forth these cost policies in Defense Procurement Circular Number 68.[13]

At this juncture in the late 1960s, dissatisfaction with the Vietnam War precipitated much adverse criticism of the Defense Establishment, including its recognition of IR&D and B&P, with one Senator referring to IR&D (including B&P) as "another example of a Government program out of control." (This charge is not supported by the facts. IR&D is not a "program" but an overhead effort, the cost of which has been a subject of continuously increasing control by both Government and industry for more than a decade.) This resulted in a GAO study initiated in 1967 and culminated in 1970 with this Senator citing the IR&D program as a "billion dollar boondoggle."[14] This rhetoric precipitated a drive that resulted in a legislated 7% reduction in IR&D in 1969,[15] which proved administratively impractical. In this climate, investigations were launched by Congress in 1970.[16,17]

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[13]U.S. Department of Defense, Defense Procurement Circular No. 68, March 17, 1969.

[14]U.S. Congress, Senate Congressional Record, Proceedings and Debates, 91st Congress, 2nd Session, March 2, 1970, p. S2448.

[15]U.S. Congress, DOD Military Procurement Authorization Act of 1970, Public Law 91-121, Sec. 403.

[16]U.S. Congress, Senate, Hearings Before the Committee on Armed Services, (Ad Hoc Research and Development Subcommittee), 91st Congress, Second Session, March 2, 6, 9, 13, 1970.

[17]U.S. Congress, House of Representatives, Review of Independent Research and Development Program Management, Report of the Armed Services Investigating Subcommittee of the Committee on Armed Services, 91st Congress, Second Session, September 18, 1970.

In the same year, GAO completed the study initiated in 1967 and issued a report.[18] As a result, although the House preferred no legislation, the Senate prevailed and Congress voted a revamping of IR&D under the Military Procurement Act of 1971 (Public Law 91-441).[19] This reshaped the entire approach to IR&D and B&P, forming it as we know and implement it today.

The major features of Section 203, Public Law 91-441 are:

a. For IR&D and B&P costs to be recoverable, the Secretary of Defense must determine that the effort generating such costs must have a potential relationship to a military function or operation.

b. Advance Agreements establishing a dollar ceiling must be negotiated with all contractors who in the preceding year received more than $2,000,000 of IR&D or B&P payments from DOD.

c. Companies required to submit detailed IR&D plans for DOD technical evaluation to support Advance Agreement negotiation.

d. Penalties of substantial disallowance of IR&D/B&P costs for failure to negotiate Advance Agreement.

e. A procedure for contractors to appeal unfavorable rulings.

f. Mandatory requirements for the Secretary of Defense to submit an annual report to the Congress on IR&D/B&P.

g. Repeal of the 7% reduction of PL 91-121.

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[18]U.S. General Accounting Office, Comptroller General Report to Congress, Allowances for IR&D Costs in Negotiated Contracts, February 16, 1970.

[19]U.S. Congress, DOD Military Procurement Authorization Act of 1971, Public Law 91-441, Section 203.

IV. THE IR&D/B&P CONTROVERSY - CURRENT ISSUES

Since the enactment of PL 91-441, there have been intensive efforts on the part of DOD to achieve effective implementation of the various provisions of the law relative to IR&D and B&P. Industry is strongly of the opinion that two sections of the law are illogical, namely cost ceilings on B&P (which effort is primarily in response to Government requests, the magnitude of which cannot be forecast) and potential military relationship of IR&D/B&P (which unnecessarily restricts these efforts from addressing the major social and environmental problems that urgently need to be addressed). Nevertheless, while continuing to press its case on contested points, industry has worked with the Government agencies to implement PL 91-441.

Congress has continued its interest in IR&D and B&P and has requested information from GAO and DOD relative to the effectiveness of PL 91-441 (see Footnote 2, p. 2). GAO issued a report in April 1972 and again in April 1973 which concluded that DOD was "being reasonably diligent" in implementing the requirements of PL 91-441. Moreover, Senator McIntyre[2] gave an excellent review of the IR&D/B&P picture generally indicating a well-managed activity. In spite of these conclusions and the repeated confirmations of DOD and NASA that both IR&D and B&P were not only greatly beneficial to their operations, but wholeheartedly endorsed as necessary costs of doing business with the Government, on September 24, 1973, Senator Proxmire again questioned the amounts being "paid" by DOD for IR&D.[2] (While he addressed IR&D primarily, he included B&P costs in his figures. It should be noted that this lumping together of IR&D and B&P costs and then drawing conclusions relating only to IR&D activities is a misinterpretation of the data.) ("Industry Response to 22 Proxmire-McIntyre Questions", see Footnote 1).

The points of criticism leveled against IR&D/B&P are sufficient evidence that their nature is not understood. Despite the fact that IR&D and B&P costs are not commodities that the Government can decide to buy or not, like the line items of the DOD RDT&E budget, there are those who choose to try to treat them as such, and a host of erroneous conclusions have been drawn. In fact, IR&D (lumped with B&P in the dollar figures) has been directly questioned and improperly compared with RDT&E - i.e., "The $700 million which the Pentagon pays to private contractors for IR&D is separate from the $8 billion which the Pentagon pays to private contractors for RDT&E. This raises a basic question: Why do we need two separate programs within the Pentagon to sponsor research and development efforts by private contractors?"[2] This comparison is incorrect and misleading. First, of the $8 billion of RDT&E, some $3 billion is spent by DOD in-house and is not available to industry. Further, of the $5 billion actually spent for contracts with industry some $4 billion

is allocated to the engineering design of systems and hardware to DOD-specified requirements, and some $1 billion for research and exploratory development, again to DOD-specified requirements. Second, IR&D is not a Government program. IR&D is a company-initiated exploratory effort not directed toward any specific customer requirements, but rather toward advancement of technology in those areas that each company believes will be of customer interest in the future.

IR&D and B&P are not programs offered for sale. As a customer, the Government, and in particular the Defense Department, is neither buying independent research and development as a commodity nor supporting or subsidizing industrial IR&D but, instead, buys goods and services which contain a proportionate allocable share of all indirect costs including IR&D.

The current allegations in the controversy over IR&D and B&P that are of concern are:

1. IR&D/B&P costs are alleged to be increasing abnormally.

   (This allegation is misleading. Costs are increasing modestly but even so, are not adequately supporting the effort. Because of inflation and Government required accounting revisions, actual effort is decreasing when it should be increasing.)

2. Controls over IR&D/B&P costs are ineffective and abuses occur.

   (This charge is false. The truth is, IR&D and B&P are over-controlled by current regulations, and industry is unaware of any so-called abuses.)

3. Reimbursement of IR&D/B&P costs may be subsidizing a segment of private industry.

   (The fact is that the segment of private industry dealing with the Government is being discriminated against unfairly, by being denied full recovery of legitimate costs of doing business. The balance of private industry recovers these costs in the price of products sold to its non-Government customers.)

4. Small industries and non-defense industries are not receiving the IR&D and B&P advantages of large space and defense industries.

(Any contract winner, large or small, defense or non-defense, receives the same "advantages" as any other winner of a Government contract competition.)

5. The benefit to the Government from IR&D and B&P expenditures has not been demonstrated.

(Benefits have been demonstrated over and over again by examples presented to Congress by DOD and NASA - also see Footnote 1, p. 1).

V. NECESSITY FOR "INDEPENDENCE" OF IR&D AND B&P

Although a major concern of the Congress has been the lack of direct control over IR&D and B&P expenditures, it is a strongly held industry position that industry must be free to decide what should and what should not be done under IR&D and B&P. Except when the Government is the customer, there is no question that each industry decides what IR&D and B&P projects to pursue and to what level of effort. Industry has reluctantly accepted increased Government controls on IR&D and B&P.

The requirements for potential military relationship is an undue constraint, and is definitely not in the best interests of the Government when it inhibits defense and space industries from addressing problems of social, environmental, energy, and other areas of concern. Critics in Congress cannot continue to decry the fact that industrial expertise that took us to the moon and back is not addressing our current domestic problems, when the Government's own constraints on IR&D and B&P inhibit such action by industry. Clearly, defense oriented companies should be as free to decide what avenues should be pursued with IR&D and B&P funds as are commercially-oriented companies.

"Independent", or synonymously "contractor-initiated", is the key word in distinguishing the nature and value of IR&D. It means the company management's own evaluation of what it must do to remain technologically competitive in the future, balanced against the competitive implications of the cost of so doing. That is perhaps the most difficult, and in the long term, most significant decision of management in any enterprise. It also represents that element of managerial judgment and skill most valuable to the customer, whether commercial or Governmental. In no other way does a company put its future on the line to the degree it does in making such decisions.

It is to the Government's advantage to preserve the independent nature of a contractor's research and development effort. It permits a contractor to apply his resources to those technologies and programs in which his capabilities are highest and which, therefore, will be of greatest benefit to the customer and in turn to himself.

A contractor's independence also provides other benefits to its customers that cannot be achieved with external controls. At any given time, a company is in the best position to evaluate its own best ideas and prospects. When research projects are judged not fruitful in terms of technical success or practical application, they can be promptly abandoned and a new approach or entirely new project quickly substituted. It is this freedom to continue pursuit of promising concepts or results, and to terminate technical efforts not achieving their objectives that is vital to the continued success of any contractor, and to his ability to compete successfully for new business. Moreover, the creative environment thus established leads to generation of feasible solutions, since the gestation period for translating new ideas into practical applications is often quite long in high technology industries.

Some IR&D projects may explore variables in fields which are reasonably well understood; however, other IR&D work is concentrated in areas in which the Nation is still largely or wholly ignorant, and in which the chance of success is too questionable for the Government to care to sponsor it aggressively. From the national point of view, however, the importance of these programs does not lie primarily in their "success" or "failure" as viewed by the company involved. Rather, for the Nation, these efforts represent a unique national storehouse of capability to address - on an urgent basis if necessary - any technical problems, whether it be sending back TV pictures from the moon, flying higher, faster, and farther, extending our knowledge of the ocean and its resources, improving our training of slow learners, or developing new sources of energy.

This national resource, i.e., the technical capability of American industry to address specific and urgent Government requirements, is never more clearly recognized than when the Government releases a Request for Proposal (RFP) on some complex defense system. It is then that the Government agency involved desires a highly competent, experienced contractor who can be counted on to perform in an exemplary manner and succeed in meeting every technical challenge. It is the company that has been very imaginative and aggressive in wisely pursuing prior IR&D efforts in appropriate technical areas that is best qualified to meet the challenge. The Government would suffer immeasurable loss if private industry were not free to pursue IR&D and B&P to prepare for and respond to these RFP's.

The independent nature of the B&P efforts of the defense/space industries have benefited Government despite erosion by the artificial and arbitrary constraints prescribed by PL 91-441:

(a) by assuring a continuing competitive environment in which better systems can be procured at lower prices;

(b) by providing, via unsolicited proposals, a fruitful source of innovative ideas;

(c) by permitting the application of technologies developed within industry to diversifications whose benefits flow to DOD and NASA, other Government agencies and the Nation; and

(d) by presenting alternative solutions to Government requirements when solicited.

VI. BENEFITS OF IR&D

a. HOW IR&D ADDRESSES DOD NEEDS

In the case of defense contractors, the principal resource applied for technology advancement activities is IR&D. Thus, IR&D represents a fundamental resource in the spectrum of industry activities typically involved in the conception, development, evaluation and production of contemporary military/defense products.

In the present system, DOD long-term plans define (and document) a broad range of military mission requirements which imply many military functional requirements[20] that cannot be economically satisfied with existing equipment/technology. Some of these military functional requirements are elaborated and made more specific in further DOD technology planning documentation. There exists a wide frontier of technology (pertinent to DOD requirements) beyond which can be seen an enormous variety of potential functional capabilities[20]. Industry IR&D explores and demonstrates potential functional capabilities. The initiative in proposing a project usually comes from a working level engineering manager or scientist in a particular field of technology who, when the project is approved, runs it with considerable independence.

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[20]Military functional requirements and capabilities, respectively, are requirements and the corresponding technical capabilities to perform desired military functions. For example, a functional requirement might be measuring the range from an anti-aircraft weapon system to an aircraft in flight, while a related functional capability might be the precision of distance measurement offered by laser technology.

The IR&D effort of defense contractors is simply what has turned out in practice to be the best way to begin the process of connecting up thousands of functional requirements in DOD's plans with thousands of "potential capabilities" known to or represented by scientists and engineers in industry.

Much of the "independence" in the conduct of IR&D is exercised by a contractor's engineering and scientific personnel. From their vantage point at the working level, they have the best view of the potential capabilities in their specialty, and (through the "multiple direct inter-connection" with working level DOD technical personnel) the best view of related DOD functional requirements. One of the most important ingredients in the current considerable value and effectiveness of IR&D work is the good balance which has been achieved between the independent initiative of the engineering and scientific personnel and the appropriate degree of guidance by management. In turn, company management uses the results of DOD's technical reviews of its IR&D as an important input to its own evaluation of the work.

b. THE DIFFERENT KINDS OF TECHNICAL OUTPUTS FROM IR&D

Although brilliant discoveries and great innovations are an exciting and important product of IR&D, they comprise only a part of the content and only part of the total value of IR&D. Valuable products include: technology advancement, systems studies, "successful failures", and the innovation of superior systems or hardware. To elaborate:

1. Technology Advancement - A tangible portion of IR&D work is aimed at attaining or maintaining a competitive capability in key technologies. There is a widespread misconception that all IR&D is aimed at, and ultimately results in, the design of products suitable for sale to a broad spectrum of customers. In point of fact, much IR&D work is directed towards attaining or maintaining a competitive capability in key technologies vital to the continued pursuit of a given type of business. The nature and technical thrust of the IR&D work performed by any company is strongly influenced by the nature of its products, and by its perception of the key long-term business opportunities in its field.

2. Systems and Other Concept Formulation Studies - This work is a vital element in defining and refining requirements essential for new or improved Defense systems or hardware, and as such forms a key supplement to DOD's development planning activity. The 1973 estimate for system and concept formulation study work is $60 million, or some 15% of the total IR&D work accepted by DOD for allocation to Defense contracts.

3. "Successful Failures" - A finite portion of IR&D work is unsuccessful (i.e., fails to achieve its desired objectives). In many cases, however, unsuccessful IR&D can be regarded as successful, in that it demonstrates at low cost that a given approach to resolution of a problem or meeting a need is inadequate or uneconomic.

4. Innovation of Superior Systems or Hardware - The major portion of IR&D effort is aimed at evolving superior hardware or systems, offering either significantly improved performance, lower cost, or both.

In the broad spectrum of work represented by the major defense contractors' total IR&D effort, many examples can be found where IR&D has successfully met these objectives. However, it must be recognized that it is the exception rather than the rule that the attainment of a dramatically increased operational capability or cost reduction is directly and uniquely traceable to a specific piece of IR&D work.

By way of illustration of this point, in 1966, DOD reported the interim conclusions of a 40 professional man-year effort over some 2-1/2 years (named "Project Hindsight") which studied the utilization of recent science and technology in DOD weapons systems. Heading the list of its conclusions was the fact that:

"Many events (50-100) which are innovations in science or technology are utilized in a typical advanced system." Or, as Dr. Chalmers W. Sherwin, ODDR&E Project Hindsight's sponsor, put it:

"It is not the great breakthrough but rather the cumulative synergistic effect of some forty-odd innovations which make the radical improvement. Each of the innovations, taken by itself, would produce little or no improvement. This finding is of fundamental importance."

It is potentially unproductive to attempt to display the benefits of IR&D by attempting to quantify the benefits of each individual company's IR&D work, and it is even less meaningful to approach such quantification of benefits on a task-by-task basis within a company's IR&D program.

c. DISPLAYING THE BENEFITS OF IR&D

Tracing the flow of IR&D results into new or improved "end-products", is a difficult task, when one considers the complexity of the end-items. This complexity influences both the number of individual "technical events" which contributed to the final result, and the number of years over which these technical events were coming together to make possible the evolution of the operational end-product.

A corollary problem is the fact that the extended period required for new or improved operational end-products to evolve, substantially impairs the identification (let alone any quantification) of the value of recently performed IR&D work.

Prior attempts to display the benefits of IR&D have tried to avoid the burden of tracing the interacting contributions of many IR&D tasks (possibly from several companies) to the evolution of lower cost or superior performance in military systems and hardware. Instead, examples were sought on a company-by-company basis where specific IR&D work had had a readily identifiable, immediate, and quantifiable result. In the broad spectrum of defense contractors' IR&D effort, many such examples can be found. However, a simple compilation of them invites the misleading interpretation that these readily identifiable examples represent the only benefits that flow from IR&D work.

A preferable approach to illustrating the benefits of IR&D is the "top-down" analysis of the contributions of IR&D to operational systems (the approach used in Project Hindsight). This approach also permits the identification of early, "intermediate products" resulting from IR&D. This first identifiable result from some IR&D work is the acknowledgment by the customer of its potential importance, by the award of a contract for continuation and expansion of the work. While this does not guarantee the eventual utilization of the IR&D in an improved end-item, it is the route by which much IR&D work ultimately reaches an end-product. Receipt of such a contract may therefore be regarded as passing an early "value milestone" or benchmark for the IR&D work in question.

The paper "Benefits Derived From IR&D Effort" (see Footnote 1, p.1) delineates the contributions of the IR&D work of many defense contractors to some forty end-items, grouped in the four categories of Technology Advancement, Components, Sub-Systems and Major Systems.

d. SUMMARY OF IR&D BENEFITS

The benefits flowing from IR&D programs to the Government can be summarized as follows:

1. Provides Major Contributions to Nation's Technological Base and Avoidance of Technical Surprises

Viewed in the context of IR&D's relationship to the amount of R&D that is not rigidly specified as part of the engineering definition of major systems and hardware developments sponsored by DOD RDT&E funding, IR&D is a major source of innovative contributions to the nation's technological base.

The greatest single benefit to be derived by all customers including the Government from a strong industrial IR&D effort is the assurance of a technologically superior industrial base and source for all future product needs.

2. Stimulates Competition and Creates Technical Alternatives for Government Requirements

IR&D stimulates both of the two inter-related aspects of competition: technical competition and cost competition. By providing a mechanism for companies to explore their individual approaches to solving known, longer-range Government requirements, it ensures the availability of alternate technical solutions and the existence of meaningful technical competition.

By encouraging the application of advanced technology to simplify existing designs and conventional production processes, it stimulates cost competition. Stated in another way, IR&D provides the ability for a contractor's "bottom-up" flow of ideas and possibilities to temper the customer's "top-down" mandated end-item performance and system characteristics, and to evolve a more cost-effective solution.

3. Provides More Technology for the Dollar

IR&D work has minimal administrative cost, since its in-house management eliminates the need to add the complex administrative overlay required to furnish the formalized financial data, and technical reporting attendant to contract R&D. In this way, IR&D cost represents a maximization of the technical effort received out of each and every dollar spent.

4. Provides Quick Reaction and Flexibility

IR&D work can be quickly initiated, terminated or redirected as its technological findings, changes to the external technological environment or changes to customer needs dictate. Company management decisions on IR&D are unencumbered by the formality and procedural constraints surrounding contract R&D.

5. Stimulates Creativity

IR&D is an important contributor to building and sustaining within a company a "climate" which encourages innovative thinking. The contractor's IR&D program attracts and holds innovative individuals because it can promptly fund the exploration of good ideas and pursue each exploration to its logical conclusion without experiencing delays attendant to additional contract funding or customer agreement to redirect a contracted effort.

6. Takes Maximum Advantage of Industry's Business and Management Approach

IR&D takes maximum advantage of industry's "applications" orientation; i.e., it effectively picks the brains of thousands of scientists and engineers and screens the resulting ideas through a critical, informed industry management view of what constitutes a producible, saleable end-item. It also benefits by its susceptibility to management financial and performance control by systems that are already in place, and necessary for the normal conduct of business of each company.

7. Reduces Risks and Provides Responsiveness to Weapons Acquisition Process

The demonstration of the feasibility of a high risk but potentially superior solution to a known need is usually accomplished by IR&D, which provides the mechanism for rapid evaluation by industry of newly identified critical customer deficiencies. The contractor management decision process is measured in days whereas the customer procurement cycle requires weeks or months. (On occasion, contractors have recognized Government needs, and have had solutions for a critical deficiency prior to its formal recognition by the Government). As a result, solutions ultimately proposed for Government contracts have reduced technical risk, and saved time and money.

Additionally, in recent years, the DOD weapons acquisition process has shifted demonstrably in the direction of requiring bidders to demonstrate in their proposals a high degree of understanding of the related problems and to offer high-confidence solutions to same (as distinct from being funded to investigate, identify the nature of, and solve these problems).

8. Generates Studies and System Concepts Supplementing Government Planning

This product of IR&D, representing industry's views of alternative approaches to satisfying customer needs, complements the Government's in-house activities which define and refine its requirements. Many unsolicited proposals for resolving critical deficiencies or for effecting significant cost reductions have resulted from such studies. The response to formal RFP's also benefit from such company operated system studies.

9. Permits Diversification

IR&D enables company management to anticipate and respond to changing requirements in its potential customers' needs in a timely and technologically sound manner.

VII. BENEFITS OF B&P

The benefits derived by the Government from B&P efforts, beyond the fundamental aspects of its absolute necessity for survival and growth of a business, include:

a. assurance of a continuing competitive environment in which better systems can be procured at lower prices;

b. availability, via unsolicited proposals, of a fruitful source of innovative ideas; and

c. industrial diversification, the benefits of which flow to all other Government agencies and the Nation as a whole.

Artificial and arbitrary constraints on B&P, such as those prescribed by PL 91-441, erode these benefits. B&P effort aims to focus knowledge and capabilities derived from IR&D and other sources such as commercial and Government programs on the particulars of emerging new customer problems and requirements as specified in Request for Proposals or equivalents. In many instances prior knowledge must be added to and enhanced in order to meet the specified need. The B&P effort describes the work to be done and determines the feasibility of meeting the specific requirements, as well as identifying additional effort which must be done in order to meet the conditions of performance which are required. Data must be generated to substantiate the results predicted as well as to establish the credibility of the proposer.

The total number of industry proposals prepared in conjunction with a major system acquisition number in the thousands; an individual contractor pursuing the prime contractor role of system designer/manager may be obliged to prepare a hundred or more. Because these efforts require major commitments of resources over extended periods of time, contractors' decisions regarding participation in an emerging system competition are made with great care. (See "Benefits Derived From B&P Effort", Footnote 1, p.1.)

Throughout this process new problems are identified and solved, dead-ends are encountered, and technological, socio-economic, or political conditions constantly change. The needs of future systems change, changing the character of such systems. Procurement actions, including timing and nature of proposal requirements, shift as do holding periods between proposal submittal and source selection (during which key proposal/program personnel must be available to the Government). These changing conditions, beyond the contractor's control, have major impacts on the timing and magnitude of his B&P expense.

The Government's historic defense/space policy of recognizing the need for flexibility in B&P effort - together with the policy of full allowability for such effort - has perpetuated a competitive atmosphere in the defense/space industry, maximizing not only the numbers of qualified competitors but also the vigor of their competition. Constraining industrial flexibility in B&P will discourage and ultimately reduce the breadth and depth of competition, limiting the Government's options. The exchange of technical information between Government and industry (prior to key development decisions) will be reduced, resulting in less well defined and understood requirements. The quality and quantity of substantiating data submitted with proposals will be limited, increasing chances of injudicious source selections. In summary, artificial limits on B&P effort increase risks in the procurement process by decreasing competition and increasing the difficulty of selecting the right system, the right contractor, and the right contract.

VIII. CONTROL OF IR&D AND B&P

Each business firm is highly motivated to control expenditures for IR&D and B&P since too little or too much can be disastrous in a free competitive market. While some critics of IR&D and B&P reimbursements under Government contracts cite the lack of competitive pressures in controlling these costs on Government contracts, this is just not supported by fact. Excessive and unreasonable IR&D expenditures result in non-competitive prices while inadequate IR&D effort leads to weakness in the competitive struggle.

It follows, that only those companies which exercise sound business judgment will survive. The Government has taken very decisive measures to stimulate competition on all procurement regardless of type of contract, and industry has responded by taking steps to become and remain competitive.

While carefully avoiding the stifling of innovation and creativity on the part of their top scientists and engineers, each firm must carefully evaluate every IR&D project and B&P activity against its own business objectives. As a matter of fact, these internal company reviews are usually much more demanding than any conducted by Government review teams. Only those projects which pass company established criteria in their own particular product area or field of interest are approved. Progress toward established goals is monitored regularly and projects accelerated, altered or stopped, based upon continuing re-evaluation. This tight control by industry is not only desirable, it is absolutely essential in the high technology, rapidly changing environment of today's world.

Government control that inhibits the flexibility of industry to respond to the changing market environment is clearly an adverse influence, and makes Government partly responsible for the success or failure of industry. It presumes that the Government possesses some sort of omniscience that has never been demonstrated. Dr. John S. Foster, Jr., former Director of Defense Research and Engineering, stated before two Congressional Investigating Committees, "We in DOD are not - and must not be - so complacent as to assume that we alone, within the limited Defense research and development community, have the wisdom and ability to judge all these technical projects and approaches that may produce beneficial results."

IR&D and B&P expense allocated to defense contracts has modestly increased in recent years. While absolute dollars have increased from $685 million in 1968 to $704 million in 1972 because of inflation and the new Government requirement to burden the direct man-hour base, man-hours of effort in IR&D have actually declined by approximately 28%. In view of the need for increased emphasis on research and development to retain our lead in the world, the question is asked whether or not IR&D and B&P are being over-controlled. Present regulations tend toward over-control and inhibition of IR&D and B&P.

Because today's defense requirements push the state of the art, high technical risk is inherent in their production. Very early and preliminary IR&D and B&P efforts minimize many of these technical risks which if left to later phases of production would unnecessarily increase costs.

The real issue is not whether IR&D and B&P efforts should be controlled, but by whom. The answer is that these efforts are controlled by company management under the constraints of the competitive marketplace. At the same time, industry aggressively pursues solutions to the most pressing national problems, because it is in these areas that future business will be found.

IX. GOVERNMENT RECOGNITION OF IR&D AND B&P COSTS

As a customer, the Government, and in particular the Defense Department, is neither buying IR&D and B&P as a commodity nor supporting or subsidizing industrial IR&D and B&P but, instead, buys goods and services the prices of which contain a proportionate allocable share of all indirect costs including IR&D and B&P.

Thus, the price of every company's products should contain its cost of doing business and each customer must pay his share of that cost. To legislate that one customer will enjoy a preferred position and not be obliged to pay his pro-rata share, unfairly discriminates against all other customers. It is particularly unfair when a single customer is in a position to enact such legislation for its own benefit.

To the extent that the Government refuses to recognize such costs in its prices, the Government receives an unwarranted discount on its purchases. And to the extent that the Government does not pay, the burden is shifted to the stockholder in terms of reduced return on his investment or - where the company also produces for the commercial market - it may be converted into higher prices for the consuming public, thereby weakening the company's competitive position in the market. The contractor is thus encouraged and even forced to shift out of this kind of business, because the return on his investment is not comparable with the return he can get in other markets (e.g., commercial). The real loss then of not allowing IR&D and B&P in Government contracting will be to drive the innovators and the most efficient producers out of the Government market into the commercial/consumer sector where a free market allows a price that will support needed IR&D and B&P.

In commercial business, as explained above, prices are controlled by competition in a free market, with some products being much more competitive than others. The ability of a company to recover IR&D and B&P expenditures, therefore varies with each product and some, in a more favorable competitive position, are able to carry the IR&D and B&P cost share normally allocable to another product.

This also holds true for that portion of the DOD procurement funds (approximately 30%) which are expended on fixed price competitive procurement. However, the remaining 70% is expended on cost analyzed procurements where each and every item of cost must be accounted for and is carefully scrutinized by Government auditors and negotiators. In this type of procurement, only the costs of producing that particular product are recoverable and it is impossible for any product to be burdened with more than its allocable share of IR&D and B&P costs. It is therefore essential that every product or service, regardless of its nature, carry its share of every indirect cost, including IR&D and B&P, when sold to the U.S. Government.

In addition, while it has been said that the contractor derives commercial benefit from the IR&D costs which are included in pricing of Government contracts, little note has been taken of the fact that defense projects benefit greatly from research directed to commercial products. There are many such examples. The transistor is one; the ultrapure silicon material that made the electro-optical sensor possible for the guidance unit of our "smart" bombs is another. Another point which should be made here is that the Government gets the benefits flowing from each contractor's total IR&D program while participating in only a share of the costs. For example, the DOD report (see Footnote 2, p. 2) published in 1973 summarizes statistics from 77 major contractors showing that in 1972 DOD obtained access to $776 million of IR&D work while accepting only $400 million as its share of the costs.

X. ALTERNATIVE CONSIDERATIONS

One point is clear at the very outset of any consideration of alternatives to IR&D and B&P effort by industry, namely, that there is no alternative to the performance of IR&D and B&P. IR&D and B&P efforts by industry is a matter of survival; the work must be done, and the costs must be incurred just like any other normal cost of doing business. Alternative means for reimbursing IR&D and B&P costs are addressed in detail in "Alternate Methods of IR&D and B&P Cost Reimbursement" (see Footnote 1). The salient points of that study are identified below.

As stated earlier, industry believes that the maximum benefit to the Government, as well as all other customers, will be realized with an unfettered approach to IR&D and B&P efforts. This requires recognition by the Government of all the costs of IR&D and B&P. Were all Government procurements fixed price, there would be no quarrel with this concept. However, since nearly 70% of all current Government procurements are negotiated contracts, every element of cost must be identified, justified and negotiated.

This includes IR&D and B&P costs. While industry has maintained for the last 35 years that these costs are necessary and valid, the very aspect that makes IR&D and B&P vital to industry, namely the "independent" aspect, has caused a recurring stream of doubt and criticism from some Government circles. The present method of recognizing IR&D and B&P costs reflects the compromises that have evolved between Congress and the cognizant Government agencies over the IR&D and B&P issue. While industry has repeatedly voiced its opinions, the legislation that has been enacted by Congress and the regulations that have been issued have not fully recognized the industry position.

The present DOD method sets a ceiling on the amount of IR&D and B&P costs which can be recovered under a company's Government contracts. For companies which recovered over $2 million of IR&D and B&P in the previous year, this ceiling is set forth in an "Advance Agreement." Only those projects considered to have potential military relationship are allowed as costs within this ceiling. For those companies which recovered less than $2 million in IR&D and B&P, the ceiling is established by means of a prescribed formula which considers the levels of the company's IR&D costs and total sales in the preceding three years, as well as an appropriate minimum and maximum level of IR&D in relation to its total sales in the current year.

While industry has learned how to comply with these restrictive regulations, there are serious drawbacks in the present method. The ceilings set through negotiations are often arbitrary. The basic concern with the present method is that it really does not recognize IR&D and B&P as legitimate costs of doing business and creates the implication that they are dispensable when they are not.

The AEC method of recognition of IR&D and B&P costs has been suggested as an alternative. Under the present AEC method, a company's recovery of its IR&D costs is limited on each individual AEC contract to only the allocable share of those IR&D projects unilaterally determined by the AEC to be directly related to the effort under that contract. The AEC method reimburses B&P costs in an amount not to exceed 1% of the total direct labor and material costs expended by the contractor on AEC contracts, to which AEC determines the B&P effort is relevant.

While the AEC method provides very tight control of IR&D and B&P expenditures, it would be totally unworkable if applied across the board. AEC operates in a very narrow field, primarily with "captive" contractors operating AEC's GOCO (Government Owned Contractor Operated) facilities; these contractor segments are very dependent upon AEC and have very little choice but to accept AEC's directives on IR&D and B&P. Moreover, AEC has reaped the benefit

of the support of DOD and all other private industry of IR&D in the broad range of high-technology, non-nuclear disciplines AEC requires, in such fields as electronics, controls, materials, etc. The AEC approach broadly applied would stifle contractor creativity and innovation. The AEC method not only fails to recognize IR&D and B&P as fully recoverable costs of doing business, but it also fails to recognize that IR&D is an indispensable innovative process and that B&P is the mechanism for turning these innovations into products.

A number of other alternative methods for Government recognition of IR&D and B&P costs have been suggested. These include such concepts as establishing budget line items in agency appropriation authorizations for establishing direct contracts or level of effort contracts, deferring recovery of IR&D and B&P until they could be recovered in the price of directly related products, recovering IR&D and B&P costs from negotiated profit rates, or universally applying a formula for cost recovery. These concepts are all considered in the paper "Alternate Methods of IR&D and B&P Cost Reimbursement" (Footnote 1, p.1). While each approach has its own set of advantages and disadvantages, as illustrated in the attached matrix, Figure 2, evaluating the alternative methods against a set of criteria, indicates that all are to some degree restrictive to the basic objectives of IR&D and B&P except Alternative A.

In the earlier sections, we have attempted to explain why IR&D and B&P efforts must not be controlled by the Government, and why they are so important and beneficial that the Government should recognize these costs on all contracts. While increasing the levels of direct Government control of these essential costs of private industry may serve to allay the fears of critics, such controls inhibit the effectiveness of IR&D and B&P. Rather than increase direct Government control, more attention should be given to reaching agreement on methods and procedures for Government monitoring of the IR&D and B&P efforts of industry. This should be done not for purposes of controlling them, but to assure that the technical excellence of the effort is being maintained, that information flows between industry and Government, and that abuses are not occurring. It is expected that normal DCAA activities will also continuously monitor these costs and provide data necessary to determine that they are being kept within reasonable limits.

In summary, only Alternative A of Figure 2 (full reimbursement of a company's costs of IR&D and B&P) puts the U.S. Government on an equal footing with all other company customers. Anything less than full reimbursement of these costs, now provided only by Alternative A, in effect is a subsidization of the U.S. Government by American industry insofar as the Government's failure to absorb its full allocable share of these essential business expenses is concerned.

EVALUATION OF ALTERNATIVE METHODS FOR GOVERNMENT RECOGNITION OF IR&D AND B&P COSTS

Criteria \ Method	A	B		C	D	E	F		G	H	I
	Inherent Economic Constraints In Competition	CWAS Plus Present Method w/o PMR (1) CWAS	Non-CWAS	Present Method w/o PMR (3)	Present Formula Universally Applied	Present Method	Budget Line Item (2) 1. Direct * Contract	2. Level of * Effort Contract	Recovery Through Profit Negotiation	Recovery of Development Costs Deferred to Related Sales	AEC Method
1. Effort Required for Financial Accountability	Accountability Normal and Cost Effective	←	→	Accountability Normal; Effort Reasonable	Normal Accountability; Effort Acceptable	Accountability Normal; Effort Acceptable	Accountability Normal; Effort Prohibitive	Accountability Normal; Effort Reasonable	Govt. Accountability not Required	Accountability Impossible; Effort Prohibitive	Accountability Normal; Effort Reasonable
2. Effort Required for Technical Accountability	Accountability Normal and Cost Effective	←	→	Accountability Normal; Cost Effective	Normal Accountability; Effort Reasonable	Accountability Excessive; Effort not Cost Effective	Accountability Excessive; Effort Prohibitive	Accountability Normal; Effort Reasonable	Govt. Accountability not Required	Accountability Impossible; Effort Prohibitive	Accountability Normal; Effort Reasonable
3. Reimbursement of IR&D Costs Sufficient to Motivate Continuance in Government Business	Excellent	←	→	Good	Excellent	Moderate	Poor	Poor	Very Uncertain	Very Poor	Very Poor
4. Administrative Economy and Practicality	Excellent	←	→	Good	Good	Moderate	Prohibitive	Poor	Excellent	Prohibitive	Good
5. Allocation Equitable to Total Business	Automatic	←	→	Automatic	Automatic	Automatic	Non-existent	Non-existent	Allocation Equitable; Recovery Very Uncertain	Non-existent	Non-existent
6. Contractor Flexibility with Respect to Resource Utilization	Excellent	←	→	Good	Good	Moderate	Non-existent	Depends on Latitude in Work Statement	Excellent	Good	Non-existent
7. Accommodation of Substantial Changes in Contractor Sales Levels	Excellent	←	→	Moderate	Moderate	Moderate	Unrelated	Good	Automatic	Good	Non-existent
8. Accommodation for Unavoidable Cost Changes, e.g., Inflation, etc.	Automatic	←	→	Moderate	Moderate	Moderate	Depends on Type of Contract	Good	Very Poor	Good	Non-existent
9. Consistent Govt. Funding to Permit Year-to-Year Program Continuity	Automatic	←	→	Good	Moderate	Good	No Assurance	No Assurance	Very Poor	Very Uncertain	Non-existent
10. Maintenance of Maximum Competitive Base in Govt. Procurement	Excellent	←	→	Good	Good	Moderate	Very Poor	Moderate	Very Uncertain	Poor	Very Poor
11. Promotion of the Survival of the Fittest Contractor	Excellent	←	→	Good	Good	Moderate	Very Poor	Poor	Excellent	Poor	Non-existent
12. Safeguards Against Excess Charges on Govt. Contracts	Controlled by Competition	←	→	Good	Good	Good	Excellent	Good	Avoids Issue	Very Poor	Excellent

(1) CWAS - The Contractor Weighted Average Share of Risk (CWAS) concept evaluates and assigns weighted ratings to sales commitments of contractors based upon competition prior to award and financial/technical risk in performance. Commercial and Government fixed price contracts receive a 100% rating and Government level-of-effort cost reimbursement type contracts, at the lower end receive a 0 rating. Each contractor is then given an annual average CWAS rating. The Armed Services Procurement Regulation (ASPR) specifies those costs to which the CWAS rating is applicable or inapplicable. Where CWAS applies and where a contractor has a sufficiently high CWAS rating (65%) his costs are subjected only to review for allocability.

(2) Inapplicable to B&P

(3) Potential Military Relationship

FIGURE 2

XI. RECOMMENDATIONS

As the subject of IR&D and B&P is undoubtedly headed for continued debate in the Congress again this year, it is important that this study of the industry position on IR&D and B&P be clearly understood. A number of points have become evident during the course of this examination of the subject. Some of these points are more properly defined as statements of principles; others are more appropriately presented as specific recommendations.

Let us first consider those points which constitute a statement of principles on the industry position on IR&D and B&P:

1. The Congress and all Government agencies should understand and fully recognize in their actions the vital nature of IR&D and B&P in support of our national interests. Relative to programs of key national importance, these activities play a major role in advancing the technological capabilities of those industries most directly involved in support of the Government. Examination of the benefits of these activities suggests that a substantial part of many technological advances that have resulted in the U.S. position of world leadership in defense and space have had their genesis in IR&D.

2. The right of industry to exercise management discretion on the content and amount of IR&D and B&P should not be abridged by arbitrary laws or regulations. It is essential that each company be able to evaluate the needs of the future in light of its own special capabilities and product interests. This is not only basic to the continued development of vigorous competition in a strong industrial base, but also provides the most prolific generation of new technology and concepts to address problems of major significance to the Nation. Rather than consideration of means to control and constrain the scope of IR&D and B&P efforts, the Government should be jealously guarding the "independent" aspect to avoid the loss of great ideas.

3. The Government should be motivated to encourage industry to increase IR&D and resulting B&P effort. In view of the need for increased effort for the U.S. to stay in the lead in the competition between nations, and the major source of technological innovation represented by IR&D and B&P, it seems obvious that they should not be allowed to decrease. Yet in the past five years, the level of effort expended on IR&D and B&P has decreased.

The increased dollar expenditures have not been sufficient to maintain real effort in terms of man-hours. This point should be understood, and pre-occupation with misleading cost data, which has not been normalized to account for Government-directed changes to financial reporting method, including application of burden to IR&D and B&P, should be avoided. The international challenge is great; this is the time to increase IR&D and B&P in terms of real effort to help meet the challenge, not the time for further retrenchment.

4. The Government should not seek ownership free rights in industry patents or inventions resulting from IR&D. This issue has been raised within the Government on numerous occasions in the past, and is a further indication that the nature of IR&D and B&P is not understood. It should be recognized that these efforts are company initiated and company funded within the indirect costs of doing business. The Government acceptance of its share of these costs appropriately allocated to Government contracts is no different than any other customer's payment of these costs included in the purchase price of a company's products or services. As any other customer, the Government benefits from improved products or services resulting from inventions conceived during IR&D. Equity demands the company retain title to its own inventions and patents.

5. A common policy and practice of independence and allowability of IR&D and B&P which recognizes their true nature as essential business costs should be employed by all Government departments and agencies. The restrictive regulations currently issued should be appropriately modified.

6. Congress should recognize that IR&D and B&P costs are not "commodities to be purchased", but rather are normal "costs of doing business." As such, they are appropriately allocated to all products and services, and are included in the purchase price. On Government contracts, industry is required to negotiate burden rates. In the process, all indirect costs are reviewed and judgments are made as to the reasonableness of these costs. Legislation which singles out IR&D and B&P costs for undue scrutiny at the Congressional level implies that these efforts are "commodities to be purchased or not" and jeopardizes a company's ability to plan and manage its total business activities.

7. The basic difference between IR&D and B&P should be clearly recognized. IR&D efforts are primarily exploratory in nature, are directed toward the advancement of technology, are aimed at future needs, and are subject to continual evaluation to determine if adequate progress is being made or if a new or different approach is needed. By way of contrast, B&P efforts are directed toward a specific set of requirements, are aimed at present needs, and are primarily concerned with thoroughly explaining that the company has already developed its expertise and technological capability to a sufficient degree to assure success. A company's proposal must demonstrate a complete understanding of all technical problems, to the point of describing therein a substantially finished design of a viable version of the system to be furnished, and discussion of the merits of the chosen design versus possible alternatives. Associated technical effort range from studies, computer modeling and design calculations to, in many cases, the construction of prototypes. Also involved in the B&P effort is the actual preparation of proposals, engaging in presentations and negotiations, and otherwise responding to the requirements of the procuring agency. This effort is often difficult and sometimes impossible to forecast, since companies are responding to evolving Government statements of need. Clearly, IR&D and B&P efforts should not be lumped together and treated as the same kind of effort simply because the same or similar technical experts of a company are called on to support each of them. They are different in purpose and are performed for very different reasons. IR&D effort can be reasonably well planned while B&P effort is much more difficult to forecast since it must be responsive to customer requirements.

Having stated these principles, and recognizing that the present method for handling IR&D and B&P costs does not fully conform to these principles, there are several specific recommendations that seem appropriate:

1. The requirement for potential military relationship in Public Law 91-441 should be eliminated as unworkable. Defense-related technology does not exist in isolation, but is part of the main stream of knowledge generally described as the national technology base. Relevancy tests are fundamentally incompatible with the nature of IR&D and B&P and invite hindsight judgments. If such tests must be included in legislation, they should appear only in the broadest context and be expressed in terms of the totality of potential U.S. Government needs.

2. The requirement for establishing ceilings on IR&D and B&P costs should be eliminated because it is in basic conflict with stated Government objectives to encourage competition and maintain a strong industrial capability.

3. Line items should not be established in any agency budgets for funding IR&D and B&P costs as though these efforts were commodities to be priced. These are indirect costs, part of industry overhead, and as such are appropriately included in product or contract estimates.

4. A new Government agency responsible for operational aspects of IR&D and B&P should not be established. Rather all Government agencies should follow a common policy and practice for IR&D and B&P which recognizes their true nature.

5. Congress, in the national interest, should specifically express positive support for IR&D and B&P and correct the current motivation to continually reduce this effort.

6. In considering "alternative methods" of funding IR&D and B&P, it should be remembered that IR&D and B&P are indirect business expenses and should be fully reimbursed. In summary, full cost recovery of IR&D and B&P would place the U.S. Government on an equal footing with all other customers. Anything less than full reimbursement of these costs, in effect, is a subsidization of the Government by American industry.

U.S. SENATE,
SELECT COMMITTEE ON SMALL BUSINESS,
Washington, D.C., January 1, 1978.

Hon GAYLORD NELSON,
Chairman, Senate Select Committee on Small Business,
Russell Senate Office Building, Washington, D.C.

DEAR GAYLORD: I was recently contacted by D. C. Spriestersbach, Vice President of the University of Iowa, with regard to Congressional interest in the area of patent policy. Dean Spriestersbach expressed the hope that hearings by the Senate Small Business Subcommittee on Monopoly and Anticompetitive Activities take into account the views of the American academic community.

Without attempting to any way prejudge the merits of their position, I believe that colleges and universities have both an interest and expertise in the question of patents on inventions developed through Federally funded research. Dean Spriestersbach provided me with a copy of a statement of Raymond Woodrow, President of the Society of University Patent Administrators. I respectfully urge that Dr. Woodrow's statement be made part of the record of the Subcommittee's hearings and that if further hearings on this subject are planned, representatives of the academic community be invited to explain their views.

Best personal wishes.

Sincerely,

JOHN C. CULVER.

STATEMENT OF RAYMOND J. WOODROW, PRESIDENT, SOCIETY OF UNIVERSITY PATENT ADMINISTRATORS

Mr. Chairman and members of the subcommittee, I appreciate the opportunity of appearing before the Subcommittee today. My purpose in appearing is to discuss with you the treatment of inventions and patents in grants and contracts from the Federal Government to colleges and universities. The primary matters of concern in what I have to say are the public interest, inventors' equities and university equities.

I should say at this point that a significant portion of my statement has been based upon a 1968 paper issued by the Subcommittee on Patents and Copyrights of the NACUBO[1] Committee on Governmental Relations. My remarks can be considered to be those of a member of that Sub-Committee in addition to my speaking as President of the Society of University Patent Administrators. We are gratified that your Subcommittee is examining the ownership of inventions resulting from Federally funded research and development, and especially gratified that the unique position of colleges and universities should be taken into consideration.

Universities by their very nature and by their charters have an obligation to serve the public interest. They do this in a variety of ways in a variety of endeavors. In order to do it effectively in the patent area, universities need to have a patent program which will make patentable inventions arising in the course of university research available in the public interest under conditions that will promote effective development and utilization.

It is said that the reason why many organizations apply for at least some patents is as a defensive measure to protect a commercial position. Universities do not apply for patents for defensive reasons, since they have no commercial position to defend. Their motivation is in the direction of seeking objectively the best qualified sources for delivery to the public on the broadest possible scale the results of their research.

Few university inventions are commercially practicable in the form in which they are conceived or reduced to practice in the University. Many, if not most, are in fact unanticipated byproducts of the research effort. Universities do not have the funds, the incentive or the expertise to develop patentable inventions to the point where they can be produced and marketed. Almost always, therefore, further investment is necessary in order to have an invention publicly available. What organization will be willing to make the necessary investment to bring an invention to the market without the kind of protection that a patent gives, protection from others who would pick the fruits without planting the tree?

[1] NACUBO stands for National Association of College and University Business Officers.

As a result of what I have said, universities need to retain rights to inventions whether made in the course of Federally funded research or otherwise. Patent applications can then be filed promptly and negotiations immediately commenced with prospective licenses, with the active assistance of the inventor, so that an invention can be developed to the point of public use. In some fields, such as drugs, agreements can be entered into for the testing of compounds with some protection for the testing firm's expenditures before it is even clear whether there is a patentable invention. By these means patentable inventions can be put into use widely and effectively. As a result, the public will benefit.

Where does the university inventor stand? University personnel, as compared with those in a commercial research organization, are employed and promoted with salaries which give *no* recognition to the value of any inventions they make. Their interests and in many ways their futures lie primarily in the publication of research results in the open literature. As a matter of equity, therefore, universities, without any exceptions that I know of, provide for a share of royalties from patented inventions to be paid to the inventor. This provides an incentive for him or her to spend the time and effort necessary to disclose an invention properly, to participate in invention evaluation, to work with patent attorneys, and to provide information and assistance to potential or eventual licensees. Without this incentive, and it must be an adequate incentive, experience shows that few inventions are disclosed, for the amount of persuasion which a university can effect with members of the faculty for disclosure is very limited.

In addition to the inventors, the university has an equity in invention made using its funds or facilities. No matter who pays for the research performed, the payments are invariably for less than the full true costs. With some exceptions the university has paid for the facilities needed. And it has a huge investment in accumulating and providing a highly competent cadre of personnel without which no Federally funded research would be possible. Should perchance lightning strike and a bonanza invention come forth, the university's share of any funds realized would by the terms of its charter be used for the public interest purposes of education, research and public service.

It is our firm and strong belief that the conditions of Federally funded research grants and contracts with colleges and universities should be consistent with and adapted to the factors I have discussed above. We have seen little evidence that Government ownership of university inventions will promote the public interest in the sense of development and production for public use, since the investment necessary to convert the professor's brainchild to a marketable product is not forthcoming. Government ownership gives the university inventor no incentive to disclose his invention and to divert time and effort to working with patent attorneys and potential users. The university has little incentive to obtain adequate invention disclosures and its equity in inventions is not recognized.

How about the Government's equity in inventions resulting from Government funded research in universities? This ought to be satisfied by a royalty-free nonexclusive license for Governmental use. The Government thus received the right to use royalty-free the results of the research which it paid for. Greater rights, such as title to inventions, are, for reasons I have already discussed, against the public interest because of the problems of development and marketing, and they vitiate the inventors' equity as we as the university's equity. The Government when it gives a contract or a grant for research is not buying an invention or inventions. One cannot contract for a patentable invention to be made which is as yet unborn and even unconceived.

I have spoken about a royalty free license for Governmental use. In recent times Governmental use has been extended to use by state and local governments as well as by the Federal Government. This seems unfortunate and undesirable. State and local governments do not have an equity. Licensees balk at tracing the payment or nonpayment of royalties through the almost impenetrable maze of manufacturers, wholesalers, distributors and outlets in order to insure the some fractional royalty hidden in various markups is not being paid by a local township.

A provision for title in the Government with the opportunity for waivers is practiced by some agencies. Sometimes the waiver is granted in advance for a particular grant or contract for all inventions that may be made. Sometimes the waiver is granted after an invention is identified. My experience and that of my colleagues are not favorable in either situation. Waiver applications are compli-

cated and costly. The agency criteria for granting waivers are difficult to satisfy and their administration demonstrates the typical bureaucratic tendency of being more stringent than necessary in order to avoid criticism. Waivers also often carry with them march-in requirements and other strings. Waivers on individual inventions after identification generally make it impossible to enter into drug testing agreements or other cooperative undertakings. Waivers put the shoe on the wrong foot. If what I have said earlier is true, there should be a very strong presumption that the country's interests are best served by vesting title to inventions in university contractors and grantees unless there is good and sufficient reason to do otherwise.

The question can be asked whether leaving title with universities for all inventions resulting from Federally funded research, with only a royalty free nonexclusive license to the Government, will adequately protect the public interest. If what I have said earlier is true, and I firmly believe it is, the probability should be very high that the public interest will be served. However, there may be the need for even greater assurances. In this case probably the best mechanism that has yet been devised is the Institutional Patent Agreement. The IPA as it is termed was first developed as far as I know by the Department of Health, Education, and Welfare and was more recently adopted by the National Science Foundation. The General Services Administration now has out for comment—and we are in the process of preparing comments—a proposed amendment to the Federal Procurement Regulations which would provide for Institutional Patent Agreements. If this FPR amendment is adopted, IPA's might then be available from all agencies except where the statutes prevent it.

Briefly the Institutional Patent Agreement is an agreement between an agency and a college or university covering the management of all inventions arising from agency grants or contracts to the institution, unless specifically excepted As an advance condition the institution's patent policy and program must meet certain criteria. There are limitations on how patentable inventions can be handled, and the Government may require licenses or additional licenses if adequate progress is not made towards practical application, or for purposes such as fulfillment of public health or safety needs.

In place of the widely varying and often equitable patent arrangement now prevalent, we would greatly prefer that the International Patent Agreement principle be applied to all Federal agencies in funding research and development at colleges and universities. This will mean a change in the statutes for some agencies, and a change in attitude in others. There will undoubtedly be some exceptions taken to the detailed requirements contained in IPA's since nothing is ever prefect, but we would hope that these requirements could be held to a bare minimum, with a termination of the agreement in the unlikely instance of a violation of the spirit of the arrangement, instead of the imposition of onerous conditions on everyone.

To summarize, I urge that the title to inventions arising from Federally funded research at colleges and universities be left with the institutions, that this be done with the Government receiving a royalty-free nonexclusive license for Federal Government purposes, and that the Institutional Patent Agreement with reasonable and minimum requirements, as the best method so far encountered, be the method for implementation. If these objectives can be accomplished, the public interest will be advanced and the equities of university inventors and of universities themselves will be satisfied.

NATIONAL SMALL BUSINESS ASSOCIATION,
Washington, D.C., January 9, 1978.

Hon. GAYLORD NELSON,
Chairman, Senate Select Committee on Small Business, Russell Senate Office Building, Washington, D.C.

DEAR CHAIRMAN NELSON: The National Small Business Association and the National Patent Council respectfully request that the attached statement on Federal Government Patent Policies be made part of the official record of the hearings that were conducted on December 19, 20, and 21, 1977.

Thank you for your co-operation.

Sincerely,

HERBERT LIEBENSON,
Vice President, Governmental Affairs.

STATEMENT OF NATIONAL SMALL BUSINESS AND NATIONAL PATENT COUNCIL

Mr. Chairman, the National Small Business Association (NSB) and the National Patent Council (NPC) sincerely appreciate having this opportunity to comment on current Federal government patent policies. NSB is a private trade association whose 50,000 members nationwide represent roughly 1,000 of the 1,200 Standard Industrial Classifications, while the National Patent Council has as its membership individuals and generally smaller companies owning patent rights.

As representatives of the small business community, NSB and NPC do not represent the interests of any one industry. Instead, our diverse memberships, involving retailing, manufacturing and distribution, give us the unique ability to address our comments to more general issues and policies without special considerations or developments that concern one industry only.

We at NSB and NPC are continually dismayed and chagrined at the lack of interest that generally exists on the condition of small business in the United States. Big business and big labor are in the public limelight to such a degree and are the center for such passionate debate, pro and con, that smaller businesses are excluded when major governmental policies are determined.

Big business is certainly far more important today, economically and politically, than it ever was. Economically, because the general health of the economy, in terms of investment, economic growth, employment, hinges very much on the economic health, or lack thereof, of big business. This also affects thousands of small business suppliers to big business.

Technically, small business plays a critical role in the process of innovation. When one surveys the new products and new processes of the past 25 years, it is extraordinary how many of them were introduced by aggressive entrepreneurs or small business firms—the Xerox copier, the Polaroid camera, the mini-computer, high-fidelity recordings, frozen foods, wash-and-dry clothing, etc. The list is long and impressive. Small business also rates high marks for conceptual innovation—developing a new way of organizing older services. Containerization; the discount store; the motel; franchising the sale of hamburgers, fried chicken, and other food products—these, among others, were ideas in the head of an individual that proved fruitful and beneficial because our economic system permitted them to compete. Obviously, not all the innovations of entrepreneurs succeed; most of them fail, as they are bound to, in a high-risk, high-payoff situation. But this willingness to risk failure is itself one of the major merits of a system of "private enterprise".

Experience has taught us that the large corporation will never be as enthusiastic about innovation as its small competitors. It has a huge investment in existing products and procedures that taxwise it would prefer not to write-off too quickly. It usually makes more economic sense for the large corporation to seek incremental improvements in productivity rather than to concentrate on a new product that may or may not work. Its vast internal bureaucracy is always, to some extent, a conspiracy against innovation.

Now, turning to patents, it is known that underlying the patent system are three fundamental assumptions. First, it is believed that the patent system promotes the development of inventions. Second, it is believed that the patent system provides the necessary incentives to develop inventions commercially once they are made. Finally, it is believed that the public disclosure required by the patent law promotes scientific and technological knowledge.

It should readily be apparent that of these three assumed benefits, only one would appear to be significantly affected by government patent policy. Public disclosure of inventions made under government contracts can take place under the contract terms no matter what policy is chosen. The effect of the incentive to invent would also appear minor since the government, in paying for research and development work, has supplied much of the incentive for invention. In addition, there are many motivations other than the present system which lead to invention.

On the other hand, government patent policy can directly affect the degree to which the patent system promotes the development of inventions, once made, to the point of commercial utilization. There is no question that the exclusivity afforded by the patent plays an important role in spurring the development of inventions. It has been said that many of the large businesses do not need patents, as new products are introduced successfully by a combination of the ability to

saturate based on marketing acumen. Therefore, there are cases concerning big business where a particular invention was commercialized just as quickly without any government-sanctioned exclusivity. Certainly, no small businessman would dare to compete against the formidable odds posed by big business or big government. Nor could small business establish at least a modicum of time of exclusivity for itself. Therefore, at least for small business, effective patent policy must take advantage of the fact that development will normally be promoted by exclusivity; at the same time, it must provide for others to exploit an invention if exclusivity does not produce the desired results of utilization on reasonable terms. The well-known Harbridge House study for the U.S. Federal Council for Science and Technology, Committee on Government Patent Policy, provides good documentation as to the benefits of generally allowing exclusivity to promote utilization.

We believe that without exclusivity many government-sponsored inventions would lie dormant, thus benefiting no one. It has been said, that which is owned by all is owned by none. Entrepreneurs would be unwilling to invest in the development of markets for an invention if others could take advantage of their efforts by producing the same product without the initial expenses invoked in the research, creation of markets, or developing and demonstrating that the item can be produced economically. In most cases, the costs of manufacturing the invention may be only a small proportion of the total cost of developing the invention into a product useful to the general public. It has been estimated that the cost of bringing typical invention to the marketplace is ten times the cost of making the invention. It is to us ridiculous for the government to assume that, because it picks up only one-tenth of the cost of innovation, someone would be willing to spend the remaining nine-tenths to bring an untried product to a untried market without a degree of exclusivity.

Having, in the foregoing, stated that it is essential to maintain a climate for small business because of our belief of the philosophic concept of liberal capitalism, we must now state that, just as NSB and NPC have proffered the concept of a two-tier government policy at other hearings—on many issues, including taxes—NSB and NPC also recommend a two-tier government patient policy. Just as there are set-asides for small business, as defined by the Small Business Administration, there must also also be a policy of set-asides to licensing small business only for patent royalties. Such licensing must have some attribute of exclusivity for a period of time which need not be the entire life of the patent. The license granted may encompass a field of use or may be limited geographically.

There are many who would argue against exclusive licenses for any time period to anyone—small business or big business. Such people feel that what all of the taxpayers paid for should belong to all. What is overlook is that research performed by the private sector is also partly financed by other taxpayers in a way, as such costs are usually tax deductible so the taxpayer winds up absorbing the costs for a major portion of research anyway.

RECOMMENDATIONS

(1) We, therefore, recommend that legislation be enacted to make entirely clear the authority of the government to give cognizance to a two-tier government patent policy. This would be accomplished by giving government agencies the authority to waive rights amounting to a grant to a contractor of a non-exclusive royalty-free license up to an exclusive license for a reasonable royalty for a period less than the life of the patents with a right to sue. Further, that qualified small business (which may or may not be the contractor) be given special preference in acquiring an exclusive license, which may be for a field of use or geographic, for a reasonable royalty and a period of time less than the life of the patents with a right to sue. This special preference should be greater even than that of the contractor if the contractor is deemed to be big business unless the contractor has demonstrated expertise by possessing background patents and/or revealed trade secrets and the contractors has given evidence of an intent to commercialize the invention or has, in fact, already commercialized the invention.

(2) To administer governmental patent policy we would recommend a Government Patent Policy Review Board, preferably located in the Patent and Trademark Office.

(3) To avoid manadatory licensing per se, we would recommend that 28 U.S.C. 1498(a) be amended to permit suit against the government in the Court

of Claims, as usual, and also in the Federal District Courts. Furthermore, suit may be brought against the contractor and against a third party exclusive or non-exclusive licensee of the government for relief presently afforded under 28 U.S.C. 1498(a). However, in the case of a contractor already having a dominating or background patent position necessary to the practice of the invention, the government agency should attempt to obtain rights thereunder for the benefit of itself and/or a government-licensed third party. Similarly, in the case of a non-contractor having a dominating patent position necessary to the practice of the invention, the government agency should attempt to obtain rights thereunder for the benefit of itself and/or a government agency-licensed third party. Furthermore, 28 U.S.C. 1498(a) should be amended to provide injunctive relief to the owner-contractor against a third party if he meets the test of use under the first recommendation provided the third party is not small business. In the case of an owner of a dominating patent who is not a contractor, injunctive relief against a government-licensed third party would lie if he has shown that he meets the test of use under the first recommendation whether or not the third party is small or big business, or unless demonstrated by the government-licensed third party that the practice of the invention constitutes a material necessity to the benefit of the public.

(4) We recommend that government agencies have broad general statutory authority to purchase or license patent rights which may be the background patents of a contractor or may be the patents of a third party. We also recommend that the government agencies be given authority to settle infringement claims administratively out of any available funds. Concomitantly with the latter, government agencies should promulgate informal procedures for administering patent claims to insure fair, prompt, and equitable treatment of claimants. Of course, overall co-ordination of administrative claims procedures should be assigned to the Government Patent Policy Review Board (Recommendation No. 2 in the above) to achieve prompt and equitable settlement of claims.

(5) We believe that the present various statutes, allocating to the government all rights to the information or data resulting from its contracts, should be repealed, and there should be enacted, in their stead, a uniform data policy setting forth broad statutory principles governing the allocation of such rights. This uniform policy should (a) provide for uniform concepts for all government contracts, defining the technical data and protectable technical data and prescribing the government's and the contractor's rights in each type of data; (b) provide for uniform handling of proposals and restrict their use for evaluation whether or not such proposals contain restrictive markings; (c) permit contractors to obtain adequate copyright protection in foreground data when such copyrights will be an incentive to achieve commercialization or the publication and dissemination objective of the particular government agency.

(6) Specific statutory provisions should be enacted to give the owners of background data a judicial remedy for compensation, when such data is misused by a government agency, provided such data has been submitted to the government agency with proper restrictions on its use or disclosure.

(7) Again, as in a previous recommendation above, the government agencies should be given authority to use available funds to purchase data rights and to settle claims for the misuse of background data submitted to them with restrictions as to its use or disclosure.

We appreciate that some of the recommendations encompass a radical departure from current thinking. But this should not be too surprising, for did not we state in the foregoing that small business is innovative?

Thank you.

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