EVALUATION

OF

NASA'S PATENT POLICIES

GPO PRICE $ ____________

CFSTI PRICE(S) $ ____________

Hard copy (HC) $6.00

Microfiche (MF) 1.25

ff 653 July 65

FACILITY FORM 602

N66 36388	
(ACCESSION NUMBER)	(THRU)
221	1
(PAGES)	(CODE)
CR-77945	34
(NASA CR OR TMX OR AD NUMBER)	(CATEGORY)

Watson and Holman

The George Washington University

An Evaluation of the Patent Policies of the National Aeronautics and Space Administration

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1966

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Preface

This study of the patent policies of the National Aeronautics and Space Administration was undertaken under a grant (NsG 425, Supplement No. 1) from NASA to The George Washington University. We had been doing patent research of our own choosing under an earlier NASA grant (NsG 425). This study, which began on September 1, 1965, was done at the request of NASA, whose officers gave us much help. But they did not direct our investigation or in any way guide us to conclusions. Thus the evaluations and conclusions, as well as the errors, are ours alone.

We are indebted to many persons for giving us factual information, opinion, and advice. In NASA we had the full cooperation of the Office of Assistant General Counsel for Patent Matters and of the Inventions and Contributions Board. We interviewed patent attorneys of many of NASA's contractors; we are grateful to all those who filled out our burdensome questionnaire. We thank the inventors and the NASA licensees who also took the trouble to answer the questionnaires we sent to them.

Our research assistants made it possible for us to deal with masses of factual materials. We acknowledge the help of Stephen Van Dyke Baer, Diana C. Flood, Adrienne L. Harkins, Nancy A. Hyman, Gerard L. Lagace, Livia T. Limarzi, Clayton C. McCuistion (who carried out some of the technical statistical analysis), Nancy A. Sweeney, and Thomas A. Zener.

As Appendix A we include a Legislative History of the Property Rights in Inventions Provisions of the National Aeronautics and Space Act of 1958 by David E. Aaronson. He cheerfully takes sole responsibility.

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Principal Investigator
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Washington, D.C.
August 31, 1966

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Chapter 1

Introduction

The controversies over the patent policies of the federal government have been clashes of opinions, most of them resting on weak foundations of little factual knowledge. Some of the issues controverted are sheer figments of imagination rather than questions that can be answered by appeals to facts. But the body of empirical knowledge on the results of patent policies is growing, so that it will be possible for policy making to depend upon firmer analyses supported by more abundant facts. Perhaps however it is too much to hope that policies will be governed by analysis. Patent policies are only one of the issues in the complex relations between government and industry. Those relations are influenced as much by tradition and by economic philosophies as by marshaling of facts.

This monograph is an analysis and an evaluation of the patent policies of the National Aeronautics and Space Administration. We offer it as an addition to the body of empirical knowledge.

The Public Interest

The patent policies of a federal agency are the servants of the public interest. The public interest consists of thousands of objectives, large and small, far and near, important and unimportant, pursued by government and by private organizations and individuals. The public interest in, say, the prevention of pollution is one thing; in the prices of farm products it is something else. Relevant here is the public interest in the disposition of rights to the inventions emerging from research and development financed by the federal government. To that particular interest we address ourselves.

The public interest that NASA's patent policies can serve is:

1. The advancement of technology;
2. the promotion of the agency's missions; and
3. the contribution to other goals of the federal government.

Before specifying these three objectives more closely, we must point out that NASA's patent policies are only one of the servants, or instruments. There are hundreds of others, if we take the federal government as a whole; most of the other instruments are much stronger and more efficacious than the patent policies of any agency, including NASA. Even so, the problem before us is that of the contribution, small though it might be, that NASA's patent policies can make to the three objectives.

The advancement of technology--the progress of useful arts--takes place in manifold ways. In large part it comes about through an onrushing stream of inventions, improvements, and innovations. In the usual economists' definition, innovations are new methods of production put into actual commercial operation by entrepreneurs. Typically if not nearly always, innovations come about through investments made under risk, and after periods, sometimes many years in length, of development effort and expense. Many innovations embody patented or patentable inventions. Economic growth depends in good part on the numbers and kinds of innovations that occur over time. Here we touch on a vast subject. For present purposes, it is enough for us to draw attention to two of the many keys to the advancement of technology, keys directly relevant to the patent policies of federal agencies. One is incentives and the other is the mechanism for the transfer of new technology.

The story of incentives and patents has been told often enough. Obviously, a government agency's patent policies should work to maintain and even to strengthen the incentives of inventors to disclose inventions to their employers, of contractors to report inventions, of contractors to work on, to refine, and to develop promising inventions. Then there are the incentives to take the risks and the expenses of bringing the promising inventions to market. A federal agency might have another objective for its patent policies, an objective which being met dulls the incentives to disclose and develop. This can happen. If it does, the agency should make up its mind as to the acceptable compromise between stimulating incentives and meeting the other objective.

The transfer of new technology, from its originator to others who will use it, is a mysterious process, so much so that organized research has not yet succeeded in ripping off the shrouds. Still, transfer does occur, through the imitation of innovations, the spread of knowledge ("the information explosion"), as well as through other means, including even theft and bribery. Government patent policies can contribute their part by pushing inventions into the stream of commerce. Patent departments in the federal government can, and some do, cooperate with programs for the diffusion of new technical knowledge.

The promotion of the agency's missions by its patent policies is a matter negative rather than positive. That is to say, its patent policies should not stand in the way of the agency's broad program objectives. In particular, procurement policy and patent policies are intertwined in relations of harmony and conflict. Procurement policy aims at securing the services of the contractors with the best know-how, personnel, and facilities. Procurement policy tries also to accommodate standing goals of national policy, such as fostering small business, aiding depressed areas, paying prevailing wages, preventing discrimination, and the like. At the same time, procurement can have consequences that are usually viewed as undesirable from the standpoint of still another goal of national economic policy. That is, despite the efforts to award more contracts to small business firms, military and space procurement dollars continue to be spent with the largest corporations. National Science Foundation data show that two-thirds of all the R & D performance in industry for the federal government is carried out by only 20 companies--the aerospace and electronics giants.

Procurement is a force many times more powerful than patent policy ever could be. What procurement does, patent policy can hardly undo.

Criteria of Evaluation

Table 1--1 takes the broad aims of the public interest served by NASA's patent policies and divides them into specific aims. These last will serve as our criteria of evaluation.

After investigation and analysis of their actual operation we shall evaluate NASA's patent policies with the following tests or criteria:

1. Disclosure of inventions: An effective patent policy

Table 1--1

The Public Interest
served by
NASA's Patent Policies

Broad Aims:	Specific Aims:
Advancement of Technology	disclosure of inventions utilization of inventions encouragement of development of inventions transfer of technology
Promotion of Agency Missions	best contractors protection in procurement
Contribution to Other Goals of Government	protection of health welfare avoidance of concentration and monopoly

results in reports of invention disclosures from all contractors receiving disclosures from their employees. Reporting, however, is in principle a simple matter of compliance on the one side and of monitoring on the other. Much more important is the effectiveness of patent policy in encouraging the inventiveness of scientists and engineers, in stimulating them not just to turn in more paper, but to work harder on promising new ideas.

2. Utilization of inventions: An effective patent policy results in early commercial use of those inventions capable of it. This means an active program of licensing and of exclusive licensing of government-owned inventions and of the transfer of principal rights to contractors when there are no overriding reasons not to do so.

3. Encouragement of development of inventions: Some inventions require further development before they can be put on the market. The investment in development is normally subject to risks which often will not be undertaken unless they can be reduced by the shelter of the temporary patent monopoly. An effective patent policy will recognize and act on such circumstances.

4. Transfer of technology: An effective patent policy is a useful ally to other policies of an agency whose overt mission includes the advancement of technology.

5. Best contractors: An effective patent policy does not stand in the way of the agency's being able to obtain the services of the best qualified contractors.

6. Protection in procurement: An effective patent policy

makes it unnecessary for an agency to pay royalties on inventions made from government funds.

7. Protection of health and welfare: An effective patent policy will make available for general use inventions having to do with health and safety.

8. Avoidance of concentration and monopoly: An effective policy will not permit visible accretions of concentrated private economic power.

An effective patent policy cannot be passive and adaptive. Nor can it expect to achieve all of the foregoing goals all at once. Here and there, compromises must be made. The government agency, no less than contractors, must make its decisions under conditions of uncertainty; retrospect will show that some mistakes will have been made.

Chapter 2

The Commercial Use and Potential of Inventions from Government-Financed Research

Few of the inventions from the research conducted by and for the National Aeronautics and Space Administration are in actual commercial use. This is true both of the inventions licensed by NASA and of those where NASA has waived part of its rights. In chapters to follow we shall present our findings on the commercial use and potential of the inventions from NASA research.

In this chapter we want to offer perspective, so as to show what can reasonably be expected of the development and adaptation of NASA-originated inventions for commercial purposes. The perspective comes mainly from the experience of other agencies of the government.

First of all, we want to deal briefly with certain prevalent ideas on the commercial value of inventions from government-financed research.

The Mythology of Government Patent Policies

In the debates over government patent policies certain themes constantly recur. Some of the principal themes are beliefs that we choose to call myths.

One of the older myths was that there should be a uniform patent policy for all agencies. This has been displaced by the newer myth that the federal agencies, with different missions, R & D programs, and decision-makers, will apply uniform criteria in the same manner.

The greatest of the myths is that the patented inventions coming from government-financed research and development are numerous and valuable. The belief prevails in industry; it is manifested by industry's continued insistence that when title goes to business firms, they will have the protection and thus the incentive to develop and to make available to the public a great many new products. The Presidential Memorandum of 1963 calls the inventions "a valuable national resource." Somehow there is an impression that a company acquiring patent rights to such inventions may "make many millions of dollars."[1] This myth is accompanied by another, to the effect that the same patent rights in R & D contractors would become quite worthless if the government should acquire them.

Another set of myths centers about monopoly and economic concentration. Somehow it is believed that letting industry acquire titles to inventions from government contracts results in undue concentration of economic power. The concentration of research and development contracts supposedly results in an equal concentration of patents. Another article of faith is that business firms cannot acquire dominant positions if the government takes titles to patents.

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[1] Editorial, "Patents and Equities," Washington Post, April 17, 1966.

Results of Other Investigations

But the inventions from government-financed R & D are neither numerous, given the vast amounts of R & D paid for by the federal government, nor are they, as a group, particularly valuable. Table 2--1 displays the results of earlier investigations yielding estimates of the percentages of these inventions in actual commercial use.

We shall take the figure of 10 per cent as a modal value for the percentage of inventions in commercial use. A good indication of the value of the inventions, i.e., the incomes earned from them, can be had by perusal of the materials assembled in 1961, by the Senate Subcommittee on Patents, Trademarks, and Copyrights. Judged by no matter what standard, that value is low.

The Senate Subcommittee on Patents, Trademarks, and Copyrights has been holding hearings on the patent system and on government patent policies for many years. During the 1965 hearings, spokesmen for industry testified that titles to inventions are necessary as incentives for risk capital. In response to this testimony, the Subcommittee asked industry to provide it with case histories of inventions from government-financed R & D that were developed because the companies owned patent rights. The request was made through associations such as the American Bar Association, the American Patent Law Association, and the Aerospace Industries Association of America. So far (1966), industry's response has been small. Only about two dozen companies have supplied any information, half of them anonymously through the Associations. None of the companies has reported amounts of income

Table 2--1

Estimates of Commercial Use of Patented Inventions from Government-Financed R & D

Source and Date	Rate of Use in Per Cent	Remarks
Watson, Bright, and Burns, 1960[a]	13	Based on responses to questionnaires sent to 102 firms owning (a random sample of) patents licensed to DOD.
Senate Subcommittee on Patents, 1961[b]	7	Based on responses to questionnaires sent to firms with largest R & D contracts with DOD.
Holman, 1963[c]	10-15	Government-owned inventions. Based on responses to questionnaires sent to inventors (of a random sample of patents).

[a]D. S. Watson, H. F. Bright, and A. E. Burns, "Federal Patent Policies in Contracts for Research and Development," Patent, Trademark, and Copyright Journal, Vol. 4, No. 4, Winter 1960, p. 342.

[b]Patent Practices of the Department of Defense, Preliminary Report of the Subcommittee on Patents, Trademarks, and Copyrights of the Committee on the Judiciary, U. S. Senate, 87th Congress, 1st Session, 1961, p. 35.

[c]Mary A. Holman, "The Utilization of Government-Owned Patented Inventions," Patent, Trademark, and Copyright Journal, Vol. 7, No. 2, Summer 1963, p. 155.

attributable to these patented inventions. Most of the companies could not identify development expenditures for particular inventions.

Experience of NASA Contractors in Other Government Research

In February, 1966, we sent a questionnaire to all organizations and persons who had, to the end of 1965, been granted waivers by NASA. The waiver holders include 68 business firms and nonprofit organizations. Questionnaires from 64 firms and organizations were returned to us. One set of questions were about the contractors themselves rather than about their waived inventions. We asked the NASA contractors who had been granted waivers to tell us how many patented inventions they own that resulted from other--other than NASA--government-financed R & D. We also asked for the percentages of these inventions that have been commercially used.

To these questions we received 36 usable replies. We did not count licensing as commercial use. After some hesitation we decided not to include the response of an aerospace company which is much more patent conscious than most of the others. This company has 440 patents from government-financed R & D. Of these it "estimated" that 50 per cent are in commercial use. This figure seems much too high; anyway, the company said that the figure is "nothing but a guess."

The 36 contractors reported a total of 3,488 patented inventions from other government research. Of these, 235, or 6.7 per cent, are in commercial use. (If the aerospace company with the doubtful reply is included, the rate of use rises to 11.6 per cent.)

This result for commercial use--the 6.7 per cent--is close to the 1961 findings of the Senate Subcommittee on Patents. Many of the companies responding to the Senate Subcommittee also answered our questionnaire. We had two purposes in seeking information on commercial use of inventions from other government research. One was to establish a point of reference to judge the commercial use of inventions originating from NASA-sponsored research. The other purpose was to see if there had been any change since 1960. We held the tentative hypothesis that there might well have been, owing to the lags of time that often exist between the issue of a patent on an invention and its entering the stream of commerce. Princeton University once had rights in a patent that yielded not a cent of income until its sixteenth year, whereupon the patent brought in a substantial sum of money. If, then, the military R & D of the 1950s has a delayed commercial spillover, we see no evidence of it from the patent data furnished us by the 36 contractors holding waivers from NASA. Patent attorneys of several of the largest companies in the economy confirm, at least for their own companies, our finding that the rate of commercial use continues to be stable at its low level.

Experience of Research Corporation

Between commercial research and patenting on the one hand and government research and patenting on the other lie the research and patent activities of the nonprofit organizations. Their activities resemble much more closely those of government than those of industry, because the research is not directed toward profits and because patentable inventions are always unplanned byproducts. The largest single center of university patenting is Research Corporation, which provides patent services for about 180 colleges, universities, and scientific institutions.

Research Corporation receives disclosures from the institutions it serves, evaluates the inventions, examines their commercial potential, has their patentabilities determined, and selects some for patent application. Income from licensing is divided among the inventors, their employers, and Research Corporation. In the period from 1946 to early 1966, Research Corporation received about 6,000 disclosures. About 700 patent applications were filed. Of the 60 inventions that were licensed, just 30 yielded any income. In other words, less than 5 per cent of the inventions covered by patents or patent applications were in actual commercial use. And only about one half of one per cent of the inventions submitted were brought into commercial use.

The inventions handled by Research Corporation come from noncommercial environments. Nearly always they come in singly. Very much the same is true of the inventions received by NASA's own laboratories and from the nonprofit organizations. Even the inventions from most contractors come from the noncommercial environment of companies' aerospace divisions, or military products divisions, or federal systems divisions, or defense and space divisions, etc. In these divisions the research work for the government is typically segregated. The principal motive in these divisions is get the next contract or to get more contracts. Perhaps the word noncommercial is a little too strong, but our purpose in employing the word is to draw attention to the similarity of attitudes and motivations between a large facility operated by a university and one operated as a segregated division of a business corporation.

The Probabilities of Commercial Use

Take a typical or average R & D contract of one million dollars. The probability that the work under the contract will yield a patented invention that will bring in any income at all is less than 0.01, somewhere in the neighborhood of 0.05. In other words, there is less than one chance in a hundred that patent rights in such a contract have any dollar value. So far as we know, patent rights have almost never been the objects of negotiation. If indeed they were highly valuable, a rational contractor would take a lower fee. For example, he would accept a 6 per cent fee with patent rights but would insist on an 8 per cent fee without them.

We now turn to the proof of the statement that there is less than a 0.01 probability that a million-dollar contract will yield an invention of commercial value:

1. There is no certainty (probability = 1.0) that the work under a million dollar contract will yield any invention disclosures. One contract might result in several, of course, but other contracts might have none. We show in Chapter 3 on disclosures that contractors disclose to NASA at a rate not higher than 0.6 inventions per million

of R & D. For present purposes, however, we will assume the probability of 0.9 disclosures per million dollars. That is, we assume a high probability, but not certainty.

2. Next we assume a probability of 0.14 that the disclosures are worth the trouble of preparing patent applications. Experience shows that NASA or its contractors think that 0.14 of all disclosures justify the expense of application.

3. The probability that a patent will be granted upon an application is 0.6. This number also reflects experience.

4. The probability that a patented invention coming from government-financed research and development will be used commercially can be put at 0.1. We have already discussed this number.

5. When these probabilities are combined by multiplication, the result is a number well less than 0.01. The four sets of decisions are independent: Those of the inventor, of the patent department, of the Patent Office, and of the market.

To illustrate the significance of the probability estimate: Suppose that a contractor would want to put a value on potential net income from the patents he might get as an incident to his doing R & D for the government. Take $100 of such income potentially receivable ten years from now. Its present value discounted at 10 per cent (a low rate of return for internal use) is about $38.50. The probability of a commercially profitable invention is 0.01, at the most. It follows that the present expected value of the $100 is 38 cents, or less.

In this chapter we have surveyed five groups of evidence or experience. The results are always the same, namely, that noncommercial research results in few patented inventions that enter the stream of commerce. This, then, is what is to be expected from the research conducted by and for NASA. The low rate of commercial use does not indicate flaws or faults in patent policy. The low rate is in the nature of things.

Chapter 3

Disclosures

Inventions are incidental and unpredictable byproducts of the research financed by the federal government. That research is undertaken to widen knowledge and to create better methods and devices for use in the manifold activities of government. It is the task of government patent policy to dispose of the rights to the inventions made in the course of government-financed research, to promote their utilization, and to do so under the public interest.

Before it brings its power to decide whose invention it is--the government's or the contractor's--patent policy plays a role, conscious or unconscious, in influencing the quality and the quantity of invention disclosures.

The National Aeronautics and Space Administration has made a greater effort than any of the other major agencies to get as many disclosures as possible from its contractors. Beginning in December, 1962 with the Reporting of New Technology clause, NASA has required the reporting of "innovations" as well as of prima facie patentable inventions. Innovations are discoveries, or improvements, or new ways of doing things, which, though not patentable, are thought to have enough merit to be worth disseminating. Upon being made known to other business firms, and upon being actually utilized, the innovations then advance technology generally and bring benefits from aerospace research to the civilian economy. Such is NASA's Technology Utilization

Program whose activities are in some ways enmeshed with NASA's patent program. We shall deal only fleetingly with TUP. We have had neither the resources nor the competence to evaluate that program.

Patent policies can influence the volume of invention disclosures in several ways. One is through programs of awards to inventors. NASA has a program for the employees in its own laboratories. Awards and other incentives to the employees of contractors had not been undertaken, with an exception to be mentioned later, by NASA in the period to the end of 1965. Any effort by a government agency to stimulate the creativity of contractors' employees is bound to raise problems, not the least of which would be resentment by many contractors at what they would consider interference with the exercise of a management function. Patent policy in operation could conceivably enlist the cooperation of contractors not just to disclose fully all that they already have but to spur the creative engineers to turn up more really good inventions. Patent policy in operation also poses a task of monitoring.

The Process of Disclosure

An invention springs into life as an idea. Creativity and serendipity both play their roles. The idea is subjective, an opinion. It may or may not be recognized and identified by other persons as something new and useful. The idea may or may not be communicated by its inventor to other persons. Whether and how the idea, which might turn out not to be new after all, is communicated to others depends on the environment the inventor works in. That environment, besides the obvious fact of the kind of engineering being undertaken, possesses a set of incentives, which can range from weak to strong. The set of incentives includes (1) those of the engineers to look for new ideas, (2) those of the engineers to report new ideas, (3) those of supervisors and others to encourage reporting, and (4) the incentives of the patent staff to identify the new ideas that can lead to something patentable.

In all this, uncertainty prevails. Decisions have to be made without knowledge of the probabilities. The decisions are to pass the idea on or to reject it. How the decisions are made is a function of the set of incentives.

Various methods are used to transform ideas into invention disclosures. A common device is the more or less elaborate invention disclosure form with spaces for the signatures of witnesses and that sort of thing. The inventor takes the time and trouble to fill out the pages of the form. Some of NASA's contractors have abandoned the long disclosure form, in the belief that it actually inhibits the communication of new ideas. Instead, these contractors rely on patent liaison, i.e., on men who act as the link between the laboratories and the patent department and whose function it is to circulate in the laboratories, to find promising ideas, to evaluate them, and to pass on the good ones in written form. In one electronics company, the "patent engineers" are young men in training to become patent attorneys. In another, they are older men, no longer creative or productive at the bench, but still valuable employees because of their experience. Other companies have tried and abandoned the use of roving patent liaison men. In one of NASA's smaller contractors, the patent attorney himself circulates in the laboratories, obtaining invention disclosures, in his words, "by osmosis."

The main point here is that the flow of invention disclosures is a stream that can be made to run fast or slow. One set of incentives for all concerned can yield, say, twice as many disclosures as another, for a given amount and kind of R & D and for a given level of inherent creativity of the engineers doing the R & D. This is true even though contractors conscientiously meet the requirement of reporting inventions and nonpatentable "new technology."

Disclosures from Commercial and from Government-Financed Research

It is common knowledge that commercial research yields far more invention disclosures than does research conducted by or for the government. The yield can be measured for a unit of input, which could be either a million dollars of R & D expenditure or a man-year of the service of a scientist or engineer. We shall shortly offer some estimates of the order of magnitude of the difference in yield between business and government.

Disclosures in commercial research

These propositions seem to be valid for large-scale commercial R & D carried on by a company for the purpose of increasing its expected future profits:

1. Disclosure of inventions by an employee is voluntary; it cannot be compelled. The employee must be motivated to write down or to take the time to talk about an idea or a proposal that might benefit his company, whose share in the expected profits seems to be always greater than the inventor's.

2. Companies with large-scale commercial R & D are usually patent conscious. If scientists and engineers are not fully aware of this, every effort is undertaken to indoctrinate them.[1]

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[1]Cf., Worth Wade, The Corporate Patent Department (Ardmore, Penn.: Advance House, 1963), Chap. XI, "Patent Indoctrination of Technical Personnel."

3. Such companies have various ways and means of providing incentives and stimulating their employees to make invention disclosures. But there are many "problems," because creativity is unscrutable, motives are complex and not fully fathomable, technology moves fast, and future profits are uncertain. Financial rewards are obvious enough, so is exhortation by top management, and so is encouragement of technical publication. Some companies like to couple the inventor's name with his invention in intracompany discussions and memoranda. Just what is the optimum mix of these and other incentives no one probably knows or ever will know. One problem is how to be sure to recognize and identify correctly those inventions not directly related to the work at hand or to a particular product line. Even General Electric looks upon this problem as important, because this company has a small group of men whose duties include the search for the off-beat new technologies that remain invisible to division patent attorneys who can see only their own product lines.

Practice differs in the ways raw inventions are put through screens to become refined enough to be considered for patent application. There can be one or two screens, or several, with formal or informal procedures. But at each screen the question is--accept or reject. The criteria are the company's patent objectives.

Everyone agrees that, if the effort is put forth, more disclosures per year can always be obtained. Suppose a large company is getting 1,000 disclosures a year from its commercial laboratories. That number could be increased to, say, 1,500 disclosures a year at a cost, and, it seems certain, at an increasing cost per disclosure. The additional 500 disclosures have an additional expected value. On the average, however, the additional expected value, per disclosure per year, must diminish. It follows that, given a clear view of the probabilities of discounted future profits, there is an optimum number of disclosures; any larger number would entail a present additional cost of the disclosure mechanism, a cost in excess of the estimated future payoff from the additional disclosures. Without a clear view of the probabilities of future profits, the decision as to how many disclosures to strive for can be made only in a fuzzy way. Nonetheless, the decision has to be made.

Disclosures in government-financed research

1. As in commercial research, disclosures by contractors' employees are voluntary.

2. The aura of patent consciousness is hardly likely to prevail in government work, because the purposes of that work do not include the fencing of a product line with patents.

3. Contractors have no incentives to stimulate the motivations of their employees to make invention disclosures. To this perhaps harsh generalization there are three exceptions: (1) Contractors who follow as literally as they can the requirement to report new technology do report more disclosures. One way to report more is to send in inventions in their raw or only slightly refined condition. Another way is to sharpen the stimuli to employees. So far as we can tell, however, only the larger aerospace companies could, in the period covered

by our analyses, have constituted this kind of exception. (2) Contractors who foresee the possibility of commercially useful inventions as a by-product of research for the government. But since this possibility is small, it does not justify the cost of a mechanism of disclosure that would bring out many more disclosures. (3) Contractors who carry over into government work the procedures of stimulation they use in their own commercial work. RCA, for example, rewards inventors when patent applications are filed, even when the government files applications. But patent counsel in RCA believe that the government is so slow in filing that the delays discourage inventors, putting still another damper on disclosures during the course of government work. Many of NASA's contractors, however, have done very little commercial work of their own. Several of the large aerospace contractors reward inventors only for patent applications filed by the companies themselves. The carry-over of commercial procedures for drawing disclosures out is stopped dead in its tracks when companies put commercial and government research into separate compartments or divisions, as most of them do.

Government-financed R & D includes much development work, extensive and expensive testing, and the construction of elaborate, special-purpose facilities. It is commonly believed that costs are not rigidly controlled in government work and that, for example, a device that will work a trifle better with gold plating will in fact be gold plated. Emphasis falls on the expected performance of the esoteric equipment wanted by the government. In contrast to normal practice in commercial work, less attention is given to detail by patent attorneys monitoring government-financed R & D.

Order of Magnitude of Disclosures from Commercial Research

A good thing to know would be the total number of disclosures in all of industry. This number is not known, but we think a plausible range for this number can be stated. The range can be found from the following estimating procedure:

1. From the Patent Office, we have 26,632 patents assigned to domestic corporations in 1963 and 27,836 issued in 1964. To smooth the numbers a bit, we take the 1963-1964 average of 27,234 assigned patents.

2. We next need an estimate of the number of patent applications. We assume that it takes 4 years from application to issue and that the ratio of patent applications to patents is 10/6. Using these assumptions and rounding, we have 45,400 as the estimated average of patent applications by domestic corporations in 1959 and 1960.

3. Here we must cope with "the propensity to patent," i.e., the ratio of patent applications to disclosures. For twelve of NASA's contractors we have information on their propensities to patent. The quality of the information varies from a patent attorney's guess to careful statistical compilations from company records. But the data are all of a piece and are consistent. The companies for which we have propensity data are: Douglas Aircraft, Electro-Optical Systems, General Dynamics, General Electric, Hughes Aircraft, IBM, North American Aviation, Northrop, RCA, Republic Aviation, United Aircraft, and Westinghouse Electric.

The propensities range from about 10 to about 25 per cent. The aerospace companies are in or near the 10 per cent ratio; the large electric companies are close to the 25 per cent figure. Because we have this information for so few companies, we would not put much trust in an average. Thus we will stay with the 10-25 per cent range.

This means an assumption that the propensity lies within that range and that occurrences outside the range are quantitatively unimportant. Table 3--1 shows that possible range of disclosures for various propensities.

4. According to the National Science Foundation, 262,600 scientists and engineers (full-time equivalent) were employed on R & D work in industry in January of 1959. Dividing the ranges of disclosures by the number of scientists and engineers gives a range of disclosures per man. The result, shown in Table 3--1, is close to the usual rule of thumb of one disclosure per man per year.

The total number of inventions disclosed to the federal government has been about 10,000 a year since 1960.[2] The Federal Council for Science and Technology reports a figure of 10,000 to 12,000 for the fiscal years 1963 to 1965.

Our range of estimates for total disclosures to domestic corporations includes, strictly speaking, those disclosures to government that resulted in subsequent title to industry. We can ignore this, because

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[2]Donald S. Watson and Mary A. Holman, "The Federal Government's Propensity to Patent," Patent, Trademark, and Copyright Journal, Vol. 10, No. 1, pp. 61-74.

Table 3--1

Estimated Range of Invention Disclosures to Domestic Corporations Average for 1959 and 1960

Propensity to Patent[a], in Per Cent	Estimated Invention Disclosures[b]	Estimated Invention Disclosures per R & D Scientist and Engineer[c]
10	454,000	1.73
15	303,000	1.15
20	227,000	0.86
25	182,000	0.69

[a]Ratio of patent applications to disclosures.

[b]Average number of patents assigned to domestic corporations in 1963 and 1964, multiplied by 10/6 (to estimate patent applications), and multiplied by the reciprocal of the propensities.

[c]Disclosures divided by 262,600, the number of full-time R & D scientists and engineers employed in industry in January, 1959, according to the National Science Foundation.

the small number gets lost in the range.

Anyway, we believe that disclosures to government are between 5 and 10 per cent of the disclosures to corporations. We shall be silent here on the comparative qualities of the two groups of disclosures.

The federal government finances about three-fifths of all research and development.

Disclosures per scientist and engineer

Another way of putting into perspective the number of disclosures by contractors to NASA is to match the disclosures against an estimate of the number of scientists and engineers employed in industry on NASA work. We have already mentioned the rule of thumb, which has many obvious qualifications and exceptions, to the effect that there can be expected one invention disclosure per year for each scientist or engineer employed in R & D activities. The rule is intended to apply, of course, to commercial rather than to government work. The 1963 report to NASA by Westinghouse[3] said that the experience of that company shows an average rate of invention disclosures of about 0.8 per engineer-year. The rate in the Westinghouse government products divisions was given at about 0.5 per engineer-year. Westinghouse counted only those engineers whose work gave them the possibility of being inventive.

Since 1963, Westinghouse has modified its policy on disclosures,

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[3]Westinghouse Electric Corporation, Astronuclear Laboratory, NASA Industrial Applications Contract (NASw-644) to Office of Technology Utilization, National Aeronautics and Space Administration, September 27, 1963, p. 8.

reducing the pressure on its divisions to hit the target of nearly one per engineer-year. Westinghouse now receives fewer total disclosures, with less strain and expense, but with, we are told, just about as many disclosures of a quality worth filing on.

We have also heard it said that an engineer employed on NASA contract work can be expected to make about one-third as many disclosures as one working in a wholly commercial laboratory. This belief can be put to test with more estimates derived from simple manipulation of received data.

Table 3--2 gives estimates of the number of contractor disclosures to NASA per scientist and engineer. The main task here is to calculate the number of scientists and engineers working in industry on NASA contracts. This number is not reported anywhere. The calculation is from National Science Foundation data. The estimated expenditures on R & D for 1960-1965 by business firms working for NASA are divided by $60,000, which is the "R & D cost" per full-time scientist and engineer engaged in R & D. This R & D cost, as reported by NSF, varies much by industry and by size of firm. We have taken the highest figure of NSF, so as to get a conservative, i.e., low estimate. And it must be clear by now that a conservative estimate is desirable.

The last column in Table 3--2 gives the disclosures per man year.

Experience of a large company

One of the large electric companies gave us internal data on its invention submissions and patent applications for the four years from 1960 through 1963. The data separate inventions and applications from

Table 3--2

Estimated Contractor Disclosures to NASA
per R & D Scientist and Engineer
1960 to 1965

Year[a]	Estimated Number of R & D Scientists and Engineers[b]	Number of Contractor Disclosures	Estimated Disclosures per Man
1960	1,500	71	0.05
1961	6,800	162	0.02
1962	12,000	449	0.04
1963	27,000	759	0.03
1964	47,000	1,203	0.03
1965	54,000	2,094	0.04

[a]Disclosures for calendar years.

[b]Estimated from NSF data. Estimated NASA expenditures for R & D from business contractors divided by $60,000--a high figure for "R & D cost" per full-time R & D scientist and engineer.

Sources: NASA and NSF.

company-funded R & D and from government-funded R & D.

The dollar volume of this firm's company-funded R & D is a confidential figure. But we have grounds to believe that half of the firm's scientists and engineers are at work on government contracts. In any event, the same firm reported in 1960 to the Senate Subcommittee on Patents, Trademarks, and Copyrights that company R & D funds in the decade of the 1950s were about equally divided between company and government R & D work. We will now assume that for 1960-1963 this company's R & D activities were also equally divided between commercial and government R & D.

From its own R & D, this company had 8 to 10 times as many invention submissions as from government-funded R & D. The following numbers are company-funded inventions as a multiple of government-funded inventions.

1960..........8.4,

1961..........9.1,

1962..........9.7, and

1963.........11.3.

The Rate of Invention Disclosure to NASA

Experience shows a fairly stable relation between dollar volumes of R & D and numbers of inventions disclosed to the government. Over the years, a million dollars of government-financed R & D has been accompanied by, roughly, one to three invention disclosures.

The rate of disclosure to NASA is lower than to other government agencies. We have made extensive tabulations, agency by agency, on R & D dollars and numbers of invention disclosures. We have split R & D into its components of basic research, applied research, and development. We have taken price inflation out of the R & D data. We have tried different time lags between R & D and invention disclosures. No matter how the calculations are made, the result is always a lower rate of disclosures to NASA.

There is no need to belabor the point. It suffices to bring forward just one computation. From the Annual Report on Government Patent Policy, June 1965, of the Federal Council for Science and Technology, we take the figure for total invention disclosures to the federal government in the fiscal year 1964. The number is 10,929. Disclosures to NASA were 1,547, and thus there were 9,382 disclosures to all other federal agencies. Because it almost always takes several months for inventions to be reported, the data on R & D for the fiscal year 1963 are appropriate. The National Science Foundation reports that R & D expenditures (not obligations) in fiscal 1963 were $11,988 million; NASA's were $2,540 million and thus the rest of the government spent $9,448 million. These numbers give 0.61 disclosures per million dollars for NASA and 0.99 disclosures for the rest of the government.

Employee and contractor disclosures

Tables 3--3 and 3--4 show the numbers of invention disclosures from NASA employees and from contractors and the average numbers of disclosures from a million dollars of R & D expenditures. The R & D figures are our estimates, based on data published by the National Science Foundation. Most of the published data of NSF are obligations,

Table 3--3

Employee Disclosures and R & D Expenditures

Year[a]	Employee Disclosures	Estimated Intramural R & D Expenditures, millions of dollars	Estimated Intramural R & D Expenditures per Disclosure, millions of dollars	Disclosures per million dollars
1960	123	162.6	1.3	0.78
1961	131	147.0	1.1	0.91
1962	212	158.0	0.7	1.43
1963	435	282.2	0.6	1.66
1964	412	598.7	1.4	0.71
1965	382	744.7	1.9	0.53

[a]Fiscal year for R & D. Calendar year for disclosures. Thus disclosures are lagged six months.

Sources: Disclosure data from NASA files. R & D data from National Science Foundation.

Table 3--4

Contractor Disclosures and R & D Expenditures

Year[a]	Contractor Disclosures	Estimated Extramural R & D Expenditures, millions of dollars	Estimated Extramural R & D Expenditures per Disclosure, millions of dollars	Disclosures per million dollars
1960	71	141.3	2.0	0.50
1961	162	490.0	3.0	0.33
1962	449	911.4	2.0	0.50
1963	759	1,816.7	2.4	0.42
1964	1,203	3,017.1	2.5	0.40
1965	2,094	3,429.1	1.6	0.63

[a]Fiscal year for R & D. Calendar year for disclosures. Thus disclosures are lagged six months.

Sources: Disclosure data from NASA files. R & D data from National Science Foundation.

whose annual amount, for an agency such as NASA, is much larger than the amount of actual expenditures. But NSF does have one historical series of expenditures for R & D and R & D plant. The ratio of these expenditure data to the obligation data is applied to the obligation data for NASA's intra- and extramural R & D, to yield the estimates in Tables 3--3 and 3--4.

The tables lag disclosures six months behind R & D expenditures. It is clear from the tables that, except for 1965, inhouse R & D yielded more inventions per million dollars than did the R & D performed by contractors.

Attitudes and opinions of inventors

In Chapter 4 we discuss the responses to a questionnaire we sent to a group of inventors of NASA-owned inventions. At this point we can make use of their responses to a question on incentives to disclose.

Question: "What do you think could or should be done to improve incentive programs to encourage greater disclosure and more complete reporting of the new technology coming from research financed by NASA?"

Thirty-seven inventors either said that they had no opinions or they left the question blank. As is to be expected, the largest number of inventors recommended monetary awards. Relatively more contractor employees than government employees made this suggestion. Clearly associated with the matter of cash awards is the administration and selection of these awards. A number of inventors urged that the awards system be improved. But almost as many believe the existing system is

Table 3--5

Attitudes and Opinions of Inventors

Responses to Question on Incentives to Greater Disclosure	Number of Replies	Per Cent
No comment	37	40.6
Monetary awards	16	17.6
Existing procedure excellent or adequate	12	13.2
Wider publication and professional recognition	10	11.0
Improve disclosure evaluation system	7	7.7
More time to write disclosures	3	3.3
Permit inventor to retain patent rights	3	3.3
Permit contractors to retain patent rights	3	3.3
Total	91[a]	100.0

[a]Some inventors gave more than one reply.

Source: Questionnaires returned by inventors. See Chapter 5.

good or at least adequate:

> More realistic awards would help. Two inventors split \$150 for a revolutionary ________ system. One inventor receives \$500 for an improvement in a motor controller. Why? Both were based on the effect on the immediate program. Both were evaluated by assorted supervisors and other persons, most of whom were not familiar with the problems, and all of whom did so by way of a form that is ill-planned. All were busy and did not want to be bothered.
>
> I feel that the incentive awards assigned to some inventors are completely out of line with the awards given to other inventors. My whole attitude and that of many others is rather negative to the incentive program for just this reason. I believe that a mistake is possible. Yet a mistake creates very much harm. The board that judges these inventions is probably given an impossible task to fairly divide the awards money. I should think that the individual supervisors are better judges of a man's work.
>
> I think the current awards program is excellent and should be continued. I do feel, however, that the entire patent procedure takes too long, but I don't know what can be done to speed it up.

In addition to monetary awards, many inventors would like to have wider publication of their reports. Professional recognition, of course, is important and some inventors resent having the name of the Administrator of NASA on the patent. Several corporate patent counsel told us that this practice creates dissatisfaction among employees.

Number of contractors making disclosures

The 4,700 contractor disclosures received by NASA to the end of December 1965 came from about 300 contractors. The exact number depends on whether parent corporations and their subsidiaries are counted as separate contractors.

NASA has had about 20,000 contractors altogether. Many of them have furnished ordinary supplies and services such as construction and transportation. How many have had R & D contracts we do not know. But whatever the number of contractors who could be expected to have one or more invention disclosure, we suspect that it is much more than 300.

Invention disclosures to the end of 1965 came from about 250 business firms. A minority of the universities made disclosures. The number of these was 33, out of a total of more than 200 which had had contracts.

From NASA's disclosure files, we obtained some incomplete data on contracts and subcontracts for some of the contractor disclosures.

It turns out that most of the invention disclosures coming from subcontract activities are sent in by companies that are also prime contractors. Subcontracts from the Jet Propulsion Laboratory are scattered all over, as is well known. Many of the corporations whose names are household words have reported inventions from JPL subcontracts. The big prime contractors also engage in extensive subcontracting among themselves, with an ensuing small flow of disclosures. We could identify only a few disclosing subcontractors who are not prime contractors.

Of the 300 contractors with disclosures, probably fewer than 10 per cent were subcontractors only. And we also guess that only about one or two per cent of all subcontractors have submitted invention disclosures.

Of the 100 largest prime contractors in 1965, only 64 had ever disclosed one or more inventions to NASA. Disclosures could, however, scarcely be expected from a few of the empty-handed 36; these few are construction and service companies.

The lack of good data

The number of disclosures to be expected from an average, rather than a particular, contractor has a fairly close relation to the dollar volume of R & D performed by the contractor. We have done enough quantitative analysis, with data other than NASA's, to be certain of this. That is to say, we think there is a strong presumption that a group of contractors doing an average of $100 million each of R & D in some time period will disclose several times as many inventions as a group doing an average of $10 million each. Whether the number is 10 times (or more or less) as great is another question whose answer is probably of interest only to economists.

However that might be, we do not know the dollar volume of R & D for the contractors who have disclosed inventions to NASA. Nor do we have such data for the leading (say, the first 50) contractors. All we have are the figures for prime contract awards. But even with these data we can do a little. There is a significant relationship between total cumulative (1959-1965) disclosures and cumulative (1959-April 1966) awards. Using Spearman's formula for rank correlation and selecting for our sample the fifty top firms ranked by total disclosures, we obtain a correlation coefficient $R_{rank} = .7058$; that is to say, the deviations between the rankings of total disclosures and of cumulative contract awards for these fifty contractors are very small. R_{rank} has a range from +1.00 when the rankings are identical to -1.00 when the rankings are exactly reversed.

A good fit (r = .823) is also obtained for this same group of 50 contractors using the simple linear regression model Y = a + bX, where

Y represents cumulative disclosures and X represents cumulative contract awards, with a and b as constants. With the top one hundred contractors ranked by total disclosures as the sample, the simple linear regression model provides a slightly better fit ($r = .839$). Our calculation of the regression constants yields the equation: $Y = 17.54 + .000257 \cdot X$; that is, one disclosure can be expected for each additional four million dollars of cumulative contract awards. For the one hundred contractors, 70 per cent of the variation in total disclosures can be explained by variation in cumulative contract awards.

The standard error, or closeness, of the regression coefficient ($b = .000257$) is very small ($s_b = .000000532$), indicating that this estimate also fits the data well. Student's t-test of the correlation coefficient is significant at 1%; i.e., there is less than one chance in one hundred that a value for r as high as .839 could occur if total disclosures and cumulative contract awards were not related. These contract data, however, are much less than could be desired for a detailed analysis of the functional relationship between disclosures and R & D effort.

We were given permission to examine figures for subcontracts for individual contractors. But then we were told that it is quite impossible, at least without a prodigious amount of sheer clerical drudgery, to know the net contract position of the leading contractors. By net contract position we mean prime contract amounts minus subcontract amounts plus amounts of subcontracts undertaken by prime contractors. We have noticed that some of NASA's large prime contractors accept small subcontracts from one another. But, unless we are very much mistaken, no one in NASA knows how much actual work is being done for the agency by its leading contractors. Neither does anyone seem to know how much R & D work, as distinct from production, each leading contractor has been doing. All this despite the computer.

For all we know the data we wish we had had lie quietly and undisturbed in the innards of the computer, needing only the touch of the programmer to become useful output for policy makers.

The point is that data on actual R & D performance for the leading contractors would be one way, but only one, to monitor, at least prima facie, the volumes of disclosures to be expected from contractors. We are aware that some kinds of R & D are expected to be less productive of inventions than others.

Causes of the Lower Rate of Disclosure to NASA

Just why the rate of disclosure to NASA is lower is not a problem to many observers of government patent policy. They would simply explain the lower rate by uttering the words "title policy."[4] So simple an explanation will not do, if only because it is also true that NASA's rate of disclosure is less, and not insignificantly less, than the rates of the other leading title-policy agencies. We shall return later to the influence of patent policy on invention disclosures.

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[4]For example: "The fact is that NASA's record on disclosures is very poor--which NASA officials freely admit--and it is difficult to avoid the conclusion that the title concept of the Space Act is largely responsible." This is from page 15 of Ownership of Inventions Developed in the Course of Federal Space Research Contracts. Report of the Subcommittee on Patents and Scientific Inventions of the House Committee on Science and Astronautics. April 5, 1962.

We think that several causes operate to make NASA's rate lower:

1. Such an apparently simple matter as the definition of "R & D" probably has something to do with it. We have been using the R & D data published by the National Science Foundation, which in turn gets its information from NASA. We have no doubt that NSF does the best it can. But good intentions alone will not give a sharp edge to a definition--of exactly what R & D is. Nor do they suffice to bring order out of intractably difficult original statistical materials. We have not had the resources to probe into the NSF data on NASA's R & D. We can only give a provisional opinion, namely, that the data overstate the amount of the R & D work for NASA. For one thing, "R & D Plant" looms large for NASA in the period 1962-1965. So does the development part of research-and-development. Few inventions can come from buildings, launch facilities, specialized structures, and elaborate testing activities. These matters probably lower the discrepancy between disclosure rates, but not enough to explain it all away.

2. Another possible cause of NASA's lower rate of disclosure is the character of the work done by and for NASA. There seems to be some agreement on this point both inside and outside the agency. Much government-financed R & D is of the exotic sort that results in few inventions. The argument here has it that NASA's R & D, by and large, is even more so. Once again, we have not had the resources to explore this matter as much as it probably deserves. But we can record a common opinion.

3. It is well known that NASA vehicles and the other

equipment need to be as reliable as they can be made. A small increment from one level of reliability toward a higher that is closer to perfect reliability is likely to produce fewer inventions because the emphasis falls on using the tried and true rather than in creating entirely new devices and methods. We have been told that NASA procurement officers have frequently specifically instructed contractors not to go ahead with novel approaches but instead to modify and improve existing technology.

4. A large part of NASA's money goes to the aerospace industry. In the course of our research into the relations between volumes of R & D and numbers of patented inventions, we have observed that this industry differs sharply from other industries when R & D and patents are important. In the aerospace industry, R & D dollars result in relatively fewer patents than in other industries. To illustrate and to indicate orders of magnitude, we can now use one of our computations.

In a simple model, let it be assumed that numbers of patents are proportional to dollars of R & D. Because basic research and because development do not, or at least are not supposed to, produce many patented inventions, take the "applied research" data of the National Science Foundation. To allow for time needed to report disclosures, to prepare patent applications, and go through the Patent Office, let patents be lagged five years after the conduct of applied research. We have an estimate of the 1962 distribution of assigned patents among industries, with the NSF classification. Accordingly, we use the 1957 data from NSF on applied research by industry.

The model is

$$P = a + bR,$$

where P is (estimated) patents by industry for 1962, R is millions of dollars of applied research, and a and b are constants. When this equation is fitted to data for 9 industries,[5] the fit is good ($R^2 = 0.925$). The 9 industries exclude the aircraft and missiles industry (NSF designation). To include this industry spoils the fit, i.e., the industry has far fewer patents per million dollars of applied research. The fitted equation for the 9 industries is

$$P = -651 + 44.8R$$

The equation can be used to calculate how many patents the aircraft and missiles "should" have had in 1962. "Should" means as many as the average of other industries, taking into account the amount of applied research. The calculation gives this result: in 1962 the aerospace industry had 1/8 as many patents as it should have had.

Such a calculation would deserve suspicion if it stood naked and alone. But qualitative support can be given to the calculation. Patents do not seem ever to have been as important in the aircraft industry as in, say, the pharmaceutical or electric industries. Aircraft profitable to their manufacturers have owed their success to superiority of design rather than to patented features. Since 1917 the Manufacturers' Aircraft Association has furnished the machinery for cross licensing of patents

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[5]Food and kindred products, drugs and medicines, other chemicals, fabricated metal products, machinery, electrical communication and equipment, scientific and mechanical measuring instruments, and stone, clay, and glass.

within the industry. Because there is no fear of infringement, firms in the industry have a smaller incentive to take out patents.[6] If, then, the aerospace companies are less interested in patents than companies in other science-based industries, it should follow that they are less concerned about ferreting out invention disclosures. That is, independently of patent rights and reporting clauses in government contracts, the environment and attitudes in the laboratories and patent departments of the aerospace companies have not been conducive to disclosure. An aerospace company makes awards to inventors when the company files a patent application; inventors also share in royalties. But no awards are made when the government files applications.[7]

5. There is no way to measure the effect of NASA's patent policies on the volume of disclosures. But we can point to two things. One is the dominating image of the patent policies and the other is the sheer number of contractors.

The prevailing image is that NASA is a title-policy agency that grants waivers only grudgingly. Of course, some contractors, especially the larger ones, do have a more or less correct understanding of how NASA

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[6] More materials on this point and on inventiveness in the industry are to be found in David R. H. Sawers, "Inventions and Innovation in Airplanes," Appendix 7, Economic Concentration, Hearings before the Subcommittee on Antitrust and Monopoly of the Committee on the Judiciary, U.S. Senate. Part 3, Concentration, Invention, and Innovation. 1965.

[7] An excellent treatment of the problem of stimulating disclosures is contained in Wilson R. Maltby, "Need for a Federal Policy to Foster Invention Disclosures by Contractors and Employees," Federal Bar Journal Vol. 25, No. 1, Winter 1965, pp. 32-40. See footnote 2 on disclosures by aerospace companies. We are aware of the fact that NASA inaugurated a large-scale TUP program at North American Aviation in the middle of 1965.

really operates. A few contractors express themselves in fact as being well pleased with NASA's policies and practices. But it is our clear impression that most contractors see not the reality but the prevailing image. Their compliance with the reporting requirements is not likely to be eager. The mechanisms they set up to obtain and report invention disclosures are almost certain to be barely minimal. In processing raw ideas for inventions the successive sets of decisions to forward or to reject are more likely to contain a higher proportion of rejections when all concerned know that somebody else is going to get the title. We know that when a government agency puts direct pressure on large contractors to disclose more, more will be disclosed. The tap can be opened wider, at a cost. But the image of NASA's policies deters contractors from doing all they can to stimulate their employees on government work to turn out really good inventions.

A title policy can work well in getting disclosures only if the agency has few contractors. The agency with the oldest title policy has very little contract research; its own intramural research is conducted in just a half dozen or so centers. The agency with the most vigorous title policy gets over 90 per cent of its disclosures from 14 contractors. It is thus easy for these agencies to monitor their contractors. In sharp contrast, NASA has thousands of scattered contractors--over 2,000 prime contractors and tier upon tier of subcontractors. Thorough monitoring would have a prohibitive cost. The alternative is to bring about better cooperation with a new system of incentives.

The Quality of Disclosures

So far we have been discussing mere numbers of invention disclosures. Besides, we have made no distinction between disclosures of inventions and disclosures of new technology. The records we examined do not make that distinction. We believe that contractors differ much in what and how they report. Some of the larger contractors apparently follow the reporting requirements as literally as they can. On the other hand, a patent attorney for a large company told one of us that he would report four times as many invention disclosures as he does, if he were to take NASA's requirements literally. Raw inventions, he explained, have to be worked on and refined. The point, then, is that ten disclosures from contractor A might be quite a different batch of inventions than ten disclosures from contractor B.

From the information available to us, the only possible measure of the quality of disclosures to NASA is preparation, or planned preparation, of patent applications. Here are decisions by patent attorneys, in NASA or in industry, that the inventions are patentable and are also worth the cost of preparing patent applications. For inventions covered by petitions for waiver, we take the petitions as indexes of quality--the contractors think the inventions are worth both the trouble of preparing petitions and applications.

For NASA-owned inventions and for the period to December 31, 1965, we counted as "quality disclosures" those on which patents had been issued, those on which an application was pending in the Patent Office, and those on which an application was being prepared. Some inventions were still undergoing search, and thus are not counted. Their numbers are offset, at least in part, by the numbers of patent applications withdrawn or denied.

As measured in this way, the quality of the inventions submitted by NASA's employees is much higher than that of the inventions turned in by contractors. Table 3--6 shows that the quality of an average 100 inventions by NASA employees is about three times as great.

The apparent difference in the qualities of contractor and NASA employee inventions needs explanation. First of all, the quality of contractor inventions is measured by petitions for waiver, as well as by patent applications. As Chapter 6 shows, many contractors have not petitioned or have been reluctant to petition because of the way (right or wrong) they look upon the waiver policy and its administration. Thus the number of petitions, and thus of quality disclosures from contractors, is lower than it could have been. But we do not know just how much the inhibitions on petitioning have lowered the index of quality for contractors.

The rate of patent applications on NASA employee inventions is about four times higher per 100 disclosures. For this there are several causes. One seems to be simple convenience. It is easier for NASA's patent staffs in the field centers to handle the employee inventions. The inventors are there at the centers, at most only a few buildings away. The inventors can help the attorneys as the applications are being prepared. In contrast, the employees of contractors are much less accessible, mere distance being only part of that inaccessibility. Then

Table 3--6

Quality Disclosures from Contractors and from NASA Employees to December 31, 1965

	Total Disclosures	Quality Disclosures	Quality in Per Cent of Total
Contractors	4,728	655	13.8
NASA employees	1,871	740	39.6
Total	6,599	1,395	21.1

Source: Files of AGP and ICB, NASA.

too, the technical evaluators who help in making the decisions on whether to file patent applications at all are said to have a predeliction in favor of the inventions from NASA's employees. The technical evaluators are likely also to be less familiar with the technologies by contractors and therefore, perhaps, fail to foresee promising devices. Conceivably, contractors could channel some of their best inventions so as to keep them out of the government's clutches and would mostly disclose inventions of no particular interest to themselves.

Decline in the apparent quality of contractor disclosures

Table 3--7 exhibits the decline in the quality of contractor disclosures, as measured by petitions for waiver. The other index of quality, patent applications, remained steady. The decline shown in the table is more apparent than real, because after 1962 disclosures came to consist of "innovations" as well as inventions. The sharp drop in 1965 is also explained by the slightly greater stringency of the waiver regulations coming into force late in 1964.

Table 3--8 shows quality disclosures by groups of contractors. The "other companies" are medium-sized and small companies.

Appendix B gives a list of all contractors who have made disclosures to NASA.

The Distribution of Disclosures Among Contractors

As is to be expected, the big contractors turn in more disclosures. Table 3--9 presents conventional concentration ratios for disclosures and cumulative prime contract awards. The discrepancy between the

Table 3--7

Ratios of Petitions for Waivers on Inventions to Disclosures from Contractors 1960--1965

Year	Petitions per Calendar Year	Disclosures per Fiscal Year	Ratio of Petitions to Disclosures, in Per Cent
1960	13	54	24.0
1961	30	77	40.0
1962	53	350	15.1
1963	46	521	8.8
1964	93	1,040	8.9
1965	78	1,610	4.8

Notes: Petitions are those for which dates are available. Petitions are lagged six months behind disclosures.

Sources: Disclosures: AGP files, NASA.
Petitions: ICB files, NASA.

Table 3--8

Quality Disclosures by Groups of Contractors for Contractors with Four or More Quality Disclosures to December 31, 1965

Group	Disclosures	Quality Disclosures	Ratio in Per Cent
Aerospace companies[a]	2,105	208	10.0
Other large companies[b]	921	89	10.0
Other companies[c]	110	51	46.0
Universities and nonprofit organizations[d]	408	155	38.0
Total	3,544	503	14.0

[a]Aerojet General, Avco, Bell Aerospace, Bendix, Douglas, General Dynamics, Hughes, LTV, Lockheed, McDonnell, North American, United Aircraft, and TRW.

[b]Companies in 1965 Fortune Directory: Ampex, Collins Radio, General Electric, General Mills, Honeywell, IBM, Monsanto, RCA, Sperry Rand, and Westinghouse.

[c]Barnes Engineering, Beckman Instruments, Electro-Optical Systems, GCA, Hazelton Laboratories, Peninsular Chemical Research, and Varian Associates.

[d]California Institute of Technology, Illinois Institute of Technology, Midwest Research Institute, MIT, Southern Research Institute, Stanford Research Institute, University of Arizona, and University of California.

Sources: Files of AGP and ICB, NASA.

Table 3--9

Concentration Ratios for Contractor Disclosures and for Cumulative Prime Contracts

Selected groups of contractors ranked by numbers of disclosures and by sizes of prime contract awards	Percentage of total		
	Disclosures, by all contractors	Disclosures, by business firms only	Cumulative contract awards to business firms
First 4 contractors	37	39	39
First 8 contractors	51	53	54
First 20 contractors	72	74	70
First 40 contractors	82	84	75
First 100 contractors	92	94	90

Note: Disclosures are for the entire period from 1959 to December 31, 1965.

Sources: Disclosures: AGP files, NASA.
Contract awards: <u>NASA's Prime Contractors and Prime Contract Awards as of April 30, 1966</u>.

ratios for the first 40 and first 100 contractors means, we are certain, that the large contractors take more seriously their duty to disclose, rather than that their work for NASA is more productive.

Pareto distributions

The distribution of disclosures among contractors--large, medium-sized, and small--can also be measured by fitting a Pareto distribution. The advantage here is that a single number states the degree of concentration.

Take double-log paper. On one axis, put numbers of contractors. On the other axis, put the cumulative distribution of disclosures by groups of contractors--the first 4 have an average of so many or more disclosures, the first 8 have an average of so many or more, etc. When the points thus plotted lie along a straight line, the distribution is a Pareto distribution. The slope of the line is the famous Pareto α , the coefficient of "inequality," or "concentration."

Table 3--10 shows the Pareto alphas, calculated by the usual least-squares method, for contractors' disclosures, quality disclosures, and for direct contracts awarded in the fiscal year 1965. The other numbers in the table indicate that the fits are good.

These Pareto alphas signify that quality disclosures are much less concentrated than total disclosures, i.e., that relatively more quality disclosures come from medium-sized and smaller contractors.

We can put the alphas into perspective by comparing them with

Table 3--10

Pareto Alphas for Contractor Disclosures, Quality Contractor Disclosures, and Cumulative Contract Awards

Distribution	Pareto Alpha	Standard Error	R^2
Disclosures of first 100 contractors ranked by numbers of disclosures	0.6832	0.0336	0.9781
Quality disclosures of first 100 contractors ranked by numbers of quality disclosures	0.7935	0.0434	0.9738
Cumulative contract awards of first 100 contractors ranked by size of contract awards	0.5505	0.0354	0.9661

Sources: Disclosure data: AGP files, NASA.
Contract data: NASA's Prime Contractors and Prime Contract Awards as of April 30, 1966.

other computations we have made.[8] The concentration of disclosures is numerically almost identical with the concentration of patents acquired by business firms under the license policy in the period 1946-1962. The higher concentration of contract awards by NASA is about the same as the concentration of the R & D prime contracts awarded by the Department of Defense in the late 1950s.

In other words, the concentration of NASA's contracting and of its disclosures follows the pattern of the big agencies of the federal government. With NASA, concentration is no more and no less than with them.

Findings

1. One of the tasks of government patent policy is to foster inventiveness. NASA's patent policies have not been as successful as they might have been.

2. The numbers of disclosures to be expected from NASA-financed R & D is about one-tenth of the number to be expected from equivalent volumes of commercial R & D.

3. Per million dollars of R & D, the rate of disclosure to NASA has been less than the rate to the combined other agencies of the federal government.

4. The rate of disclosure from contractor R & D has been lower

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[8] Donald S. Watson and Mary A. Holman, "Concentration of Patents from Government-Financed Research in Industry," Review of Economics and Statistics, forthcoming.

than the rate from NASA employees. In 1965, however, the contractor rate was higher.

5. Only 300 of the thousands of NASA contractors have made any disclosures at all. Most of the few disclosures coming out of subcontracts have come from firms that are also large prime contractors. Some large prime contractors have made no disclosures to NASA.

6. The low rate of disclosures by NASA contractors has many causes. Important causes are the character of R & D work for NASA, the patent tradition of the aerospace industry, the absence of incentives to contractors to motivate their employees to disclose, and the prevailing image of NASA's patent policies.

7. A title policy cannot work well, owing to the expense of monitoring, with hundreds or thousands of scattered contractors.

8. The "quality" of invention disclosures can be measured by the numbers of patent applications and petitions for waiver. Employee disclosures have a higher quality. Contractor disclosures have been declining in quality, owing to the inclusion among disclosures of a larger proportion of nonpatentable innovations.

9. The quality of the disclosures for the smaller contractors, and from the universities and nonprofit organizations is much higher than those of the aerospace companies and of other large contractors.

10. The distribution of disclosures among large, medium-sized, and small contractors is "normal." It follows the pattern of the distribution of contracts.

Chapter 4

The Utilization of NASA-Owned Inventions

At the end of 1965, the National Aeronautics and Space Administration held a portfolio of 780 inventions--512 of them patent applications, the others issued patents.

Most of the inventions on which NASA has title or has applied for title are devices or processes of use solely in NASA and in other government programs. In taking title, NASA has protected the interests of the government. In selecting inventions for patent application, the criterion of government use is, however, only one of those employed by NASA's patent attorneys and technical evaluators. They adduce in fact several criteria, one of which is commercial potential.[1] This criterion is much more important for employee inventions than for contractor inventions. Contractors have the option of petitioning for waivers; if they do not it seems reasonable to suppose that they do not think much of the commercial future of the inventions in question.

In any event some small fraction of NASA's inventions have commercial potential. These inventions are available for private exploitation in NASA's licensing program.

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[1]Appendix H contains tables on the use of the criteria to select inventions for patent application. The data in the tables cover the period to July 31, 1963. The pattern of decisions is fairly stable over time. The Appendix also has tables on the time lags between the various sets of decisions in bringing inventions to the stage of patent application.

NASA's Propensity to Patent

The ratio of the number of patent applications filed by NASA to the number of inventions disclosed to NASA is the propensity to patent. The size of the propensity is, of course, the result of NASA's screening of inventions for patent applications. Table 4--1 shows data on NASA invention disclosures and on patent applications. To allow for evaluation and time for patent preparation, application data are lagged one year, e.g., applications filed during calendar year 1960, are divided by the number of invention disclosures in 1959. The table shows a decline in NASA's propensity to patent. Disclosures have been coming in at a faster rate than the numbers of patent applications filed.

A drop in the propensity to patent from 56 per cent to 15 per cent[2] cannot be explained solely by the fact that NASA has been receiving more disclosures covering innovations and unpatentable items since it incorporated the more stringent "Reporting of New Technology" clauses into its contracts. Indeed, data separating the propensity for contractor inventions and for employee inventions show that the propensity has been stable for contractor inventions. Table 4--2 shows that between 1963 and 1965, the propensity to file on employee inventions dropped by about

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[2]Between 1945 and 1963, the government-wide propensity to patent was about 28 per cent. It declined in the late 1940s, after the backlog of invention disclosures from World War II had been handled. Then it rose in the early 1950s, declining again in the early 1960s. The propensity varies widely by government agency (from a low of 10 per cent to a high of 80 per cent), depending on the numbers of attorneys and the criteria used for selecting inventions. See Watson and Holman, "The Federal Government's Propensity to Patent," Patent, Trademark and Copyright Journal, Vol. 10, No. 1, pp. 61-74.

Table 4--1

NASA's Declining Propensity to Patent

Calendar Year	Invention Disclosures	Patent Applications	Propensity in Per Cent: Applications Lagged One Year
1959	109	26	--
1960	194	61	56
1961	293	69	36
1962	661	96	33
1963	1,194	138	21
1964	1,615	197	17
1965	2,476	249	15

Note: The propensity for a year is the number of patent applications in that year divided by the number of disclosures in the preceding year, to allow for the time to evaluate inventions and to prepare applications.

Source: AGP, NASA.

Table 4--2

Propensities to Patent for Employee and Contractor Inventions

Calendar Year	Employee Inventions	Applications on Employee Inventions	Propensity for Employee Inventions, Per Cent	Contractor Inventions	Applications on Contractor Inventions	Propensity for Contractor Inventions, Per Cent
1962	212	80	--	447	16	--
1963	435	101	48	759	37	8
1964	412	131	30	1,203	66	9
1965	382	158	38	2,094	91	8

Notes: Applications separated for employee and contractor inventions only since 1962. Applications are lagged one year behind disclosures.

Source: AGP, NASA.

10 percentage points. NASA has been compelled to become more selective in choosing inventions for patent applications. This is another way of saying that given the size of a patent department, there tends to be an inverse relation between the numbers of inventions and the propensity to patent.

Table 4--2 also reveals how much higher is NASA's propensity for employee inventions than for contractor inventions. In Chapter 3, we indicated that employee inventions seem to be of higher quality than contractor inventions. But it is doubtful if employee inventions are, on the average, four times as good.

Patent counsel in NASA suggest several reasons for the large difference in the propensities. One is that the time required and probably the cost to file patent applications are greater for contractor inventions. Some of NASA's attorneys in field offices guess that it now takes two or three times as long to file applications on contractor inventions. A contractor's employee might be located across the continent rather than across the street.

Patent counsel in at least one large field center wait to file applications on contractor inventions because they expect contractors to file petitions for waivers. With waivers, NASA contractors are obligated to file patent applications, thus reducing NASA's burden of filing. However, in rapidly moving fields of technology this delay might mean fewer applications on inventions made by employees of contractors.

The Technology Utilization Program

On the total of about 6,600 inventions disclosed to NASA at the end of 1965, well over half (3,952) did not warrant patent applications; of these, about 1,090 inventions were not patentable.[3] We conjecture that some of the remaining inventions are patentable. The Office of Technology Utilization screened some of these; the more promising ones have been among the approximately 600 inventions published as Tech Briefs. Another unknown proportion of these inventions are available in documents to industry through NASA's Regional Dissemination Centers. We do not know how many of these "rejected" inventions reach the mainstream of commerce, nor do we know if any good ones have been lost.[4]

The Licensing of Government-Owned Inventions

The government does not use its inventions in the same ways as business firms. Government agencies usually grant revocable, royalty-free, nonexclusive licenses upon request. With minor exceptions, the government does not use its patented inventions for bargaining or for

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[3]The figure of 1,090 is an estimate, based on information about invention disclosures submitted to NASA to July 31, 1963. Of the 1,008 cases to that date 633 did not become the subjects of patent applications. Of these, 177 inventions received adverse search reports. Without examination of each docket, it is not possible to know why inventions receive "P-3," i.e., inactivated ratings. We did not examine individual disclosure dockets for inventions submitted after July 31, 1963.

[4]From time to time the Technology Utilization Program publishes case histories of technology transfers.

income. The Federal Aviation Agency's licensing policy is one exception. That agency attempts to recover some of its R & D costs by charging royalties, hoping to shift the R & D burden from the general taxpayer to those benefiting directly from the research.

An exclusive license agreement entered into by NASA in mid-June, 1966, might be considered the result of bargaining. But the agreement is really a means of protecting the government in its procurement activities. AVCO, Inc., and NASA filed patent applications on similar inventions. The AVCO invention did not result from any government funds. Patent counsel in NASA believe that AVCO's claims were stronger than those of the government. Patent counsel also believe that the government would probably use the invention. To avoid the possibility of an infringement suit and also the cost of attacking the AVCO patent in court, NASA requested and got a cross-license agreement. AVCO gave the government a nonexclusive, royalty-free license to its patented inventions. In exchange, NASA gave AVCO an exclusive license to its patent.

Use without licenses

The government does not usually prosecute companies infringing its patents.[5] Because of this patent counsel in industry, and some in government, argue that government ownership of patents is contrary to the philosophy of the patent system. However, most government patent attorneys maintain that widespread commercial use of government-owned inventions either with or without licenses benefits the economy.

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[5]The Tektronix Case is the exception.

NASA's Licensing Program

By December 31, 1965, NASA had granted 107 nonexclusive licenses on 46 different patented inventions and inventions under patent applications. (This information was given to us directly by the office of the Assistant General Counsel for Patent Matters. We are unable to explain the discrepancy between these numbers and the somewhat higher figures appearing in NASA's Program Review Document, Patent Program, April, 1966, page 32.) Ninety-seven different companies hold these licenses. These inventions comprise 6.0 per cent of NASA's portfolio of patent applications and patents. Of the issued patents, 10.1 per cent were licensed. This compares with a government-wide rate of 14.2 per cent for patents licensed at the end of fiscal year 1964.[6]

If a patented invention is not licensed nonexclusively within two years after its issue, NASA can grant an exclusive license. At the end of 1965, NASA had one exclusive license agreement in effect. NASA terminated another exclusive license agreement with Union Carbide Corporation, at the request of the licensee. Under this agreement, Union Carbide was to spend at least $20,000 annually (for a three-year period) for development of the licensed invention. Because superior substitutes became available, Union Carbide could not justify substantial development expenditures on this invention.

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[6] Federal Council for Science and Technology, Annual Report on Government Patent Policy, June 1965, p. 35.

Questionnaires to licensees

In February, 1966, we sent one questionnaire to each firm for each nonexclusively licensed invention. A copy of the questionnaire is in Appendix D. We questioned licensees to find out about the actual commercial use and the commercial potential of their licensed inventions. We also wanted to know how well the rate of NASA's licensing reflects the rate of commercial use. Previous studies have shown that the number of licenses is not a good measure of use.[7]

From responses to the initial mailing, a mail follow-up in late March, and about a dozen phone calls in April, we found out about almost all (over 90 per cent) of NASA's licensed inventions. Appendix Tables F--1 through F--6 show the responses to this questionnaire. The telephone company had no business or personal listing for 7 of the licensees. These companies are probably no longer in business. Officers in six companies disclaimed being licensees (i.e., they had requested information and not licenses).

As a group, the companies licensed to use NASA's inventions are quite different from the contractors granted waivers. Most of NASA's licensees are small businesses, scattered over the country; many of the companies holding waivers are large firms, geographically concentrated. We asked the licensees to give us brief descriptions of their firms, including major product lines and numbers of employees. Of those

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[7]Mary A. Holman, "The Utilization of Government-Owned Patented Inventions," Patent, Trademark, and Copyright Journal, Vol. 7, Nos. 2 and 3, Summer and Fall, 1963, pp. 135-139 and pp. 330-335.

responding to this request, 16 per cent had fewer than 10 employees, 38 per cent employed between 10 and 50 people, 13 per cent between 51 and 100, 11 per cent between 100 and 1,000, and 22 per cent of the companies had more than 1,000 employees. Ten of NASA's licensees are also NASA contractors; two of them have petitioned for waivers.

The major product lines of NASA's licensees are too diverse and too numerous to list completely. Some of the major product lines of NASA's licensees include:

> Photographic and fishing tackle accessories;
> electrical protection services for fire, burglary, etc.;
> water conditioning equipment;
> manufacture of loud speakers;
> consulting engineers;
> residential real estate;
> paints, varnishes, lacquers, and resin;
> producing, refining, and marketing of petroleum and petroleum byproducts;
> inks and epoxy compounds;
> micro-clean packaging materials;
> marine equipment;
> machinery maintenance;
> industrial air and hydraulic cylinders;
> molded rubber products;
> high temperature vacuum furnaces; and
> hospital equipment (sales).

Sources of information on inventions

Almost 50 per cent of the responding licensees learned about the availability of the inventions directly from NASA's information disseminating channels. NASA's Tech Brief series was the most frequently cited source of information. Ten licensees learned about the inventions from NASA employees. Indirectly, NASA's information disseminating mechanism must have been the source of the information to some additional licensees. Of the 6,000 to 7,000 names on the mailing list of Technology

Utilization, 3,000 to 4,000 are those of trade and professional journals. As Table 4--3 shows, trade and professional journals are an important source of information about NASA inventions. Five companies made the inventions under prime or subcontracts.

The sources of information about NASA's inventions contrast sharply with the sources of information about government-owned inventions licensed by other government agencies. In 1962, 44 per cent of a group of randomly sampled companies licensed to use government-owned inventions stated they knew about their licensed inventions because they made them under one of their contracts. Eighteen per cent of the same group of licensees learned about the inventions by routine patent searches, 7 per cent from trade and professional journals, and only 9 per cent from government publications.

Commercial Use and Potential of NASA-Owned Inventions

Before we discuss the use and the potential use of NASA-owned inventions, we shall now explain the definitions that will be employed.

Definitions of use

We shall put inventions from NASA-financed R & D into seven groups. We do this for both the licensed and the waived inventions. We use the replies of licensees and of waiver holders to our

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[8]As might be expected, discussion with agency representatives was the source of information of about a third of the patents licensed by the Department of Agriculture. Holman, *op. cit.*, pp. 328-330.

Table 4--3

Sources of Information About NASA Inventions

Sources of Information	Number	Per Cent
NASA Tech Brief	25	34.7
Trade journal	23	32.0
NASA personnel	10	13.9
Patent Gazette	5	6.9
Made the invention	5	6.9
Told by another company	2	2.8
Small Business Administration	2	2.8
Total	72	100.0

Source: Licensee Questionnaire.

questionnaires to group the inventions.

The advantage of seven groups over the usual two (commercial use or no commercial use) lies in the effort to get at commercial potential. This of course is a matter of judgment. The judgments will be those of the persons--contractors, inventors, and licensees--supplying us with information. We have to interpret that information, and in so doing, make other judgments.

The seven groups are:

Group CU. <u>Inventions in actual commercial use</u>: These inventions bring in revenue, or reduce costs. The inventions are products sold, or parts of products sold, or are used in the sale of services. We include sales to foreign governments as commercial use. Income from licensing also puts an invention in this group. But the mere fact that an invention is licensed does not put it into this group. Employment of the invention in manufacturing operations does, however, count as use.

Group GU. <u>Inventions in government use</u>: This group contains the inventions with some kind of actual use by or for the government. Some inventions from government-financed R & D are used, not in commerce in the ordinary sense, but in activities conducted by or for the government. Contractors can use such inventions in conducting R & D for the government, or include them in special-purpose equipment sold to the government. Besides this, inventions developed in government laboratories can be and are used in further R & D in government laboratories.

The importance of inventions used only in or for the government has been almost totally neglected. They too are a "national resource."

Because they are not likely to know, we did not ask licensees about government use. In Chapter 6 we report on government use of the inventions waived by NASA.

Group CA. Inventions commercially available but not yet sold: These are products or components, etc., that are available for sale but are not yet actually sold. They can be listed in catalogues or otherwise advertised. Because many a product comes to market only to fail, we think it well to distinguish groups CU and CA.

Group HP. Inventions with high commercial potential: To be included in this group, inventions must meet two or more of the following tests: Funds must have been spent by the owner or the licensee on development or marketing, or both. Commercial use must be expected in the fairly near future. The owner or licensee must have a high degree of belief (i.e., probability of at least 50 per cent) of expected use. Where a contractor has licensed the invention to a business firm, the license is negotiated and there is some statement of specifics about the commercial potential of the inventions.

Group MP. Inventions with moderate commercial potential: These must meet two or more of the following tests: The owner or licensee must have a moderate degree of belief of expected use (i.e., probability of at least 25 per cent). It is expected that funds will be spent for developing or marketing the invention. There is some statement of specifics.

Group LP. Inventions with low commercial potential: These have some glimmering of commercial utility. In this group we also put the inventions covered by automatic cross-licensing agreements.

Group NP. Inventions with zero commercial potential: They hardly need definition.

Opinions of inventors

We asked inventors about the commercial use and potential of the inventions they had made for NASA. Although inventors probably tend to be unduly optimistic, we believe that most try to observe the life cycles of their inventions.[9] The inventors in our survey had made the 101 patented inventions that issued to NASA on or before December 31, 1964. We chose that date to make some allowance for possible time lags

[9] We also sent questionnaires to inventors to get facts that are comparable to existing data supplied by inventors employed in other government agencies and from inventors whose work is not supported with federal funds. Finally, we wanted the opinions of inventors so as to gain more insight into incentives to disclose, to disseminate information, and to use new technology.

between patent issue and commercial use.[10]

One questionnaire was sent in February, 1966, to each inventor (142 inventors) for each of his inventions (169 questionnaires). We sent follow-up questionnaires in late March. Fifty-seven per cent of the inventors completed questionnaires, providing information for 72 per cent of the inventions in the survey. Appendix Tables E--1 through E--8 show the rates of reply to each question--by invention, by inventor, and by questionnaire.

The replies of inventors to our questions clearly reflect the wide gap between their vision of commercial potential and the actual commercial use of the inventions. The replies also show that many inventors believe that exotic power systems and components have commercial potential. Of the 73 different inventions for which we have information, their inventors believe that 52 (70 per cent) hold commercial potential. Whether an invention has commercial potential or not is, of course, an opinion.[11] Inventors, particularly government employees, usually do not make the management decisions to commercialize

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[10]The total number of patented inventions that issued to NASA on or before December 31, 1964, was 134. We did not send questionnaires to the inventors of the 33 patented inventions conceived before NASA's inception.

[11]An examination of about half of all invention disclosures received by NASA between its inception and July 31, 1963, showed that technical evaluators in NASA either could not or would not express an opinion about the commercial potential of 794 of the 1,008 cases studied. There was a statement about the commercial potential of only 66 of the 375 inventions on which patent applications had been filed. Of the 66 inventions, technical evaluators believed that 80 per cent had commercial potential.

inventions. However, NASA has issued licenses on 18 different patented inventions included in the inventor survey. On fifteen of these patents, the inventors believed the invention had commercial potential, as the licensee obviously believed.

The following excerpts are typical of the descriptions that inventors give about the commercial potential of their inventions:

> Commercial potential is apparent in that the Aircraft Company is currently considering the concept for application in their supersonic transport design.
>
> The patented invention could have application in high performance engines where aerodynamic loading is high. Generally, operation performance is kept below that at which blade vibration would be critical.
>
> The patented invention can be used for propelling commercial aircraft, or may be used as the exhaust nozzle for lift engines in some types of vertical take-off aircraft.
>
> The basic concept is applicable to any fluid propulsive system; hence such systems which may eventually have commercial transportation use are probable. On the other hand, immediate utilization for commercial use is not likely.
>
> For holding the body in a fixed position for medical reasons.
>
> If rocket engines have commercial use--yes.
>
> Any process requiring a heat exchanger capable of heating gases to very high temperatures, above the capability of present day commercial heat exchangers.
>
> The most likely commercial application would be attitude control and station keeping for a communications satellite.
>
> For testing hydrodynamic drag characteristics of underwater vehicles.
>
> It can replace rivets in aluminum structures...Boats and automobiles could be fabricated using the process wherever rivets or spot welds are currently used.
>
> Scuba divers, boat enthusiasts, small plane enthusiasts, etc., for the device is small, compact, light, and pocket-sized.

Only one inventor reported that his invention is in commercial use. The inventor reports that, "It is part of the Company's entry in the supersonic transport competition now under way." According to the inventor, the invention cannot be commercially used without further development. "It must be tailored to the specific design it is to be used on--that is the portion of wing that moves must be determined for stability and control considerations."

Although the inventor reported actual commercial use of this invention, such use, obviously, will not materialize for several years. The supersonic commercial transport seems to be still in the drawing board stage.

Use by licensees

The replies of licensees about the actual and anticipated use of their licensed inventions contrast sharply with the opinions of inventors about the commercial potential of inventions. Table 4--4 shows that only 9 of the 47 (about 19 per cent) inventions licensed by NASA are in actual use or are commercially available. One of these inventions is licensed exclusively.

NASA's licensing program is new and so far small. That any inventions at all have reached the market must be looked upon as a favorable indication. We shall later compare NASA's licensing program with those of four nonprofit organizations.

Table 4--4

Commercial Use and Potential of Inventions Licensed by NASA

Use	Number	Per Cent
Commercially used	5[a]	10.6
Commercially available	4	8.5
High potential	4	8.5
Moderate potential	7	14.9
Low potential	23	49.0
No potential	4	8.5
Total	47[a]	100.0

[a]Includes one invention under exclusive license.

Source: Licensee Questionnaire.

Case histories of NASA's licensed inventions

In this section we present short case histories of the 20 inventions that have moderate or higher potential for commercial use.

Group CU Inventions. Five of NASA's licensed inventions are in actual commercial use. To repeat, for an invention with a "CU" rating the licensee must have reported income or use in manufacturing.

Inventions (2): Variable Frequency Magnetic Coupled Multivibrator (Patent Application Serial Number: 14,488)

Variable Frequency Magnetic Multivibrator (Patent Number: 3,128,389)

Company: Electro-Mechanical Research, Inc., an electronics firm, with about 1,500 employees. Sole licensee of both inventions.

Description of commercial use: The company first used the two inventions as components in a telemeter system it made for NASA. Electro-Mechanical Research later incorporated the two inventions in five spaceborne telemeter systems that were sold to the Sociètè d'Instrumentation Schlumberger for the French space program. The five systems were sold for $200,000. Roughly 20 per cent of this income is attributable to the inventions licensed from NASA. The company spent a "slight" amount for development. It does not expect to undertake any future development, nor does it plan further use of the inventions because the "state of the art has past the usefulness of the device."

Invention: Cryogenic Connector for Vacuum Use (Patent Application Serial Number: 411,944)

Company: Cryolab, Inc. The company is a NASA contractor with 7 employees. Cryolab learned about its licensed inventions from a trade journal. Sole licensee.

Description of commercial use: The connector is a part of an all-metal valve for vacuums. Several of the devices have been made; one has been sold. The company spent "some" money to make shop and sales drawings. The president of Cryolab says that his company has not benefited from its work on the device because of insufficient market demand. "Moderate" development effort might be undertaken in the future, if a better market materializes. The company believes that it would put more of its resources into product improvement and market development if it had exclusive rights to the invention.

Invention: Differential Temperature Transducer (Patent Application Serial Number: 255,132)

Company: The Delta-T Company is a one-man, one-product operation. The owner, a former NASA employee, is patentee and sole licensee.

Description of commercial use: The inventor left the government to establish the Delta-T Company, which produces the differential temperature transducer. The company spent a "moderate" amount for technical development. Expected future development costs are "slight." Sales are reported to have been quite modest. The licensee has tried unsuccessfully to obtain exclusive rights to the invention. He believes exclusive rights are essential for the success of the product because of market development costs.

Invention: Function Generator or Line Following Servosystem (Patent Number: 2,837,706)

Company: EXACTEL Instrument Company, Inc., has 15 employees. The company's president made the invention about 10 years ago when he was employed by NASA.

Description of commercial use: EXACTEL Instruments holds an exclusive license to use this invention. In October, 1965, the company sold two systems. In mid-1966, the commercial future and benefits to the company were unknown. The company spent about $7,000 developing the invention.

Group CA Inventions. Four of NASA's licensed inventions are in this group. These are inventions that are available on commercial markets, but have not yet actually been sold.

Invention: Automatic Thermal Switch (Patent Application Serial Number: 453,231)

Company: Arthur D. Little, Inc. Sole licensee.

Description of commercial use: Arthur D. Little, Inc. learned about the invention from a NASA Tech Brief. It subsequently requested and was denied an exclusive license. The device has been incorporated in highly specialized cryogenic equipment made by the company. Corporate officials hope to sell between 10 and 20 units of the equipment annually. The expected sales price of each unit is between $300 and $400. If expected sales materialize, some fraction of this income will be attributable to the licensed invention.

Inventions (2): Space Capsule
(Patent Number: 3,093,346)

Aerial Capsule Emergency Separation Device
(Patent Number: 3,001,739)

Company: Spacerama, Inc. (formerly the Steelcraft Corporation). According to the licensee, the company had no employees at the time it replied to the questionnaire (February 15, 1966). Sole licensee for both inventions.

Description of commercial use: At a cost of $147,000, the company produced one model of the space capsule as an entertainment ride. The capsule was on top of a 106' tall "rocket." The device is now for sale.

Invention: Dynamic Transducer
(Patent Application Serial Number: 355,129)

Company: Straindyne Engineering Company. The 10 employees of this company engage in the production of transducers. Sole licensee.

Description of commercial use: Straindyne Engineering has spent about $3,500 on this invention. There have been over 300 inquiries about this invention; but there have been no sales and the company has had only "negative benefits" from the licensed invention. The company would engage in market research if it had exclusive rights to the invention.

Group HP Inventions. There are four inventions with high commercial potential.

Invention: Alkali Metal Protective Coating
(Patent Application Serial Number: 452,945)

Companies (3): W. P. Fuller Paint Company, a division of Hunt Foods, Inc. Approximately 1,300 people are employees of Fuller Paint.

Garan Chemical Corporation, with 50 employees, makes chemical specialty products.

Louisville Paint Manufacturing Company, Inc. This company was purchased in September, 1965. It has 15 employees, but it expects employment to rise to about 30 by the end of 1966.

Description of commercial potential: The probability of use is estimated to be between 50 per cent and 90 per cent. Two of the three companies believe the product will be commercialized late in 1966. Each of the companies has spent funds for development. One spent $300, another spent about $4,000, and a third made a "moderate" expenditure. Future costs might total between $25,000 and $30,000 for two of the firms. Most of this is to be for testing and sales development. The three companies gave the same reason why the invention has not yet been actually commercialized--inability to standardize formulas. None of the firms would commercialize the invention more rapidly with exclusive rights.

Thirteen additional firms are licensed to use this invention; commercialization by 10 of the 13 companies is remote. The other 3 companies are more enthusiastic and might commercialize the invention. These companies have also encountered serious flaws in development.

Invention: Sterilization Process and Product (Patent Application Serial Number: 440,033)

Company: Scientific Enterprises, Inc. The company manufactures micro-clean packaging materials for the aerospace industry. It has 20 employees. Sole licensee.

Description of commercial potential: Scientific Enterprises is in the process of putting the invention in use, having spent a "moderate" amount on development. The company believes that there is a 75 per cent probability that the invention will be on the market in the spring of 1967. At present, the technology is too sophisticated for the aerospace industry. According to the company, exclusive rights to the invention would not hasten commercialization.

Invention: Electrical Connector for Flat Cables

Companies (2): G. T. Schjeldahl Company's 900 employees produce special purpose machinery.

Brown Engineering Company, Inc. The company employs 3,500 professionals to develop and to make electronic equipment and vehicle and ground support structures.

Description of commercial potential: The probability of expected commercialization in the near future is 50 per cent. Each company has spent funds for development; one company believes future development costs could amount to $50,000. The reasons for lack of use are insufficient market demand and high development costs. Each company says it would develop the invention faster with exclusive rights. One company is waiting for a specific order to justify development investment.

Invention: Optical Communications Device
(Patent Number: 3,215,842)

Companies: This invention shows strong commercial potential when the replies of the 29 licensees are pooled.

Description of commercial potential: One firm, the Acme-Lite Manufacturing Company, believes there is a 50 per cent probability that it will commercialize the invention by 1967. But that company has not yet spent money on the invention. Four additional firms are less optimistic about the commercial potential of the invention, believing the probability of use is between 30 to 40 per cent. Only one of these companies has incurred development costs, which were "slight". The concensus among all of the firms is that future development costs will be small. The main reasons for lack of actual commercial use are insufficient market demand and better alternatives. None of the five licensees who are most likely to commercialize the invention believe exclusive rights would expedite matters. Almost all of the 20 licensees learned about the invention from local newspapers, popular magazines, and trade journals.

Group MP Inventions. Seven of NASA's licensed inventions hold moderate commercial potential.

Invention: Gas Purged Dry Box Glove
(Patent Application Serial Number: 425,096)

Companies (2): The Pioneer Rubber Company

Renco Dry Box Glove Company

Description of the commercial potential: The combined replies of the two licensees give this invention a moderate chance of being commercialized. Each company has spent development funds. One company made the invention for NASA; that company believes there is only a 10 per cent probability of commercial use. The other company estimates the probability at 25 per cent. One of the companies believes the invention would be developed with exclusive rights. The reasons for the lack of actual commercial use are insufficient market demand and the availability of substitutes.

(One additional company is licensed to use the invention but commercial use by that company appears to be unlikely.)

Invention: Slit Regulated Gas Journal Bearing (Patent Number: 3,132,903)

Company: Miniature Precision Bearing Company, sole licensee.

Description of commercial potential: After spending about $500 on this invention, the company gives a 10-20 per cent probability that it will commercialize the invention in late 1966. Actual commercialization is contingent on the success of additional development work. At present, the technology is too sophisticated.

Invention: Process for Applying a Protective Coating for Salt Bath Brazing (Patent Number: 3,008,229)

Company: R. S. Cowen, Inc. Manufactures marine equipment.

Description of commercial potential: The company does not yet know whether the invention has marine applications. The firm made a "moderate" expenditure for development. The company believes that its efforts would be greater with exclusive rights.

(Use by the other licensees is remote.)

Invention: Hydraulic Drive Mechanism (Patent Application Serial Number: 425,362)

Companies (2): Barry Controls

Superior Manufacturing and Instrument Corporation

Description of commercial potential: After "slight" development expense, one of the companies hopes to have the product commercialized by January, 1967. That company believes exclusive rights would help in recovering a possible $20,000 for future development costs. When that company has only nonexclusive rights, it uses the technology in products on a "as needed basis" rather than investing in a "broad product line." The other company, which to date has only investigated market potential, believes it would do more with the invention if it had exclusive rights.

Invention: Frangible-Tube Energy Dissipation
(Patent Application Serial Number: 209,479)

Companies (2): Aerotec Industries, Inc.

Hexcel Products, Inc.

Description of commercial potential: The combined replies of the firms give this invention a moderate possibility for commercial use. One company expects a change in the size of the market by 1968 or 1969. The company gives the invention a 50 per cent probability for that time. One of the companies said that exclusive rights would hasten development. Future development costs might total between $30,000 and $50,000.

Invention: Method of Improving the Reliability of a Rolling Element System
(Patent Application Serial Number: 431,235)

Company: Houdaille Industries, Inc.

Description of commercial use: "Moderate" funds have been spent on this invention. The company gives the invention a 50 per cent probability of being used in "the next few years." Company officials state that commercialization would be faster with exclusive rights.
(Use by the other licensee is remote.)

Reasons for nonuse of NASA's inventions

A sizable proportion of NASA's patented inventions are not commercialized because the inventions have government applications only. Whether NASA or NASA contractors hold titles to the patents on these inventions is of little importance. Twenty-five per cent of all inventors believe that this is why their patented inventions have not been and will not be used. This reason is cited more frequently by NASA employees than by employees of NASA contractors--29 per cent compared with 12 per cent, respectively. "For government use only," is the reason given by a slightly larger percentage of inventors with AEC and

Table 4--5

Reasons for Nonuse of Inventions Owned by NASA

Reasons	By Inventor No.	By Inventor Per Cent	By Licensee No.	By Licensee Per Cent
Insufficient market demand	34	30.7	34	27.2
Government use only	28	25.2	3	2.4
Superior substitutes	9	8.1	20	16.0
More important alternatives	3[a]	3.0	14	11.2
Technology too sophisticated	12	10.8	3	2.4
Insufficient time	2[b]	1.8	12	9.6
Development showed serious flaws	1	.9	9	7.2
Development cost too high	7	6.9	8	6.4
Insufficient publicity	11	9.9	0	0.0
Outside product line	0	0.0	7	5.6
Invention obsolete	3	2.7	4	3.2
Other	1[c]	.9	11[d]	9.6
Total	111	100.0	125	100.0

[a]Inventors reported more important research and development projects.

[b]Inventors reported inventions still in experimental stage.

[c]Invention being tested for safety by the United States Coast Guard.

[d]Includes: 7 licensees that are no longer in business and four licensees having only academic interest in the inventions.

Source: Inventor and Licensee Questionnaires.

with DOD--31 per cent.[12] The closely related reason, too sophisticated technology, accounts for the nonuse of an additional 10 per cent of NASA's inventions.

Because the licensed inventions have been selected by firms for their apparent commercial potential these two reasons are less important reasons for nonuse by licensees. In contrast, insufficient market demand, availability of substitutes, and better alternative investments are the main deterrents to commercialization by nonexclusively licensed firms. A better invention was the reason why Union Carbide requested NASA to terminate its exclusive license.

Use without licenses?

The commercial use of NASA's patented inventions without licenses could be important if it would impair estimates of how much new technology gets used. We know of no evidence suggesting that any of NASA's inventions have been used without licenses. But we cannot rule out the possibility.

Furthermore, it is not likely that many of NASA's inventions are, or will be, used without licenses. This would be true even if NASA did not enforce its patents. NASA provides technical assistance to its licensees, including the heretofore unheard of thing of seeing to it that licensees can get copies of patent applications pending in the U. S. Patent Office. This technical information is not as readily available to unlicensed firms. NASA can grant exclusive rights to its

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[12] Holman, *op. cit.*

patented inventions that have not been licensed nonexclusively. The exclusive licensee can, of course, enforce the rights transferred by NASA.

If the experience of other government agencies is any guide, the most that can be expected is that for each licensed invention in use, another will be used without a license.[13] But whether this will happen to NASA is sheer speculation.

Development Expense and Effort

It is generally agreed that patent rights can be necessary as an incentive to call forth private risk capital to bring inventions to the point of practical application. When inventions are technically developed, risks can still exist. They include those risks associated with advertising and marketing. Inventors and firms licensed to use NASA's inventions provided some information about development expenditures.

As we said, inventors believe that about 30 per cent of their inventions lack commercial potential. Obviously, no funds will be spent on these inventions. Inventors report that slightly over half of those with commercial potential require further development. The percentage of NASA's inventions that need more development is about the same as that for government-owned patented inventions administered by the Department of Defense and by the Atomic Energy Commission.[14]

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[13] Ibid., pp. 149-161.

[14] Ibid., p. 152.

The response of licensees to the request that they supply data on actual amounts spent to develop NASA's inventions was disappointing. Only 8 companies (including NASA's exclusive licensee) provided dollar figures on development costs. Twenty-six additional companies, however, supplied qualitative information. These qualitative statements about development expenditures must be interpreted cautiously. The amount of development that one company believes to be "slight" might be considered "moderate" or "substantial" by another company. For example, several thousand dollars spent for development might be insignificant to a company with annual sales amounting to millions of dollars, whereas the same expenditure for a one-man, one-product company might be "substantial." Nevertheless, qualitative statements about development costs tell us something about the relative importance of NASA-owned inventions compared with alternative investment opportunities within a given firm.

The following 7 companies spent about $17,000 (together) developing NASA-owned inventions: Fuller Company, Koppers Company, Louisville Paint Manufacturing Company, Miniature Precision Company, The Pioneer Rubber Company, G. T. Schjeldahl, and Straindyne Engineering Company. Slightly over half of that amount was for the development of the Alkali Metal Protective Coating. The Steelcraft Company spent $147,000 to build the entertainment device that incorporates two of NASA's licensed inventions.

The qualitative replies show that no company spent what it believed was a "substantial" amount on a NASA-owned invention. Sixteen of the 26 companies giving qualitative information incurred "slight" development expenses. The remaining 10 licensees spent "moderate" amounts.

So far, NASA's exclusive license agreements require licensees to spend funds for development.[15] Union Carbide's exclusive license ended when development funds were not justified. In its exclusive license agreement with NASA, the Exactel Instrument Company agreed to spend a minimum of $5,000 annually (for at least three years) on engineering and market development. By mid-1966, that company had spent about $7,000.

Exclusive Rights

Nonexclusive licensing is a factor contributing to the lack of use of NASA's inventions. To be sure, it is not the only reason nor is it the most important one. The great majority of NASA's inventions lack commercial potential. Nevertheless, 19 of NASA's nonexclusively licensed inventions have at least a moderate chance of being used commercially. Replies of licensees indicate that 11 of the 19 inventions would have been developed faster, or brought into use, if the companies had had exclusive rights to the inventions. Several of the companies stated that they had requested, and were denied, exclusive licenses. Two of the three firms with inventions in actual use want exclusive rights. The third company does not: the inventions are obsolete.

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[15]Does not include the unusual license agreement with AVCO, Inc.

Comparison of NASA with Four Nonprofit Organizations

A little more, though admittedly incomplete, light can be thrown on NASA's licensing program by comparing it with those of three leading universities and Research Corporation. Some numbers are displayed in Table 4--6.

For the comparison, the universities we chose are the California Institute of Technology, the University of California, and the Massachusetts Institute of Technology. These distinguished universities are important as contractors to NASA. Besides that, their patent officers furnished us with data. So far as we can tell, the other nonprofit organizations that are important NASA contractors, as judged by numbers of disclosures and petitions for waiver, carry on patent activities on only a meager scale. A possible flaw in our comparison is that still other larger and patent-conscious universities might have patent operations quite different from those of the three we have selected.

NASA and these patent-conscious institutions resemble each other in several ways. They are nonprofit and they have fairly sizable patent operations. For the universities, inventions are a mere byproduct of the research they conduct and sponsor. Patentable inventions do turn up; something must be done with them. In addition to obtaining patents on inventions from its sponsored research, Research Corporation also serves about 180 universities and other nonprofit organizations through its invention evaluation and patent licensing (see Chapter 2) programs. To put the good inventions into commercial use, NASA, the universities,

Table 4--6

Patent Licensing Activities of NASA, of Research Corporation, and of Three Leading Universities--California Institute of Technology, University of California, and Massachusetts Institute of Technology

Periods: For NASA and Caltech, to Dec. 31, 1965
For Univ of Calif and MIT, to June 30, 1965
For Research Corporation, early 1966

	NASA	Research Corporation	Caltech	Univ of Calif	MIT
Portfolio					
Patents issued	268	NA	62	NA	143
Patent applications	512	NA	52	NA	62
Total	780	700[a]	114	117[b]	205
Inventions licensed					
Patents issued	25	NA	22		118
Patent applications	22	NA	6		36
Total	47[c]	60[a]	28		154
Total licenses	87	200[a]	28	43	39[d]
Inventions yielding income	5[c,e]	30[a]	19[f]	27[g]	20

[a]Numbers are approximate. [b]"Upwards of 117." [c]Includes exclusive licensee.

[d]"Active" licenses. The government had licenses on 54 patents and 33 applications. There were 13 additional patents licensed both to the government and to business firms. The total of patents and applications with licenses to business firms only was 54.

[e]In actual commercial use, i.e., income to NASA's licensees.

[f]Includes 3 patents sold. [g]For 1963-64 and 1964-65.

Source: Data supplied by the five organizations.

and Research Corporation must find willing licensees. A great difference is that NASA does not seek licensing income, whereas the other organizations do. This is not because profits have even less of a meaning for NASA, but rather because of the tradition in the federal government that, in contrast to tradition, say in Western Europe, federal agencies do not engage in the ordinary, routine, business activity of buying, selling, and leasing property.

Another great difference is that the four nonprofit organizations almost never file patent applications unless their patent officers think the inventions have enough commercial potential to justify costs of filing. Because it tries to recoup its patenting expenses, Research Corporation considers NASA inventions as "not attractive" (not to mention two or three from The George Washington University). In contrast, only about 14 per cent of NASA's inventions were thought, at the time of filing, to have any <u>commercial</u> potential at all (see Appendix Table H--3).

Thus it is not at all surprising that NASA has a much smaller proportion of inventions in actual commercial use. Another cause must be the newness of the agency and of its licensing program. The three universities and Research Corporation have been in the patent business much longer. They have built and are experienced in dealing with networks of communications with possible and potential licensees. They solicit licenses for their patents. One of them employed for one year a full-time agent with the principal duty of finding new licensees; but he could not produce enough income to justify his salary. In contrast, Research Corporation has (1966) a full-time agent whose duty it is to find licensees for just a single invention (a cottage cheese flavoring process). It is reported that he has more than paid his way. Although the scale of their licensing operations is not large enough for really aggressive soliciting, the three universities do in fact solicit within the constraints of their resources. Each of these universities as well as Research Corporation, is also an established center of research, with many satellite private and public research organizations. In contrast, NASA's patent licensing program works remotely and almost passively. Lists of inventions available for licensing are disseminated broadly by the Department of Commerce and by the Small Business Administration. The Technology Utilization Program also participates in this activity.

Can NASA Encourage Wider Use?

Some information about the effectiveness of NASA's efforts to encourage commercial use of its inventions comes from inventors and licensees. Questions two and three of Part II of the inventor questionnaire were designed to get comments from inventors that reflect approval or dissatisfaction with NASA's utilization policies. In addition to the nine specific questions we asked licensees, we asked for any comments that they wished to make about NASA's patent policies.

NASA's technical information programs

We asked inventors, "How could or should NASA improve its programs for disseminating information about the inventions it owns?" (Part II-2).

Replies to this question indicate that most inventors are satisfied with NASA's programs for disseminating information about the patented inventions it owns. Also, the responses of NASA inventors are no different than the replies in 1962 of a group of inventors employed in government agencies.[16]

This question was not answered by 31 per cent of the inventors who returned our questionnaires. Undoubtedly, this reflects some indifference. Many NASA employee inventors think that their research results are reaching industry because of the exchange of visits between people in industry and in government, and also because of NASA's publication policies. With only a few exceptions, suggestions made by inventors for improving NASA's information programs are the very things that NASA is already doing. Inventors recognize this and believe that these efforts should be intensified.

A frequent suggestion is that NASA establish a program and a staff to rewrite technical reports for as many appropriate trade journals as possible. Two inventors want NASA to subsidize publication in trade journals to insure widespread coverage. This recommendation is in line with statements made by licensees. About one-third

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[16]Holman, *op. cit.*, pp. 354-355.

of them learned about their licensed inventions from trade journals.

Six inventors suggest that NASA establish "Trade Fairs" where working models of inventions could be shown. One inventor was quite enthusiastic about a technology utilization conference that the Lewis Research Center held for the petroleum industry. He believes that NASA should sponsor more of these conferences.

NASA's utilization programs

We also asked inventors, "How could and should NASA increase the commercial use of inventions arising from the research it sponsors?" (Part II-3).

Comments made by inventors reveal that they believe the generation and dissemination of information about NASA's new technology should be the limit of NASA's responsibilities to get inventions into the mainstream of technology. Forty-three per cent of those answering this question said that NASA should advertise its new technology. And another 22 per cent say that NASA has done all it should do and that it is industry's responsibility to commercialize those inventions it wants. About a fourth of the responding inventors believe that some kind of exclusive rights is necessary for commercial development and use of NASA's patented inventions. Exclusive licensing was cited as the means to accomplish this as frequently as actual ownership of patent rights by industry.

Few (only 24 per cent) licensees accepted our offer to comment on NASA's patent policies. The conclusions that can be made from the responses are: (1) there is no sharp criticism of NASA's patent policies and (2) there is some indifference toward NASA's patent policies by licensees. Several of them stated that they wanted some form of exclusive rights, others merely elaborated on reasons for lack of commercial use of licensed inventions, and still others described their experiences with NASA's technology utilization programs. The following are typical of the statements made by licensees:

> I still wish to obtain an exclusive license. I have exploited this patented invention for three years with moderate success.
>
> You should find a means of providing exclusivity (at least some degree). Public funds and public ownership are not incompatible with parceling up exclusive areas for exploitation (i.e., management of the asset).
>
> We are still proceeding with development work; to date we have had little success. The films are powdery, lack adhesion, and are of inferior quality.
>
> Although we have used none to date, we feel that the NASA Tech Briefs are worthwhile and appreciate receiving them.
>
> We feel that most businesses, particularly small businesses such as ourselves, are not aware of the programs available to them through NASA. Some program should be initiated to bring to the attention of more businessmen, the programs which are available through NASA.
>
> It would help us and help NASA to gain a better use of its available technology if we could, first, receive a listing of NASA's available inventions, preferably classified by scientific discipline and/or area of technology and/or type of manufacturing capabilities required; and, second, get more detailed information on the items in which we might express an interest on the basis of such a list.

Government Use of NASA-owned Inventions

Inventors were asked to report use by NASA, or by any other government agency, of their patented inventions. Their replies show that about 65 per cent of NASA's inventions are used by the government.

See Appendix Table E--7. By government use we mean production in government installations; research in government laboratories; production for the government in facilities owned by contractors; and research for the government in laboratories owned by contractors.

From most of the replies it is difficult to know whether NASA's is the only government use. Only three inventors explicitly state that their inventions have been used by the Department of Defense. From the descriptions of the government's use, we believe that most of NASA's inventions are used only by NASA. One inventor said, "First USA man in space." Another stated that, "The NASA surveyor spacecraft employs a limited form of the invention." Still another inventor briefly said, "Mercury spacecraft." A final typical reply was, "Used by JPL for Mariner Space Probes."

The largest number of inventions used by NASA are products or components of products. The next most important use of NASA inventions is use in contractor-owned or government research laboratories. The remaining inventions cover processes.

The rate of government use of patented inventions administered by NASA is somewhat lower than the rate of government use of DOD's and AEC's patented inventions. The government uses about 75 per cent of the inventions administered by these agencies. The lower rate of government use of NASA's inventions probably reflects NASA's policy of filing patent applications on some inventions that hold promise for commercial use and little prospect for government use. Also, NASA uses a larger percentage of the inventions it owns in research activities, compared with wider procurement use for AEC and DOD.[17]

Not surprisingly, the actual rate of government use as reported by inventors is lower than the rate of use anticipated by NASA's technical evaluators. Although it is probably less than for commercial use, uncertainties create a gap between expected and actual government use. The government also faces possibilities of nonuse of its inventions because of rapid obsolescence, serious flaws in development, and changing objectives. Examination of NASA disclosure cases shows that technical evaluators expect that NASA has or will be using about 98 per cent of the inventions on which it files patent applications (see Appendix G--2).

Findings

1. Two-thirds of the inventions owned by NASA are used by or for the government.

2. The rate of licensing has little or no relation to the rate of commercial use.

3. Five of the inventions licensed by NASA are in actual commercial use. Four of them are used by the companies where they originated. Three others are on the market, but are not yet (end of 1965) in actual use.

4. Five more licensed inventions have high commercial potential. Seven others have moderate commercial potential.

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[17] *Ibid.*, p. 363.

5. As of April 1966, no NASA-owned invention appeared to have a high value.

6. The development expenses so far incurred by NASA's licensees have been quite modest.

7. The predominant causes for nonuse of the inventions licensed by NASA are insufficient market demand and the availabilities of superior substitutes.

8. NASA's licensing program can best be compared with those of other nonprofit organizations.

9. Inventors believe that most of their inventions need further technical or marketing development, or both.

10. Inventors employed by contractors dislike seeing the Administrator's name on patents.

Chapter 5

The Operation of the Waiver Policy

Public controversy over the patent policies of the National Aeronautics and Space Administration has focused on the waiver policy. NASA has been criticized both for granting too many and for granting too few waivers on inventions made under its contracts.

Background of the Waiver Policy

Section 305(a) of the National Aeronautics and Space Act of 1958 says that title to inventions made under NASA contracts shall go to the United States. Section 305(f) says that the Administrator may waive part of the rights of the government if he determines that doing so will serve the interests of the United States.

The Act does not say that taking title shall be the normal action and granting waivers the exceptional action. Neither does it say the opposite. The Act offers no guides or criteria for this highest of policy decisions: The wise mixture of titles and waivers. The intent of Congress in adopting the patent provisions of the Space Act of 1958 is not fully clear. Appendix A covers the legislative history of these patent provisions. In our opinion, the intent of Congress was to provide a flexible blance betweeen the needs of government and the preservation of incentives for individuals and business firms.

The atmosphere in 1958 was one of urgency. The space program was new; space research held out the possibilities of unprecedented and perhaps awesome discoveries. Great inventions would have to be under control of the government, either because they would be part of the keys to wholly new fields of science or would help create new industries. The obvious precedent for NASA's taking title was atomic energy. At the same time, the interests of industry in undramatic inventions were recognized in the traditional manner, by providing in the waiver policy for the preservation of incentives.

Title, then, was to be taken to the great or path-breaking inventions of indisputable national interest. Waivers were to be granted on humdrum inventions of interest to industry and without importance to government. So we interpret the intent of the Act.

The space program has accomplished much since 1958; space technology has advanced far. To date (1966), however, no powerful or great invention has appeared. The significance of the patented inventions coming out of NASA's programs is weak when it is contrasted with the technical accomplishments in and for outer space.

The Presidential Memorandum of 1963 resembles the Space Act of 1958 in giving no guides as to the proportions in which titles go to the government and to contractors. Although all federal agencies now use the same criteria in deciding on the rights to inventions resulting from their R & D, the various agencies interpret differently the criteria set forth in the Memorandum.

NASA's Cautious Procedures

In considering and acting on petitions for waiver, NASA has proceeded with great caution and circumspection. The cautious procedures did not change after the Presidential Memorandum. The Inventions and Contributions Board studies each petition with care; the staff of the Board prepares written analyses of the petitions; the members of the Board deliberate the merits, under the regulations, of each of the petitions. The General Counsel passes on the recommendations of the Board before they reach the Administrator.

Each petition must recite factual materials on, among other things, the kind of business the contractor is engaged in. NASA does not take judicial notice that the companies whose names are household words do what they do. The telephone company must prove that it is in the communications business. The best-known computer company must get together a package of brochures to help prove it is in fact in the computer business. World-renowned universities must explain who they are and what they do. A contractor making a second petition must repeat the recital of facts. Each time a university petitions for a waiver, it must explain how it intends to get the invention into commercial use. NASA has no list of universities with approved patent policies.

On top of its prudence in granting waivers, NASA retains "March-in-Rights." With them, NASA may compel contractors to grant licenses on the waived inventions to others. At NASA's option, the licenses might be royalty-free. NASA can use its "March-in-Rights" if:
(1) contractors do not work waived inventions, and make them reasonably

available to the public, within three years of issue; (2) the inventions are needed for the public health; and (3) the inventions are needed for public use by government regulations.

NASA also asks contractors to report annually on the actual and expected commercial use of their waived inventions.

Titles and Waivers for Contractor Inventions

Even with its waiver policy, NASA still takes titles to contractor inventions. At the end of 1965, NASA's balance between titles and waivers was about three to two.[1] The experience of the Department of Defense during the 17-year period ending in 1962 resulted in a ratio of titles to licenses of about 1 to 3. At the end of 1962, DOD had been assigned 5,158 patented inventions and had licenses to an additional 16,925 patented inventions resulting from its contract research.

For employee inventions there are no policy issues. The inventors are an unorganized and inarticulate group. Since 1950, government agencies have been required by Executive Order to take titles to inventions made by their employees. The Presidential Memorandum of October 10, 1963 does not mention inventions made by government employees. Occasionally, government employee inventors ask for titles to their inventions. Some NASA inventors have acquired ownership rights; a few of their inventions have been commercialized.

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[1]NASA owned 339 inventions from contractors. This number includes patents issued and applications pending and in preparation. The Inventions and Contributions Board had granted or recommended grant of 238 waivers.

Action Under the Waiver Regulations

It would be inappropriate for us to make detailed commentaries on the Patent Waiver Regulations of 1959, 1964, and 1966. Although the petitioners and the Inventions and Contributions Board have to observe them and proceed with due respect for their form, many of the provisions in the regulations have not been operational, in the sense that waivers are granted or denied because of these provisions. Hence we shall ignore them and shall focus our attention on the policy essentials.

Under the 1959 regulations the Inventions and Contributions Board could recommend the grant of a petition if it found that the invention was of only incidental utility to NASA, and that either the invention had substantial promise of commercial utility or the contractor had spent more of his own money than of NASA's on research leading to the invention, or both. The 1964 waiver regulations follow verbatim the guide lines of the Presidential Memorandum of 1963. In brief, a waiver was granted if the petitioner could show that he would not acquire a dominant position in a field of technology mainly developed and funded by the government and that waiver of title was a necessary incentive to induce him to spend money on the invention.

The 1964 regulations were more cumbersome in form and in substance; they placed a much heavier burden of proof upon petitioners. The Board does not accept naked allegations. It demands, and deliberates upon, statements of specific facts. It is easy to see this in the Board's published decisions.[2] The 1966 regulations seem to relax just a little the rigor of the proofs the petitioner must submit.

Table 5--1 summarizes the actions of the Board to the end of 1965. In our analysis of the waiver program we consider a petition granted when the Administrator signs the document, rather than when the Board recommends that he do so. Thus our percentage figure for grants under the 1964 regulations might be too low; it is indeed based on small numbers. In the Board's published decisions, 19 of 25 petitions, i.e., 76 per cent, are recommended for grant.

Petitions for waivers on individual inventions

To December 31, 1965, 102 contractors had petitioned for waivers on 313 inventions.[3] There is a minor, and unimportant, discrepancy between the numbers of petitions we counted from NASA's files and the numbers of petitions reported by NASA in its April, 1966 Program Review Document, Patent Program. In that report, the total number of petitions on individual inventions is given as 326. As Table 3--7 shows, petitions have been a sharply declining percentage of invention disclosures since

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[2] NASA, Petitions for Patent Waiver. Findings of Fact and Recommendations of the NASA Inventions and Contributions Board. Washington, D. C., 1966.

[3] After filing, 18 contractors withdrew 31 of their petitions. The usual reason for withdrawal was that the invention lacked commercial potential after superior substitutes were developed. Almost all of these inventions were of little use to the government. NASA did not file patent applications on most of these inventions and even abandoned several patent applications. Under the waiver regulations of 1959, the Inventions and Contributions Board granted 173 waivers to individual inventions. Of these, contractors later requested NASA to void 13 waivers. These inventions too had lost their commercial potential and contractors decided not to file patent applications.

Table 5--1

Waiver Petitions Granted
to December 31, 1965

NASA Regulation	Petitions	Net Petitions[a]	Granted	Per Cent of Net Petitions Granted
1959 regulations	220	192	173[b]	90.1
1964 regulations	93	14	9[b]	64.3
Blanket waivers (105)	76	11	7[c]	63.6
Advance waivers (104)	151	136	30[c]	22.1
Combined blanket and advance waivers	227	147	37[c]	25.2

[a]Petitions minus those withdrawn and pending.

[b]By the Administrator.

[c]Includes those recommended for grant.

Source: ICB and AGP files, NASA.

1961. Petitions were 40 per cent of disclosures in 1961. In 1965, contractors filed petitions on fewer than 5 per cent of their disclosures.

Table 5--2 shows that under the 1959 regulations the ICB granted the majority of waivers (68 per cent) because of the inventions' commercial potential. Twenty-seven inventions qualified under two or more criteria. Only five per cent of the waivers were granted because the inventions were conceived prior to and independently of work performed under NASA contracts. Contractors owned patents, or had filed patent applications, before awards of contracts.

We have some information about the relative amounts spent by contractors and by NASA for 27 of the 38 inventions waived because they had spent more of their own than of NASA's money on research leading to the inventions. These amounts were reported by contractors in their petitions for waivers. The amounts reported spent by contractors in the field of technology of the invention are many times the amounts funded by NASA. See Table 5--3.

Reasons for denial

NASA denied 24 petitions for waivers to individual inventions on or before December 31, 1964.[4] All but five of these inventions were denied under the 1959 regulations. NASA denied 11 petitions because the inventions were primarily used for the operation of space vehicles (Section 1245.104(a)). In addition to being inventions not generally

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[4]We do not include petitions for waivers recommended for denial by the ICB, nor do we include those inventions on which NASA granted waivers for foreign rights.

Table 5--2

Criteria for Granting Waivers under the 1959 Regulations

Criteria	Applications of Criteria	Per Cent
Application filed before award of NASA contract (b-1)	9	4.4
Contract to nonprofit organization not requiring delivery of models or equipment (b-2)	12	6.0
Substantial promise of commercial utility (b-3)	138	68.3
Contractor equity (b-4)	38	18.8
Foreign rights only (c)	4	2.0
Other[a]	1	.5
Total[b]	202	100.0

[a]Paragraph (d) of section 1245.104 of Waiver Regulations. Invention outside the scope of paragraph (b); Administrator deemed that a waiver would be in the interest of the United States.

[b]Total number of individual waivers granted under the 1959 Regulations is 173. The applications of criteria are 202 because 25 inventions qualified under 2 criteria and 2 inventions qualified under 3 criteria. The total excludes one blanket waiver and 2 class waivers.

Source: ICB files, NASA.

Table 5--3

Amounts Spent by Contractors and by NASA
on Fields of Technology of Certain Waived Inventions

Amounts Reported Spent by Contractor in Field of Technology of the Invention	Amounts Reported Funded by NASA	Remarks
$289,300,000	$26,300,000	Approximate amount spent by contractor since 1941.
110,000,000	20,000	Time period not given.
6,300,000	60,000	Amount spent by contractor since 1947.
4,500,000	61,000	Amount spent by contractor in 10 years. Contractor had $25 million in sales during preceding decade.
3,000,000	185,414	Amount spent by contractor between 1952 and 1963.
3,000,000	400,000	Time period not given.
2,549,000	243,145	Amount spent by contractor between 1957 and 1961.
2,430,000	364,500	Time period not given.
2,100,000	523,530	Time period not given.
1,800,000	27,000	Amount spent by contractor since 1951.
1,000,000	263,000	Time period not given.
1,000,000	14,000	Time period not given.

Table 5--3: Continued

Amounts Reported Spent by Contractor in Field of Technology of the Invention	Amounts Reported Funded by NASA	Remarks
$ 600,000 to 1,000,000	$ 11,000	Amount spent by contractor in last 20 years. Contractor provided extensive list of patents
700,000	80,000	Time period not given.
625,000	57,000	Amount spent by contractor in fiscal 1963. Contractor has 4 patents in field.
600,000	95,000	Three inventions and 3 petitions. Contractor in field of technology since 1940s. Contractor holds patents in field.
442,000	11,000	Time period not given.
436,000	26,000	Time period not given.
400,000	48,000	Time period not given.
400,000	5,990	Two inventions and 2 petitions. Timer period not given. NASA funds for feasibility study.
363,000	1	Time period not given. A one dollar contract, but contract made much government information available.

Table 5--3: Continued

Amounts Reported Spent by Contractor in Field of Technology of the Invention	Amounts Reported Funded by NASA	Remarks
$ 350,000	$ 103,696	Amount spent by contractor in fiscal 1957-1960. Contractor had sales of $2.5 million in fiscal 1961 and $3.5 million in fiscal 1962.
200,000	100,000	Time period not given.
103,000	28,000	Time period not given.

Note: Contractors' names and waiver case numbers are not given, to avoid disclosing information that might be regarded as confidential.

Source: ICB files, NASA.

eligible for waivers, the petitioners failed to show that these 11 inventions held substantial promise of commercial potential or that the contractor's background R & D expenditures were large compared with government funds. Petitions for waivers to inventions, not essential to the space program, were denied because contractors failed to show the inventions' commercial potential and also failed to prove that substantial amounts of private R & D funds had been spent. The other inventions denied under the 1959 regulations were made by nonprofit organizations, under NASA contracts that called for the delivery of models, equipment, or the development of practical processes.

Five petitions were denied under the 1964 regulations. The University of Arizona had four of these petitions. NASA denied the four petitions because the University of Arizona failed to show how it planned to get the inventions into commercial use. North American Aviation filed the other petition. That company's contract was in the field of technology of "soft-landing space vehicles."

The Inventions and Contributions Board published early in 1966 its reasons for recommending denial of four additional petitions for waivers on inventions. Two petitions filed by Midwest Research Institute were recommended for denial. In its petition Midwest Research Institute said that it had an arrangement with Battelle Development Corporation, but it failed to prove that it would submit the two inventions to Battelle for evaluation. Avco Corporation was turned down because it failed to show that risk capital had or would be spent for developing the invention and because it failed to show that other companies had patents. Hughes Aircraft Company's petition was recommended for denial for similar reasons. Many of the petitions that ICB rejected were poorly prepared. Some merely restated NASA's criteria for granting waivers, giving no specifics. None of the petitions denied under the 1964 Regulations for individual inventions were denied because the inventions were essential to the public health. Early in 1966 (after our cut-off date), however, the ICB recommended denial of one of the four petitions for reconsideration made by the University of Arizona, because the invention relates to public health. The other three were recommended for grant. Several contractors asked for reconsideration of their denied petitions. In most cases, reconsideration resulted in favorable action by the Board, because the contractors furnished the information lacking in their first petitions.

Fate of inventions in denied petitions

Seven contractors filed the 24 petitions denied by NASA by the end of 1965. One contractor, North American Aviation, filed 12 of them.

Patent counsel in NASA considered 13 of the inventions in the denied petitions to be sufficiently valuable to warrant patent action. Patent search for two of the inventions was adverse. One invention was pending search and another was pending preparation of a patent application at the end of 1965. NASA filed patent applications on nine of the inventions. NASA has not granted any licenses to use these inventions because there have been no requests.

Waivers as a Function of Disclosures, Contract Awards, and Contract Size

The determinants of the number of waivers granted are numerous and complex. A statistical analysis of the relationship between the number of waivers granted (variable Y), total cumulative (1959-1965) disclosures (X_1), cumulative (1959-April 1965) NASA prime contract awards in millions of dollars (X_2), and contractor size in thousands of employees (X_3) has been somewhat fruitful. Constraints on data limited this analysis to twenty-seven fairly large firms.

Utilizing the technique of multiple linear regression with the number of waivers granted (Y) as the dependent variable and with X_1, X_2, and X_3 as the independent variables results in the following equation:

$$Y = 1.5148 + .0107 \cdot X_2 + .0022 \cdot X_2 - .0038 \cdot X_3$$

The coefficients describe the average effect on Y for a one unit change in the independent variable being considered--holding the other independent variables constant. That is, given the level of contract awards and contractor size, one additional waiver is expected for about one hundred additional disclosures by a contractor. Similarly, given the level of total disclosures and contractor size, one additional waiver is to be expected for about each additional $450 million in cumulative contract awards.

The interrelation between cumulative disclosures and cumulative contract awards is, as was shown in Chapter 3, highly significant (r_{12} = .8088). In Chapter 3 we stated that it takes approximately four million dollars of cumulative contract awards to yield one disclosure; the coefficient for X_2 indicates that almost one half billion dollars of additional cumulative contract awards are necessary to yield one additional waiver.

The linear model fits the data for this group of contractors very well. Fifty-eight per cent ($R_{y\cdot123} = .7631$) of the variation in the number of waivers granted can be explained by variations in the number of disclosures, cumulative contract awards, and contractor size in the equation. If no correlation exists between waivers and these variables, a value of $R_{y\cdot123}$ as high as .7631 could be expected to occur by chance less than one time in one hundred (according to a test for the significance of the correlation coefficient using Student's T-Test--t = 5.66 with 23 degrees of freedom).

Influence of size

The size coefficient is so small that it can be neglected. The coefficient and its sign are not significant in the statistical sense; that is, they could easily reflect chance variations. If size were a definite determinant of the number of waivers granted to contractors we could expect to find a significant relationship between Y and X_3. However, among this group of large firms, differences in size do not appear to be an important characteristic in determining differences in waiver holdings. The size variable contributes little to the explanation of the variation in waivers, and when it is not included the variation explained drops only 0.6 per cent.

Class, Blanket, and Advance Waivers

Waivers granted at the time of contract are variously known as class, or blanket, or advance waivers. These terms are roughly interchangeable. Class waivers, however, were granted early in NASA's activities, as the result of attention to special situations. The recent tendency has been to refer to all waivers not covering individual inventions as advance waivers.

The class waiver (W-140) granted under a cooperative agreement with the American Telephone and Telegraph Co. in 1961 resulted in 24 "suggestions." Applications were filed on only two or three of these, and only, we were told, for the sake of the inventors' egos. Otherwise, the inventions have, we are told, no use to the Bell System, though they might have to Comsat.

RCA's class waiver (W-248) granted in April, 1964 resulted in two invention disclosures by the end of 1965. One of these was found by RCA to be less promising than had originally been believed. RCA chose not to file a patent application and turned the invention over to NASA. On the other invention, already in use in RCA laboratories (though not yet in commercial work), RCA did file a patent application.

IBM's petition for a class waiver (W-133) was denied early in 1963. The Inventions and Contributions Board thought that since the contract in question was a subcontract the petitioner ought to wait for individual inventions and petition on them.

By the end of 1965 the Inventions and Contributions Board had received a total of 76 petitions for blanket waivers, most of the petitions being made in 1965. Four were denied, four were withdrawn, and only seven were granted. Still pending on December 31, 1965 were 61 petitions for blanket waivers. However, the Inventions and Contributions Board had recommended action on some of these. One or two of the petitions were withdrawn because the contractors finished work under their contracts, before any inventions appeared, and before the Board could act.

In 1965 requests for over 200 advance waivers were decided in NASA's field centers. About half the requests were denied. The ratio of denials to requests varied much from one field center to another. We have the impression that a higher proportion of requests for advance waivers are carelessly prepared than is true of petitions to the Board.

Of course, a good number of the requests are prepared carefully with full documentation. One of the largest electrical companies sent in such a request. The Board reviewed and approved the favorable action of the contracting officer. The company was granted a blanket waiver on all of the inventions coming from the work under the contract--which was for $5,260.

Under the waiver regulations, universities and other nonprofit organizations may not be granted blanket or advance waivers. Even though they might otherwise fully qualify, these organizations do not meet the test of having "an established nongovernmental commercial position." The fault here lies, not so much with the 1964 regulations, as with the Presidential Memorandum from which the regulations were adapted.

So far as we can tell few inventions have been (to mid-1966) reported by contractors who have received advance waivers. In mid-1966 headquarters had received invention disclosures from only one field center.

The inventions came from three contractors. Other field centers have received invention disclosures but have not had time to forward reports to headquarters. Invention disclosure reports first go to Technology Utilization offices. Marshall Space Flight Center, however, has not received any inventions from contracts with advance waiver provisions.

Patent counsel at Goddard informed us that one contractor reported 10 inventions. After patent search, the contractor filed applications on two of the inventions. Langley has received about 18 disclosures, with contractors filing patent applications on about half of the inventions. The Lewis Center has had one invention disclosure, under patent application. Lewis also reports that there have been 6 invention disclosures made under a contract with a request pending for advance waiver.

International Business Machines disclosed 6 inventions to the Manned Space Flight Center. That company indicated it had no intention of filing patent applications on any of the 6 inventions. In addition, MSFC has received 2 inventions, under patent applications, from Union Carbide.

Union Carbide also disclosed an invention to JPL. The invention is covered by a patent application; it is under security restrictions. In addition, JPL reports that work has been completed, with no inventions, on another subcontract that incorporated the advance waiver clause.

There is little doubt that time lags are responsible for the few inventions reported by contractors holding advance waivers. There can be delays in beginning work after a contract is executed. Then there comes the unpredictable lapse of time until an invention is made. After that there is the period of time for the handling of the invention by inventors' supervisors and by other men who pass upon it. When the report of the disclosure finally gets into the stream of NASA's information system more time elapses.

Contractors' Opinions of the 1964 Regulations

In Chapter 3 we discuss the effect on disclosures of the prevailing image of NASA's patent policies. Many contractors think of NASA as a title-policy agency with a tough waiver policy. It is not known or understood that NASA does in fact grant most petitons for waiver.

As we have said, for individual inventions the 1964 regulations are more onerous than those of 1959. The great difference is the provision for advance waivers in the 1964 regulations. Contractors, accordingly, must weigh the disadvantage of the higher standards of proof required in petitions for waivers on individual inventions against the advantage of having the right to request advance waivers. But just how the scales are tipped in contractors' minds we do not know for certain. This is an important matter because opinions of regulations can influence the actions of contractors.

What we are sure of is that there is widespread misunderstanding and ignorance of the waiver regulations. To this there are of course exceptions. Still, it is to be remembered that nearly all of the contractors we wrote to, or sent questionnaires to, or interviewed were contractors with direct experience with the waiver regulations.

In the waiver questionnaire we asked contractors their opinions of the effectiveness of the 1959 and the 1964 regulations in getting inventions into the mainstream of commerce. Question 2, Part VI of our questionnaire was:

> In your opinion, do NASA's new (1964) waiver regulations do more or less than the old (1959) regulations to move inventions into the stream of commerce?

Table 5--4 shows a slight preference for the 1964 regulations, despite the fact that a somewhat smaller percentage of petitions for waivers have been granted under these regulations. The reason for the preference must be the provision in the 1964 regulations for advance waivers. A fourth of the contractors, all of whom had been granted waivers, do not know which set of regulations are superior. We believe that this, along with the other kinds of replies shown in the table, reflect misunderstanding and ignorance.

The following excerpts are typical of those made by contractors who prefer the new regulations.

A small research (for profit) firm responded:

> Yes--Because the new regulations require the contractor to establish his commercial position prior to the contract. If the contractor wants commercial rights, he must pursue them with a firm basis.

Table 5--4

Opinions of NASA Contractors
About the 1959 and the 1964
Waiver Regulations

Reply to Question	Number of Contractors	Per Cent of Contractors
Prefer 1964 regulations	19	32.2
Prefer 1959 regulations	9	15.2
Indifferent or no opinion	13	22.1
Neither regulation satisfactory	3	5.1
Do not know[a]	15	25.4
Total responding to question	59	100.0

[a]Includes 4 contractors who said "no comment."

Source: Waiver questionnaires.

A medium-sized firm replied:

> More. Simply because it is easier to obtain a waiver and obtaining title is some inducement to develop an invention.

A large aircraft company said:

> More; by virtue of provision for waiver at time of contract. Although the new provisions concerning waiver after reporting of inventions may be some improvement by reason of incorporation of the President's Patent Policy of 1963, there remain the old problems of satisfying NASA concerning petition content and waiver voidability backfire effect.

A large electronics company replied:

> The 1964 NASA regulations are a step forward in that the contractor can now know prior to accepting a contract whether he will be able to retain title to inventions. This aids the contractor in protecting his proprietary interests, and benefits the government in that the contractor is more likely to seek contracts in areas in which he has know-how gained from his own research and manufacturing experience. Since contractors will be more likely to do government research in the areas they know best, the flow of inventions into the stream of commerce should be increased.

One large contractor displayed the quality of his understanding of the regulations in his reply:

> Yes. The regulations and criteria are now simpler. Non-use is no longer grounds for termination of waiver. It is not seen, however, that such factors will increase the requests for waiver.

One university replied simply, "Old regulations easier for universities."

A spokesman for another university said,

> From the University's standpoint they (the new) do less since the universities do not have an established commercial position as such.

Contractors were also unhappy about the lack of uniformity among field centers in interpreting criteria for advance waivers and also in granting them. To some extent, this was corrected in May, 1966 when NASA took the responsibility for granting advance waivers away from contracting officers and placed that responsibility with the Inventions and Contributions Board.

A large chemical firm replied,

> Experience with the new NASA waiver regulations is that the contracting officer will not make a decision on the blanket waiver so we prefer to request waivers as the inventions are made. Thus for our corporation, the regulations are substantially the same.

Problems of Administration

Like other quasi-judicial bodies, the Inventions and Contributions Board is faced with administrative problems. We confine ourselves to four following problems of administration: (1) defining "field of technology;" (2) handling the nonprofit organizations; (3) speeding the time required for acting on petitions; and (4) coordinating with the Office of Technology Utilization.

Field of technology

Perhaps the most difficult task in interpreting and applying the regulations of 1964 is given by the phrase "field of technology." The Patent Waiver Regulations follow verbatim the language of the Presidential Memorandum of 1963. Our comments here apply, then, both to the regula tions and to the memorandum.

Obviously there can be no single and everlastingly correct definition of field of technology. Definitions depend on purposes of investigation or decision. Because of this, no help can be found in established and well tested classifications or systems of definitions, such as the classification of patents by the Patent Office, or the classification of industries by the Bureau of the Census, or the classification of fields of science by the National Science Foundation.

How to classify things is a problem sometimes solved by time; those concerned come in the end to satisfactory agreement as to what belongs into which group--or field. Such a solution is however unlikely to occur for technology, in view of its ever-changing nature and the rapid rate of obsolescence of so many of its parts. Besides that, solution does not come when opposing interests try to frame definitions of the same thing. Examples are "fair return" in the regulation of public utilities and the "relevant market" in the prosecution of the antitrust laws. Although a "good" definition of fair return or of relevant market might be worth millions of dollars to a business firm, we find it hard to imagine that much money could be at stake in a definition of field of technology.

Clearly, science or technology can be divided into any number of fields. If they are few, each field is then broad, with the result that waivers would nearly always go to contractors. With many narrowly defined fields, contractors would often find it difficult to qualify to receive waivers.

It seems to be generally agreed that atomic energy is an example of the kind of field where the test of government funding together with the possibility of dominance would keep title out of the hands of private contractors. It is only slightly irrelevant for us to draw attention to the fact that the long-standing and firmly administered policy of government acquisition of all inventions having to do with atomic energy did not prevent domination of the business of producing large-scale nuclear reactors by two companies, which in 1966 had only modest potential competition. Here again, it ought to be obvious that patents are less important than they are usually made out to be. The success of two companies in getting orders for nearly all of the reactors for large electric power plants seems to be due scarcely at all, or for all we know not at all, to patents but rather to background, know-how, and to copious amounts of private R & D.

However that may be, there is now no agreed-upon list of fields of science or technology meeting the criteria of government funding plus possible dominance. The Federal Council for Science and Technology in its Annual Report on Government Patent Policy (June, 1965, p. 19) has recommended that agencies identify the fields meeting the criteria. If NASA would follow this suggestion, draw up and publish a list of these fields, there would be costs and benefits. The costs would be the trouble and the manpower of making the list. The benefits would accrue to NASA field patent counsel, to headquarters patent counsel, and above all to the Inventions and Contributions Board. The benefits should much exceed the costs.

Still, the concept of "preferred or dominant position" remains quite vague. In its 1965 interpretive statement on the Presidential

Memorandum, the Federal Council for Science and Technology uses the expressions "dominant position" and "position of patent dominance."[5] Dominant position in a "field" suggests the idea of "too large" a share of a market and holding smaller competitors in some kind of thrall. Patent dominance is, or easily could be, something quite different, or for that matter, several different things. It could mean dominating a small market, with one or several patents; or it could mean dominating several closely related markets, with dozens of patents; or perhaps it could mean the sheer sizes of patent portfolios.

Anyway, in following the directive of the Presidential Memorandum, NASA has a difficult task. The Inventions and Contributions Board must decide whether exclusive rights to inventions would give contractors dominant positions in fields funded by the government. The Board cannot and should not proceed with the same deliberation employed by the antitrust agencies when they face the problem of what are relevant markets.

We venture the opinion that the Inventions and Contributions Board has been too narrow, too literal, and not always consistent, in its interpretation of field of technology. The lack of parallel definition of field of technology arises in part because the Board starts from definitions supplied by contractors in their petitions for waivers. This speeds up the decision process a little. NASA's published waiver cases show that the ICB acted on six petitions for waivers in the field of

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[5] _Ibid._, p. 18.

computer technology.[6] This field of technology was defined in five different ways--some broad and some narrow. The definitions included: data processing, special-purpose digital computers, special-purpose guidance computers, plated wire or thin memory devices, and fluidics.

The universities and nonprofit organizations

In some ways the universities and nonprofit research organizations are the second-class citizens in the community of research and patents. This is not because the nonprofits are unimportant in federal R & D programs. On the contrary, their role has been increasing and it is not small. In the fiscal year 1965 alone, NASA had contracts with 197 universities and 74 other nonprofit organizations. By the end of 1965 NASA had received invention disclosures from 43 of these institutions. California Institute of Technology heads the list of contractors with the most "quality disclosures" (see Chapter 3). Waivers on 25 inventions had been granted to 8 universities and nonprofit organizations by the end of 1965.

Part of the problem of the position of the universities in NASA's waivers program lies with attitudes both within and without the university community. To discuss them is outside the scope of this inquiry. We can however mention a few things. In their corporate capacities a few universities will have nothing to do with patents. Two of NASA's waivers

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[6] National Aeronautics and Space Administration, Petitions for Patent Waiver, Findings of Fact and Recommendations of the NASA Inventions and Contributions Board, (NHB 5500.1) Washington, D.C., 1966. The Waiver cases are W-423, W-373, BW-322, W-366, W-367, and W-368.

came from research conducted at Brown and Harvard Universities. In both cases the petitioners were the professors, acting as individuals. In general, however, the universities do have patent policies, practices, and procedures.[7] Many of them use as agents Research Corporation, Battelle Development Corporation and others. A few large universities handle their own patent activities.

The nonprofit organizations are generally new. Theirs tends to be a hand-to-mouth existence, with a preoccupation about keeping the contracts coming in. Patents are less important than the flow of new contracts. For years, one nonprofit organization waived patent rights on all contracts so as to be sure to keep getting them; to its later chagrin, this organization saw one of its inventions, from work sponsored by a large business firm, become patented by that firm; the results of this invention are seen by millions of people every day. The same nonprofit organization now however has an active patent program. Other such organizations try to find licensees who will award contracts to the organization for the further development of the licensed inventions.

The Presidential Memorandum of 1963 puts the universities and nonprofits in another difficulty. That document does not once mention them as contractors. Section 4 on definitions does, it is true, say that the word contractor means, besides the obvious, "public corporation," and "institution" and "other entity." But in the critical Section 1 on

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[7] Archie M. Palmer, University Research and Patent Policies, Practices and Procedures, Publication 999, (Washington, D.C.: National Academy of Science--National Research Council, 1962).

basic policy, the Memorandum seems simply to have forgotten about any contractors except those with commercial positions and commercial interests. The best that the universities and nonprofits can hope for is to come within "exceptional circumstances" under Section 1(a) or "special situations" under Section 1(c).

NASA's waiver regulations of 1964 (and of 1966) follow the Presidential Memorandum. Thus, a business firm may qualify for an advance waiver, but a university may not. The university does not have "an established nongovernmental commercial position." In petitioning for a waiver on an individual invention, the university has to go to more trouble in proving that waiver of title is a "necessary incentive to bring the invention to the point of practical application..." The university has to show what its licensees have done or would do, or what its patent agent's experience and probable future activities are.

The time required to act on petitions

From the records of the Inventions and Contributions Board we have dates for 192 petitions. The dates are the dates of petition and of action (grant or denial) by the Administrator of NASA. In analyzing the time required for action, we omit the petitions withdrawn, those still pending, and those recommended by the Board for grant or denial on December 31, 1965. For 24 petitions granted or denied, one or both of the dates are not readily available from the records.

The average time in the period 1959-1965 was 10.8 months. The median was 10 months, i.e., half took less than 10 months and half took more.

The standard deviation was 5 months, i.e., about two-thirds of the petitions were acted on and decided (by the Administrator) within a period of 5 to 15 months.

The range was 2 to 31 months. Only 21 petitions were acted on in 6 months or less. Seven took 2 years or more. Fifteen took 18 months or more.

Here is a summary:

-- 11 per cent took 6 months or less;

-- 72 per cent took 12 months or less;

-- 81 per cent took 18 months or less; and

-- 97 per cent took 24 months or less.

<u>TUP versus waiver policy</u>

NASA created its office of Technology Utilization to insure wide dissemination of information about the new technology resulting from its research and development. Technology Utilization officers evaluate and screen invention disclosures made by government employees and by employees of NASA contractors. The Office of Technology Utilization publishes, usually as Tech Briefs, descriptions of inventions and innovations believed to be valuable to business firms and other organizations.

NASA's technology utilization policy and its waiver policy seek to accomplish the same end by different means. The goal of both, of course, is the fastest and widest possible use of new technology. The different means to this end reflect a century-old and continuing controversy over the value and the effectiveness of the patent system. Which is better in advancing technology? Free availability or temporary exclusivity? If both means are to be employed, what is the domain for each?

The Office of Technology Utilization publishes Tech Briefs on some of the inventions covered by pending and granted petitions for waivers. That Office reports that it reviewed 204 inventions under petitions for waivers filed between October 29, 1959 and December 31, 1964 and decided to publish 72 of them. Our understanding of the matter is that Technology Utilization published these cases in the belief that the waiver process creates delays in getting inventions into the mainstream of commerce. Several of NASA's contractors have complained strongly about TUP's actions, contending that they are contrary to the intent of the waiver policy.

The publication policy can also make contractors hesitate in deciding to file petitions for waiver on individual inventions. Publication of an invention creates a statutory bar; patent applications must be filed within one year of publication. By the end of December, 1965, petitions for waivers had been pending an average of nearly 11 months. Contractors usually file patent applications on inventions under petitions for waivers only after favorable action by the Inventions and Contributions Board. One contractor said that his company began to file a petition for waiver on an invention that seemed to have strong commercial potential. To the contractor, "it did not make sense" to file the petition after NASA described the invention in a Tech Brief. This contractor was disturbed because NASA did not file a patent application on the invention. He said that more of the instances will arise if the waiver procedure becomes slower and the publication program more rapid.

When Tech Briefs describe already patented inventions the effect can be quite different from that of publication of inventions under patent applications. This is true particularly when waiver holders have licensing agreements. The patent application does not give the filing party the right to exclude. Of course, assignees can file infringement suits against unlicensed users after patent issue. Several contractors complained that Tech Briefs hurt licensing arrangements that were in process on inventions under patent applications. One contractor said that he believes that, because of a Tech Brief, one of his inventions will not be used by firms that otherwise might have been licensees.

The reaction of one NASA contractor to publication of waived inventions in Tech Briefs was, however, favorable. The contractor, a small nonprofit research organization, welcomed the "free publicity."

Publication of Tech Briefs and granting waivers do not always conflict as means of putting NASA's new technology into use. Not all of NASA's inventions are patentable and not all of those that are patentable have commercial applications. But the policies do conflict for some inventions. When NASA grants waivers to its inventions, NASA relinquishes ownership rights, with certain stipulations. NASA contractors can, and some have, reacted adversely because of the publication of the technology covered under their granted waivers. NASA should request, and get, permission if it wants to publish inventions under granted and pending petitions for waivers.

Also, if NASA does get permission to publish these inventions in Tech Briefs, NASA should make certain that the individuals using the

Tech Briefs know that the inventions are not freely available and that arrangements for use of the inventions will have to be made with the waiver holders.

Why So Few Petitions for Waiver?

To the end of 1965, only 121 of NASA's contractors had petitioned for waivers. This number must be aligned with the number of contractors reporting invention disclosures rather than with the total of many thousands of contractors. About 40 per cent of the contractors with disclosures to NASA made 389 petitions. Of these, 75 were petitions to the Inventions and Contributions Board for class or blanket waivers. Thus, 40 per cent of the disclosing contractors petitioned for waivers on about 6 per cent of the inventions they reported.

We have already mentioned the fact that the number of requests for advance waivers under the 1964 waiver regulations has also been small. Only a little more than 2 per cent of the contracts executed from October 1964 to the end of December 1965 were accompanied by requests for advance waivers.

Patent counsel at NASA's leading centers have given us a little more information on the ratios of requests for advance waivers to the numbers of contracts executed. The ratio in 1965 varied from about one per cent to about 8 per cent. At the center with the 8 per cent ratio, however, all requests (from August 1964 to December 1965) were denied, because they were poorly or inadequately prepared.

Part VI of our Waiver Questionnaire contained this question:

"It seems that NASA's contractors have made relatively few petitions for waiver. What could be the cause(s)?"

We had already been told that NASA officials themselves are a little puzzled by the sluggish response of industry to the waiver policy. For this reason and after a look at NASA's own patent statistics we decided to put the question into the waiver questionnaire. After we had sent the questionnaire out, we learned that the patent department of one of the largest companies had been wondering why its R & D activities for NASA had been generating few petitions for waiver. An internal memorandum in March 1966 from patent headquarters to the field patent attorneys contains this sentence: "The number of Company requests for waiver is lower than might be expected from NASA's --th largest contractor."

The replies to our question, the remarks made to us during interviews, together with reflection on our other findings lead to the heart of the explanation as to why so few petitions have come in. Most inventions from NASA contract research have no commercial potential, or forseeable "civilian" application.

In reply to the question about the fewness of petitions, only a minority (31 per cent) of the respondents said flatly that NASA inventions generally do not have commercial prospects. Those who put it this way, without any further explanation, often added that NASA inventions are space oriented, or in esoteric fields, or are highly specialized, or flatteringly, many years ahead of the times.

An additional 39 per cent of the respondents, however, expressed themselves somewhat differently. But when their replies are carefully considered the answers amount to the same thing, i.e., lack of commercial potential. The majority's typical answer, expanded a little and paraphrased freely was this: "There have been few petitions because of the red tape, the complicated procedure, the inordinate delay, the time and effort, and the great expense of developing these inventions."

People will go to a lot of trouble and effort if they expect large rewards. So too, we think, a patent attorney would devote much time and effort to a petition for waiver if he thought his company would thus acquire a really valuable invention. People will also wait, if they have to, for a reward with expected value larger than the cost of waiting. So too with the patent department of a NASA contractor. To this last statement there are, however, some qualifications. A few contractors said that in today's technology, time is of the essence. If an invention cannot be moved through its stages of development quickly, it might as well be abandoned. The delay on the waiver cannot be brooked. A patent attorney for one of the largest electronics firms said that his company considers it unsound to petition for waiver on an individual invention because "you don't know the terms." That is, the delay of perhaps a year accompanies the uncertainty that the waiver will be granted at all. There is, he continued, no pressure on ICB "to give the invention back." His company prefers to request advance waivers from field centers. There, the attorney said, NASA's technical people want jobs to be done and will put pressure on the contracting officers to grant the advance waivers.

Even though many of the contractors' complaints about the waiver regulations should be discounted, some of them heavily, we do think that the reactions of contractors to the regulations are, other things being equal, a minor cause of the fewness of petitions. Contractors react to the image they see. Believing as many do that NASA interprets the Presidential Memorandum of 1963 far more rigidly than was intended, that NASA grants few waivers, that NASA is unreasonable in insisting on proof of commercial position, some contractors do not prepare the petitions that they could.

Ignorance and misunderstanding of the waiver regulations seem to have stifled a few petitions. We have heard that small contractors who must rely on outside legal advice have on occasion been told not to bother with waivers. Attorneys for a large nonprofit contractor expressed the opinion that the waiver regulations are hard to understand and that the whole procedure seems to be too much trouble. One of the smaller nonprofit contractors found that one of its petitions cost more than twice as much as a patent application.

But not all contractors holding waivers complain and object. More than a few say that they are well satisfied with the operation of the waiver policy. Some find government paper work a normal fact of life. Others are pleased with the cooperation they have had from NASA patent personnel. One company with a waived invention already commercially successful has nothing but praise for the waiver policy.

There could have been still fewer petitions were it not that several were filed with the Board more for the experience than for anything else. Attorneys for several large contractors told us that they filed their first petitions to see how the Board operates, to learn its procedures, in short, to acquire the know-how for successful petitions.

The contractors replying to our Waiver Questionnaires gave still other explanations for the small number of petitions for waiver. Remember that they were asked not so much to say why their own petitions were few in number but rather to give us opinions about waiver petitions in general. It is ironic that attorneys for two small contractors said that they think that large contractors are wary of waivers for "political" reasons. That is, large contractors might find themselves in positions where they would have to make public justifications of their actions in seeking and holding waivers. Whether this is so we do not know, because we are not privy to the inner decisions of the very large corporations. Two of these whose names are household words do say of themselves that they are highly selective in picking inventions for petition. For all we know their selections committees keep their eyes on the weathervanes of politics.

A waiver of title conveys of course only limited patent rights to the contractor. Besides the usual license to the government the waiver is subject to other reservations--the ominous "March-in Rights" of NASA. Naturally, contractors do not like these other reservations. Some of them make their dislike a cause for not petitioning more often.

In addition to the replies to our questionnaire, we obtained other information that helps to explain why there are relatively few petitions. Several of NASA's large contractors, each with more than a few invention disclosures, had not petitioned at all by the end of 1965. Three of these are aerospace companies.

We wrote to a selected group of the nonpetitioners, asking them why. We had just a few replies. They are consistent with those appearing in the completed Waiver Questionnaires. Once more, the main theme sounds--the inventions from NASA contracts have little or no commercial potential. In its letter to us one of the companies said that, "If an invention appears which appeals to us as being of the type which we could satisfactorily exploit either through manufacturing and marketing as a commercial product or to license out to others for such exploitation, we would not hesitate to request a waiver." Another company explained its not having petitioned by pointing to three sets of causes. One has to do with the reporting of "new technology." In meeting its obligations to NASA, said this company, it had been submitting nonpatentable inventions. Apparently, then, this company found few inventions worth even a thought of possible petition. Of these inventions, the letter went on to say, still fewer lie within the commercial positions of the company. The candidates for petition surviving these two screens could not pass through the third: the "...further extensive proof of position required by NASA when considering a waiver request, the uncertainty of obtaining it, the cost of patent prosecution, the continual administrative reporting to NASA required if a waiver is obtained, the uncertainty of retention of ownership of patent rights and the mandatory licensing obligations..." Small wonder, then, that this company has found "...no invention to date...to offer a potentially sufficient economic remuneration to warrant the request of a waiver."

Willingness to Bid for NASA Contracts

In the late 1950s and in the early 1960s there was public discussion of the question of the effects of government patent policies on contractors' willingness to bid on R & D contracts with federal agencies. We know how sensitive this question is and how difficult it would be to answer it satisfactorily. Here too are motives, as well as real reasons and ostensible reasons for doing something or not doing it.

Our waiver questionnaire included this question:

"Has your company ever declined to bid on some other NASA contract because of NASA's patent policies?"

We had replies to this question from 61 of the 67 contractors who returned questionnaires. Of the 61, 47 said "no." This is about three-quarters of them. The 14 respondents who said "yes" are, it should not be forgotten, already contractors for NASA. The "yes" replies, then, signify only that at one time or another the companies had not bid on NASA contracts and that patent policy was the reason. With the resources available to us, we could not, nor did we try, to find out if there are any highly qualified companies which never bid on NASA work, solely because of NASA's patent policies.

To some of the "no" answers additional remarks were added. A few of these are worth repeating:

> With the present waiver policy our fields of commercial interest are adequately taken care of (a large electric company).
>
> ...but conditional bids have been submitted based on the granting of a waiver. Advance waiver provision alleviates this problem (an aerospace company with more than a small commercial position).

> ...but NASA's policy is a strong incentive to develop a product without NASA's support (a small company).
>
> Our business is 90 per cent government. We can't afford the luxury of not bidding (a medium-sized research and engineering firm).

Where the answer was "yes," i.e., the company had indeed ever declined to bid, the usual reasons was that such companies do not want to jeopardize commercial patent positions. Three small firms gave such answers. So did two aerospace companies. One of these, however, told another group of researchers in 1965 that the company had spent about $75 million of its own money during a three-year period on projects aimed solely at enabling the company to bid on defense and space contracts.

A number of companies, including one of the largest, told us in interviews that NASA's patent policies affect the timing of research. These companies say they postpone, rather than refuse, work under contract with NASA. They have their scientists and engineers do enough research before accepting a NASA development contract, so as to make sure that all important inventions would be reduced to practice.

During interviews with patent counsel in some of NASA's leading centers we learned of corporations that will not undertake any R & D at all for government unless they acquire patent rights. One attorney told us of a large chemical company that would not do research for NASA. Another remembered four or five isolated cases of ostensible refusals to bid without assurance of advance waivers.

All in all, we have the distinct impression that NASA's patent policies--the image rather than the reality--can have had only the slightest adverse effect on the procurement of research and development.

A companion question to that of possible refusals to bid is the effect of patent policies on the quality of research and development. We are obviously not able to judge the quality of the R & D done for NASA. And to establish a relation between the quality and patent policies boggles our imaginations. We have, however, noticed the list of "one hundred most significant products" published each December since 1963 by the journal Industrial Research. A distinguished committee selects the 100 products from among thousands; criteria are uniqueness, usefulness, and importance. For the three years, 1963, 1964 and 1965, the companies with the largest number of significant new products were leading NASA contractors. Companies with 5 or more significant new products, in descending order, are: General Electric, Westinghouse, RCA, GT & E, Honeywell, Perkin Elmer, Beckman Instruments, AT & T, Control Data, IBM, and Varian Associates.

Findings

1. Judged by any relevant standard--numbers of contracts, of contractors, of disclosures--NASA has received few petitions for waiver and few requests for advance waivers.

2. NASA is slow in acting on petitions. The average time from petition to grant or denial is about 10 months.

3. The Inventions and Contributions Board has been liberal in granting waivers. Under the 1959 Regulations, 9 of 10 petitions were granted. Under the more stringent 1964 Regulations, nearly 7 of 10 petitions were granted.

4. The universities and nonprofit organization are at a disadvantage under the 1964 Regulations and appear to be under the 1966 Regulations.

5. The Inventions and Contributions Board has been defining "field of technology" narrowly, thus increasing the burden of proof upon contractors.

6. Publication of inventions in the TUP program conflicts with the purpose of the waiver program.

7. Among contractors there prevails widespread, though not universal, misunderstanding and ignorance of NASA's waiver program and the regulations.

8. Petitions have been few because of the low commercial potential of the inventions from NASA-financed research, and because of the misunderstanding of the waiver program.

9. There seems to be only the slightest adverse effect of NASA's patent policies on its procurement of R & D.

Chapter 6

Results under the Waiver Policy

The National Aeronautics and Space Administration had granted waivers on 182 individual inventions by December 31, 1965. Because it is relatively new the results of the waiver policy cannot be finally appraised and evaluated once and for all. The number of waivers is so small that one problem of policy--the impact of waivers on the concentration of economic power--will have to be handled by pretending that the number is large enough so that the direction of the impact can be seen. On the other hand, the number is not so small as to give misleading results for another issue of policy--utilization of the inventions.

The Waiver Questionnaire

Our sources of information on the waived inventions are the files of the Inventions and Contributions Board, the responses to the questionnaire we sent in January, 1966, to all organizations and persons holding waivers at the end of 1965, interviews with patent attorneys of 34 leading NASA contractors, and discussions with patent attorneys in NASA headquarters and in its leading centers.

Like the licensee questionnaire, the responses to the waiver questionnaire make it an almost unqualified success. The rate of response was much higher than is usual for a questionnaire of this kind. Questionnaires on 149 of 154 waivers, held by 56 of 60 business firms, were returned. All of the 8 universities and nonprofit organizations gave us replies for their 25 inventions. Three of the 5 persons replied.

The four business firms that did not reply by July 15, 1965, include one aerospace company whose outright refusal we had almost expected. One of the patent attorneys in the same company was however kind enough to grant an interview. Another missing questionnaire will probably reach us after this report will have been submitted. In general, the questionnaires were carefully and conscientiously filled out. Most of the replies were internally consistent. One of the computer companies, however, gave us no more information about its several waived inventions than that they are available for licensing. This, said the company, means that the inventions "are in commercial use." We disagree.

Utilization of the Waived Inventions

Commercial use

The rate of commercial use of the waived inventions is in line with the expected rate we described in Chapter 2. The rule that one half of one per cent of inventions are commercially used applies also to NASA. With 4,700 contractor disclosures, the rule gives 23 inventions in commercial use. The replies to the waiver questionnaire show that 21 of the inventions are in the stream of commerce.[1] This is

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[1]Because the 4,700 disclosures probably include several hundred merely reportable items, the rate of use of the waived inventions might be well above one half of one per cent of the disclosures that are true inventions.

11.5 per cent of the total of waivers granted as of the end of 1965.

Table 6--1 shows the distribution of the waived inventions held by business firms and nonprofit organizations. Two inventions, both in commercial use, held by individuals are not included in the table. Hence the total of 21. One of the waivers held by an individual is on an invention which, according to him, is being manufactured by a company that seems to have learned of the invention from a NASA Technical Report. In correspondence with us, the inventor gave the distinct impression that he believes he has been deprived of what is rightfully his. If this is so, his experience is another possible example of the clash between the waiver policy and the policy of publication. We touched upon this matter in the preceding chapter.

In the count of 21 inventions in actual commercial use, GCA Corporation's gauge counts as one invention, although NASA records show two waiver case numbers. We do this because GCA has informed us that the earlier invention (W-109) has been superseded. We list McDonnell's tools as four inventions. In its Patent Program (pp. 21 ff), NASA gives eight "case histories of waivers." They cover 13 waiver case numbers. One of the eight waived inventions in the case histories does not meet our definition of commercial use: No sales had yet been made of the dry tape battery being developed and promoted by Monsanto Research Corporation.

Table 6--2 lists the contractors with inventions in commercial use. Remember that one is "being manufactured" by a firm that has had no negotiations, so far as we know, with the inventor who holds the

Table 6--1

Commercial Use and Potential of Waived Inventions by Groups of Contractors end of 1965

	Waived Inventions Held By				
Use	Aerospace Companies	Other Large Companies	Other Companies	Universities and Nonprofit	Total
Commercially used	8	1	9	1	19
Commercially available	0	0	1	0	1
High potential	4	5	5	2	16
Moderate potential	3	8	7	5	23
Low potential	25	26	16	13	80
No potential	8	1	10	3	22
Other	6	2	4	1	13
Total	54	43	52	25	174

Note: This table accounts for 174 of 179 waived inventions held by business firms and nonprofit organizations. Waivers held by 2 individuals are excluded from this table. "Other large companies" are in The Fortune Directory for 1965. "Other companies" are not in this Directory. "Other" use includes inventions under secrecy orders or abandoned or withdrawn or not allowed.

Source: Replies to Waiver Questionnaire.

Table 6--2

Waived Inventions in Commercial Use
end of 1965

Contractor	Invention
Aerojet-General Corp.	Attitude control system for sounding rockets
Allis-Chalmers Mfg. Co.	Moisture removal system for fuel cell
Ball Brothers Research Corp.	Temperature monitor
Bell Aerosystems Co.	Catalyst bed
California Institute of Technology	Seismometer
DeBell & Richardson	Hollow filament forms for winding composite structures
DeBell & Richardson	Solid filament forms for winding composite structures
Douglas Aircraft Co.	Drill (bit)
GCA Corporation	High vacuum cold cathode ionization gauge
Gulton Industries, Inc.	Damped accelerometer
Harvard University (Professor Ingrano)	Ferroelectric bolometer
James E. Lovelock Foreign rights	Cross-section detector for gas chromatography
McDonnell Aircraft Corp.	Tube cleaning tool
McDonnell Aircraft Corp.	Tube cut-off tool
McDonnell Aircraft Corp.	Tube-end deburring tool
McDonnell Aircraft Corp.	Brazed fluid system
Peninsular ChemResearch, Inc.	Process for synthesis (of 1, 2-diflouroethylene)

Table 6--2: Continued

Contractor	Invention
United Aircraft Corp.	Heat transfer garment (cooling or heating)
Varian Associates	Electrodeless discharge lamp
Varian Associates	Electrodeless discharge lamp apparatus
Varian Associates	Optical magnetometer
Engineering Physics Co.[a]	Magnetic flowmeter apparatus[a]

[a]Commercially available.

Source: Responses to Waiver Questionnaire.

waiver.

We shall have more to report later on these inventions, on development effort, on income from them, and on markets. In the meantime we shall pursue the subject of utilization.

Commercial potential

Since it often takes time to develop an invention for the market place and since NASA's waiver program is relatively new, we sought through our questionnaire to elicit information about waived inventions with commercial potential. We have had to rely on contractors' opinions, which probably tend on such a matter to be optimistic. In Chapter 4 we give our definitions of high, moderate, and low commercial potential.

The last column of Table 6--1 gives the distribution of the waived inventions according to the degree of their commercial potential. Table 6--3 has a list of waived inventions with high commercial potential. Table 6--4 shows the expected kinds of future commercial use.

Benefits even without commercial potential

Many of the waived inventions had some glimmering of commercial potential at the time of petition. But later they lost it. Table 6--5 shows why.

NASA's waiver program can confer benefits even if the initial promise of commercial potential vanishes. Duke University told us that a waiver granted on an invention, which now has no commercial use that can be foreseen, was instrumental in helping a new company get started in Durham, North Carolina. The co-inventor, a former graduate student

Table 6--3

Waived Inventions with High Commercial Potential
end of 1965

Contractor	Invention
Aerospace Research Association	Energy absorbing device
California Institute of Technology	Portable planetarium
California Institute of Technology	Accelerometer
Chicago Aerial Industries, Inc.	Film reader
Chicago Aerial Industries, Inc.	Developer-Processor
General Dynamics Corp.	Distributed constant pulse line
General Electric Co.	Nonlinear circuit
Monsanto Co.	Preparation method for crystal electronic material
North American Aviation, Inc.	Three axis optical alignment unit
North American Aviation, Inc.	LOX "Safe" penetrant
G. T. Schjeldahl Co.	Adhesive removal process
Shell Development Co.	Hydrazine decomposition
Sperry Rand Corp.	Recording apparatus
United Aircraft Corp.	Space suit water boiler and control
United Aircraft Corp.	Thermal garment
EIMAC, Division of Varian Associates	Ceramic-to-Metal seal

Table 6--4

Kinds of Expected Future Commercial Use of Waived Inventions

Expected Use[a]	Inventions with Replies	Inventions with "Yes" Replies	Per Cent with "Yes"
In own manufacturing	91	42	46.2
In own research	71	46	64.8
Sold as a new product	84	34	40.5
Sold as a component of own product	77	40	51.9
Sold as a component of other company's product	72	27	37.5
Sold as a part of service	65	10	15.4

[a]Some inventions are expected to have more than one kind of future use.

Source: Replies to Waiver Questionnaire, Part IV, Questions 4 and 5.

Table 6--5

Reasons for Lack of Commercial Potential of Thirty-seven Waived Inventions

Reasons Given by Contractors	Number	Per Cent
Development cost too high	9	15.4
Development showed flaws	3	5.2
Invention already obsolete	7	12.1
Superior substitutes available	10	17.2
Expected market failed to materialize	9	15.5
Technology too sophisticated	8	13.8
Too few claims allowed by Patent Office	4	6.9
Other	8	13.8
Total	58	100.0

Note: Two or more reasons apply to some of the inventions.

Source: Replies to Waiver Questionnaire, Part V, Question 2.

at Duke, is now president of the company which performs research for private industry and for NASA. Though the benefits from this waived invention are "indirect," they are "important."

Other indirect benefits expected by contractors are summarized in Table 6--6.

Government use

About 60 per cent of the waived inventions are reported as having some use by or for the government. This is brought out in Table 6--7. For all we know--without the examination in depth that we could not undertake--there may be some benefit here to NASA from its waiver policy. The possible benefit we have in mind is small, but it is ignored in most discussions of patent policy. Assume that because he has a waiver, a contractor puts more effort into the invention, improving it more than if there were no waiver. If this assumption is correct for a few of the inventions with government use, it then follows that NASA's technical programs have been benefited.

Development Effort

One of the justifications for permitting industry to acquire the principal rights to inventions from government-funded R & D is that the inventions need further development. That development entails expense and effort made under risks that are reduced but not eliminated by the temporary patent monopoly.

The question of fact is how often and how much industry spends its own money on developing the inventions it gets from government work.

Table 6--6

Expected Benefits Other than Commercial Potential from Waived Inventions

Benefits to Contractors	Number of Replies	Per Cent of Total
Expanding company's command over area of technology	16	26.2
Increasing protection of existing product or product line	9	14.8
Prestige for the inventor and for the company	16	26.2
Increase company's patent portfolio, to show competence to secure government contracts	15	24.6
Other	5	8.2
Total	61	100.0

Note: Since an invention can yield more than one benefit, the number of replies exceeds the number of inventions, which is 28.

Source: Replies to Waiver Questionnaire, Part V, Question 3.

Table 6--7

Government Use of Waived Inventions

Use	Number	
Inventions with no government use	61	
Inventions with government use	116	
Kind of government use (some inventions have more than one use):		
Contractor R & D for NASA		33
Use in NASA laboratories		28
Use by other contractors		1
Component delivered or sold to NASA		49
Component delivered or sold to other government agency		5
Product or process delivered or sold to NASA		37
Product or process delivered or sold to other government agency		3

Source: Replies to Waiver Questionnaire, Part I, Question 2.

A good empirical answer to this question could contribute much to future modifications of high policy on the dispositions of patent rights.

In the meantime we have a fairly good answer to the question, for the small group of contractors who hold waivers from NASA. Table 6--8 summarizes the replies to our question about actual and expected development expense. Table 6--8 must be distinguished from Table 5--3 in Chapter 5. Table 5--3 shows expenditures by petitioners on fields of research broader than the inventions. In contrast, Table 6--8 covers only the expenses of individual inventions.

In compiling Table 6--8 we had to take "moderate" and "substantial" at face value. Perhaps a few inventions were put in the wrong place. That, however, does not matter much, because the chief message conveyed by a glance at the table is that, at first sight, one-third of the inventions have, or are expected to have, little or no development expense.

This ratio of one-third needs interpretation, because it pertains to usable replies only. To give an example of an unusable reply: One of the aerospace companies reported for 5 of its waived inventions, which we classified as having low commercial potential, that "no further development expense is anticipated." We cannot be sure if that company had ever spent any funds at all on the 5 inventions. The strong likelihood is that these and dozens of other waived inventions simply have a bleak future.

Thus, the 34 inventions with little or no reported development expense should be compared with the total. Then their ratio shrinks to a little less than one-fifth.

Table 6--8

Development Expense and Effort Incurred or Expected for Waived Inventions (92 usable replies)

	Number	Per Cent
Inventions with little or no incurred or expected development expense. (Criteria: Less than $5,000 expense, "one man-year," "minimal," "low," "fully developed," "not large," "developed during the performance of the NASA contract," "costs incurred before the NASA contract.")	34	37.0
Inventions with moderate incurred or expected development expense. (Criteria: $5,000--$50,000 expense, "several man-years," "two man-years," "moderate.")	27	29.3
Inventions with substantial incurred or expected development expense. (Criteria: Over $50,000 expense, "much time and effort," "substantial.")	28	30.4
Other inventions. (Criteria: "Government is funding further development," "development of the system rather than the invention itself.")	3	3.3
Total	92	100.0

Source: Replies to Question 3 of Part IV of Waiver Questionnaire.

The following statements are a little impressionistic but are closer, we are certain, to the whole truth:

1. Of the inventions waived by December 31, 1965, just less than one-fifth needed little or no development.

2. A little less than one-third required extensive development.

3. The remaining one-half were found not to be worth any development effort.

Value of Waivers

We shall now face the problem of the value of the waivers to NASA's contractors. That problem is a small part of the larger problem of the value acquired by industry when the government permits contractors to acquire title to inventions emerging from government-sponsored research.

The value of anything traded in a market or subject to bargaining is what is paid for it. Where bargaining is fairly complex, with many things for the buyer and the seller to negotiate, there are usually several trade-offs and compromises before a final settlement is reached. Once a business firm acquires a bundle of rights that cannot feasibly be further sold or exchanged, the value of that bundle consists of its expected future net earnings discounted to the present. If business firms thought that the patent rights in R & D contracts were valuable, they would be willing to pay for them. And if the government had the same thought, it would either sell these rights or adjust the terms of the contracts so as to accomplish the same thing.

So far as we can tell, the values of patent rights are rarely if ever negotiated. But if they were valuable, why not? Why would not a contractor accept a reduction in fee, in exchange for patent rights, if he could expect future profits much larger than the cut in the fee? And why would not the government offer patent rights in exchange for a lower fee?

Value of advance waivers

Patent attorneys at NASA field centers have told us that patent rights, i.e., Section IV waivers, are never negotiated. In fact, they seemed to think our question about this was a little odd. In addition to the absence of negotiation, few contractors for NASA even ask for patent rights. At Goddard, advance waivers have been requested for only one or two per cent of all contracts executed. At Lewis, 23 requests for Section IV waivers were made on 290 contracts, in the period from August, 1964, to December, 1965. This is less than 10 per cent. At other centers, where figures like these are not readily available, the answer is about the same--very few requests for the nonnegotiated patent rights. From October, 1964 to the end of 1965, over 9,400 NASA R & D contracts (prime and first and second tier subcontracts) were executed. There were 224 requests for advance waivers.

Any commercial right that businessmen will not ask for, when they can, possesses hardly any value to them. A right they ask for, but will not sacrifice money to get, cannot be worth very much. Many requests for advance waivers have been denied. Few denials have been appealed. Again, if the rights were valuable, contractors would undertake the expense of appeal.

For a contractor to acquire patent rights in an R & D contract is like getting a lottery ticket in a lottery with an unknown number of prizes of unknown value, awarded at unknown dates in the future.

Value of waivers on individual inventions

The value of the waivers granted by NASA is the present value of the streams of future net profits attributable to the waivers. Where the holders of the waivers have licensed others, the value to the holders is the present value of the flows of future income from licensing.

So defined, the value in 1966, of the waivers can only be guessed at. Any guess must stumble on the uncertainties of future markets and future changes in the technologies in which the waived inventions fall. Shifts in future markets and technologies can make any of the waivers worthless. Some of them have already become so, having been abandoned and returned to NASA.

Table 6--9 presents the information made available to us on gross sales revenue and development expense. Presumably, though not necessarily, the gross sales revenues include profits. What these might be, we do not know. If a high ratio of profits to sales is assumed, say, 10 per cent, then for the five inventions in Table 6--9 with dollar figures, it is obvious that development expense has so far exceeded profits.

For only three inventions, where dollar figures are available, have gross sales revenues exceeded development expenses. It seems that for the other inventions in commercial use development expense probably also has so far exceeded gross revenue. If those answering the

Table 6--9

Development Expense and Gross Sales
Revenue for Waived Inventions
to end of 1965

Waiver Case Number	Development Expense	Gross Sales Revenue	Remarks
	Inventions for which dollar figures are available:		
109, 167	$ 25,000	$270,000	
219	5,000	20,000	
162	25,000	7,200	expense incurred by licensee
102	10,000	25,000	
196	25,000	20,000	
Subtotal	$ 90,000	$342,200	
	Inventions in commercial use with incomplete dollar figures:		
293	"slight"	$ 3,299	
206, 207, 208, 232	"moderate"	"small"	
282, 283, 320	"moderate"	"slight"	
222	"substantial"	"confidential"	
172	$ 50,000	"2 units sold"	
158, 189, 317	not available	not available	
276	"slight"	"not known"	licensed abroad
231	"moderate"	none--but reduction in costs	
Subtotal	$ 50,000	$ 3,299	
	Inventions commercially available:		
147	$ 55,000	--	
Subtotal	$ 55,000	--	

Table 6--9: Continued

Waiver Case Number	Development Expense	Gross Sales Revenue	Remarks
Inventions with high or moderate commercial potential, for which dollar figures are available			
216	$ 100,000	--	
312	1,000	--	"business development effort"
307	1,500	--	"business development effort"
311	100,000	--	
365	11,000	--	
230	245,000	--	
229	265,000	--	
295	15,000	--	"expected future development expense is $20,000"
114	37,000	--	
249	150,000	--	
200	500	--	"business development effort"
Subtotal	$ 926,000	0	
Grand Total	$1,121,000	$345,499	

questionnaires were consistent in their use of language, this ought to follow, because a moderate amount of money should be more than a slight amount.

To the end of 1965, the companies with waivers granted by NASA had spent on development of the inventions about three times as much as they had received from the sale of products embodying the inventions.

The data in Table 6--9 on development expense, we are fairly sure, contain some exaggeration. We were as careful as we could be in excluding the spending of government funds by contractors. The possible exaggeration comes from two sources. One is the natural tendency for anyone to overstate his costs. The other and more serious possibility is that some contractors probably report their development expense for a whole field of technology rather than for the particular inventions that come along. We noticed this when we were examining the waiver files of the Inventions and Contributions Board.

In particular, waivers 229 and 230 account for nearly half the dollar figure for development expense.

Three of the inventions from the information available to us, only three--seem to have probabilities of yielding fairly large gross incomes in the future. By large we mean more than $100,000 annually. These inventions are Caltech's portable planetarium, GCA Corporation's gauge, and Engineering Physics' flowmeter. The potential beneficiaries of the fairly large incomes are a university and two small businesses, one of them quite small.

To sum up on the value of the waivers on individual inventions:

1. To the end of 1965, the value was almost certainly negative. Expense seems to have exceeded revenue.

2. But expense is incurred in the expectation of profit. We are unable to pinpoint the expense that could be attributed directly to the waived inventions. We can only guess that the value of the waivers on the individual inventions, i.e., the expected profits discounted to the present, is a few tens of thousands of dollars. And in an enterprise economy it is expected profits that move inventions into the stream of commerce.

The Distribution of Waivers Among Contractors

A few contractors hold several waivers each; most contractors with waivers have just one each. Here is the question of the distribution, or concentration, of waivers among contractors. Have "too many" waivers been granted to "too few" contractors?

This is one question, to which we shall give an answer. A related though different question is whether NASA's waiver policy has added to "the concentration of economic power" in the American economy. That question we shall handle separately.

By December 31, 1965, waivers had been granted on 182 inventions to 73 petitioners. Of these, 5 were persons and 68 were organizations. Of these in turn, 8 were universities and 60 were business firms.

Table 6--10 displays the ranking of the waiver holders as of December 31, 1965. Table 6--11 shows the distribution in each year

Table 6--10

Ranking of Organizations and Persons Holding Waivers
as of December 31, 1965

Contractors	Number of Waivers Granted	Contractors	Number of Waivers Granted
No Amer Aviation	16	Allis Chalmers	1
Caltech	9	Bell Aircraft	1
TRW	9	Bendix	1
IBM	8	Brown Univ (Prof. Dobbins)	1
McDonnell Aircraft	8	Cook Elec	1
Geophysics	7	Curtiss-Wright	1
United Aircraft	7	Electrochimica	1
Ampex	5	Electro Radiation	1
Sperry Rand	5	Engineering Physics	1
Varian Assoc	5	Farrand Optical	1
G. E.	4	Fenwal	1
So Res Inst	4	Franklin Inst	1
Ball Bros	3	Garrett	1
Barnes Engineering	3	General Dynamics	1
Collins Radio	3	Gulton Indus	1
Duke Univ	3	Harvard (Prof. Ingrano)	1
Douglas Aircraft	3	Hazeltine	1
Electro Optical	3	Honeywell	1
General Mills	3	Internat'l Elec	1
Livingston Elec	3	Kaman Aircraft	1
Monsanto	3	Kinelogic	1
Peninsular ChemRes	3	Kulite-Tungsten	1
Stanford Res	3	A. D. Little	1
Aerojet General	2	Litton	1
Beckman Instr	2	J. A. Lovelock	1
Chicago Aerial	2	MB Assoc	1
DeBell & Richardson	2	Midland-Ross	1
GT & E	2	Wm. R. Moss	1
Hughes Aircraft	2	No Amer Phillips	1
Kollsman Instr	2	Northrop	1
Midwest Res Inst	2	Republic Aviation	1
Nat'l Res	2	G. T. Schjeldahl	1
Princeton Univ	2	Z. G. Shawhan	1
Radiation Instr	2	Shell Development	1
Westinghouse	2	Univ of Calif	1
Aerospace Res	1	Yardney Elec	1
Air Prods & Chems	1		

Source: ICB files, NASA.

Table 6--11

Waivers to Business Firms

1960 to 1964[a]

Year	Number of Waivers Granted[a]	Number of Firms	Distribution
1960	8	5	4 waivers to GCA; 1 each to 4 firms
1961	12	11	2 waivers to IBM; 1 each to 10 firms
1962	34	19	4 waivers to No. Amer. Av.; 3 each to Ampex, General Mills, and McDonnell; 2 each to 6 firms; 1 each to 9 firms
1963	37	19	7 waivers to No. Amer. Av.; 5 to TRW, 3 each to Douglas, Electro-Optical, and IBM; 2 each to 2 firms; 1 each to 12 firms
1964	57	34	6 waivers to United A/C; 4 to Sperry Rand; 3 each to Livingston Electric, No. Amer. Av., and Peninsular ChemResearch; 2 each to 9 firms; 1 each to 20 firms

[a]Waivers granted are here included in the year of petition. Total of 148 waivers were granted to business firms who petitioned in the period 1960-1964. 1965 is excluded because many petitions were still pending. Blanket and class waivers are excluded.

Source: ICB files, NASA.

from 1960 to 1964; in this table, waivers granted are included in the year of petition.

We shall confine our analysis to the distribution, or concentration, of waivers among the contractors that are business firms. The 5 persons got one waiver each. The 8 universities and nonprofit organizations were granted 25. No one, except for some academicians and perhaps the National Science Foundation, is interested in concentration among the universities, and least of all in the concentration of waivers among them.

In Chapter 3 we measure the concentration of disclosures by using conventional concentration ratios and a Pareto distribution. Neither device can give a meaningful description of the distribution of waivers among business firms. The Pareto method would give bad results because of the small number of business firms and because of the long string of firms with one waiver each. Even concentration ratios give distorted results when there is a small number of firms. To illustrate: If NASA in some month were to grant 10 waivers to 10 firms, the conventional concentration ratio for the first 4 firms says that concentration is 40 (per cent). This of course is as absurd as it is wrong. Obviously, it is better to say that 10 per cent of the firms are granted 10 per cent of the waivers. Thus to compare the small group of contractors holding waivers with other and larger groups of contractors, the percentage method is satisfactory.

The waivers granted to business firms by NASA are less unequally distributed than business contractors' other activities with NASA.

The first 10 per cent of contractors have well over 90 per cent of dollar amounts of prime contracts from NASA. The first 10 per cent of the business-firm contractors account for 78 per cent of the disclosures made by business firms. In contrast, the first 10 per cent of the firms receiving waivers have been granted 36 per cent of the waivers going to business firms.

Another contrast is with the distribution of patents to industry under the license policy in the period before the Presidential Memorandum of 1963. As a result of statistical studies we had previously conducted, we know that patents acquired under the license policy by contractors performing R & D for the federal government are less concentrated than the R & D.[2] The first 10 per cent of the R & D contractors acquired about 50 per cent of the patents resulting from the license policy.

It follows, therefore, that NASA has not, at least to the end of 1965, been unduly concentrating its waivers among the very few. It should not be forgotten that concentration exists just about everywhere and in most activities. There are more inventions than inventors; dozens of patents are held by each of a few inventors. A minority of scholars publishes the majority of scholarly papers. We do not think that NASA has granted too many waivers to too few contractors.

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[2]Watson and Holman, "Concentration of Patents from Government-Financed Research in Industry," Review of Economics and Statistics, forthcoming.

In Chapter 5 we discuss the probable causes of the relatively small number of waiver petitions that NASA has received. One of the main causes is the misunderstanding among contractors as to how the waiver policy actually works. That misunderstanding is more prevalent, we have found, among the medium-sized and the smaller contractors. If NASA would dispell most of the misunderstanding while creating the proper image of its patent policies, one of the results would be more petitions from the medium-sized and smaller contractors. By no means would there be a flood, but there ought to be more. From the patent attorneys of the large contractors the flow of petitions can be expected to continue about as it has in the past.

If, then, we are right in thinking that a better image for NASA would stimulate more contractors other than the largest to send in petitions, the distribution of waivers should become somewhat less concentrated than it is, though, to repeat, the distribution is not very much concentrated as it stands.

Concentration of Economic Power

One of the issues of discussion and controversy about government patent policies generally is whether, by permitting business firms to acquire patent rights, the policies contribute to concentration in industry. We shall try to measure the impact, even though it is almost infinitesimally small, of NASA's waivers on concentration in industry.

By convention, "concentration" means either the share of the largest 100 or 200 corporations of total assets (or employment, etc.)

in the manufacturing industries, or the share of the largest 4 or 8 or etc., firms in the assets (or sales or employment, etc.) in particular industries.

Economic concentration, or the "problem" of big business, has been an issue of domestic politics during the last century. The issue, of course, has taken many shapes. The postwar version of the issue, it might be generally agreed, is the market power of large corporations. But along with that market power goes the contribution of many large corporations to the advancement of technology. National policy moves in directions that are not parallel. On the one hand, the antitrust agencies keep their vigil over competition, watching in particular for mergers that might throttle competition. On the other hand, agencies with billions of dollars of research funds continue to pour most of their money into relatively few large corporations. Just 20 companies account for two-thirds of all of the research and development dollars spent in industry on work for the government.

This is not the place to probe into these matters. It suffices here to point to federal procurement, including NASA's, as a cause working to maintain or to increase the existing concentration in several industries. The question here is patent policy.

The few dozen waivers granted by NASA can have no visible effect on concentration in industry. It is ridiculous to suppose that this could be so. Nonetheless, NASA can receive criticism each time it waives an invention to a large and prominent company. Not that a particular waiver makes much difference, so runs the standard criticism, but that it is wrong in principle to let large companies acquire patent rights from research paid for by the government. There is an incipient threat to competition.

Did the license policy result in increased concentration?

Before undertaking this evaluation of NASA's patent policies, we had already analyzed the issue on concentration from the operation of the license policy in the period to the end of 1962. The supposed creation of undue concentration of economic power, to some observers, was one of the strongest objections to the license policy. The objection was raised repeatedly by attorneys general, by some legislators, and by a few economists. In 1947, one of the recommendations of the Attorney General's exhaustive study[3] of government patent practices and policies was this:

> 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 of power 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 the national economy; and will thus strengthen our American system of free, competitive enterprise.[4] /our italics/

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[3]Department of Justice, Investigations of Government Patent Practices and Policies: Report and Recommendations of the Attorney General to the President, 3 vols., 1947.

[4]*Ibid.*, I, p. 37.

The 1956 Report[5] of the Attorney General was more cautious. This Report was in compliance with a provision of the Defense Production Act of 1950 which directed the Attorney General to report on possible "undue concentration of economic power" ensuing from defense procurement. Here of course is the familiar and still unresolved problem of national economic policy--how to maintain effective competition while utilizing the talents of big business for both research and production. The Attorney General observed in 1956 that a "disproportionate share"[6] of federal R & D funds goes to the largest firms and that they benefit from the profits on the research, from subsequent procurement contracts, from commercial applications of government-financed research, from the resultant acquisition and training of scientific personnel, from the acquisition of technical information, and from the acquisition of patents.[7] This last advantage to firms doing R & D for the government received in 1956 the most attention as a source of increased concentration. But the patent data available in 1956 were scattered and spotty. One of the indications of patent concentration that the Attorney General mentioned was the fact that only 15 companies accounted for 52 per cent of 6,788 patent applications resulting from R & D conducted for the Department of Defense in the five-year period ending

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[5]Report of the Attorney General Pursuant to Section 708 (e) of the Defense Production Act of 1950, as Amended. November 9, 1956.

[6]Ibid., mimeographed version, p. 32.

[7]Ibid., pp. 19-28.

June 30, 1956.[8] But because of the unavailability of good and comprehensive data, the Attorney General did not take a firm stand. He was careful to point to the obvious, namely, that more R & D funds should go to small firms.

In a forthcoming article in the Harvard Review of Economics and Statistics, we show in a statistical analysis of thousands of patents from government-financed R & D, that concentration of these patents among large corporations actually declined in the late 1950s and was significantly less than the concentration of R & D.

The impact of NASA's waivers

What is the impact of NASA's waivers on the concentration of economic power in American industry? The immediate and realistic answer is wholly obvious--the impact is virtually zero. That fact, however, does not stop or deflect the criticism that NASA strengthens the power of big business when it gives a few waivers to a few large companies. Hence we must pursue this matter further.

Concentrated economic power has many dimensions, which include assets, employment, sales (market shares), and patents. We choose patents as the relevant dimension. Table 6--12 gives the patent portfolios of the groups of business firms granted waivers by NASA. Inspection of the table shows plainly how utterly negligible is the accretion to patent portfolios from the grants of waivers. Some small fraction of the inventions covered by waivers will never issue as patents anyway. Besides that, the values of the inventions have to be taken into account. In all likelihood, the average waived invention has a much lower value than the average patent from commercial research.

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[8] Ibid., p. 40.

Table 6--12

Patent Portfolios of Groups of Business Firms Granted Waivers

Groups	Waivers		Patent Portfolio			
			Total		Fed. Fin. R & D	
	No.	Per Cent	No.	Per Cent	No.	Per Cent
Large Aerospace Companies	55	36	13,240	17	2,652	34
Other Large Companies	43	28	58,469	77	5,083	64
Other Companies	54	36	4,717	6	174	2
Total	152	100	76,426	100	7,909	100

Note: Waivers granted on individual inventions to the end of 1965. Total patent portfolios are 17-year totals to the end of 1962. "Fed. Fin. R & D" means the patents (17-year total) acquired to the end of 1962 by these companies from R & D contracts with the federal government.

Sources: ICB files, NASA. U.S. Patent Office.

It may be of some interest to know the names of the contractors in the three groups of firms included in Table 6--12. We now list the names.

The large aerospace companies are: Aerojet General, Bendix, Curtiss-Wright, Douglas Aircraft, Republic Aviation (subsidiary of Fairchild Hiller), Garrett, General Dynamics, Hughes Aircraft, Kaman Aircraft, McDonnell Aircraft, North American Aviation, Northrop, Bell Aircraft (subsidiary of Textron), TRW Inc., and United Aircraft.

The other large companies (not aerospace and in 1965 Fortune Directory) are: Air Products & Chemicals, Allis-Chalmers, Ampex, Collins Radio, General Electric, General Mills, General Telephone & Electronics, Honeywell, International Business Machines, International Electric (subsidiary of International Telephone & Telegraph), Litton Industries, Monsanto Research, National Research Corporation, Shell Development, Sperry Rand, and Westinghouse Electric.

The other companies (not aerospace and not in 1965 Fortune Directory) are mainly medium-sized and small firms. They are: Aerospace Research Associates, Ball Brothers Research, Barnes Engineering, Beckman Instruments, Chicago Aerial Industries, Cook Electric, DeBell & Richardson, Electrochimica, Electro Optical Systems, Engineering Physics, Farrand Optical, Fenwal, GCA Corporation, Gulton Industries, Hazeltine, Kinelogic, Kollsman Instrument (subsidiary of Standard Kollsman Industries), Kulite Tungsten, A. D. Little, Inc., Livingston Electronic (subsidiary of G. & W. H. Carson), MB Associates, Midland-Ross, North American Phillips, Peninsular ChemResearch, Radiation Instrument Development Labs, G. T. Schjeldahl, and Varian Associates.

Whose patent portfolios has NASA fattened most?

The 152 waivers granted to business firms will, as we have clearly said, cause scarcely a ripple in the patent portfolios of these contractors. Of course, there are one or two exceptions, namely the very smallest contractors. On the other hand, not all of the 152 will issue as patents; several have already been abandoned.

It seems to be agreed that NASA's total R & D programs will probably not expand much in the foreseeable future. The reporting requirements will probably bring in more disclosures than arrived in 1964, and 1965. But there seems to be no reason to expect much of an increase in petitions for waiver, even if the waiver regulations were to be administered more liberally. To get perspective on the impact of the waivers on contractors' patent portfolios, we shall have to exercise a little arithmetical imagination.

Imagine that the number of waivers is ten times as large as it was at the end of 1965. With the numbers of waivers for the three groups of contracotrs from Table 6--12 and with the combined portfolios of these same groups from the same table, the results of the calculations are these:

-- the aerospace companies' portfolios would be increased by about 4 per cent,

-- the other large companies' portfolios would be increased by less than one-tenth of one per cent, and

-- the group of the medium-sized and small companies would have patent portfolios about 11 per cent larger.

The direction, or tendency, of the waiver policy is therefore to fatten the portfolios of the smaller companies relatively more.

As we said, not all of the waivers result in issued patents. Besides that, one more remark needs to be added here. The probability that a waived invention will be commercially used is about 0.11; that, at least, is the experience to date. But the probability that a private patented invention is commercially used is much higher. The estimates from empirical studies in the postwar period are in the neighborhood of 0.5. About the same figure, as an average, was given us by the contractors who responded to our waiver questionnaire. These facts must also be weighed in considering the inventions acquired under the waiver policy.[9]

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[9]Another part of our examination of the "impact" of NASA's waivers on the concentration of patents was a look at the corporations with portfolios larger than 1,000 patents. There were 53 of such corporations in 1962, the latest year for which we have portfolio data. Their portfolios are 37 per cent of all the patents assigned to domestic corporations. The same 53 companies include 17 which hold 28 per cent of NASA's waivers.

Of the 53 firms with more than 1,000 patents, 11 have had no contracts with NASA. Another 16 have had cumulative contracts of less than $1 million each. These 27 are mainly oil companies. The companies with really large (over 2,000) patent portfolios holding waivers on individual inventions are General Electric, Westinghouse, Bendix, Monsanto, IBM, Shell, Sperry Rand, General Telephone and Electronics, and Honeywell. In the same group, but with class or blanket waivers only, are AT & T, RCA, and Union Carbide.

Danger of Monopoly?

The question of the concentration of economic power is one economists would call a macro question, i.e., it has to do with the whole economy or with substantial parts of it. We turn now to the micro problem, i.e., to the possibility that the waiver policy of NASA has resulted or could result in monopolistic exploitation of the buyers of products that are waived inventions or that contain them as components.

By way of preliminary, we have some comments to make on the thesis that, whenever the government permits contractors to acquire title to inventions, "the public pays twice." The public (taxpayers) pays to have the invention made and when it is marketed the public (consumers? or business firms? or both?) pays again for the invention, the price being monopolistic, and therefore "high". The same thesis holds that when government takes title, the public (which is now the government) gets what it pays for. And when the invention is marketed, necessarily by a licensee of the government, the price is not monopolistic.

The thesis is false. What the public pays for first is to have research done. If the purpose of the research in the contract is to create new products or methods for commercial use, title goes to the government anyway (Presidential Memorandum, Section 1(a)(1)). But if the research is of the type in 99 per cent of all of that financed by the federal government, inventions are unplanned, unpredictable byproducts. The contractor never pays, by taking a lower fee, for the prospect of getting them. If he did, the public would make a negative payment. To the government the only cost, a negligible one, is the diversion of the efforts of the inventor from his main job of getting on with turning out the hardware the government wants.

If the invention is commercially sold, somebody buys it. Here now is the public paying for the invention, but just once. Inventions whose title is with the government include some that require further development. If exclusive licenses are hard to come by, as they are, few business firms have the urge to develop and market such inventions. Thus with government ownership of inventions, the public might never have the opportunity to pay even once.

When the public does pay, is the price high and profitable to the seller? Is the consumer exploited?

The seller of a patented product does indeed have a perfectly lawful monopoly. But this kind of monopoly position is worthless if no one wants the product; no one wants 9 out of 10 patented inventions from government research enough to pay anything for them. If there are in fact buyers for the product, the price they are willing to pay could be, as it often is, just adequate to cover the unit cost of the product. Such a price could hardly be called profitable, nor could it be said that the buyers are exploited. Most of the inventions from government research that are in actual commercial use seem to be of this sort. Then again it can occur that the demand for a patented product is great, that buyers are eager to pay prices that happen to be well above the costs per unit. Here then is the patent system in operation with a seller making profits from his temporary monopoly.[10] It is precisely the prospect of such profits that gives the incentive to develop inventions. All of the evidence available, however, does not show any example of a business firm's earning substantial profits by selling anything incorporating an invention from government-financed research.

We turn now to the markets for the inventions waived by NASA.

Markets for the waived inventions now in commercial use

Some of the waived inventions now in commercial use are sold to research organizations or for use in research activities. Aerojet-General's attitude control system (W-222, foreign rights only) has a market among space research organizations in other countries. Allis-Chalmers offers its moisture removal device for a fuel cell mainly to academic laboratories; the company is said to be selling its device at a minimum profit so as to disseminate fuel cell technology as widely as possible. Since 1952, Allis-Chalmers has spent over $3 million of its own funds on research in fuel cells. Government funding of such research apparently did not begin until 1962. The waived invention of Peninsular ChemResearch is a chemical process, whose market is in research in polymers; sales by early in 1966, had been very small.

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[10]The G. T. Schjehldahl Company was denied an advance waiver on the ground that it would have a dominant position in a field of technology funded by the government. Schjehldahl is a small company, with fewer than 900 employees in 1965. The company has know-how in the design and manufacture of inflatable structures. One of the ingredients of economic growth is the temporary monopoly position of the small company ahead of others in some branch of technology.

Other waived inventions are instruments, or controls, or tools that are being sold to other business firms. McDonnell Aircraft has a package of portable tools for brazing. They have been licensed to Aeroquip Corporation which has already made a few sales, and which expects a large market in the sale of the tools to airlines for the repair of jet engines. The licensee of Caltech's seismometer had sold 12 of these instruments by the end of 1965, and had lowered the price from over $1,000 each to less than $600. The highest volume of sales seems to have been achieved by GCA Corporation. Buyers of GCA's pressure gauge have included Bendix, General Dynamics, General Electric, IBM, Lockheed, Union Carbide, Westinghouse, and Stanford University.

Two of the inventions seem to have futures as possible consumer goods. One is United Aircraft's heat transfer garment which can keep a man comfortable when he has to work in extremes of heat or cold. United Aircraft has reported a few sales of "cooled suits for auto-racing and flight personnel." The company expects moderate sales in the future for use by "flight personnel, undersea divers, and personnel in heat treatment departments in the primary metals industries." Such uses would not of course make the garments a consumer good. They could be a consumer good if they were bought by people engaging in amateur automobile racing, if there is such a thing. The other possible consumer good is Varian Associates' magnetometer which incorporates inventions covered by two waivers. A skier would wear a small magnet on his belt. If he would fall victim to an avalanche, rescuers could find him by using one of Varian's magnetometers. They have already been employed by archeologists examining the ruins of an ancient city in Greece.

We cannot see that anybody is being exploited as a buyer of any of the products incorporating inventions waived by NASA. No consumer goods seem to have been sold so far (early 1966). The few thousand dollars worth of sales have been made by business firms to one another. None of the inventions could ever be called major; all are minor improvements for which substitutes are available. The buyers of GCA Corporation's gauge are business firms that ought to be able to take care of themselves.

The Possibility of Misuse

Any patent can be managed in such a way as to violate the anti-trust laws. This is true of the patents acquired by business firms to which NASA has waived its rights to title. The only question for us here is to draw attention to the probabilities of misuse. Of the inventions to which NASA had waived its rights by the end of 1965, 98 were held by aerospace and by other large companies; see Table 6--12. The aerospace companies have long had a cross-licensing agreement. Most of the other large companies are subject to court decrees under which they must license all or most of their patents. Misuse of patents is a complex subject; we hazard the guess that existing licensing arrangements go far to render unlikely the misuse of patents by the large companies holding waivers from NASA.

There are two more groups of waiver holders. One group consists of universities and nonprofit organizations. It is not impossible for a foundation of a university to handle patents in violation of the antitrust laws, as history plainly shows. That violation, however, continues to be a mild embarrassment to university patent officers. Here we venture to say that another breach of the antitrust laws by a university or other nonprofit organization is a most unlikely occurrence. The medium-sized and small firms are the fourth group of contractors holding waivers. With them also the possibility of misuse seems faint.

The new sentence (1245.109(7)(b)) in the 1966 Patent Waiver Regulations shows NASA's recognition of the possibility of misuse. A waiver can be voided if the patent is held to have been used in violation of the antitrust laws "in an unappealed or unappealable judgement." By the time this would happen, the harm, such as it might be, would long since have been done.

Findings

1. Of the 181 waived inventions, 21 or about 11 per cent, are in commercial use.

2. There is good evidence that an additional 16 waived inventions have high commercial potential.

3. Two-thirds of the waived inventions are used by or for the government.

4. The value of the patent rights in the average R & D contract is so low that it is not negotiated.

5. The value of the rights transferred to industry by NASA's waiver program is very low. To the end of 1965, the companies holding

waivers had spent more on development than they had received in sales revenue.

6. Two small business firms and a university hold the waivers to the inventions with the greatest promise of future income.

7. The patent rights acquired by industry from NASA-financed research are too insignificant to have any visible effect on existing concentration in industry.

8. When the trends in the granting of waivers are assumed to be magnified, the effect is to increase the patent portfolios of medium-sized and small firms relatively more.

9. The waived inventions in actual commercial use are components of products sold to other business firms. The danger of monopolistic "exploitation" seems faint.

10. Any patent can be misused. There is no reason to suppose the danger is greater for a patent originating from NASA research.

Chapter 7

Evaluation

Here we bring together our findings of fact and the results of our analyses in an evaluation of the patent policies of the National Aeronautics and Space Administration. The criteria of evaluation are those of the effective patent policies described in the first chapter.

Costs and Effectiveness

Government programs are now being put under the scrutiny of cost-effectiveness analyses. After giving the matter much thought, we have come to the conclusion that the cost of a formal cost-effectiveness analysis for government patent policies would exceed its effectiveness.

It would not be at all difficult to construct a model, complete with equations and symbols, for the cost-effectiveness of patent policies. But any such model would lack substance and operational value.[1] One of the problems is costs. What are the costs of NASA's patent policies? These could be the dollar costs to NASA, the costs to contractors, to industry generally, and to "society" ("social costs"). It would be no small amount of work to estimate the costs to NASA of patent prosecution and of administering the waiver policy; patent

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[1]Cf., Bruno Fritsch, Helmut Krauch and Richard A. Tybout, "Classification of Social Costs and Social Benefits in Research and Development," in Richard A. Tybout, ed., Economics of Research and Development (Columbus: Ohio State University Press, 1965), pp. 258-267.

counsel in NASA spend part of their time on patent activities other than these. In any event, some part of the cost of the patent operation is agency overhead that would be incurred whatever the patent policy might be. On the other hand, it should not be hard to estimate the incremental cost of monitoring closely the activities of thousands of contractors and subcontractors. Whether it would be worthwhile making such an estimate is a different matter. The task of estimating the costs of NASA's patent policies to contractors is much more formidable. Here we do not have in mind such trivial things as the costs of reporting and petitioning. Rather, the relevant costs are the foregone values of the missed opportunities and the costs of uncertainties. The costs to industry generally and to "society" are remote and hard to see.

Effectiveness is a different matter. We have already defined it and discussed it in Chapter 1 and we shall cope with it again. The trouble is that effectiveness comes in several dimensions (quantities and qualities of disclosures, incentives, rates of utilization, dollars of investment, transfers of technology, procurement of R & D, and effects on competition). They cannot be reduced to a common denominator. Nonetheless, it is possible to make some statements about gains in effectiveness and their costs.

Unknowns and Unknowables

Any evaluation of the patent policies of a federal agency must face the fact that some things are inevitably unknown and others are unknowable.

Among the unknowns is the utilization of inventions in the future. The history of invention shows that typically many years elapse between the making of major inventions and their employment in innovations, i.e., in new industries or in the manufacture and sale of radically new products. One study[2] of the interval of time between invention and innovation for 35 different products and processes gives the average interval as 13.6 years. These are major inventions, causing revolutionary changes in ways of doing things. There are wide deviations from the average. A few major inventions are put on the market within a year or two. On the other hand, the onrush of technology causes some major inventions to become quickly obsolete, in at least some of their uses; the transistor is an example.

None of the inventions coming out of the NASA programs could be called a major invention. Those now in commercial use are all minor devices or improvements. One or two belong to a group of inventions associated with what might in the future turn out to be a major innovation--fuel cells. Still, a major invention is nearly always recognized

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[2]John L. Enos, "Invention and Innovation in the Petroleum Refining Industry," in National Bureau of Economic Research, The Rate and Direction of Inventive Activity: Economic and Social Factors (Princeton: Princeton University Press, 1962), pp. 307, 308.

as such only after its success is demonstrated. Thus, no one can know with certainty whether one or more of the inventions, past and future, from NASA's programs will be major inventions.

No business firm has earned substantial profits by acquiring patent rights from R & D funded by NASA or by any other government agency. All the evidence available supports this statement. But here too is an unknown. Though it is good the evidence is not complete. For all we know, some business firm might have been able to conceal from public knowledge the large profits it has been making from one of these inventions. We recognize this only as a possibility. We know of nothing like this among NASA's contractors. Still another possible unknown is misuse of a patent.

Among the unknowables to be recognized in an evaluation of patent policy are the "lost" inventions. They would be a problem only if it were believed that a few of them were potentially valuable and that it is a pity that they were lost. Inventions can be lost anywhere--by the inventors who for one reason or another do not communicate them, by patent attorneys and others who do not recognize them and by managers of patent portfolios in industry and government who do not see their potentials. Inventions can also be lost in a flood of disclosures that overwhelms a small patent staff. All this of course is speculation. The relevant question is whether NASA's patent policies to date have increased or decreased the probabilities of losing good inventions. We do not know the answer.

Another unknowable is full knowledge of all aspects of incentives. We have in mind here in particular the incentives of inventors and the role (a small one?) that patent policies play in companies' decisions to bid on contracts for R & D for the government.

Disclosure of Inventions

We shall now give our evaluation of NASA's patent policies.

It is paradoxical that the rate of invention disclosure to NASA is relatively low, despite the fact that NASA has put so much effort into getting reports of new technology. In part, the low rate is explainable on grounds other than patent policy. To some small extent, however, the generally unfavorable image of NASA's patent policies must result in reluctant compliance with the reporting requirements. More serious seems to be the fact that only 300 contractors have made any disclosures at all. We have no way of knowing how many more contractors "should" have been disclosing inventions. We do believe, however, that if we had been able to obtain a view of R & D activities among NASA's contractors we could have made a good guess. Another of our findings is that few disclosures have been coming from subcontractors who are not also prime contractors.

There are three sides to the problem of disclosures. One is getting more disclosures from contractors already submitting them. The second is getting disclosures from the contractors who so far have remained beyond the reach of the monitoring mechanism. The third is the problem of getting really good disclosures from contractors. The first two sides present no real difficulty. It is simply a matter of spending more money on monitoring and on coping with a larger flood of paper. In our opinion the additional costs of such an effort would exceed the value of the additional benefits.

The third side of the disclosure problem is the important one. We repeat what we said in Chapter 3: As matters stand, contractors are obligated to report what is there, that is, what is new in, say, their engineers' notebooks. The contractors directly affected by the program for the reporting of new technology will have supervisors extract more from the notebooks. But in all this, there exist no mechanisms for motivating engineers and scientists to create better inventions. If these mechanisms are present anywhere in the laboratories of contractors doing work for NASA, we have not heard of them. By mechanisms we mean sets of recognition and reward strong enough to raise the level--the quality, not the numbers--of inventions. Of course, some inventors will keep on inventing anyway; but the successful ones of this type are not likely to remain long on government work. Among the thousands of talented scientists and engineers who are on NASA work there must be some whose creativity can be sparked. The cost of establishing and operating, in cooperation with contractors, a new system of incentives would be much less than the cost of thoroughly monitoring several hundred contractors. The carrot here is cheaper than the stick, and should be more effective.

Utilization of Inventions

The rate of commercial utilization of the inventions from NASA-sponsored research is about what can be expected in the light of the experience of other federal agencies. About two-thirds of both the licensed and the waived inventions are used by or for the government. In general, the firms originating inventions are those that can commercially exploit them. The exception of course occurs in the licensing programs of the universities and nonprofit organizations. In NASA's own licensing program, four of the five commercially used inventions are being exploited by the firms where they were made. Though not yet in actual use, several of the licensed and waived inventions appear to have high commercial potential.

The Inventions and Contributions Board has proceeded with caution in its careful interpretations of the Patent Waiver Regulations. It has been liberal in granting waivers--9 of 10 petitions under the 1959 regulations and nearly 7 of 10 under the somewhat more stringent 1964 regulations. But NASA has received relatively few petitions for waiver on individual inventions and very few requests for advance waivers. The causes are the low commercial potential of most inventions, the widespread misunderstanding and ignorance of the waiver program (NASA's "image" again) and NASA's slowness in acting on petitions. The average time from petition to grant or denial is nearly 11 months. A flaw in the Presidential Memorandum of 1963, which NASA strictly follows, puts the universities and nonprofit organizations at a disadvantage under the 1964 and 1966 regulations.

What can NASA do to foster increased utilization of the inventions it owns and waives? Not much. NASA's is a passive or permissive role; initiative and action must come from business firms. NASA can, however, widen the field for initiative and action.

The cost of an aggressive licensing program would far exceed any possible gain in effectiveness. What could be done, however, at a zero cost of funds and personnel, is to grant more negotiated exclusive licenses and to grant them earlier than two years after patent issue. Inventions that are candidates for possible exclusive licenses are made public anyway at the time of patent application. The time of pendency in the Patent Office ought to be long enough to meet the spirit of the regulations for exclusive licenses.

In cost-effectiveness analysis, one of the main points is to analyze alternatives. In its waiver program the only important alternatives open to NASA are to be stricter or more liberal in granting waivers.

In a tighter waiver policy, more rigorous interpretations of the regulations would be applied. More requests for advance waivers would be denied; fewer petitions for waivers on individual inventions would be granted. There would not be the slightest difficulty in applying the more stringent interpretations. The effect would be, in a little while, a slowdown in the flow of requests and petitions. There might also be a smaller volume of disclosures. Contractors not subject to close monitoring would not find as many inventions to disclose. The percentage of waived inventions that would get into the stream of commerce might rise, but the absolute number would almost certainly fall.

By a more liberal waiver policy we mean one where decisions come much faster than they have been coming and one where interpretations are less strict than they have been. We do not mean that any and all requests and petitions should be rubber stamped without scrutiny. After all, there would still be the occasional inventions that would be classed as "public health and welfare." And although none has come along yet, NASA must remain alert to the possibility of the revolutionary invention that, by more or less general agreement, should be exploited by the federal government rather than by a business firm. A more liberal waiver policy could come from broader definitions of "field of technology" and by making it a little easier for contractors to show that waiver of title is a "necessary incentive." This in fact has already been done; the 1966 regulations put a smaller burden on the contractor than did the 1964 regulations.

Until 1966, there had been more than a casual lack of uniformity among the field centers in acting on requests for advance waivers. One center denied all requests. Under the 1966 regulations, headquarters will decide. But since the centers will still have to do the preliminary work on requests, headquarters should establish uniform policies and provide guidance on matters such as "field of technology."

A more liberal waiver policy with much quicker decisions would result in more requests and petitions. There would be no flood, only a larger trickle. The percentage rate of commercial utilization would likely remain steady or even fall a little. But the absolute number of inventions in commerce ought to be greater.

The cost in resources of a faster working, more liberal waiver policy would be very small, perhaps even close to zero. In our opinion the gain in effectiveness would be small, but in all probability, in excess of the cost.

Encouragement of Development of Inventions

Experience to the end of 1965 shows that somewhat less than one-fifth of the waived inventions require little or no development effort, that about one-third need relatively substantial development expense, and that the remainder have such dubious futures that no money has been or will be spent on them. NASA's licensees have also spent a little on further development of inventions.

So far as we know, the data in Chapters 4 and 5 on development expense are the first to be gathered in an investigation of government patent policies. We cannot be sure, however, that the microcosm of the licensees and of the contractors holding waivers from NASA is representative of government contractors generally. But it is clear that development expenses, both for inventions in use and for those where expectations are high, are in fact being incurred. This is all to the good. Because development is so closely coupled with utilization, actual and potential, we need not go farther here. What we just said about gains in effectiveness in utilization applies to the encouragement of the development of inventions.

Transfer of Technology

Some transfer of technology has been taking place through NASA's licensing program and through the licensing activities of a few of the contractors who hold waivers. The Technology Utilization Program has disseminated knowledge of the features of several hundred inventions in the disclosure stream. On occasion, however, TUP's overenthusiasm can block, rather than push, the use of an invention.

The greatest obstacle to the transfer of technology is the almost universal segregation of government-financed research and development. We have seen little evidence of overt mechanisms for moving inventions from government laboratories to commercial divisions. There is of course some, and perhaps growing, communication between the two worlds, but not so much as there probably could be. The pattern of segregation took shape before NASA came into existence; among the causes were security regulations and economies of scale. There seems to be nothing that patent policy can do to break down this obstacle. That effort would require a mammoth reorganization of the entire R & D complex.

Best Contractors

A title-policy agency, as NASA is considered to be, faces the problem of not being able to get bids from the best qualified potential contractors. We recognize the fact that this question might be a chimera rather than a real problem. Sensitive for both government and industry, this issue has come up in public discussions in the past.

About three-quarters of the contractors holding waivers from NASA told us in answers to our questionnaire that they had never declined to bid on any other NASA contract because of the agency's patent policies. The other one quarter said in effect that they would decline if they thought that a NASA contract would imperil a commercial position. Granting that they might do so, we think that the potential loss to NASA is exceedingly small, simply because most of NASA's research is so far removed from lines of commerce. A few contractors say that NASA's patent policies cause them to postpone involvement with NASA; they do and pay for the research themselves, acquiring the inventions they expect; after this they take a development contract from NASA. But the provision for advance waivers has increased the willingness of such contractors to bid on R & D contracts.

Protection in Procurement

There is no problem here--nothing for us to evaluate. NASA either owns or has a royalty-free license on every invention from its research. In procuring equipment embodying one or more of these inventions, NASA is fully protected.

Protection of Health and Welfare

NASA's entire patent program is alert to the need to protect the public health and welfare (e.g., safety). To date (1966), only one or two patented inventions resulting from NASA's research are related to public health; they are not of major importance. For waived inventions, NASA's March-in-Rights are another and probably unnecessary degree of precaution.

Avoidance of Concentration and Monopoly

Like the other major federal agencies, NASA awards the bulk of its R & D funds to a relatively few large corporations. The effect is to contribute to the maintenance of the existing pattern of concentration in industry. In its waiver policy NASA has transferred patent rights to some large corporations, as well as to small ones and nonprofit organizations. The value of these patent rights is very low; to the end of 1965, the companies holding waivers had spent more on development than they had received in sales revenue. The waived inventions with the greatest promise of future income belong to two small business firms and a university.

The patent rights acquired by industry from NASA's waiver program have an infinitesimal impact on the existing concentration of patents. The direction of this impact is to increase the patent portfolios of the medium-sized and smaller firms relatively more than those of aerospace and other large companies. Small though it is, the effect of the waiver program, then, is to move away from rather than toward greater concentration. And we can see not the slightest evidence of undue monopolization.

NASA is fully aware of its obligations to support national goals of economic policy. The licensing and waiver regulations, both as they stand and as they are administered, advance technology while preventing any serious threat to competition.

A Summing Up

On disclosures, NASA's accomplishments have been disappointing; we think that something can be done. On utilization the record has been fairly good; only a small improvement seems possible. On the development of inventions, the accomplishments of contractors and licensees seem to be good; here too the possibilities for improvement are not large. There has been a little transfer of technology through licensing; patent policy cannot do much here. In protecting NASA's interests in procurement, all is in order. Similarly there is no problem with health and welfare; NASA is alert in maintaining the safeguards. In granting waivers, NASA is not adding to existing concentration of economic power; the tendency of the waiver program is to benefit medium-sized and smaller firms relatively more. The danger of undue monopolization is invisible.

Recommendations

1. NASA should take the steps to create a better image of its patent policies.

2. With a new system of incentives, worked out in cooperation with contractors, NASA should spark the creativity of contractors' employees. The goal should be better, rather than more, invention disclosures.

3. NASA should establish more liberal provisions for exclusive licenses.

4. In its waiver program, NASA should speed action on petitions, should interpret its regulations a little more liberally, and should ensure uniformity among its field centers.

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Appendix A

LEGISLATIVE HISTORY OF THE PROPERTY RIGHTS IN INVENTIONS PROVISIONS OF THE NATIONAL AERONAUTICS AND SPACE ACT OF 1958

by

David E. Aaronson

ACKNOWLEDGEMENTS

The cooperation and assistance of many persons made this study possible. I am especially indebted to the following persons whose assistance is gratefully acknowledged:

Mr. Gayle Parker, a patent attorney in the Office of the General Counsel for Patent Matters, National Aeronautics and Space Administration, provided invaluable help. He gave useful suggestions, use of an original bibliography and source materials, permission to use the NASA law library, and criticism of a tentative draft of this paper. He kindly and patiently made available his time and considerable expertise.

Mr. Philip B. Yeager, Counsel, House Committee on Science and Astronautics, generously shared his files on The National Aeronautics and Space Act of 1958. He provided useful suggestions, interesting background information, and criticism of the tentative draft.

Mr. Spencer M. Beresford, an attorney in private practice in the District of Columbia, who was formerly Special Counsel, House Select Committee on Astronautics and Space Exploration, gave useful suggestions and criticism of the tentative draft. I am grateful, too, for suggestions from Mr. Paul G. Dembling, Deputy General Counsel, National Aeronautics and Space Administration and Mr. Robert F. Allnutt, Assistant General Counsel for Patent Matters, National Aeronautics and Space Administration, both of whom kindly read the tentative draft. Also, I wish to express my appreciation to Mr. John C. Herberg, Senior Counsel, Senate Legislative Counsel's Office, and Mr. Gerald W. Siegal, Vice-President and Counsel, the Washington Post Company, for useful information and suggestions.

Last, but very important indeed, Mr. Herschel F. Clesner, Inventions Coordinator, Office of the Surgeon General, Department of Health, Education and Welfare, provided valuable insights and suggestions, and criticism of the tentative draft.

I found the task of researching this paper most enjoyable, largely because of the assistance of these persons. The decision whether to accept their suggestions and criticism was, of course, my own, and I, alone, am responsible for any errors of fact, reasoning, or judgment.

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LEGISLATIVE HISTORY OF THE PROPERTY RIGHTS IN INVENTIONS PROVISIONS OF THE NATIONAL AERONAUTICS AND SPACE ACT OF 1958

David E. Aaronson*

INTRODUCTION

> If legislative intent has meaning for the interpretative process it means not a collection of subjective wishes, hopes, and prejudices of individuals, but rather the objective footprints left on the trail of legislative enactment. Legislative intent can't be "dreamed-up." It can be <u>speculated about</u>; but it can be <u>discovered</u> only by factual inquiry into the history of the enactment of the statute, the background circumstances which brought the problem before the legislature, the legislative committee reports, the statements of the committee chairman, and the course of enactment.1/

A plethora of literature has been contributed on the subject of Federal government patent policy. The question of how to allocate the ownership rights to inventions made under contracts for government-sponsored research has occupied an important place in this literature, has been the

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1/ Sutherland, J.G., *Statutes and Statutory Construction*, Vol II, (3rd Ed. by Frank K. Horack, Jr., 1943) at 322.

subject of continuing controversy, and has recently been the subject of Congressional hearings.

Yet, prior to the enactment of The National Aeronautics and Space Act of 1958,[2/] little public comment was offered by Congressmen and other interested persons on this question relative to research to be contracted by the new National Aeronautics and Space Administration.[3/] Subsequent to the enactment of this statute, however, this question has received the continuing attention of Congress and others interested in the patent policies of NASA. Discussions of the NASA patent policies have sometimes included comments about the legislative history of the property rights in inventions provisions.

These references to the legislative history may be usually placed in one of three categories: First, comments that since little or no legislative history exists, nothing definite may be concluded about the intent of Congress;[4/]

2/ 72 Stat. 435, 42 U.S.C. 2451 (1958). Often referred to herein as the Space Act.

3/ Often referred to as NASA.

4/ See Caruso, Lawrence R., "A Study In Decision-Making: The Patent Policies of the National Aeronautics and Space Administration," 7 Howard Law Journal (1961) 93, one of the few published scholarly articles dealing with the legislative history. On page 100, he states: (continued)

Second, comments equivalent to assumptions about the apparent intent of Congress;[5/] Third, comments equivalent to speculations, based on some evidence, about the intent of Congress. Surprisingly, the available literature reveals few examples of attempts to discover the intent of Congress on a particular question based on a thorough factual examination of the legislative history of the Space Act patent provisions.[6/]

The major purpose of this study is to make an objective and thorough examination of the legislative history of

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"The legislative history of the Space Act of 1958 fails to state any reasons for the inclusion of the special patent provisions. Indeed, it is difficult even to speculate on the reasons for the NASA patent provisions because the legislative history of the Space Act includes so very little on this point," citing O'Brien & Parker, "Property Rights in Inventions Under The National Aeronautics and Space Act of 1958," 19 Federal Bar Journal (1959) 255, 260 and Federal Patent Policy at 49 (Machinery and Allied Products Institute, and Council for Technological Advancement, 1960).

5/ See Gordon, Benjamin, "Government Patent Policy and the New Mercantilism," 25 Federal Bar Journal (1965) 24,25.

6/ See Caruso, Lawrence, R., op. cit. supra, note 4; Maltby, Wilson R., "The National Aeronautics and Space Act of 1958 Patent Provisions," 27 George Washington Law Review (1958-1959) 49; O'Brien, G.D., and Parker, Gayle, "Property Rights In Inventions Under The National Aeronautics And Space Act Of 1958," 19 Federal Bar Journal (1959) 255; Parker, Gayle, "Comparison of the Patent Provisions of The NASA Act and the property rights in inventions provisions of the Space Act. Other complementary provisions of the Space Act are also considered. A subsidiary purpose is to attempt to answer the following question: What intent did Congress express, if any, relative to how the Administrator of NASA should exercise the discretionary authority of Subsections 305 (a) and (f) of the Space Act to prescribe regulations, and pursuant thereto, decide whether to waive all or part of the rights acquired by NASA to the inventions of its contractors and subcontractors? Sections 305(a) and (f) constitute the statutory basis for NASA's waiver policies. This question was selected because of its relevance to other research work on NASA's waiver policies, and because it is an important question on which differences of opinion have been expressed.

A careful attempt has been made to approach this study in an objective manner. Much factual information is presented in the form of direct quotations. This method preserves the speaker's own emphasis and the context in which his statement was made. It minimizes a major potential source of inaccuracy and may also provide the reader with a sense of the realism and dynamics of what happened

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AEC Act," 3 Patent, Trademark, and Copyright Journal of Research and Education (1959) 303.

that could not be given through concise summaries. It is recognized that value judgments are implicit in the task of selecting, presenting, and interpreting evidence. Information has been selected and presented with the objective of providing the reader with as complete a picture as possible of what happened. When inferences have been drawn from the evidence, an attempt has been made to state them explicitly. An additional element of disinterested reasoning and judgment is required to answer the subsidiary question posed above. The reasons for arriving at an answer to this question are explicitly set forth in the final section of this paper. The validity of the examination of the legislative history of the property rights in inventions provisions of the Space Act is in no way dependent upon the acceptance of this answer.

As indicated above, Congress delegated discretionary power under Subsections 305(a) and (f) to the Administrator of NASA to formulate a waiver policy. A mere reading of the language of this statute, which is set forth in the following section of this paper, suggests that Congress may have permitted a choice among a variety of possible waiver policies. Let us hypothesize that among the possible choices, five general types of waiver policies, covering the entire range of choice, may be distinguished. Any particular waiver policy will tend to approximate one of the following general cases:

> Policy No. I. An All-Government policy. After title is initially taken under Subsection 305(a), it should always remain in the United States. The Administrator should never exercise his discretionary power under Subsection 305(f) to waive title.

> Policy No. II. A Favor-The-Government policy. After title is initially taken under Subsection 305 (a), it should usually remain in the United States. The Administrator should only waive title under Subsection 305(f) in unusual or exceptional circumstances upon the request of the contractor.7/

> Policy No. III. A Flexible or Balance-The-Interests policy. After title is initially taken under Subsection 305(a), upon request of the contractor, it should be waived or retained according to which alternative best advances the "interests of the United States" based on an evaluation of the intersts of the parties involved for each invention or class of inventions.

> Policy No. IV. A Favor-The-Contractor policy. After title is initially taken under Subsection 305(a), it should usually be waived upon the request of a contractor. The Administrator should only deny waiver under Subsection 305(f) in unusual or exceptional circumstances.

> Policy No. V. An All-Contractor policy. After title is initially taken under Subsection 305(a), title should always be waived upon the request of a contractor. The Administrator should never exercise his authority under Subsection (f) to retain title, unless the contractor subsequently retransfers his rights to the invention.

7/ See, supra, note 5, for a recent article in which this policy is stated to be policy apparently intended by Congress.

The above five general types of waiver policies are theoretically possible ways in which the Administrator could exercise his authority under Subsections 305(a) and (f). Yet, a careful reading of the language of these subsections strongly suggests, if not compels, the conclusion that if the Administrator were to attempt to pursue a policy approximating either Policies No. I or V, he would be exercising his authority contrary to the intent of Congress.

A careful reading of these statutory provisions does not, however, appear to exclude a waiver policy approximating either Policies II, III, or IV. It is necessary to go behind the language of these provisions and to examine their legislative history to determine whether Congress intended to limit the Administrator's range of choice among these three general policy types.

Three possible conclusions may result from such an examination. First, Congress may have expressed no intention which would limit the Administrator in formulating a waiver policy falling somewhere within this range. Second, Congress may have expressed an intention to reject one or more of these general policy types. Third, Congress may have expressed a positive preference for one or more of these general policy types. The method of answering the question posed earlier in this section is to test these hypotheses in light of the factual information revealed by an examination of the legislative history.

This report is organized into seven sections followed by a section summarizing the findings and stating the principal conclusions. The seven sections are as follows: I. Section 305 of the Space Act and Related Provisions; II. The President's Message and Committee Hearings on H.R. 11881 and S. 3609; III. Enactment of Patent Provisions in the House; IV. Deletion of Senate Patent Provisions by Floor Amendment; V. The Recommendations and Report of the Natcher Patent Subcommittee; VI. Informal Pre-Conference Discussions, the Conference Meeting, and the Conference Report; VII. Floor Discussion and Final Passage.

A time table of the legislative process is now presented in order to enable the reader to follow more easily the subsequent discussion. All of the major legislative decisions were made within a time period between February and July, 1958. The table is as follows:

Table No. I

LEGISLATIVE TIME TABLE
THE NATIONAL AERONAUTICS AND SPACE ACT OF 1958

Date All Dates in 1958	Legislative Action Taken
February 6th	Creation of Senate Special Committee on Space and Astronautics.
March 5th	Creation of House Select Committee on Astronautics and Space Exploration.
April 2nd	The President's Message recommending the creation of a new, independent agency.
April 14th	The Administration's Bill introduced into the House (H.R. 11881) and the Senate (S. 3609) with no patent provisions.
April 15th through May 12th	Public Hearings held by House Select Committee.
May 6th through May 15th	Public Hearings held by Senate Special Committee.
May 24th	House Select Committee reported out new bill (H.R. 12575) with patent provisions after meeting in executive session.
June 2nd	House unanimously passed H.R. 12575 with patent provisions unchanged.
June 11th	Senate Special Committee reported out amended bill (S. 3609) with patent provisions

	almost identical to the House provisions.
June 16th	Deletion of Senate patent provisions by Floor Amendment. Senate passed bill with no patent provisions. Senate asked for Conference.
June 18th	House agrees to Conference.
Late June or early July	Recommendations and Report submitted by Natcher Patent Subcommittee.
The Second Week of July	Informal Pre-Conference discussions, negotiations, and drafting of final patent provisions by staff members.
July 15th	Conference Meeting adopted new patent provisions and resolved differences between House and Senate bills.
July 16th	Discussion and passage by House and Senate of bill reported out of Conference with patent provisions unchanged.
July 29th	President Dwight D. Eisenhower signed H.R. 12575 as Public Law 85-568, enacting into law The National Aeronautics and Space Act of 1958.

Source: Based on information reported in this study.

It is hoped that this report, as an historical study, may be of interest as an end in itself. It is hoped, too, that it may be useful to policy makers, not only because of the question relating to waiver policy, but as a source of information to which other questions may be referred.

I. SECTION 305 OF THE SPACE ACT AND RELATED PROVISIONS

Section 305 of the Space Act is the principal section governing the policy of the National Aeronautics and Space Administration toward inventions conceived or developed as a result of its contracts with private parties.

Section 305 provides as follows:

> Sec. 305. (a) Whenever any invention is made in the performance of any work under any contract of the Administration, and the Administrator determines that—
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> (1) the person who made the invention was employed or assigned to perform research, development, or exploration work and the invention is related to the work he was employed or assigned to perform, or that it was within the scope of his employment duties, whether or not it was made during working hours, or with a contribution by the Government of the use of Government facilities, equipment, materials, allocated funds, information proprietary to the Government, or services of Government employees during working hours; or
>
> (2) the person who made the invention was not employed or assigned to perform research, development, or exploration work, but the invention is nevertheless related to the contract, or to the work or duties he was employed or assigned to perform, and was made during working hours, or with a contribution from the Government of the sort referred to in clause (1),
>
> such invention shall be the exclusive property of the United States, and if such invention is patentable a patent therefore shall be issued to the United States upon application made by the Administrator, unless the Administrator waives all or any part of the rights of the United States to such invention in conformity with the provisions of subsection (f) of this section.

(b) Each contract entered into by the Administrator with any party for the performance of any work shall contain effective provisions under which such party shall furnish promptly to the Administrator a written report containing full and complete technical information concerning any invention, discovery, improvement, or innovation which may be made in the performance of any such work.

(c) No patent may be issued to any applicant other than the Administrator for any invention which appears to the Commissioner of Patents to have significant utility in the conduct of aeronautical and space activities unless the applicant files with the Commissioner, with the application or within thirty days after request therefor by the Commissioner, a written statement executed under oath setting forth the full facts concerning the circumstances under which such invention was made and stating the relationship (if any) of such invention to the performance of any work under any contract of the Administration. Copies of each such statement and the application to which it relates shall be transmitted forthwith by the Commissioner to the Administrator.

(d) Upon any application as to which any such statement has been transmitted to the Administrator, the Commissioner may, if the invention is patentable, issue a patent to the applicant unless the Administrator, within ninety days after receipt of such application and statement, requests that such patent be issued to him on behalf of the United States. If, within such time, the Administrator files such a request with the Commissioner, the Commissioner shall transmit notice thereof to the applicant, and shall issue such patent to the Administrator unless the applicant within thirty days after receipt of such notice requests a hearing before a Board of Patent Interferences on the question whether the Administrator is entitled under this section to receive such patent. The Board may hear and determine, in accordance with rules and procedures established for interference cases, the question so presented, and its determination shall be subject to appeal by the applicant or by the Administrator to the Court of Customs and Patent Appeals in accordance with procedures governing appeals from decisions of the Board of Patent Interferences in other proceedings.

(e) Whenever any patent has been issued to any applicant in conformity with subsection (d), and the Administrator thereafter has reason to believe that the statement filed by the applicant in connection therewith contained any false representation of any material fact, the Administrator within five years after the date of issuance of such patent may file with the Commissioner a request for the transfer to the Administrator of title to such patent on the records of the Commissioner. Notice of any such request shall be transmitted by the Commissioner to the owner of record of such patent, and title to such patent shall be so transferred to the Administrator unless within thirty days after receipt of such notice such owner of record requests a hearing before a Board of Patent Interferences on the question whether any such false representation was contained in such statement. Such question shall be heard and determined, and determination thereof shall be subject to review, in the manner prescribed by subsection (d) for questions arising thereunder. No request made by the Administrator under this subsection for the transfer of title to any patent, and no prosecution for the violation of criminal statute, shall be barred for any failure of the Administrator to make a request under subsection (d) for the issuance of such patent to him, or by any notice previously given by the Administrator stating that he had no objection to the issuance of such patent to the applicant therefor.

(f) Under such regulations in conformity with this subsection as the Administrator shall prescribe, he may waive all or any part of the rights of the United States under this section with respect to any invention or class of inventions made or which may be made by any person or class of persons in the performance of any work required by any contract of the Administration if the Administrator determines that the interests of the United States will be served thereby. Any such waiver may be made upon such terms and under such conditions as the Administrator shall determine to be required for the protection of the interests of the United States. Each such waiver made with respect to any invention shall be subject to the reservation by the Administrator of an irrevocable, nonexclusive, nontransferrable, royalty-free license for the practice of such invention throughout the world by or on behalf of the United States or any foreign government pursuant to any treaty or agreement with the United States. Each proposal for any waiver under this subsection shall be referred to an Inventions and Contributions Board which shall be established by the Administrator within the Administration. Such Board shall accord to each interested party an opportunity for hearing, and shall transmit to the Administrator its findings of fact with respect to such proposal and its recommendation for action to be taken with respect thereto.

(g) The Administrator shall determine, and promulgate regulations specifying, the terms and conditions upon which licenses will be granted by the Administration for the practice by any person (other than an agency of the United States) of any invention for which the Administrator holds a patent on behalf of the United States.

(h) The Administrator is authorized to take all suitable and necessary steps to protect any invention or discovery to which he has title, and to require that contractors or persons who retain title to inventions or discoveries under this section protect the inventions or discoveries to which the Administration has or may acquire a license of use.

(i) The Administration shall be considered a defense agency of the United States for the purpose of chapter 17 of title 35 of the United States Code.

(j) As used in this section—

(1) the term "person" means any individual, partnership, corporation, association, institution, or other entity;

(2) the term "contract" means any actual or proposed contract, agreement understanding, or other arrangement, and includes any assignment, substitution of parties, or subcontract executed or entered into thereunder; and

(3) the term "made" when used in relation to any invention, means the conception or first actual reduction to practice of such invention.

Two other sections of the NASA Act are closely related to Section 305. Section 203 (b)(3) provides authority to acquire and dispose of property, including patents, as follows:

(3) to acquire (by purchase, lease, condemnation, or otherwise), construct, improve, repair, operate, and maintain laboratories, research and testing sites and facilities, aeronautical and space vehicles, quarters and related accommodations for employees and dependents of employees of the Administration, and such other real and personal property (<u>including patents</u>), or any interest therein, as the Administration deems necessary within and outside the continental United States; to lease to others such real and personal property; to sell and otherwise dispose of real and personal property (<u>including patents and rights thereunder</u>) in accordance with the provisions of the Federal Property and Administrative Services Act of 1949, as amended (40 U.S.C. 471 et seq.); and to provide by contract or otherwise for cafeterias and other necessary facilities for the welfare of employees of the Administration at its installations and purchase and maintain equipment therefor;8/ (Emphasis added)

Section 306 provides for making awards for scientific and technical contributions, as follows:

> Sec. 306. (a) Subject to the provisions of this section, the Administrator is authorized, upon his own initiative or upon application of any person, to make a monetary award, in such amount and upon such terms as he shall determine to be warranted, to any person (as defined by section 305) for any scientific or technical contribution to the Administration which is determined by the Administrator to have significant value in the conduct of areonautical and space activities. Each application made for any such award shall be referred to the Inventions and Contributions Board established under section 305 of this Act. Such Board shall accord to each such applicant an opportunity for hearing upon such application, and shall transmit to the Administrator its recommendation as to the terms of the award, if any, to be made to such applicant for such contribution. In determining the terms and conditions of any award the Administrator shall take into account —
>
> (1) the value of the contribution to the United States;
>
> (2) the aggregate amount of any sums which have been expended by the applicant for the development of such contribution;
>
> (3) the amount of any compensation (other than salary received for services rendered as an officer or employee of the Government) previously received by the applicant for or on account of the use of such contribution by the United States; and
>
> (4) such other factors as the Administration shall determine to be material.

8/ (From p. 16) Authority to lease buildings in the District of Columbia was added to Sec. 203 (b)(3) by Public Law 86-20 (73 Stat. 21), May 13, 1959.

(b) If more than one applicant under subsection (a) claims an interest in the same contribution, the Administrator shall ascertain and determine the respective interests of such applicants, and shall apportion any award to be made with respect to such contribution among such applicants in such proportions as he shall determine to be equitable. No award may be made under subsection (a) with respect to any contribution—

(1) unless the applicant surrenders, by such means as the Administrator shall determine to be effective, all claims which such applicant may have to receive any compensation (other than the award made under this section) for the use of such contribution or any element thereof at any time by or on behalf of the United States, or by or on behalf of any foreign government pursuant to any treaty or agreement with the United States, within the United States or at any other place;

(2) in any amount exceeding $100,000, unless the Administrator has transmitted to the appropriate committees of the Congress a full and complete report concerning the amount and terms of, and the basis for, such proposed award, and thirty calendar days of regular session of the Congress have expired after receipt of such report by such committees.[9/]

The above provisions, part of H.R. 12575, were signed into law by President Eisenhower on July 29, 1958,[10/] marking

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9/ Another related section is Sec. 303, "Access to Information," which provides that information obtained or developed by the Administrator in the performance of his functions shall be made available for public inspection, except when such information is classified or authorized or required by Federal statute to be withheld. This section makes most technical information publicly available. Sec. 305 was drafted in a manner to assure that the mandate of this section would not be defeated.

10/ 104 *Cong. Rec.* 15,610.

the final official act in our story of the legislative history. The major _dramatis personae_, as far as the official record is concerned, in the United States House of Representatives, were: Representatives John W. McCormack, Overton Brooks, Brooks Hays, Leo W. O'Brien, Lee Metcalf, Gordon L. McDonough, James G. Fulton, Kenneth B. Keating, Gerald R. Ford, Jr.;[11/] in the United States Senate, the corresponding figures were: Senators Lyndon B. Johnson, Richard B. Russell, Theodore F. Green, John L. McClellan, Warren G. Magnuson, Styles Bridges, Alexander Wiley, Bourke B. Hickenlooper, Leverett Saltonstall.[12/]

11/ Designated as "Managers on the Part of the House," Conference Report, Report No. 2166 (85th Cong., 2nd Sess. July 15, 1958) at 14.

12/ Designated as "Managers on the Part of the Senate," _Ibid_.

II. THE PRESIDENT'S MESSAGE AND COMMITTEE HEARINGS ON H.R. 11881 AND S. 3609.

Perhaps, our story begins officially on April 2, 1958, when the President of the United States transmitted to the Congress a special message recommending the establishment of a new, independent Federal agency, The National Aeronautics and Space Agency. The message recommended that this Agency should be given broad powers to be responsible for programs concerned with problems of space technology, space science and civil space exploration, and to continue the aeronautical research programs of the National Advisory Committee for Aeronautics.[13/] President Eisenhower stated:

> I recommend that aeronautical and space science activities sponsored by the United States be conducted under the direction of a civilian agency, except for those projects primarily associated with military requirements...

13/ House Document No. 365, 85th Cong. 2d Sess., April 2, 1958.

The National Advisory Committee for Aeronautics (NACA), the predecessor to the National Aeronautics and Space Administration (NASA), was established in 1915 to "supervise and direct the scientific study of the problems of flight, with a view to their practical solution... and to direct and conduct research and experiments in aeronautics." 38 Stat. 930, 50 U.S.C. 151 (1915). Unlike NASA, which is primarily a contracting agency, NACA's research work was conducted primarily by its own employees, numbering about 8,000 scientists, engineers and supporting personnel shortly before the Space Act was passed.

> I am, therefore, recommending that the responsibility for administering the civilian space science and exploration program be lodged in a new National Aeronautics and Space Agency, into which the National Advisory Committee for Aeronautics would be absorbed. Hence, in addition to directing the Nation's civilian space program, the new Agency would continue to perform the important aeronautical research functions presently carried on by the National Advisory Committee for Aeronautics....
>
> The National Aeronautics and Space Agency should be given that authority which it will need to administer successfully the new programs under conditions that cannot now be fully foreseen.14/

Prior to this message, hearings on the Nation's satellite and missile programs were conducted from November 25, 1957 to January 23, 1958, by the Preparedness Investigation Subcommittee of the Senate Committee on Armed Services. These hearings began less than two months after the launching of the first earth satellite, Sputnik I, by the Soviet Union on October 4, 1957.15/ Congress had begun to respond to a crisis. The Soviet Union had dramatically demonstrated that

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14/ Id. at 2.

15/ Spherical in shape with a diameter of 22.8 inches, this 184 pound satellite, Sputnik I, circled the world in an initial time of 96.2 minutes. Its altitude ranged from 145 to 560 miles. It carried two radio transmittors.

On November 3, 1957, Sputnik II, carring a dog, Laika, was launched by the Soviet Union. According to the Tass announcements, the "containers with apparatus" of this rocket-shaped satellite weighed 1,120 pounds, and it contained "instruments for studying solar radiation in the United States had fallen behind in long range missiles. Fears were widely expressed that the conquest of space might provide a decisive means of military victory. Rep. McCormack's opening remarks to the House before the final vote on July 16, 1958, which is quoted in the last section of this paper, illustrates the atmosphere of urgency prevailing in Congress. The legislative actions resulting in the passage of the Space Act must be considered against this background.

A Special Committee on Space and Astronautics was

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the short wave ultraviolet and X-ray regions of the spectrum, instruments for cosmic ray studies, instruments for studying the temperature and pressure, an airtight container with an experimental animal, an air conditioning system, food and instruments for studying life processes in the conditions of cosmic space, measuring instruments for transmitting the results of scientific measurements to the earth, two radio transmitters." It had an initial orbit time of 103.7 minutes and a maximum altitude of 1,056 miles.

On December 6, 1957, a mechanical failure in the propulsion system of a Vanguard rocket caused it to burst into flames two seconds after it was fired in an attempt by the Navy to launch a 6.4 inch test satellite.

On December 14, 1957, Major General John B. Medaris, Commander of the Army Ballistic Missile Agency, testifying before the Senate Preparedness Investigating Subcommittee, stated: "Because I have no responsibility to carry this out, I think I can say in open meeting that it is my personal opinion unless this country can command 1 million pounds of thrust by 1961, we will not be in pace... we will not be in the race."

established by the Senate on February 6, 1958.[16/] A corresponding committee, the Select Committee on Astronautics and Space Exploration was created by the House of Representatives on March 5, 1958.[17/] The designated chairmen of these two committees were Senator Lyndon B. Johnson and Representative John W. McCormack, respectively.

The Administration's bill was introduced in the House, as H.R. 11881, by Rep. McCormack on April 14, 1958, and was introduced on the same day in identical form in the

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On January 31, 1958, the first American satellite, Explorer I, was launched by the Army using a modified Jupiter-C rocket. Weighing 30.8 pounds, the satellite and final stage rocket was 80 inches long and 6 inches in diameter. It carried 11 pounds of instruments for gathering data on skin and internal temperature, cosmic dust erosion, and cosmic rays. It carried two radio transmitters. It reached a maximum altitude of 1,587 miles.

House Report No. 1758, 85th Congress, 2d Session (1958) at 217-219, 222.

16/ Senate Resolution 256, 85th Congress, 2d Sess., February 6, 1958.

17/ House Resolution 496, 85th Cong. 2d Sess., March 5, 1958. The selection of the majority leader, the minority leader, and members from the key standing committees to serve on this special committee was described by a Congressman as an "unprecedented action".

Senate, as S. 3609, by Senators Johnson and Bridges.[18/] These bills were referred to the newly created special House and Senate committees. This was twelve days after the President's Message.

No provisions relating to the determination of property rights in inventions from government-sponsored research with private parties and for awards for scientific and technical contributions were included in these bills, nor were they mentioned in the President's Message.

Both committees soon began to hold hearings on the respective bills. The Senate Special Committee on Space and Astronautics, which heard testimony from May 6 through May 15, 1959, was the setting for a three-way conversation between Senator Clinton P. Anderson, Mr. Paul G. Dembling, General Counsel of the National Advisory Committee for Aeronautics (NACA), and Dr. James H. Doolittle, Chairman of the

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18/ H.R. 11881, 85th Cong. 2d Sess., 104 Cong. Rec. 6325, a bill to provide for research into problems of flight within and outside the earth's atmosphere, and for other purposes.

S. 3609, 85th Cong. 2d Sess., 104 Cong. Rec. 6288. Also, on April 14, 1958, five other bills, identical to H.R. 11881 were introduced in the House: H.R. 11882 (Rep. Arends), H.R. 11887 (Rep. Haskell), H.R. 11888 (Rep. Keating), H.R. 11961 (Rep. Frelinghuysen), and H.R. 11964 (Rep. Fulton).

National Advisory Committee for Aeronautics (NACA):

Senator Anderson: Was there any provision made in this legislation with reference to patents?

Mr. Dembling:[19] No, sir.

Senator Anderson: Was there a long, hard and bitter fight, in your opinion, over the question of patents when the Atomic Energy Act was adopted? Do you recall?

Dr. Doolittle: I do not recall.

Senator Anderson: The very author of that bill, Senator Hickenlooper, would recognize that there was a fight over the patent section, because there was a feeling that somebody ought to protect the public rights on these patents. Now, this bill is completely silent on that, is it not?

Dr. Doolittle: Yes, it is.[20]

19/ The administration's bill was drafted in the Bureau of the Budget at the request of the President. Mr. Dembling was one of the principal drafters of this bill.

20/ Hearings on S. 3609 before the Senate Special Committee on Space and Astronautics, 85th Cong. 2d Sess., (Part I) at 27,28.

Deputy Secretary of Defense, Donald A. Quarles, was later questioned by Senators Anderson and Johnson as follows:

(Senator Anderson) Now, let me ask you this. Is there any provision in this bill with reference to patents?

Mr. Quarles: I think there is no specific provision in this bill for patents.

Senator Anderson: No. So that whoever developed the project could patent it and claim it and keep it as his own; one of these private groups.

Mr. Quarles: Well, I don't think I would like to agree with that, but you are in a much better position to have an opinion about that than I am, Senator.

Senator Anderson: Only because the burnt child fears the fire, and we went through this in Atomic Energy Commission for a long, long time. Would it not be well to try to protect it as we get underway, perhaps?

Mr. Quarles: Well, I think we have been assuming in the Department of Defense that the work that this agency would carry on with Government funds and for the Government would carry with it the same kind of patent provisions that our own work carries with it, and this is well established by law and practice, and I had assumed that the same practice would apply to the new agency. I will assume it not as a lawyer, however.

Senator Johnson: Thank you, Senator Anderson. Mr. Secretary, I notice your reply to Senator Anderson's question on the lack of adequate patent protection so far as the statute is concerned is based on what you assumed would be the case. Would you ask the counsel to prepare for the committee a memorandum on what is the case as they understand it, together with any recommendations in that field that the Department might be inclined to make?

Mr. Quarles: I would be glad to do so, Mr. Chairman.[21/]

In response to Senator Johnson's request, Mr. Quarles submitted a statement on May 19, 1958, providing as follows:

21/ *Id*. at 78-79.

With respect to patents, the proposed new agency would be governed by existing laws and regulations.

As to Government employees, which would of course include employees of the proposed agency, Executive Order 10096... relating to patent policy is applicable. By this order, the Government obtains title when, under the policy enunciated in the order, the Government has a paramount interest; but where the equities of the employee are greater than those of the Government, the employee retains the title but Government receives an irrevocable royalty-free license for its own use. We have found in the Department of Defense that a license to the Government preserves all necessary rights; and leaving title with the employee so that he can receive any benefits from nongovernmental commercial use provides an incentive to employees to make inventions.

As to contractors, the Department of Defense in the Armed Services Procurement Regulations... requires the inclusion in contracts for research and development of a patent-rights clause which permits the contractor to retain the title to the invention but gives the Government an irrevocable royalty-free license throughout the world. Again, as noted in the employee's inventions this provides the Government all the rights it needs and leaves an incentive to the contractor.

With respect to secrecy of patents, the Patent Secrecy Act (35 U.S.C. 181 et seq.), provides adequate authority to withhold the issuing of patents falling within the classified area.

We are advised that the NACA policy and procedures on patent matters are similar to those of the Department of Defense. The above authority and procedures have provided an adequate basis for the handling of patent matters relating to Department of Defense problems not only in the area of advanced research and missilry but in other important areas [as] well. Therefore, it would

> appear that special patent provisions are not required in the proposed legislation.22/

The above statement and preceding excerpts are the primary references made to the question of ownership to rights of inventions during the Senate hearings.

Little discussion of patent policy appeared in the more lengthy hearings before the House Select Committee on Astronautics and Space Exploration, April 15 through May 12, 1958, which resulted in 1542 pages of published testimony and exhibits.23/ The most detailed discussion of patent policy was the testimony of Dr. Hugh L. Dryden, Director, the National Advisory Committee for Aeronautics, April 22, 1958, who described the application of Executive Order 10096, referred to in Mr. Quarles' statement, as follows:

> NACA regulations require that all employee inventions be reported, with full information concerning the circumstances under which they were

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22/ *Id.* at 97-98. Executive Order 10096, cited in Mr. Quarles' statement, was issued on January 23, 1950. It provided for a uniform patent policy for Government departments and agencies for inventions made by Government employees. The Executive Order did not cover government contractors. It directed each Government agency to issue such regulations as were necessary to carry out the order. A new Government Patents Board was established.

23/ Hearings on H.R. 11881 before the House Select Committee on Astronautics and Space Exploration, 85th Cong. 2d Sess., (1958).

made. If patent protection is deemed advisable and a prior art search confirms the existence of patentable novelty, a determination regarding the disposition of the rights to the invention is made by NACA, in accordance with the provisions of the Executive order. If title, or all rights are to be left with the inventor, the concurrence of the Chairman of the Government Patents Board must be obtained. The employee may appeal to the Chairman of the Government Patents Board from a decision made by NACA. The decision of the Chairman upon any such appeal is final.[24/]

Rear Adm. Hyman G. Rickover, Assistant Chief, Bureau of Ships, For Nuclear Propulsion, Department of the Navy, testified before the House Committee on April 18, 1958. In response to a request by Rep. McCormack, he submitted a letter on May 7, 1958, stating his views on patent policy, as follows:

> Dear Mr. McCormack: At the time of my testimony on April 18, 1958, before your committee you asked that I submit comments for the record on patent provisions for outer space legislation.
>
> Of course I lack the expertness to recommend specific legislative language, but I would like to make some general observations. I believe that one can distinguish clearly between patent rights arising from discoveries made with the expenditure of public money and those which are developed privately. In the case of inventions conceived during the course of a Government contract or similar relationship, strong provision should be

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24/ Hearings on H.R. 11881 before the House Select Committee on Astronautics and Space Exploration, 85th Cong. 2d Sess., (1958) at 440. A statement of NACA patent regulations appears in the Hearings at 452 et.seq.

> made for the patent rights to be vested in the Government. A provision such as this does not freeze patents because the Government has continuously licensed others to use such patents in the interest of the country as a whole.
>
> Whenever a private party conceives of an invention or discovery and no Federal funds are involved in the work, he has a rather sacred constitutional right to the exclusive use of his invention or discovery. I do not think that writing a provision in outer space legislation which would award the Government title to patents developed with the use of Government funds would, in any way, infringe upon this right.
>
> Perhaps some may think that this oversimplifies the matter but I have long felt that patent provisions of the many laws surrounding Government research work could be simplified to a greater extent.
>
> I do feel strongly that no provision of the law setting up the space agency should ever be construed to confer on any individual a right which could in any way impede or restrict the use of relevant technology by our Government for domestic or for international purposes. An unequivocal statement to this effect in the law would be an earnest [sic] of our intention to help other nations.
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> I hope these comments are of help to you.25/

Only after the close of the above hearings, the House committee in executive session determined that a patent

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25/ Id. at 237. Concerning Adm. Rickover's reference to "a rather sacred constitutional right," Article I, Section 8 of the Constitution of the United States provides..." To promote the progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries;"

provision should be included in the bill.[26/] The basis for this determination and the discussions that took place are not officially recorded. On May 24, 1958, the full House committee reported a new bill, H.R. 12575,[27/] to replace H.R. 11881, which, in addition to other changes, contained a patent provision, Section 407.[28/] It provides as follows:

> Sec. 407. (a) Any invention or discovery made or conceived under any contract, subcontract, arrangement, or other relationship with the Administrator, regardless of whether the contract or arrangement involved the expenditure of funds by the Administrator, shall be deemed to have been made or cenceived by the Administration, except that the Administrator may waive the Administration's claim to any such invention or discovery under such circumstances as the Administrator may deem appropriate.
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> (b) In any case where the Administrator waives the Administration's claim to an invention or discovery as authorized by subsection (a), the Administrator shall retain the full right to use such invention or discovery in carrying out his functions under this Act and to license other

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26/ See "Proposed Revision to the Patent Section, National Aeronautics and Space Act of 1958," Report of the Subcommittee on Patents and Scientific Inventions of the Committee on Science and Astronautics, U.S. House of Representatives, 86th Cong. 2d Sess. (1960) at 1.

27/ H. Report No. 1770

28/ The House patent provision in H.R. 12575 is referred to in preliminary drafts and in most subsequent references as Sec. 407, although it actually bore the label, "Sec. 507," when printed in The Congressional Record, House Report No. 1770 (May 24, 1958). For convenience it is referred to as Sec. 407 in this paper.

persons on such terms and conditions as he may deem appropriate to use such invention or discovery in the conduct of any activities authorized by or under this Act. In any such case the Administrator may provide for the payment by the Administration or by the other persons licensed under this subsection, for the use of the invention or discovery, of a reasonable royalty fee determined by the Administrator in accordance with such standards and procedures as he may by regulation establish.

(c) In any case where the Administrator does not waive the Administration's claim to an invention or discovery which is deemed to have been made or conceived by the Administration under subsection (a), the Administrator may grant to the persons who made or conceived the invention or discovery, as compensation therefor, a cash award in an amount determined by the Administrator in accordance with such standards and procedures as he may by regulation establish.[29]

The March 8, 1960 report of Representative Erwin Mitchell, Chairman, Subcommittee on Patents and Scientific Inventions of the House Committee on Science and Astronautics, stated that the above Section 407 was patterned "after certain sections of the Atomic Energy Act of 1946 as amended."[30] Corroboration for this statement results from an

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29/ Section 407, H.R. 12575, 85th Cong. 2d Sess., 104 Cong. Rec. 9091.

30/ See Parker, Gayle, "Comparison of the Patent Provisions of the NASA Act and AEC Act," 3 The Patent, Trademark, and Copyright Journal of Research and Education (Fall 1959) 303; O'Brien and Parker, "Property Rights in Inventions Under the National Aeronautics and Space Act of 1958," 19 The Federal Bar Journal (July 1959) 255.

examination of the language of The Atomic Energy Act of 1954, as amended, which, in part, provides as follows:

> Any invention or discovery, useful in the production or utilization of special nuclear material or atomic energy, made or conceived under any contract, subcontract, arrangement, or other relationship with the Commission, regardless of whether the contract or arrangement involved the expenditure of funds by the Commission, shall be deemed to have been made or conceived by the Commission, except that the Commission may waive its claim to any such invention or discovery if made or conceived by any person at or in connection with any laboratory under the jurisdiction of the Commission as provided in section 33, or under such other circumstances as the commission may deem appropriate.31/

The language quoted above is remarkably similar and in some respects identical to the language of Sec. 407(a).

While there is no official record or published report of the executive session, at which the House Select Committee on Astronautics and Space Exploration added a patent section to the Administration's bill, some interesting facts are revealed from the working drafts of the committee.32/

31/ Atomic Energy Act of 1954, Section 152, 68 Stat. 919, 42 U.S.C. 2011-2281. Section 151 provides that under certain circumstances the government must take title with no waiver provision.

32/ The drafts are from the official files of the legislative history of The National Aeronautics and Space Act of 1958.

Eleven working drafts were examined, arranged in chronological order, and assigned numbers, Exhibit No. 1, 2, etc. Exhibit No. 1, which has handwritten on the first page the words, "Master Copy," bears the date, "April 1958." The other Exhibits are dated as follows: No. 2 - April 18, 1958; No. 3 - April 30, 1958; No. 4 - May 1, 1958; No. 5 - May 9 , 1958; No. 6 - May 9, 1958; No. 7 - May 13, 1958; No. 8 - May 14, 1958; No. 9 - May 16, 1958; No. 10 - May 19, 1958; No. 11 - May 22, 1958. As mentioned above, the House Select Committee on Astronautics and Space Exploration reported out the new patent provisions on May 24, 1958.

Exhibit No. 1, which is a Xerox copy of a working draft, bearing only the date "April , 1958," is more specifically identified by the handwritten words, "Master Copy," and the handwritten initials, "LEF" on the first page, and the handwritten letters, "24090" and "X6373" also on the first page. Its patent section, Section 605, is as follows:

DOCUMENT NO. I

directly involves the Commission or in which the Commission is directly interested.

PATENT RIGHTS

[illegible] considered [illegible] on p. 35.9 [illegible] AEC, [illegible] waiver authority

SEC. 605. (a) Each contract or other arrangement executed pursuant to this Act which relates to scientific research shall contain provisions governing the disposition of inventions produced thereunder in a manner calculated to protect the public interest and the equities of the individual or organization with which the contract or other arrangement is executed: *Provided, however,* That nothing in this Act shall be construed to authorize the Commission to enter into any contractual or other arrangement inconsistent with any provision of law affecting the issuance or use of patents.

show as alternative (a)

(b) No officer or employee of the Commission shall acquire, retain, or transfer any rights, under the patent laws of the United States or otherwise, in any invention which he may make or produce in connection with performing his assigned activities and which is directly related to the subject matter thereof: *Provided, however,* That this subsection shall not be construed to prevent any officer or employee of the Commission from executing any application for patent on any such invention for the purpose of assigning the same to the Government or its nominee in accordance with such rules and regulations as the General Manager of the Commission may establish.

Of interest in reading Section 605 of the above working draft is a comparison to the patent provision of the National Science Foundation Act of 1950, which provides, in part, as follows:

> (a) Each contract or other arrangement executed pursuant to this chapter which relates to scientific research shall contain provisions governing the disposition of inventions produced thereunder in a manner calculated to protect the public interest and the equities of the individual or organization with which the contract or other arrangement is executed...
>
> (b) No officer or employee of the Foundation shall acquire, retain, or transfer any rights, under the patent laws of the United States, or otherwise, in any invention which he may make or produce in connection with performing his assigned activities and which is directly related to the subject matter thereof... 33/

A comparison of the language of these two provisions demonstrates that in many respects the language is identical.

There may have been dissatisfaction with the above provisions, as evidenced by the handwritten notes in the margin of the working draft, stating "substitute underscored material on p 38-9 of AEC, <u>without</u> waiver authority; show (Section 605(a)) as alternative (a)." However, it is probable that no patent provision was clearly favored at

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33/ The National Science Foundation Act of 1950, 64 Stat. 154, 42 U.S.C. Section 1871.

this stage and that alternative patent provisions, derived from The Atomic Energy Act of 1954 and from The National Science Foundation Act of 1950, were suggested to be listed so that House Committee members, after consideration of both provisions, could make a decision at a later date.

Exhibit numbers 3,4,5,6, dated April 30 through May 9, 1958, set out the patent provision in alternative terms, one reflecting the patent provision in The Atomic Energy Act and the other reflecting the patent provision in The National Science Foundation Act. Exhibit numbers 7,8,9, are similar to Exhibit numbers 3,4,5,6, with respect to the patent provision and, in addition, contain "staff explanation and comments." Exhibit No. 9, dated May 16, 1958, may be used to illustrate the contents of these exhibits and it is interesting, also, because of a handwritten note in the margin. It is as follows:

DOCUMENT NO. II

TEXT OF COMMITTEE PRINT

ADVISORY COMMITTEES

SEC. 507. The members of the General Advisory Committee established pursuant to section 204, and the members of such other scientific and technical committees as the Administrator may establish to carry out his functions under this Act, may serve as such without regard to the provisions of sections 281, 283, 284, or 434 of title 18 of the United States Code or section 190 of the Revised Statutes (5 U. S. C., sec. 99), except insofar as such sections may prohibit any such member from receiving compensation in respect of any particular matter which directly involves the Administrator or in which the Administrator is directly interested.

PATENT RIGHTS

SEC. 508. Any invention or discovery made or conceived under any contract, subcontract, arrangement, or other relationship with the Administrator, regardless of whether the contract or arrangement involved the expenditure of funds by the Administrator, shall be deemed to have been made or conceived by the Administration.

[Alternative section 508

[SEC. 508. (a) Each contract or other arrangement executed pursuant to this Act which relates to scientific research shall contain provisions governing the disposition of inventions produced thereunder in a manner calculated to

What is [illegible] w DOD?
use this alternative, plus (1) waiver procedure (2) reasonable [illegible] [illegible] [illegible]

protect the public interest and the equities of the individual or organization with which the contract or other arrangement is executed; but nothing in this Act shall be construed to authorize the Administrator to enter into any contractual or other arrangement inconsistent with any provision of law affecting the issuance or use of patents.

[(b) No officer or employee of the Administration shall acquire, retain, or transfer any rights, under the patent laws of the United States or otherwise, in any invention which he may make or produce in connection with performing his assigned activities and which is directly related to the subject matter thereof; but this subsection shall not be construed to prevent any officer or employee of the Administration from executing any application for a patent on any such invention for the purpose of assigning the same to the Federal Government or its nominee in accordance with such rules and regulations as the Administrator may establish.]

COMPTROLLER GENERAL AUDIT OF CONTRACTS NEGOTIATED WITHOUT ADVERTISING

SEC. 509. Any contract with the Administrator negotiated without advertising shall include a clause to the effect that the Comptroller General of the United States or any of his duly authorized representatives shall, during the performance of such contract and until the expiration of three years after final payment thereunder, have access to and the right to

In Exhibit No. 9 (Document No. II herein) the handwritten note in the margin next to the first alternative statement of the patent provision, which is based on The Atomic Energy Act, reads as follows:

> What if K (contract) is w/ DOD (Department of Defense)? Use this alternative, plus (1) waiver and procedure; (2) reasonable monetary award for inventions.34/

The "staff explanation and comments," which are not reproduced above, that accompany the first alternative statement are as follows:

> Same as in Atomic Energy Act, except (1) does not permit the Administrator to waive his claim to an invention or discovery, and (2) does not prescribe the procedures governing the issuance of patents. The Administrator would have no discretion to permit an employee or contractor to retain the patent on his invention or discovery.
>
> Views and Recommendations of Witnesses: Bill should make it mandatory that anything discovered by any person while working for the Government belongs to the United States (Rickover)35/

34/ Exhibit No. 9, "Bill Establishing a National Aeronautics and Space Administration with Staff Explanation and Comments: Printed for the use of the Select Committee on Astronautics and Space Exploration," Section 508 (May 16, 1958) at 42.

35/ *Ibid*.

The "staff explanation and comments" accompanying the second alternative statement (Section 508(a)), are as follows:

> Substantially same as in National Science Foundation Act. Would permit a contractor of the Administration to retain the patent on his invention or discovery in a proper case.36/

It appears from the handwritten note in the margin that a decision was made after May 16, 1958, to use an approach based on The Atomic Energy Act rather than on The National Science Foundation Act. Whether this decision resulted from a full committee vote, instructions from a committee member or from a staff member, or in some other manner, is not known.

Exhibit No. 10, dated May 19, 1958, includes a patent provision based on the approach of The Atomic Energy Act. There is no alternative section. Exhibit No. 11, dated May 22, 1958, includes a patent provision identical to Section 407, as reported out of the House Select Committee on Astronautics and Space Exploration, as part of the new bill, H.R. 12575, on May 24, 1958.

36/ Ibid.

III. ENACTMENT OF PATENT PROVISIONS IN THE HOUSE.

On June 2, 1958, H.R. 12575 was called up on the floor of the House for debate and vote. Rep. Thornberry, at the direction of the House Rules Committee, introduced House Resolution 577, which formally permitted consideration of H.R. 12575, and also, provided that general debate on the bill would be limited to two hours. The resolution was agreed to.

Rep. McCormack made the opening statement on the bill. The following comments are from his statement:

> Mr. Chairman, the bill before the House today is probably one of the most important bills that has ever come before the Congress. It is a bill establishing an agency, the agency of our Government which will have facing it problems, duties, and responsibilities of exploring outer space, so called, and making discoveries for the benefit of man, an agency that will be civilian in nature and headed by a single administrator.
>
> ....
>
> H.R. 12575 is a new bill, unanimously adopted by the Select Committee on Astronautics and Space Exploration, to take the place of the original administration proposal, which I introduced as H.R. 11881, to establish a civilian space agency.
>
> There is no need to stress here that the prompt enactment of this measure is required in the national interest. The artificial satellites whirling above our heads have kindled the imagination of mankind. The challenge and the opportunity are limitless. In its interim report, the committee spelled out the dimensions

> of this opportunity for science and technology; for military uses; for economic growth - both the immediate stimulus to production and employment and, even more important, the ultimate economic benefits of technological progress; for peaceful competition with the Communist world; and, above all, for the human adventure in a largely unknown universe.37/

Most of the two hours of debate was of a general nature, as illustrated by the above excerpts from Rep. McCormack's statement. The patent provisions were a minor aspect of the bill, and official comment was not directed toward them. At the conclusions of the discussion, H.R. 12575 was unanimously passed.38/

Subsequently, representatives of industry and of the legal profession displayed a marked interest in the patent provision.39/ There was much dissatisfaction with Section 407.40/

A very critical statement was adopted by the American

37/ 104 Cong. Rec. 9916-9917 (1958)

38/ Id. at 9941 (1958)

39/ Supra, note 23, at 2.

40/ Ibid.

Patent Law Association (APLA) and was submitted to the United States Senate on June 3, 1958, recommending an alternative provision to this section. Their statement is interesting as an example of the nature of the criticism directed against Section 407, with arguments addressed to the procedure under which it was adopted as well as to its substance. [41] The statement, in part, is as follows:

> The American Patent Law Association is quite concerned with the patent provisions included under Section 407 of H.R. 12575 as it was sent to the Senate on June 3, 1958. Further the American Patent Law Association is concerned that, insofar as indicated by Report 1770 of the House Select Committee on Astronautics and Space Exploration, no consideration was given to these provisions during the public hearings. The report merely summarizes the content of each of the Subsections without commenting or indicating that any consideration of the significance and effect of these provisions was undertaken by the Committee. The attention of the House in passing this legislation was undoubtedly directed to the broad aspects of outer space, which was the subject of the extensive hearings, and the vote by no means indicates consideration or support by the vast majority of the House members with respect to the patent provisions.
>
> It should be noted that the bill upon which the hearings were held, H.R. 11881, the companion bill to S. 3609, contained absolutely no patent

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41/ The statement is interesting, also, because some of the differences between the final patent provision, Sec. 305, as adopted in the Space Act, *supra*, and Sec. 407 of H.R. 12575, *supra*, seem to reflect acceptance of arguments of this type.

provisions. Section 407 was added in the rewritten bill <u>after</u> the hearings and no opportunity was provided for interested persons or organizations such as APLA to make their views known. (Emphasis in the statement)

...

Considering more specifically the patent provisions of the subject bill, Subsection(a) is essentially the same as the first sentence of the Atomic Energy Act of 1954. The APLA has consistently taken a position in opposition to this provision of the Atomic Energy Act. Even the author of this provision has indicated his dissatisfaction with it and, prior to his resignation from the Congress, was contemplating at least amendment thereof, (Citation omitted)

...

Aside from the basic considerations outlined above, APLA points out that Section 407(a) employs the very generalized language found so confusing and undesirable in the Atomic Energy Act of 1954, namely, "arrangement or other relation with the Administrator, regardless of whether the contract or arrangement involved expenditure of funds by the Administrator." This language, like that of the Atomic Energy Act of 1954, is sufficient to embrace the assumption by the new National Aeronautics and Space Administration of rights to an invention which may be made as a result of such relationships as mere renting of facilities or the taking of a license under patents owned by the Administration.

The APLA is also understandably concerned with the provision of Section 407(b) of H.R. 12575, under which, as the Association understands it, the Administrator, even where he waived the Administration's claims to an invention or discovery, would retain the right to license others to use the invention on such terms as the Administrator decides, including the establishing by him of what he considers a reasonably royalty. This license would apparently not be limited to use for the Government but merely on the very generalized basis "in the conduct of any activity authorized by or under this Act." It is believed that the retention of a non-exclusive license by the Government to make or have made for governmental purposes should fully satisfy all requirements of the Government in this area. This may perhaps be the intention of the provisions, but, if so, we suggest it be revised in accordance with present Department of Defense practice to make this clear.

... At a minimum the APLA feels that no provisions of the magnitude of those in Section 407 of H.R. 12575 should be enacted without the most serious consideration being given by the Congress. Since it is apparent that these provisions have been greatly subordinated, if not entirely overlooked, in the consideration of the major items of providing for the establishment of the proposed National Aeronautics and Space Administration, it is submitted that, if speedy enactment of this legislation is considered of the essence, Section 407 be eliminated entirely therefrom and that separate legislation on this subject, if ultimately considered necessary, be enacted only after the Congress has had an opportunity to receive extensive comments from interested individuals and organizations and to consider in full the significance of such provisions.42/

42/ "Statement by the American Patent Law Association, Re: H.R. 12575 (As Sent to the Senate on June 3, 1958)." (mimeographed)

The date this document bears, June 3, 1958, is probably erroneously stated. The first paragraph of this document refers to the same date. Also, it is unlikely that such a resolution could be drafted, agreed to, and submitted to the Senate the day after House passage of H.R. 12575.

IV. DELETION OF THE SENATE PATENT PROVISIONS BY FLOOR AMENDMENT.

The same day the American Patent Law statement was released, June 3, 1958, H.R. 12575 was referred to the Senate Special Committee on Space and Astronautics.[43/] On June 11, 1958, the Senate Committee reported out an amended S. 3609, which, in addition to other changes, included a patent provision almost identical to that of Sec. 407 in H.R. 12575. Section 303 of S. 3609, as reported out of the Committee, included three sections, as follows:

> Sec. 303(a) Any invention or discovery made or conceived under any contract, subcontract, arrangement, or other relationship with the Agency, regardless of whether the contract or arrangement involved the expenditure of funds by the Agency, shall be deemed to have been made or conceived by the Agency, except that the Director may waive the claim of the United States to any such invention or discovery under such circumstances as he may deem appropriate.
>
> (b) In any case in which the Director waives the claim of the United States to an invention or discovery as authorized by subsection (a), he shall retain on behalf of the United States the full right to use such invention or discovery in carrying out any functions under this act and to license other persons, on such terms and conditions as the Director may deem appropriate, to use such invention or discovery in the conduct of any activities authorized by or under this act. In any such case the Director may provide for the

43/ Senate Report No. 1701, 85th Cong. 2d Sess., (June 11, 1958).

> payment by the Agency or by persons licensed under this subsection, for the use of the invention or discovery, of a reasonable royalty fee determined by the Director in accordance with such standards and procedures as he may establish by regulation.
>
> (c) In any case in which the Director does not waive the claim of the United States to an invention or discovery which is deemed to have been made or conceived by the Agency under subsection (a), the Director may grant to the person who made or conceived the invention or discovery, as compensation therefor, a cash award in an amount determined by the Director in accordance with such standards and procedures as he may by regulation establish.44/

On June 16, 1958, the amended S. 3609 was debated in the United States Senate.45/ An amendment was offered by Senator Lyndon Johnson, Chairman of the Senate Special Committee on Astronautical and Space Exploration to delete Section 303. The explicit reason in support of this amendment was to provide leeway to permit the subject of a patent provision to be resolved in Conference. The debate included the following discussion in relation to the patent provision, as quoted from The Congressional Record:

44/ 104 Cong. Rec. 11291-11292 (June 16, 1958) reprints the above quoted material.

45/ 104 Cong. Rec. 11289-11306 (1958)

Mr. Johnson of Texas....

I might add that the Senate bill includes a patent rights section which is practically identical with the section in the House bill. I shall offer an amendment which provides that that section be deleted in order that the subject of patent rights may be in conference, because some Senators feel that it should be in conference.

....

Mr. Bridges: What did the Senator from Texas say he would propose to have deleted?

Mr. Johnson of Texas: The patent rights section. The Senate bill contains a provision (Sec. 303) which is practically identical with the section in the House bill. Some of our friends on the committee, as the Senator may recall - at least one member of the committee - asked for time for further study. In order to give him that opportunity, and still to enable the Senate to act on the bill and send it to conference, it is proposed to delete the patent rights section, because the House bill will contain that section. Then the whole subject will be in conference, and the conferees can attempt to evolve a section which will be satisfactory to both sides.

...

Mr. Anderson: Mr. President, will the Senator yield?

Mr. Johnson of Texas: I yield.

Mr. Anderson: That would not mean, however, that the action of the Senate would be regarded as desiring to leave the patent section out of the bill, would it?

Mr. Johnson of Texas: Not at all. It is simply proposed to have the provision in the conference, so that it can be adjusted and framed in language which will be most desirable.

Mr. Anderson: I have received telegrams concerning the patent section. I do not think much of them. But I think it would be well to have the section in conference, so that it can be adjusted.

Mr. Johnson of Texas: That is the procedure which we expect to follow. I am grateful to the Senator from New Hampshire [sic.] (from New Mexico) for his statement.

...

Mr. Johnson of Texas: The committee bill states clearly that it is the fundamental policy of our country that aeronautical and space activities should be dedicated to peaceful purposes and the benefit of all mankind. We can today see only a short distance into the future, and we can only speculate upon a few of the ultimate benefits which the space age can bring to the people of the world.

We know that there will be tremendous gains in the economic and physical well-being of people brought about by discoveries in the areas of weather prediction and control, communications, medical science, and transportation.

...

There is a provision in the bill directing the civilian space agency to make publicly available all technical information which the security interests of the country will permit. We also recommend the enactment of patent provisions like those contained in the House bill. These provisions are intended to provide protection to the interests of the Government and at the same time permit ample rewards and inducements to inventors to insure their maximum effort. The patent provisions are similar to those in the Atomic Energy Act, and to the regulations used now by the Department of Defense and the National Advisory Committee for Aeronautics.[46/]

The Committee reported in accordance

46/ Equating Section 303 with the patent provisions in the Atomic Energy Act and the patent provisions in the regulations used by the Department of Defense (Armed Services Procurement Regulation, Section 9-107) may be merely an oversight or it may suggest that little attention was given to the patent section by the Senate Committee. Compare the description of the Department of Defense patent practice as stated by Deputy Secretary of Defense, Donald A. Quarles, *supra*, with the Atomic Energy Act provision, *supra*.

with the statement I have just made; but in view of the desire of several able members of the committee to give further study to the House section and because unanimous consent would be required to write any new language into the bill if the Senate adopted the identical language of the House bill, I offer an amendment and ask that it be read. The amendment strikes the patent section from the Senate bill in order that the House patent section will be in conference. Then whatever the conferees may agree upon can be done.

...

The Presiding Officer: The question is on agreeing to the amendment of the Senator from Texas, to strike out the patent rights section of the bill.

Mr. Anderson: Mr President --

Mr. Johnson of Texas: I yield to my friend, the Senator from New Mexico.

Mr. Anderson: The House provision is not identical with the Senate provision, is it?

Mr. Johnson of Texas: I am informed it is practically identical. It is nearly enough identical so that the Members who have raised the question are fearful that in the conference we would not have sufficient leeway if this provision were included in the Senate bill.

Mr. Anderson: The telegrams which were received stated that this provision would permit the agency to obtain patents. The Atomic Energy Commission has obtained thousands of patents, and I know of nothing wrong with that arrangement.

I am only trying to get the Senator from Texas to establish whether this will be done without prejudice to the general idea---

Mr. Johnson of Texas: Again, I assure the Senator from New Mexico that it is my understanding that the patent rights provisions now in the Senate bill, which the amendment seeks to strike out, are similar to those in the Atomic Energy Act.

But some of our friends on the committee who have deep interest in this field and who have great knowledge of it believe that since the provisions in the two bills are practically identical, in the conference we would not have sufficient leeway if, following further study, it was felt that the provision should be changed.

So if the amendment is agreed to, we then could accept the provision of the House bill, which is the same as the one which now would be stricken; or we could broaden it in accordance with the judgment of the conferees.

...

The Presiding Officer: The question is on agreeing to the amendment of the Senator from Texas.

The amendment was agreed to.

...

Mr. Bricker...

...

When the meeting was held to write up the bill I was in the frame of mind that I did not wish haste to create delay, and at the time of the hearing I objected to some of the provisions of the patent section. I did likewise today.

I know of no field of the law in which there is more complication, in which there is more detail and classification of the various provisions of the law, or in which there is more highly specialized activity than in the field of patent law. I believe that other lawyer Members of the Senate will confirm what I say when I state that very few general practitioners are in a position to criticize the patent provisions of the bill, or to make constructive suggestions, without a thorough consideration of the various provisions.

As a result of that feeling, and of the opposition which I have heard from patent lawyers in various parts of the country, I asked the distinguished chairman, the Senator from Texas (Mr. Johnson) if he would not delete that section, so that there might be an opportunity in conference to consider the objections which have been made, and perhaps devise a more constructive provision.

It is different from the atomic energy section. It varies somewhat from the law of the country with regard to the ordinary relationship between the individual employee and his employer. A new trail is being blazed in connection with the relations between the Government and scientists employed by it, on the subject of patents.

...

Mr. Saltonstall: Is not the relationship of a man who may discover something new in space research, on which he can obtain a patent, different from that in civilian research activities? Almost assuredly he will be an employee of some Government agency or engaged in work supported or directed by a Government agency when he makes his discovery.

Mr. Bricker: That is altogether true. Yet the relationship of an employee of the Government, as it affects his creation or invention, and the obtaining of a patent for his creative work, is vitally important.

It is possible that the bill adequately covers the situation; but what I wish to do, if possible, is to protect the Government in all its rights which arise by reason of the expenditure of Government money. Yet, in doing so, I do not wish in any way to inhibit the creative urge on the part of the scientists to do something which may ultimately result in some benefit to him.

The chairman of the Armed Services Committee knows that several years ago we made provision for the payment of approximately a quarter of a million dollars to certain scientists who had invented or created one of the atomic energy schemes, and has obtained a patent on it. As a result, they were rewarded. I want a man who works on his own to have an opportunity for such reward, even though his work may be related to some Government activities in the space field.47/

On June 16, 1958, the same day the patent section, Section 303, of S. 3609 was deleted, the Senate passed H.R. 12575, after substituting the language of amended S. 3609 for the House text.48/

47/ 104 Cong. Rec. 11292-11294, 11304-11305 (1958).

48/ Id. at 11306 (1958).

V. THE RECOMMENDATIONS AND REPORT OF THE NATCHER PATENT SUBCOMMITTEE.

As a result of the marked interest in the patent provision, following the passage of H.R. 12575 in the House on June 2, 1958, and dissatisfaction with Section 407, as illustrated by the statement of The American Patent Law Association, Rep. John McCormack, Chairman of the Select Committee on Astronautics and Space Exploration, appointed a patent subcommittee to review the question prior to any House-Senate conference.

Rep. William H. Natcher of Kentucky was appointed chairman of the patent subcommittee. Other members were: Representatives Brooks Hays, Arkansas; Lee Metcalf, Montana; Leslie C. Arends, Illinois; Gordon L. McDonough, California; Kenneth B. Keating, New York. The subcommittee and its staff discussed the problems involved with many interested parties, both Government and private, for several weeks.[49/]

On the basis of its investigation the patent subcommittee recommended a revised patent section and a report to be considered in conference and submitted it to the full

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49/ Supra, note 26, at 2.

committee.[50] Their recommended patent provision is as follows:

Substitute For Section 407 of H.R. 12575—
Property Rights in Inventions

Sec. 407. (a) Whenever the Administrator determines that an invention or discovery was conceived, reduced to practice, developed, or otherwise made under, pursuant to, or as a result of any contract, subcontract, or other arrangement entered into, with, or on behalf of the Administration, the Administrator shall determine, under subsection (b), whether he is entitled to all right, title, and interest in and to such invention or discovery. In the event he determines that he is not entitled to all right, title, and interest in and to such an invention or discovery he shall require the person who conceived, reduced to practice, developed, or otherwise made the invention or discovery (or his successor in interest) to grant to him a nonexclusive, irrevocable, royalty-free, worldwide license to make, use, and dispose of the invention or discovery, or to have the invention or discovery made, used, or disposed of, for governmental purposes.

(b) The Administrator shall be entitled to, and may require the assignment to him of all right, title, and interest in and to an invention or discovery referred to in the first sentence if he finds that—

(1) the person who conceived, reduced to practice, developed, or otherwise made the invention or discovery was employed or assigned to perform research, development, or exploration work and the invention or discovery is directly related to the work he was employed or assigned to perform, or that it was within the scope of his employment

50/ "Report of the Patent Subcommittee, House Committee on Astronautics and Space Exploration, Re: Section 407, H.R. 12575," (mimeographed, n.d.), (often referred to herein as the Natcher Report.)

duties whether or not it was made during working hours, or with a contribution by the Government of the use of Government facilities, equipment, materials, allocated funds, information proprietary to the Government or services of Government employees during working hours, or

(2) the person who conceived, reduced to practice, developed, or otherwise made the invention or discovery was not employed or assigned to perform research, development, or exploration work, but the invention or discovery is nevertheless directly related to the contract or to the work or duties he was employed or assigned to perform and was made during working hours, or with a contribution from the Government of the sort referred to in clause (1).

(c) The Administration shall be considered a defense agency of the United States for the purpose of chapter 17 of title 35 of the United States Code.

(d) The Administrator may acquire, purchase, and hold patents and other property rights in inventions and discoveries, and he may use, lease, license (exclusively or nonexclusively), grant, exchange, sell, and otherwise dispose of the whole or any part of an invention or discovery to which he retains title under this section. As herein provided, the Administrator may, in cases where he has a right to title under this section accept a license in lieu thereof when such action is deemed by him to be in the national interest.

(e) The Administrator is authorized to take all suitable and necessary steps to protect any invention or discovery to which he has title and to require that contractors or persons who retain title to inventions or discoveries under this section protect the inventions or discoveries to which the Administration acquires a license to use.

(f) To enable him to carry out his duties under this Act, the Administrator, under regulations to be prescribed by him, may require all parties who have entered into contracts, subcontracts, or other arrangements with or on behalf of the Administration, to disclose all necessary technical data and other pertinent and followup information relating to inventions and discoveries made by them or their employees. Such regulations shall require the contractor to make disclosure in writing of each invention or discovery to which subsection (a) may apply promptly after its conception or first actual reduction to practice. Any person who shall reduce to practice any patentable invention or discovery and who is or has within six months been employed under or pursuant to any contract, subcontract, or other arrangement involving research, development, or exploration, shall be deemed prima facie to have conceived, reduced to practice, developed, or otherwise made such invention within the meaning of this section.

(g) In any case in which the Administrator retains title to an invention or discovery under this section, he may grant to the individual or individuals who conceived, reduced to practice, developed, or otherwise made the invention or discovery an incentive cash award in an amount determined by the Administrator in accordance with such standards and procedures as he may by regulation establish. Notwithstanding any agreement to the contrary entered into as a condition of or incident to his employment, such individual may not be required to pay such award over to his employer or other person.

(h) There is hereby established within the Administration an Inventions Review Board which shall consist of three members appointed by the President by and with the advice and consent of the Senate. Members of the Board, while attend-conferences and meetings of the Board, shall be entitled to receive compensation at a rate to be fixed by the Administrator, but not exceeding

$75 per diem, and while away from their homes or regular places of business they may be allowed travel expenses, including per diem in lieu of subsistence, as authorized by law for persons in the Government service employed intermittently. Members of the Board may serve as such without regard to the provisions of section 281, 283, or 284 of title 18 of the United States Code, except insofar as such sections may prohibit members from receiving compensation in respect of any particular matter which directly involves the Administrator or in which the Administration is directly interested.

(i) Any interested person who is dissatisfied with the Administrator's action under subsection (a) or (b), may appeal to the Inventions Review Board within 90 days from the date of such action. The Board shall hear and decide the issues presented in accordance with the Administrative Procedure Act. Any interested person who is dissatisfied with the decision of the Board under the preceding sentence may appeal such decision to the United States District Court for the district in which he resides. The summons and notice of appeal may be served at any place in the United States. Such appeal shall be governed by the provisions of Section 10 of the Administrative Procedure Act, and, for the purposes of that Act, the decision of the Inventions Review Board shall constitute the final agency action with respect to the issues involved in the appeal. The judgment of the court shall be subject to review by the appropriate United States Court of Appeals and the Supreme Court of the United States as provided in section 1291 and 1254 of title 28 of the United States Code.51/

51/ "Substitute For Section 407 of H.R. 12575 - Property Rights In Inventions," Patent Subcommittee, Select Committee on Astronautics and Space Exploration, as quoted in op. cite, note 26 , supra, at 2-4.

Accompanying their recommended patent provisions, the patent subcommittee submitted a report which was not published, has not been reprinted in the available literature, and, surprisingly, has been rarely mentioned in published references to the legislative history. The report is eight double-spaced pages. Since one of the major conclusions of this study is that this report is crucial to an understanding of the legislative history of the patent provisions, and since its significance has been largely overlooked, a substantial portion of its text will be quoted. It is entitled, "Report of the Patent Sub-Committee, House Committee on Astronautics and Space Exploration, Re: Section 407, H.R. 12575." After quoting the language of Section 407, the report states as follows:

> This section was not in the original bill recommended by the Administration, on which hearings were held. The section was added by the full committee in executive session and reported as part of H.R. 12575 on May 24.
>
> After the bill was passed by the House but prior to Senate consideration of a similar section of its bill, on the Senate floor on June 11,[52] various segments of private industry,

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52/ On this date S. 3609 was reported out of Committee. See, supra, note 44.

plus a number of the specialized patent law organizations, registered objection to the patent rights section. Their basic thesis was and is:

(1) Section 407 as it stands is arbitrary and restrictive; it will tend to stifle interest and private endeavor in the space research and development field.

(2) There is no need for the Government to retain ownership rights; its interests will be adequately protected if the proposed agency acquires simply a royalty-free, non-exclusive license to use the inventions or discoveries which result from its research and development contracts.

(3) There is no need for any patent provision in the space agency bill since a license to use may be acquired by regulation and contract.

After due consideration of the problem, your subcommittee finds itself partially in agreement with the objection raised in (1) above. It is not in agreement with (2) and (3).

We recognize that the research and development work of the new agency will not be comparable, in most respects, to the field of atomic energy - - and hence that there is no necessity for a Government monopoly of rights or interests in all inventions and/or discoveries relating to space exploration. For this reason we believe section 407 should be amended.

At the same time your subcommittee believes there are at least five basic reasons for placing title to space inventions in the Government under certain conditions. These reasons are:

(A) While the nature of developments to come out of space research in the future are unknown we do know that some discoveries are likely to be unprecedentedly powerful and significant. In certain instances it may be imperative that the Government have ownership rights from the beginning. This need may be as great as in the case of atomic energy, or even more so.

(B) It may be highly inequitable and contrary to our traditional competitive system to permit a single private party to patent an invention developed with taxpayers money in cases where the invention proves to have unusual commercial value or answers some universal human need.

(C) The right to title would carry with it, in essential cases, the ability to exclude others from the field for reasons of security or of public health and safety.

(D) Title to the invention would bestow on the Government an ability to use such rights for protective or bargaining purposes.

(E) Government ownership could be a source of income, it could also be used as an offset or counterclaim in infringement suits against the Government, whereas a mere license is an unenforceable defense to an infringement suit.

For such reasons as the foregoing, your subcommittee is of the opinion that the bill should contain a patent right provision which will protect the legitimate interests of the United States.

When the Senate acted on H.R. 12575 it eliminated entirely the Patent Right section,

> explaining that its purpose in so doing was to allow the matter to be reconsidered in conference.
>
> After careful study of the problems involved, and in an effort to balance the requisites of government against the needs of private enterprise, your subcommittee presents the accompanying revised draft of section 407 with the recommendation that it serve as a guide to House conferees and as the basis for conference discussion on H.R. 12575.53/

The rest of the report is an explanation of the provisions of their recommended substitute Section 407. Since some of their proposals are similar, and in certain instances, identical to the patent provisions ultimately adopted, it is of interest to consider the official explanation of the patent subcommittee, which is as follows:

> EXPLANATION OF THE RECOMMENDED NEW DRAFT OF SECTION 407
>
> Title - - Since there is no question here of patent issue or patentability, the Section title, "Patent Rights," has been changed to the more correct title of "Property Rights In Inventions."
>
> Subsection (a) - - Under the old version, title to inventions developing from any agency contract, arrangement or "other relationship" automatically vested in the Administrator. The Administrator could, however, waive the government's title if he chose. Under the new version, the Administrator determines if he is entitled to ownership of the invention according to

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53/ Supra, note 26, at 2-5.

specified standards. If he is so entitled, he may claim all ownership rights. If he is not so entitled, he is required to obtain from the contractor a royalty-free license to use the invention for government purposes in any way he deems appropriate. The new version is not designed to be applicable to inventors or others directly employed by the Agency as government employees. The rights of government employees in such matters are already set forth by Executive Order. (E.O. 10096, Jan. 23, 1950).

Subsection (b) - - This spells out the two conditions under which the Administrator is entitled to claim ownership in inventions. In essence these are (1) when the inventor is employed or assigned to do research and development on Agency business and the invention is made as part of his job, regardless of government contribution; (2) when the inventor is not hired to do research and development on Agency business, but the invention is made in relation to an agency contract and during working hours - or with government contribution.

Subsection (c) - - New provision. This brings the Agency under the patent secrecy provisions of the U.S. Code. Thus if the Administrator determines there is a need for secrecy on an invention developed under Agency contract he may request the U.S. Commissioner of Patents to hold up the patent until security permits its issuance.

Subsection (d) - - New provision. It gives the Administrator broad authority to acquire and dispose of patents and property rights in inventions, or any part thereof, as he sees fit. The section is added because under existing law the government - on the theory that its rights or title in inventions are held on behalf of all the people of the United States - - can do little more with a patent than dedicate it to public use. Such limitations would be likely to hamstring the Agency in many ways. This subsection gives the Administrator the authority he will need to make effective use of government patents or title rights.54/ It further authorizes the Administrator to take a license to an invention, even though he may be entitled to ownership, when such action is deemed appropriate.

Subsection (e) - - New provision. It permits the Administrator, when necessary, to make sure that those who contract with him take steps to protect their inventions by patent or otherwise.

Subsection (f) - - New provision. This gives the Administrator, at his discretion, authority to require that those who contract with him submit all technical data and information concerning inventions and discoveries which may be necessary to effective implementation of the national space program. When required, such regulations shall require prompt disclosure in writing.

Subsection (g) - - New provision. This authorizes the Administrator, at his discretion, to make incentive cash awards to inventors in cases where the Administrator elects to take title to an invention developed under Agency contracts. Such awards are to go to the individual who conceived the invention and are not to be claimed by his employer or firm under any contract of employment.

Subsection (h) and (i) - - New sections. These set up an Inventions Review Board and provide for an administrative appeal from the

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54/ Compare this subsection with Sec. 203(b)(3) of The NASA Act, *supra*.

Administrator's decisions regarding title to inventions under the act. They permit contractors who are dissatisfied with such decisions to appeal them within 90 days of the decision and give the Board authority to take evidence and sustain or overrule the Administrator. The decisions of the Board, which are to be made in accordance with the Administrative Procedure Act, may be appealed further to the Federal Courts.55/

55/ *Supra*, note 50, at 5 - 8.

VI. INFORMAL PRE-CONFERENCE DISCUSSIONS, THE CONFERENCE MEETING, AND THE CONFERENCE REPORT.

On June 16, 1958, the same day the Senate passed H.R. 12575, having deleted the patent section, the Senate formally asked for a Conference on the bill.[56/] Two days later, June 18, 1958, the House officially agreed to a Conference.[57/] The Congressmen who were designated as Managers on the Part of the House and Senate to constitute the Conference Committee are listed earlier in this paper.

No official record or papers exist relating to the deliberations of the Conference members and their staff prior to conference, and virtually no reference is made to this period in the available literature. The following persons were interviewed and requested to state, if they could recall, what happened immediately prior to Conference: Mr. Spencer Beresford, formerly Special Counsel, House Select Committee on Astronautics and Space Exploration; Mr. Herschel F. Clesner, formerly on the staff, Senate

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56/ 104, *Cong. Rec.* 11,306 (1958).

57/ *Id.* at 11,606 (1958).

Judiciary Committee, on loan to the Senate Special Committee on Space and Astronautics; Mr. John Herberg, formerly of the Senate Legislative Counsel's Office, on loan to the Senate Special Committee on Space and Astronautics; Mr. Gerald W. Siegel, formerly on the staff of Senator Lyndon B. Johnson; and Mr. Philip B. Yeager, formerly Special Consultant, House Select Committee on Astronautics and Space Exploration.[58/]

Prior to the House-Senate Conference, staff members of the House Select Committee on Astronautics and Space Exploration and the Senate Special Committee on Space and Astronautics discussed the language of the patent provisions. The patent subcommittee's recommendation was used as a guideline. The Senate members and staff had taken no fixed position regarding how the patent provision should be written, unlike the House side which had the patent subcommittee's proposal.

The drafting of the provisions for an Inventions and contributions Board, which appears in Sections 305 and

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58/ The present positions of these persons are listed, *supra*, in the Acknowledgements.

306 of the Space Act, resulted from these pre-conference informal discussions. This idea resulted from a previously expressed need for a means to provide incentive awards. A study had been undertaken of all previous legislation with awards provisions by a Senate staff member.

In an attempt to lessen Senate objections to the House patent subcommittee's proposals, changes were informally negotiated by Mr. George J. Feldman, Chief Counsel and Staff Director, House Select Committee on Astronautics and Space Exploration; Mr. Philip B. Yeager, Mr. Herschel F. Clesner, and others immediately prior to Conference.

The actual language of the patent provisions that was approved in Conference was written by staff members immediately prior to the Conference. Mr. Clesner and Mr. Yeager, independently of each other, recalled that the final version of Section 305 was a Senate staff draft, except for subsections 305 (a)(1) and (2), which were based upon the House patent subcommittee's recommendations. Mr. Clesner stated that the Senate staff draft was used simply because it was clearer and because the particular draft was the closest one to the recommendations of the patent subcommittee, as the Senate members and staff had taken no position on this or other working drafts.[59/]

One official meeting of the Conference Committee was held, which was on July 15, 1958. The only official record of the Conference Committee is the Conference Report, House Report No. 2166, dated July 15, 1958.[60/]

59/ The influence of the staff members on the content of Sec. 305 was the subject of comment of the Patent Section of the American Bar Association, Supplemental Report of Committee No. 1 - Government Relations to Patents (ABA, Patent Section, 1958). The Report states the following:

> On the day before this Conference Report (Report No. 2166, July 15, 1958, to accompany H.R. 12575, 85th Cong. 2d Sess.) the Section Chairman, accompanied by the Chairman of the Committee on Legislation and the Chairman of the Committee, conferred with the Legislative Assistant to the Honorable Lyndon Johnson, Senate Majority Leader, to outline the position of the American Bar Association with respect to analogous provisions of the Atomic Energy Act. At that conference, the Section representatives were assured that the Senate conferees were endeavoring to have the original House patent provisions modified to protect inventors and industry. SO FAR AS CAN BE ASCERTAINED THE PATENT PROVISIONS OF THE "NATIONAL AERONAUTICS AND SPACE ACT OF 1958" ORIGINATED WITH A MEMBER OF THE STAFF OF THE SENATE COMMITTEE. To express the opposition of our Section and the American Bar Association to this legislation hastily enacted without opportunity of hearings, this Committee recommends the second paragraph of the resolution... (disapproving the patent provisions). (Emphasis added)

60/ House Report No. 2166, 85th Cong. 2d Sess. (July 15, 1958).

The patent provisions were one of several issues to be resolved at Conference. Senator Saltonstall listed six major issues, including the question of the patent policy, that remained to be resolved, as a result of differences between the House and Senate bills. The other five issues were as follows: (1) whether there should be a Policy Board and an operating agency headed by a single civilian or merely a one-man agency; (2) whether there should be a joint committee of Congress or two separate committees; (3) whether special pay provisions, including supergrades, should be included; (4) whether a provision for transfer authority should be included; (5) the question of the jurisdiction of the Department of Defense on purely defense matters.[61/] However, by this time the patent provisions had become a very important issue. Mr. Philip B. Yeager stated that the question of the patent provisions and the question whether there should be a joint committee of Congress were the two issues on which most time was spent in Conference. The patent section, as Rep. McCormack noted

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61/ "Government Assistance to Invention and Research: A Legislative History," Study of the Subcommittee on Patents, Trademarks, and Copyrights of the Committee on the Judiciary, United States Senate, 86th Cong., 1st Sess. (1960) at 131, quoting Senator Saltonstall's statement.

in a statement quoted below, was the only part of the bill extensively revised by the Conferees.

As a result of the Conference meeting, the differences between the House and Senate bills were resolved. The patent section agreed to was Section 305 of the National Aeronautics and Space Act of 1958. The entire discussion of this patent section in the Conference Report is as follows:

> Patents and invention rights
>
> The House bill contained a section on "Patent Rights" which in essence provided that -
>
> (1) The United States should receive title to any invention or discovery made or conceived under any contract or other arrangement with the Administration.
>
> (2) The Administrator could waive title to such discoveries at his discretion, but in such instances was required to retain the "full right" to use the invention for Government purposes. He could further license other persons to use the invention on terms and conditions to be promulgated by him.
>
> (3) The Administrator was authorized, in cases where title was retained in the Government, to make cash compensation awards in accordance with regulations determined by him.
>
> The Senate eliminated a similar section entirely in order to permit further consideration of the problem in conference.
>
> <u>OPERATING ON THE THEORY THAT THE GOVERNMENT'S INTERESTS MUST BE PROTECTED, BUT WITH</u>

<u>THE CONCOMITANT PURPOSE OF PROTECTING PRIVATE INTERESTS AND OF KEEPING PRIVATE INCENTIVE AND INITIATIVE AT A HIGH LEVEL,</u> THE COMMITTEE OF CONFERENCE ADOPTED ENTIRELY NEW PATENT PROVISIONS. (Emphasis added)

Section 305. Property rights in inventions

The section has been renamed "Property Rights In Inventions." Since there are no questions of technical patentability or patent issue involved here, the new title is more accurate.<u>62/</u>

Subsection (a) provides that title to inventions and discoveries made pursuant to or as the result of contracts with the Administration shall become the property of the United States <u>according to a specified standard</u>. (Emphasis in Report) The two conditions under either of which the Administrator is entitled to ownership in inventions are (1) when the inventor is employed or assigned to do research and development on Administration business and the invention is made as part of his job; (2) when the inventor is not hired to do research and development on Administration business, but the invention is made in relation to a contract with the Administration either during working hours or with Government contribution. The Administrator, however, is authorized to waive all or any part of the Government's rights of ownership.<u>63/</u>

<u>62/</u> Compare the similarity of the language of this paragraph with that of the first paragraph in the Natcher Report's Explanation of the Recommended New Draft of Section 407, <u>supra</u>.

<u>63/</u> Compare the similar and, in some respects, identical language of Sec. 305(a) (1) and (2) and Sec. 407 (b) (1) and (2) of the Natcher patent subcommittee's "Substitute For Section 407 of H.R. 12575 - Property Rights in Inventions." <u>supra</u>.

Subsection (b) authorizes the Administrator to require that those contracting with him disclose promptly all pertinent technical information respecting inventions and innovations made pursuant to such contracts.64/

Subsections (c) and (d) provide a means for the determination, by independent authority subject to judicial review, of any controversy with respect to the validity of the Administrator's claim of title to any invention. Any person could file with the Commissioner of Patents an application for a patent supported by a statement of the facts concerning the relationship of the invention described therein to work performed under Administration contracts. If such invention were determined by the Commissioner to be patentable, a patent would be issued to the applicant in due course unless the Administrator, within 90 days after receipt of the supporting statement, made request for the issuance of such patent to him. If such request were to be made by the administrator, the applicant would be entitled to receive a hearing before a Board of Patent Interferences in the Patent Office on the question of the entitlement of the Administrator to take title to such patent, and the determination made by such Board would be subject to review by the Court of Customs and Patent Appeals in accordance with usual procedures for review of determinations made by such Board in other proceedings.

Subsection (e) provides means whereby the Administrator may claim title to any patent issued to a private party on the ground that such patent had been procured through a false representation made by such part as to material facts

64/ Compare Sec. 305 (b) with Sec. 407 (f) of the Natcher patent subcommittee's "Substitute For Section 407 of H.R. 12575 - Property Rights in Inventions," supra.

concerning the relationship of the invention described therein to work performed by such party under an Administration contract. The issue so presented would be determined initially by a Board of Patent Interferences in the Patent Office after hearing, and its determination would be subject to review by the Court of Customs and Patent Appeals.

Subsection (f) sets out the conditions under which the Administrator may waive title to inventions. THESE ARE THAT THE WAIVER MUST BE IN THE INTERESTS OF THE UNITED STATES AND THAT, UPON WAIVER, THE ADMINISTRATION SHALL ACQUIRE A LICENSE TO USE THE INVENTION FOR GOVERNMENT PURPOSES THROUGHOUT THE UNITED STATES OR ABROAD, AND FOREIGN GOVERNMENTS, PURSUANT TO PROPER TREATIES AND AGREEMENTS MADE BY THE UNITED STATES, MAY BE GIVEN A SIMILAR RIGHT OF USE. WHERE WAIVER IS BEING CONSIDERED, PROPOSALS FOR WAIVER ARE SUBMITTED TO AN INVENTIONS AND CONTRIBUTIONS BOARD, SET UP WITHIN THE ADMINISTRATION. THE BOARD HEARS ALL INTERESTED PARTIES, MAKES A RECORD OF FACTS INVOLVED, AND RECOMMENDS FINAL ACTION TO THE ADMINISTRATOR. (Emphasis added) 65/

Subsection (g) requires the Administrator to promulgate regulations specifying the terms and conditions upon which licenses would be

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65/ With regard to the authority to waive rights in an invention, Sec. 305(f) uses the standard "... if the Administrator determines that the interests of the United States will be served thereby"; Sec. 407(a) as passed by the House in H.R. 12575, uses the standard "... under such circumstances as the Administrator may deem appropriate"; the patent subcommittee's proposed substitute Sec. 407(d) uses the standard "... when such action is deemed by him to be in the national interest." See pages 15, 32 and 60, *supra* for these provisions. If there is any significant difference in these broad tests for waiver, Sec. 305 is more like the proposed substitute Sec. 407(d) than the House passed Sec. 407(a).

granted by the Administration for the practice of inventions for which the Administration holds patents.

Subsection (h) permits the Administrator, when necessary, to make sure that those who contract with him take steps to protect their inventions, by patent or otherwise, and minimizes the risks resulting from patent interference.

Subsection (i) brings the Administration under the patent secrecy provision of the United States Code. Thus the Administrator may request the Commissioner of Patents to hold up patents on inventions where a need for secrecy may exist.66/

Subsection (j) contains definitions of terms used in this section.67/

In addition to Section 305, the Conference Committee in Section 203(b)(3) retained a House provision authorizing the acquisition, use, and disposal of property, but added language specifically including patents and patent rights.68/ Also, in Section 306, the Conference Committee

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66/ Sec. 305(i) is worded identically to Sec. 407(c) of the patent subcommittee's proposed substitute Sec. 407. Compare then the subsections, *supra*.

67/ House Report No. 2166, 85th Cong. 2d Sess. (July 15, 1958) at 22 - 24.

68/ Supra, note 64, at 19.

authorized payment of cash awards for scientific and technical contributions.[69]

69/ Sec. 306 is broader in scope than analogous provisions of Sec. 407(g) of the patent subcommittee's proposed substitute, and of Sec. 407(c) of H.R. 12575. Compare these sections, *supra*.

VII FLOOR DISCUSSION AND FINAL PASSAGE.

The day after the Conference Meeting, July 16, 1958, H.R. 12575 was called up in the House of Representatives. The statement of the Managers on the Part of the House was read.70/ The entire portion of this Statement relating to Section 305 was earlier quoted.

After the above statement was read, the Conference Report was accepted. Rep. McCormack made the opening address. His statement is probably the most significant official statement of the Congressional intent of the property rights in inventions provisions of the Space Act. As quoted from The Congressional Record, his statement begins as follows:

> Mr. McCormack: Mr. Speaker, this body is meeting in a time of crisis. The safety of the Free World hangs on the wisdom of the leaders of this country and of the other countries who have the same basic goals of freedom and human dignity which motivates the United States....

70/ 104 Cong. Rec. 13,978 (1958).

I know that it is hard for all of us in the middle of a current crisis demanding immediate solutions (referring to the Lebanon crisis) to turn our attention to the approaching shadow of a future crisis. But I am sure that the majority of the Members recognize that unless the United States acts swiftly today to meet the future crisis of Soviet outer space supremacy, this country in a very few years, sooner than most people realize, will face a crisis of such magnitude as to make the problems of today seem picayune.

...

If the Soviet Union alone develops its space capabilities, the terrible possibility is that the United States and the Free World will eventually come face to face with an ultimatum for surrender, with destruction of our people and cities the only alternative.

> Freedom, fought for over the centuries, will have been lost to the first world-wide tyranny. This we must not let happen through our failure to heed the clear warning of today. Five or ten years from now it will be too late.71/

The above paragraphs from Rep. McCormack's opening address on H.R. 12575 illustrate the feelings of urgency in Congress, set off by the launching of the first earth satellite, Sputnik I, by the Soviet Union on October 4, 1957, mentioned earlier in this paper.

After discussing the potential for peaceful uses of a space-development program, Rep. McCormack continued his address, in part, as follows:

> This House and the Senate have shown they understand both the great blessings which can flow from space development and the grim realities of defense. They showed this by unanimously passing their respective bills relating to space. Yesterday the conference committee of the

71/ *Id*. at 13,985-13,986.

two Houses met and reconciled the differences of language between the two bills. There was never any real difference as to fundamental purposes...

The unanimous report of the conference committee and the explanation of the House managers is before you. When the Congress enacts this bill, it will provide the Chief Executive with the tools he requires to carry out a well-integrated space program.

...

<u>THE PATENT PROVISION OF THE HOUSE BILL IS THE ONLY PART OF THE BILL EXTENSIVELY REVISED BY THE CONFEREES. THE SENATE VERSION CARRIED A PATENT PROVISION CLOSELY SIMILAR TO THE PROVISION IN THE HOUSE BILL. THIS WAS DROPPED BY FLOOR AMENDMENT JUST BEFORE PASSAGE IN THE SENATE IN ORDER TO ALLOW THIS SECTION TO GO TO CONFERENCE.</u>

<u>THE REVIEW AND THE REDRAFTING WERE WISE. THE SELECT COMMITTEE CREATED A SPECIAL SUBCOMMITTEE TO STUDY THE MATTER, AND</u>

AFTER TALKING WITH MANY EXPERTS IN AND OUT OF GOVERNMENT ARRIVED AT A NEW VERSION, DRAWING UPON BOTH SENATE AND HOUSE SUGGESTIONS. THE ORIGINAL PATENT PROVISION WAS TOO CLOSELY PATTERNED AFTER THE STRINGENT REQUIREMENTS IN THE ATOMIC ENERGY ACT WHICH ARE NOT FULLY APPLICABLE TO THE SPACE FIELD. THE SUBSTITUTE PROVISION AGREED TO BY THE CONFEREES PROTECTS BOTH THE INTERESTS OF THE GOVERNMENT AND AFFORDS ENOUGH FLEXIBILITY TO THE SPACE ADMINISTRATOR TO LET HIM MEET NEEDS FOR PRESERVING THE INCENTIVES OF THE INDIVIDUALS AND COMPANIES WHOSE EFFORTS IT IS PUBLIC POLICY TO ENCOURAGE. (Emphasis Added) 72/

The above sentence stating that "[t]he original patent provision was too closely patterned after the stringent requirements in the Atomic Energy Act which are not fully applicable to the space field" officially emphasizes one of the principal conclusions in the Natcher Report. Since this sentence is immediately preceded in the same paragraph by a reference

72/ *Id*. at 13,986-13,987.

acknowledging the investigation of the Natcher patent subcommittee and its recommended substitute provisions, it is a reasonable, if not compelling, inference that Rep. McCormack's statement was either based upon, or influenced by, the Natcher Report.

After Rep. McCormack's address, the next Congressman to discuss the patent provisions was Rep. Keating. His comments were the most extensive made on the floor of Congress.

While reading Rep. Keating's statement, the reader should compare the similar and in many respects identical, language of his statement with the language used in the Natcher Report. For example, Rep. Keating's list of the reasons for placing title to space inventions in the Government under certain conditions is identical to the list in the Natcher Report. This statement, as with Rep. McCormick's statement, shows agreement with the Natcher Report and is apparently an attempt to make the results of the deliberations of the patent subcommittee public and part of the official record. His statement is as follows:

> Mr. Keating: Mr. Speaker, much discussion is going on over the patent section to this bill - and rightly so, for the American

patent setup is certainly one of the keystones to our national economic system.

I want to emphasize that the patent section in this bill has been subjected to careful scrutiny and study. It represents, as the statement of managers suggests, a balancing effort. We felt we would be derelict in our duty if we failed to protect the legitimate interests of government. At the same time we endeavored not to remove any incentive from private enterprise.

We think this section will accomplish both ends.

After H.R. 12575 passed the House, the Chairman of our committee appointed a patent subcommittee to review the entire matter. It [sic.] [I] was a member of this subcommittee - which considered extensively the views of private industry, the patent law associations and other bar groups, counsel for the Senate and House

Judiciary Committees, the patents section of the Department of Justice and members of the Government Patents Board. The Senate committee and its staff made a similar investigation.

It soon became clear that the Congress was faced with three major alternatives in dealing with the patents question.

First. It could drop entirely any reference to patents or property rights in inventions. This would leave the matter mainly up to the Administrator to handle as he sees fit.

Second. It could follow the policy employed by various departments of government and require that contractors dealing with the administration and doing its research and development should give the Government an irrevocable, nonexclusive, royalty-free license to use the inventions so developed. My personal inclination, I might say parenthetically, leaned in favor of this approach.

Third. It could give the Government title to the inventions developed - either automatically in all cases, or in certain selected cases with the provisio that the Government be accorded a license of use in instances when it did not have - or want - title.

The objections raised to the original patent sections of the House and Senate may be summarized as follows:

First. The sections were arbitrary and restrictive and would tend to stifle interest and private endeavor in space research and development.

Second. There is no need for the Government to retain ownership rights; its interests will be adequately protected if the administration acquires simply a royalty-free, irrevocable license to use the inventions which result from the research and development contracts it sponsors.

Third. There is no need for any patent provision, since a license to use may be acquired by contract or agreement.

After due consideration of the problem, the committees of both Houses found themselves in partial agreement with the objections raised in the first summary. They are not in agreement with those raised in the third summary. I am personally sympathetic to the contentions advanced regarding the second summary, but I feel a reasonably satisfactory result has been achieved.

The conferees recognized that research and development in the aeronautical and space sciences will not be comparable, in most respects, to that in the field of atomic energy - and hence that there is no necessity for a Government monoply of rights or interests in all inventions and/or discoveries relating to space exploration. For this reason, it was felt that the patent section needed amendment.

And the patent provision in this conference report does not automatically - as I understand the Atomic Energy Act does - give all property rights in inventions to the Government.

At the same time there appears to be a number of vital reasons for placing title to space inventions in the Government under certain conditions. Some of the reasons are these:

(A) While the nature of developments come out of space research in the future are unknown, we do know that some discoveries are likely to be unprecedentedly powerful and significant. In certain instances it may be imperative that the Government have ownership rights from the beginning. This need may be as great as in the case of atomic energy, or even more so.

(B) It may be highly inequitable and contrary to our traditional competative system to permit a single private party to patentan invention developed with taxpayers' money in cases where the invention proves to have unusual commercial value or answers some universal human need.

(C) The right to title would carry with it, in essential cases, the ability to exclude others from the field for reasons of security or of public health and safety.

(D) Title to the invention would bestow on the Government an ability to use such rights for protective or bargaining purposes.

(E) Government ownership of patent rights permits offset or counterclaims in infringement suits against the Government.

Mr. Speaker, I submit these are substantial reasons for giving title to the United States under appropriate circumstances.

But I want to emphasize those words "appropriate circumstances." It is because the new provision actually does set up a reasonable standard for regulating public ownership that I feel it serves its intended purpose. Under this bill the United States is entitled to ownership only in two instances:

First. When the inventor is employed or assigned to do research and development in relation to a contract with the new Space Agency and the invention is made as part of his job.

Second. When the inventor is not specifically hired to do research and development, but the invention is made in relation to a contract with the Administration and is made during working hours or with a Government contribution of money, facilities, equipment, and so forth.

In all other circumstances, title to the invention remains in the inventor or his employer, depending on their contractual relationship.

This seems to me to be a fair requirement on the part of the Government, as well as an essential one for the benefit of private industry.

Let me point out, too, that in this new version we have provided for appeal and judicial review in cases where inventors feel their invention is improperly classified as subject to Government ownership. In such cases they may take their case to the Board of Patent Interferences in the Patent Office of the United States, and the decision of the Board may be reviewed by the courts.

We have added a new section which provides that incentive cash awards may be given to inventors or firms which make significant technical contributions to the national space program.

Note that such awards may go to any person or any organization, whether or not the contribution is patentable and whether or not is made under government contract. Note also that standards and safeguards have been provided to guide the Administrator in making such awards and to assure

> they are kept within reason.
>
> In conclusion, it is my feeling that the conference report in general represents an excellent solution to what has been a difficult approach to a very nebulous area.
>
> We may have to make some changes in the space program as we have set it up. I suspect we will, since it is impossible to see exactly where we are going.
>
> But this act is a good start and I am confident it will put our space program on the road.[73/]

The above statement of Rep. Keating is essentially consistent with and an elaboration of the statement of Rep. McCormick. Their statements constitute the two most important declarations of Congressional intent relating to the patent provisions made on the floor of Congress prior to the passage of the Space Act.

The same day that the above two statements were made, July 16, 1958, H.R. 12575 came up for a final vote in the United States House of Representatives. Other than the above

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73/ 104 Cong. Rec., at 13,987-13,988 (1958).

two statements, no further explanation of the patent provision was made. The House then unanimously passed H.R. 12575.[74/]

Also, on July 16, 1958, H.R. 12575, as reported out of the Conference Committee, was called up on the United States Senate.[75/] During the discussion, which occupied less than one full page in The Congressional Record, there was no statement of legislative intent with reference to the patent provision.[76/] A final vote was taken on the bill and the Senate unanimously passed H.R. 12575.[77/]

On July 29, 1958, President Dwight D. Eisenhower signed H.R. 12575 as Public Law 85-568, enacting into law the National Aeronautics and Space Act of 1958.[78/]

74/ *Id*. at 13,985 (1958).

75/ *Id*. at 13,936 (1958).

76/ *Ibid*.

77/ *Ibid*.

78/ *Id*. at 15,610 (1958).

FINDINGS AND CONCLUSIONS

The major purpose of this study was to examine the legislative hisotry of the property rights in inventions provisions of the Space Act. Other complementary provisions were also considered. A subsidiary purpose was to attempt to answer the following question: What intent did Congress express, if any, relative to how the Administrator of NASA should exercise the discretionary authority of Subsections 305 (a) and (f) of the Space Act to prescribe regulations, and pursuant thereto, decide whether to waive all or part of the rights acquired by NASA to the inventions of its contractors and subcontractors?

The existing literature has omitted, in my opinion, a key link to a proper understanding of the legislative history. The significance of the Natcher patent subcommittee investigation, its recommendations, and, most importantly, its unpublished report, has not been adequately recognized. This information permits a clearer understanding of what happened both before and, especially, after the work of this subcommittee, and, also, a clearer understanding of the intent of Congress with respect to the question posed above. Also, the literature does not include an examination of the preliminary working drafts from the official files of the legislative history of the Space Act. This information reveals indecisiveness in the early stages of the legislative history about what type of patent provisions, if any, should be included. In addition, very little reference is made in the literature about what happened immediately prior to the Conference Meeting. Interviews with former staff members provided interesting, although probably not legally significant, information, of the Pre-conference discussions, negotiations, and drafting, and particularly, of the role played by staff members.

The story of the legislative history of the property rights in inventions provisions of the Space Act may be summarized and conclusions stated by somewhat arbitrarily dividing the sequence of events into three stages. The first stage may be termed, Pre-H.R. 12575 or Period of Unimportance and Indecision. This period began after the launching of the first earth satellite, Sputnik I, by the Soviet Union on October 4, 1957, and, perhaps, began officially on April 2, 1958, with a Presidential Message to Congress. It ended shortly before May 24, 1958, the date a new bill, H.R. 12575, was reported out of the House Select

Committee on Astronautics and Space Exploration, following a decision made in executive session to include a patent section in the bill. Prior to this date, no patent provisions were officially under consideration in Congress and little attention was focused upon the question of patent policy.

The second stage may be termed, H.R. 12575-To-Conference or Period Of Decision Followed By A Period Of Investigation. This period began on May 24, 1958, when H.R. 12575 with the new patent section was reported out of the House Committee. During this period H.R. 12575 was enacted by the House on June 2, 1958, with the patent section unchanged. On July 16, 1958, an almost identical section was deleted from the Senate bill, S. 3609, by Senator Lyndon B. Johnson's floor amendment. The Natcher patent subcommittee was appointed, undertook the most extensive investigation made of the patent provisions, and submitted a recommended substitute patent section and an accompanying report. Pre-Conference discussions, negotiations, and drafting ensued, bringing this stage to a close before the Conference Meeting on July 15, 1958.

The third stage may be termed, Conference-Debate-Final Enactment or Period of Decision and Official Comment.

This period began with the Conference Meeting on July 15, 1958. Subsequently, three major statements of Congressional intent were delivered, one in writing and the other two orally, as follows: (1) one paragraph on page twenty-three of the Conference Report; (2) Rep. John W. McCormack's statement on the House floor on July 16, 1958; (3) Rep. Kenneth B. Keating's statement on the House floor on July 16, 1958. The final votes were taken in the House and Senate on July 16, 1958. This stage ended on July 29, 1958, when President Dwight D. Eisenhower signed H.R. 12575, as Public Law 85-568, enacting into law The National Aeronautics and Space Act of 1958. Following this discussion, a section with conclusions to the question of the Congressional intent of the waiver provisions will conclude this paper.

I. PRE-H.R. 12575 or PERIOD OF UNIMPORTANCE AND INDECISION.

Congress was called to action in a period of crisis. The launching of Sputnik I on October 4, 1957, dramatically demonstrated to the world that the Soviet Union claimed the first major victory in the space race.[79/] It was a blow to America's national prestige. It illustrated the Soviet Union's military advantage in the area of long range missiles. It provoked fears that a decisive military advantage might be obtained by the first nation to "conquor" outer space. It raised the possibility of enormous economic advantages in such areas as communications and weather forecasting from the peaceful use of outer space. President Eisenhower responded officially by transmitting a Message to the Congress on April 2, 1958, recommending the establishment of a new, independent agency. This agency would be given power and funds adequate to assume the responsibility for programs relating to space technology, space science, and civil space exploration, and to absorb the existing National Advisory Committee of Aeronautics. Twelve days later this Message was followed by the Administration's bill, drafted in the

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79/ *Supra*, note 15, at 21.

Bureau of the Budget and introduced in identical form in the House, as H.R. 11881, by Rep. John W. McCormack and in the Senate, as S. 3609, by Senators Lyndon B. Johnson and Styles Bridges.[80/]

Congress was expected to act quickly. A subcommittee of the Senate Committee on Armed Sercies already had conducted hearings on the country's satellite and missile programs from November 25, 1957, to January 23, 1958. Extraordinary action already had been taken by Congress in creating a Special Committee on Space and Astronautics in the Senate on February 6, 1958, headed by Senator Lyndon B. Johnson and a Select Committee on Astronautics and Space Exploration in the House on March 5, 1958, headed by Rep. John W. Mc-Cormack.[81/]

At this time the question of patent policy was the major "sleeper" of the Space Act. Many major policy questions then appeared to warrant the attention of the House and Senate special committees and none of them had anything to do with patent provisions. The President's Message did not mention this question. The Administration's

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80/ *Supra*, pages 20-24.

81/ *Ibid*.

bill included no patent provisions.[82/]

Few references were made to patent policy in the public hearings before the House Select Committee on Astronautics and Space Exploration from April 15 through May 12, 1958. In the 1542 pages of published testimony and exhibits, the major discussion of patent policy was by Dr. Hugh L. Dryden, Director, The National Advisory Committee for Aeronautics, who described NACA's patent practices. Also, Adm. Hyman G. Rickover, Assistant Chief, Bureau of Ships, For Nuclear Propulsion, Department of the Navy, submitted a written statement urging the need for patent provisions that would protect the rights of the United States in inventions resulting from government-financed research.[83/]

Likewise, few references were made to patent policy in the public hearings before the Senate Special Committee on Space and Astronautics from May 6 through May 15, 1958. Mr. Paul G. Dembling, General Counsel, The National Advisory Committee for Aeronautics, in response to a question from Senator Clinton P. Anderson, noted that no patent

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82/ *Supra*, page 24.

83/ *Supra*, pages 29-31.

provisions were included in the Administration's bill. Mr. Donald A. Quarles, Deputy Secretary of Defense, testified to the patent policy of the Department of Defense. He recommended that the new agency should follow the patent policy of his Department, which would not require adding patent provisions to the Administration's bill.[84/]

While the question of patent policy was rarely mentioned during the public committee hearings, there is clear evidence that during this period this question was considered by House staff members, who were presumably acting according to instructions. Eleven preliminary working drafts of the House Select Committee on Astronautics and Space Exploration were examined. These drafts were obtained from the original files of the legislative history of the Space Act. Among the proposed changes to the Administration's bill, these drafts show the addition of a patent section.[85/]

Moreover, these drafts show that while the question of patent policy was considered, indecisiveness prevailed as to what type of patent policy was desired. The first draft had a patent section, included in this paper as

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84/ Supra, pages 24-29.

85/ Supra, pages 34-39.

Document No. I, patterned after The National Science Foundation Act of 1950. The next eight drafts included two patent sections, alternatively stated, one patterned after The National Science Foundation Act of 1950 and the other patterned after The Atomic Energy Act of 1954. The ninth draft, dated May 16, 1958, is the last draft containing the two patent sections. The tenth draft, dated May 19, 1958, had only one patent section, the one patterned after The Atomic Energy Act of 1954. Therefore, sometime between May 16 and May 19, 1958, a decision was made, assuming that patent provisions were to be included, to recommend an approach patterned after The Atomic Energy Act of 1954.[86]

86/ Ibid.

II. H.R. 12575-TO-CONFERENCE or PERIOD OF DECISION FOLLOWED BY A PERIOD OF INVESTIGATION.

The decision to add a patent section to the Adminstration's bill and the decision to add a particular section patterned after The Atomic Energy Act of 1954 were made in executive session by the House Select Committee on Astronautics and Space Exploration. Available information does not include a statement of the reasons for making this decision or a statement of intention or purpose by the Committee.[87/]

This patent section became Section 407 of H.R. 12575, a new bill reported out of the House Select Committee on Astronautic and Space Exploration on May 24, 1958, to replace the Administration's bill, H.R. 11881. No statement of intention or explanation relating to Section 407 accompanied this new bill.[88/]

On June 2, 1958, H.R. 12575 was called up on the House floor for debate and a vote. A House Rules Committee resolution limited debate to two hours. The debate was mostly of a general nature and comments were not directed

87/ Supra, pages 31-34.

88/ Ibid.

to the patent section. Rep. McCormack's opening statement urged that prompt enactment of H.R. 12575 was required in the national interest. H.R. 12575 was unanimously passed.[89/]

Representatives of the legal profession and of industry began to display an increasingly intense interest in the newly enacted Section 407. The American Patent Law Association's statement is an example of the strong protest against this section, critizing not merely its content, but the legislative procedure that was followed.[90/]

On June 3, 1958, H.R. 12575 was referred to the Senate Special Committee on Space and Astronautics. On June 11, 1958, this Committee reported out an amended S. 3609, which included a patent section almost identical to Section 407. On June 16, 1958, this bill was called up on the Senate floor for debate and a vote.[91/]

Senator Lyndon B. Johnson made a motion to delete the patent section. He explained that his amendment was offered to allow time for further study requested by Committee

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89/ *Supra*, pages 40-41.

90/ *Supra*, pages 41-44.

91/ *Supra*, pages 45-46.

members and, because the language of the House and Senate bills was almost identical, to permit the subject to be considered and resolved in Conference. The amendment was agreed to, and the Senate passed H.R. 12575, after substituting the language of amended S. 3609 for the House text.[92/]

The question of patent policy was now emerging as an issue of major importance. Rep. John W. McCormack appointed a patent subcommittee to review the question of patent policy prior to a Conference Meeting. Rep. William H. Natcher, of Kentucky, was appointed chairman of this subcommittee. Other representatives appointed to this subcommittee were: Brooks Hays, Arkansas; Lee Metcalf, Montana; Leslie C. Arends, Illinois; Gordon L. McDonough, California; Kenneth B. Keating, New York. The appointment of this subcommittee reflects the importance of the question of patent policy and, also, reflects the fact that the question had received insufficient attention prior to the passage of H.R. 12575 in the House on June 2, 1958, and in the Senate on June 16, 1958.[93/]

The Natcher patent subcommittee and its staff discussed the issues involved with many interested parties,

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92/ Supra, pages 46-57.

93/ Supra, page 58.

both Government and private, for several weeks. Its inquiry was the most extensive official investigation made of the patent provisions. As a result of its investigation, the subcommittee submitted a substitute patent section and an accompanying unpublished report expressing its intention or purpose and reasons for recommending changes.[94/]

The report of the Natcher patent subcommittee, which has been largely neglected in the literature, in my opinion, is crucial to a correct understanding of the legislative history. Section 407, patterned after The Atomic Energy Act of 1954, and unaccompanied by any statement of legislative intent or purpose, presumably was intended to embody a legislative purpose similar to the corresponding Section 152 of The Atomic Energy Act of 1954.

A major significance of the Natcher Report is that it explicitly recognized that the research and development work of the new Space Agency would be different from the research and development work of the Atomic Energy Commission. Because of this fact, the subcommittee concluded that the approach to patent policy of The Atomic Energy Act of 1954, with its emphasis upon the protection of the Government's interests relative to the interest of private endeavor, was

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94/ Supra, pages 58-69.

more stringent than necessary in the field of space research and development. In my opinion, this difference in underlying philosophy is probably more significant than the actual changes in the wording of the subcommittee's recommended section, "Substitute For Section 407 of H.R. 12575 - Property Rights in Inventions," as compared with Section 407 of H.R. 12575. However, this section did contain new subsections that were not in Section 407, including, inter alia, authorization to require contractors to report technical data relating to inventions, creation of an Inventions Review Board to which adverse rulings of the Administrator may be appealed, and criteria to determine the ownership of inventions based on the relationship of the invention to the duties of the employee of the contractor.[95/]

Another major significance of the Natcher Report is that the subcommittee attempted to make concrete the nebulous concept of "national interest". This phrase is the standard of Section 407 (d) of the recommended substitute section for determining when the Administrator may waive title to an invention and retain a license to use the invention for governmental purposes. The corresponding phrase in

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95/ *Ibid.*

Section 305 (f) of the Space Act is "interests of the United States." While the patent subcommittee recognized that the approach of The Atomic Energy Act of 1954 was more stringent than necessary in the field of space research and development, it also recognized that it was essential to protect the legitimate interests of the United States. The subcommittee's purpose was "to balance the requisites of government against the needs of private enterprise." 96/ The subcommittee attempted to arrive at a balance to these sometimes conflicting objectives, specifically, by determining that "... there are at least five basic reasons for placing title to space inventions in the Government under certain conditions. These reasons are:

> (A) While the nature of developments to come out of space research in the future are unknown we do know that some discoveries are likely to be unprecedentedly powerful and significant. In certain instances it may be imperative that the Government have ownership rights from the beginning. This need may be as great as in the case of atomic energy, or even more so.
>
> (B) It may be highly inequitable and contrary to our traditional competitive system to permit a single private party to patent an invention developed with taxpayers' money in cases where the invention proves to have unusual commercial value or answers some universal human need.

96/ Supra, page 66.

(C) The right to title would carry with it, in essential cases, the ability to exclude others from the field for reasons of security or of public health and safety.

(D) Title to the invention would bestow on the Government an ability to use such rights for protective or bargaining purposes.

(E) Government ownership could be a source of income, it could also be used as an offset or counterclaim in infringement suits against the Government, whereas a mere license is an unenforceable defense to an infringement suit." 97/

By using the words, "at least," the subcommittee recognized that other reasons might arise where the "national interest" would be furthered by retaining all of the rights to an invention in the United States.

After the Natcher subcommittee submitted its recommended substitute section and its accompanying report, and before the Conference Meeting, staff members of the House Select Committee on Astronautics and Space Exploration and the Senate Special Committee on Space and Astronautics labored over the patent provisions. The subcommittee's recommendation was used as a guideline. The Senate side had no fixed position regarding how the patent provisions should be written, unlike the House side which had the recommendation of the subcommittee. 98/

97/ *Supra,* pages 64-65.

98/ *Supra,* pages 70-73.

The provision for an Inventions and Contributions Board, which appears in Sections 305 and 306 of the Space Act, resulted from these informal staff sessions. Previously, the need to provide a monetary incentive to stimulate private inventive activities was recognized, and a Senate staff member had made a study of previous awards legislation.[99/]

In an attempt to lessen Senate objections to the patent subcommittee's recommendation, changes were informally negotiated by Mr. George J. Feldman, Chief Counsel and Staff Director, House Select Committee on Astronatuics and Space Exploration, Mr Philip B. Yeager, Special Consultant to the House Elect Committee, Mr. Herschel F. Clesner, a Senate Judiciary Staff member on loan to the Senate Special Committee on Space andAstronautics, and others, prior to Conference. The actual language of the patent provisions that was approved in Conference was written by staff members shortly before the Conference Meeting.[100/]

99/ *Supra*, pages 71-72.

100/ *Supra*, pages 72-73.

III. CONFERENCE-DEBATE-FINAL ENACTMENT or PERIOD OF DECISION AND OFFICIAL COMMENT

Section 407 of H.R. 12575, as passed by the House, on June 2, 1958, was the only part of the bill extensively revised at the Conference Meeting on July 15, 1958.101/ No one present in Congress when the Administration's bill was first introduced could have foreseen that the question of patent policy would play such an important role in the final deliberations. While several other differences between the House and Senate bills were resolved at Conference, the question of patent policy was one of the most important issues.102/

The Conference consisted of those Congressmen designated as Managers on the Part of the House and Managers on the Part of the Senate. The Managers on the Part of the House were Representatives John W. McCormack, Overton Brooks, Brooks Hays, Leo W. O'Brien, Lee Metcalf, Gordon L. McDonough, James G. Fulton, Kenneth B. Keating and Gerald R. Ford, Jr.

101/ Supra, page 84.

102/ Supra, page 74.

The Managers on the Part of the Senate were: Senators Lyndon B. Johnson, Richard B. Russell, Theodore F. Green, John L. McClellan, Warren G. Magnuson, Styles Bridges, Alexander Wiley, Bourke B. Hickenlooper, and Leverett Saltonstall.[103/]

Unfortunately, no record exists of the deliberations of the Conferees. The only official record of this meeting is the Conference Report.[104/]

The new patent provisions appeared primarily in Section 305. The similarity between the ideas and language of some of the subsections in Section 305 and the recommended substitute section of the Natcher patent subcommittee is evident from a comparison of these sections. The criteria of Subsection 305 (a)for determining whether an invention made in the performance of work under a NASA contract shall become the exclusive property of the United States is almost identical to Subsection 407 (b) of the subcommittee recommended provisions.

However, Subsection 305 (a) states that when these criteria are met, the Administrator "shall" take title,

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103/ *Supra*, page 19.

104/ *Supra*, pages 73, 75 - 80.

subject only to the waiver provisions of Subsection 305 (f). In this respect the Conferees changed Subsection 407 (b) which provided that when these criteria are met the Administrator "shall be entitled to, and <u>may require</u>" the assignment of title. Under Subsection 407 (b) the Administrator would have had the option to take title or not at the very beginning. Subsection 305 (i) is identical to Subsection 407 (c). Subsection 305 (h) is almost identical to Subsection 407 (e). The reference to patents in Subsection 203 (b)(3) of the Space Act was added in Conference and corresponds to the first sentence of Subsection 407(d). Subsection 305 (b) is similar to the first two sentences of Subsection 407 (f). The subcommittee idea of an Inventions Review Board was rejected in Conference. The procedure on appeal from an adverse decision of the Administrator was modified. The idea of an Inventions and Contributions Board was added in Conference and appears in Section 305 (f) and Section 306, which provides incentive awards for scientific and technical contributions, and not just inventions.[105/]

If the Natcher patent subcommittee's recommended patent section and report had no greater influence on the

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105/ *Supra*, See notes on pages 76-80.

on the final patent policy than that which has been described above, it would have played a most significant role in the legislative history. However, its influence extends further to the enunciated legislative intent or purpose of the final patent provisions. This influence, in my opinion, resulted in a more significant underlying change in spirit than even its influence on the language of the statute.

The impack of the unpublished Natcher report was seen the next day, June 16, 1958, when H.R. 12575, as reported out of Conference, was called up in the House and in the Senate for debate and a final vote. In the House two major statements of legislative intent or purpose were delivered on the floor prior to the final vote. The statements were complementary and uncontradicted by any other remarks. The statements were made by Rep. John W. McCormack and Rep. Kenneth B. Keating.[106/]

Rep. McCormack made the opening statement on the bill. Relating to the legislative intent or purpose of the patent provisions, he stated:

> The review and the redrafting were wise. The select committee created a special subcommittee to study the matter, and after talking with many experts in and out of Government arrived at a new version, drawing upon both Senate and House suggestions. The original

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106/ Supra, pages 81-95.

> patent provision was too closely patterned after the stringent requirements in the Atomic Energy Act which are not fully applicable to the space field. The substitute provision agreed to by the conferees protects both the interests of the Government and affords enough flexibility to the Space Administrator to let him meet needs for preserving the incentives of the individuals and companies whose efforts it is public policy to encourage.107/

The sentence stating that "[t]he original patent provision was too closely patterned after the stringent requirements in the Atomic Energy Act which are not fully applicable to the space field" directly reflects the principal conclusion of the Natcher Report. Additional evidence that Rep. McCormack's statement was making official the patent philosophy expressed in the Natcher Report is the fact that the sentence preceding the sentence quoted above directly mentions and gives credit to the Natcher patent subcommitte.

Moreover, Rep. McCormack's statement states that it is in the "interests of the United States" to preserve the incentives of the individuals and companies dealing with NASA in addition to the protection of the interests of the Government. These interests are to be harmonized by dele-

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107/ *Supra*, pages 84-85.

gating power to the Administrator to deal flexibly with situations as they arise.

The statement of Rep. Kenneth B. Keating is more closely tied to the Natcher Report than the statement of Rep. John W. McCormack. Rep. Keating served as a member of the patent subcommittee. Referring to the subcommittee, he stated:

> I want to emphasize that the patent section in this bill has been subjected to careful scrutiny and study. It represents, as the statement of managers suggests, a balancing effort. We felt we would be derelict in our duty if we failed to protect the legitimate interests of government. At the same time we endeavored not to remove any incentive from private enterprise.108/

Using the identical language of the Natcher Report, Rep. Keating restated the five reasons "for placing title to space inventions in the Government under certain conditions." As in the Natcher Report, Rep. Keating's statement used a qualifying word to suggest that other reasons might arise where the national interest would require taking full title.109/

The only other official statement of legislative intent or purpose is a paragraph in the Conference Report, referred to in the paragraph quoted above from Rep. Keating's

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108/ *Supra*, page 87.

109/ *Supra*, pages 91-92.

statement. This statement is consistent with the McCormack and Keating statements and pinpoints the departure in underlying philosophy from the original Section 407 of H.R. 12575, resulting from the patent subcommittee's investigation, recommended substitute patent section, and report. Prefacing the explanation of Section 305, the statement is as follows:

> Operating on the theory that the Government's interests must be protected, but with the concomitant purpose of protecting private interests and of keeping private incentive and initiative at a high level, the committee of conference adopted entirely new patent provisions.110/

The emphasis of this statement appears to go one step further than Rep. McCormack's statement. Rep. McCormack's statement emphasizes the need for "preserving" the incentives of private endeavor. The Conference Report's statement not only emphasizes maintaining the *status quo*, by use of the word, "protecting." but also emphasizes the objective of "keeping private incentive and initiative at a high level..."

The only three official statements of legislative intent or purpose relative to the patent provisions that were made after the Conference Meeting were the McCormack,

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110/ *Supra*, pages 75-76.

Keating, and Conference Report statements. In the Senate the entire debate on the Space Act occupied less than one full page in The Congressional Record. No reference was made to the patent provisions.[111]

On July 16, 1958, the Space Act was passed in both the House and the Senate by unanimous votes. On July 29, 1958, President Dwight D. Eisenhower signed H.R. 12575 as Public Law 85-568, enacting into law The National Aeronautics and Space Act of 1958.[112]

111/ *Supra*, page 96.

112/ *Ibid*.

IV. THE WAIVER POLICY.

What intent did Congress express, if any, relative to how the Administrator of NASA should exercise the discretionary authority of Subsections 305 (a) and (f) of the Space Act to prescribe regulations, and pursuant thereto, decide whether to waive all or part of the rights acquired by NASA to the inventions of its contractors and subcontractors?

Subsection 305 (a) of the Space Act provides that title to inventions made in the performance of work under NASA contract shall be the exclusive property of the United States when the criteria specified in Subsections 305 (a) (1) or 305 (a) (2) are met, unless the Administrator waives all or any part of the rights in accordance with Subsection (f).[113/]

Subsection 305 (f) provides that under such regulations as the Administrator shall prescribe, he may waive all or any part of the rights to any invention or class of inventions if he determines that the "interests of the

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113/ *Supra*, page 12.

of the United States" will be served thereby. Any such waiver may be made upon such terms as the Administrator shall determine to be required for the protection of the "interests of the United States." Each waiver shall be subject to the reservation by the Administrator of an irrevocable, nonexclusive, nontransferable, royalty-free license for use by or on behalf of the United States or a foreign government purusant to a treaty or agreement. Each proposal for waiver shall be referred to an Inventions and Contributions Board for a hearing and submission of findings of fact and a recommendation to the Administrator.[114/]

At the beginning of this paper, five general types of waiver policies were hypothesized covering the entire range of possible choice.[115/] Any given waiver policy would tend to approximate one of these general types. Two of these policies were dismissed as contrary to the plain meaning of the language of Subsections 305 (a) and (f). The other three policies appear to be permissible ways in which the Administrator could exercise the discretionary authority

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114/ *Supra*, pages 14-15.

115/ *Supra*, page 6.

delegated under Subsections 305 (a) and (f). They are as follows:

> <u>Policy No. II</u>. <u>A Favor-The-Government Policy</u>. After title is initially taken under Subsection 305 (a), it should usually remain in the United States. The Administrator should only waive title under Subsection 305 (f) in unusual or exceptional circumstances upon the request of the contractor.
>
> <u>Policy No. III</u>. <u>A Flexible or Balance-The-Interests Policy</u>. After title is initially taken under Subsection 305 (a), upon request of the contractor, it should be waived or retained according to which alternative best advances the "interests of the United States" based on an evaluation of the interests of the parties involved for each invention or class of inventions.
>
> <u>Policy No. IV.</u> <u>A Favor-The-Contractor Policy</u>. After title is initially taken under Subsection 305 (a), it should usually be waived upon the request of the contractor. The Administrator should only deny waiver under Subsection 305 (f) in unusual or exceptional circumstances.

The legislative history of Subsections 305 (a) and 305 (f) demonstrates that Congress did express a definite preference for one of the general Policies II, III, and IV. The conclusion is that Congress clearly expressed an intention that the waiver policy should follow an approach approximating Policy No. III. Congress intended that a flexible or balance-the-interests policy should be followed by the Administrator to determine when title should be waived.

With reference to the Natcher Report and Rep. Kenneth B. Keating's statement, Congress also may have suggested a method how the Administrator should proceed to balance the legitimate interests of the government in retaining full title to certain inventions and the sometimes conflicting interests of preserving and keeping at a high level the private incentive and initiative. The approach suggested is one based on the "rule of reason." The five reasons listed in the Natcher Report and Rep. Kenneth B. Keating's statement were not intended to be exhaustive, but suggest that when an invention may be so characterized, full title should remain in the United States, unless overriding reasons exist for waiving title to the contractor or subcontractor.

The absolute number or proportion of inventions that the Administrator should waive in any one year was not directly the concern of Congress. The Flexible or Balance-The-Interests approach suggests that any such guidelines, if rigidly adhered to, would be arbitrary. Rather, the concern of Congress evident throughout the legislative proceedings may be illustrated by the following statement of the then Senator Lyndon B. Johnson, which was made on the Senate floor on June 16, 1958, during the debate on his amendment to delete the patent section from the Senate bill:

> ... We can today see only a short distance into the future, and we can only speculate upon a few of the ultimate benefits which the space age can bring to the people of the world.
>
> We know that there will be tremendous gains in the economic and physical well-being of people brought about by discoveries in the areas of weather prediction and control, communications, medical science, and transportation.116/

This statement shows a concern with the extraordinary invention, not the ordinary, everyday or average invention. Congress was pioneering into a new area. Major discoveries and breakthroughs were expected to result from the stimulus to space research that Congress was providing through the creation of a new National Aeronautics and Space Administration.

The first two reasons in the Natcher Report and in Rep. Kenneth B. Keating's statement for placing all of the rights to certain inventions in the government are strong evidence of this primary concern with inventions potentially having a big impact on the government or on the economy. While Congress was willing to declare that it is

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116/ Supra, page 49.

the public policy to protect private interests and to keep private incentive and initiative at a high level, it was not willing to relinquish rights to important inventions of this type. However, a reasonable inference is that Congress did intend that the Administrator would generally exercise his discretion to waive humdrum, everyday, or ordinary inventions at the request of the contractor or subcontractor.

Appendix B

Disclosures from Contractors to December 31, 1965
Contractors Ranked by Number of Disclosures

Contractor	Number of Disclosures
North American Aviation	810
United Aircraft Corporation	386
California Institute of Technology	290
Westinghouse Electric	256
Radio Corporation of America	181
General Electric Co.	180
Hughes Aircraft Co.	158
TRW, Inc.	148
Lockheed Aircraft Co.	113
General Dynamics	110
Honeywell, Inc.	102
International Business Machines	100
Aerojet General Corp.	97
Douglas Aircraft Co.	97
Boeing Co.	90
McDonnell Aircraft	73
Chrysler Corp.	59
Ling-Temco-Vought	58
Massachusetts Institute of Technology	44
Sperry Rand Corp.	41
Martin Marietta Corp.	35
Garrett Corp.	34
American Telephone & Telegraph	33
Electro Optical Systems	29
Illinois Institute of Technology	27
Brown Engineering Co.	26
Grumman Aircraft	26
Collins Radio Co.	25
Melpar Inc.	25
Stanford Research Institute	25
Bendix Corp.	24
Monsanto Research Corp.	24
GCA Corp.	23
General Motors Corp.	23
General Telephone and Electronics Corp.	23
Beckman Instruments	22
David Clark Co., Inc.	20
Battelle Memorial Institute	18
Arthur D. Little	18

Contractor	Number of Disclosures
Textron Inc.	18
Fairchild Hiller	17
General Precision	16
Avco Corp.	15
Ball Brothers Research Corp.	15
Varian Associates	15
Aircraft Armaments	14
Philco Corp.	14
Northrop Corp.	13
Perkin-Elmer Corp.	12
Duke University	11
Electro-Mechanical Research Inc.	11
International Telephone & Telegraph	10
Motorola Inc.	10
National Research Corp.	10
Peninsular ChemResearch	10
American Optical Co.	9
Borden Co.	9
Edgerton, Germeshausen & Grier	9
Spaco Inc.	9
Whittaker Corp.	9
Auto Control Laboratory	8
Kollsman Instrument	8
Microwave Electronics Inc.	8
Ampex Corp.	7
Barnes Engineering	7
Consolidated Electrodynamics	7
Documentation Inc.	7
B. F. Goodrich Co.	7
Goodyear Aerospace	7
Packard-Bell Electronics	7
Ryan Aeronautical Co.	7
Thermo Electrical Engineering	7
Air Reduction Co.	6
American Machine & Foundry	6
Clevite Corp.	6
Computer Control Co.	6
Engineering Physics	6
FMC Corp.	6
General American Transportation	6
Harshaw Chemical Co.	6
Marquardt Corp.	6
Midwest Research Institute	6
Union Carbide	6
University of California	6
Vitro Corporation of America	6

Contractor	Number of Disclosures
Allis Chalmers Manufacturing Co.	5
Atlantic Research	5
Cornell Aeronautical Lab Inc.	5
Dynatronics, Inc.	5
Electric Storage Battery	5
Farrand Optical Co.	5
General Mills Inc.	5
Harvey Aluminum	5
G. T. Schjeldahl Co.	5
Solid State Radiation	5
Southern Research Institute	5
Spacelabs Inc.	5
Telecomputing Corp.	5
Thiokol Chemical Corp.	5
University of Arizona	5
Aeronca Manufactoring Corp.	4
Air Products & Chemicals	4
Arrowhead Products	4
Astro Research Corp.	4
CBS, Inc.	4
Chicago Aerial Industries	4
Curtiss-Wright Corp.	4
Electronic Communications	4
General Nuclear Engineering	4
Geonautics, Inc.	4
Hazeltine Corp.	4
Hazelton Labs	4
Hoffman Electronics	4
Higgins Laboratory, Inc.	4
IRCO Corp.	4
Radiation Systems, Inc.	4
Raytheon Co.	4
Scientific Data Systems	4
Smith Electronics	4
Southwest Research Institute	4
Trident Engineering Associates	4
Yardney Electric Co.	4
Advanced Kinetics	3
Applied Psychological Services	3
Bio Technology Inc.	3
DeBell & Richardson	3
Dorne & Margolin	3
Engelhard Hanovia	3
Harvard College	3
Keltec Industries	3
Kinelogic Corp.	3

Contractors	Number of Disclosures
Laboratory for Electronics	3
Litton Industries	3
Livingston Electronic	3
Plasmodyne Corp.	3
Raymond Engineering Laboratory	3
Santa Barbara Research Center	3
Spectra-Physics Inc.	3
Stanford University	3
Texas Instruments	3
Utah Research and Development Co.	3
University of Minnesota	3
University of Rochester	3
Washington Technological Associates, Inc.	3
Whirlpool Corp.	3
Abtronics, Inc.	2
Airborne Instruments Laboratory	2
American Science and Engineering	2
Baylor University	2
Bolt, Beranek and Newman	2
Columbia University	2
Comprehensive Designers	2
Datacraft Inc.	2
Datametrics Corp.	2
Dynamic Services, Inc.	2
Fenwal Electronics	2
Franklin Institute of the State of Penn.	2
Georgia Institute of Technology	2
Giannini Controls	2
Gulton Industries	2
Industrial Nucleonics	2
Institute of Research and Instrumentation	2
International Latex Co.	2
Ion Physics Corp.	2
Labko Scientific Inc.	2
Leesona Moos Labs.	2
J. A. Maurer, Inc.	2
Mechanical Technology	2
Oak Ridge Technical Enterprises Inc.	2
Parametrics Inc.	2
Pennsylvania State University	2
Princeton University	2
R & D Consultants, Inc.	2
Radiation Inc.	2
Radiation Instrument Development Labs.	2
Razdow Laboratory	2
Rensselaer Polytechnical Institute	2
Research Triangle Institute	2

Contractor	Number of Disclosures
Roback Corp.	2
Rodana Research Corp.	2
Smithsonian Institute	2
Spectrolabs	2
Texas Institute for Rehabilitation	2
University of Denver	2
University of Illinois	2
University of Michigan	2
University of Pennsylvania	2
University of Virginia	2
Vickers Ltd.	2
Weston Hydraulics, Ltd.	2
Wilmore Electronics Co., Inc.	2
Wilmot Castle Co.	2
Advanced Technology Labs	1
Aerospace Corp.	1
Aerospace Research Associates, Inc.	1
Aero Vac Corp.	1
Air Preheater Co.	1
Allied Air Products and Chemicals, Inc.	1
Allied Research Associates, Inc.	1
American Aerospace Controls, Inc.	1
American Bosch Arma Corp.	1
Applied Physics Corp.	1
Ardel Corp.	1
Astro Met Associates, Inc.	1
Astro-Space Laboratories, Inc.	1
Baldwin-Lima-Hamilton Corp.	1
Beech Aircraft Corp.	1
Bionetics Research Labs, Inc.	1
Block Engineering Co.	1
Booz-Allen Applied Research	1
Brandeis University	1
Branson Instruments, Inc.	1
Brown University	1
Bunker-Ramo Corp.	1
Cadillac Gage Co.	1
California Computer Products	1
Carbons, Inc.	1
Consolidated Controls Corp.	1
Continental Testing Lab., Inc.	1
Cook Electric Co.	1
Cornell University	1
Cryonetics Corp.	1
DeHavilland Aircraft of Canada, Ltd.	1
Ebasco Services, Inc.	1

Contractor	Number of Disclosures
Ecco High Frequency Corp.	1
Electrac, Inc.	1
Electrochimica Corp.	1
Electro Radiation, Inc.	1
Exotech, Inc.	1
Franklin GNO Corp.	1
General Instrument Corp.	1
General Technologies Corp.	1
Genisco Data	1
Gould-National Batteries, Inc.	1
Hallicrafters Co.	1
Hayes International Corp.	1
Heat Technology Laboratories, Inc.	1
Hittman Associates	1
International Harvester Co.	1
Ipsen Industries, Inc.	1
Isomet Corp.	1
Jered Industries, Inc.	1
Johns Hopkins University	1
Kaman Instruments	1
Kelsey-Hayes Co.	1
Bernard Knust Co.	1
Kulite Tungsten Co.	1
Lear Siegler, Inc.	1
Leeds and Northrup Co.	1
Lexington Laboratories, Inc.	1
P. R. Mallory Co., Inc.	1
Mason Rust	1
MB Associates	1
Mellon Institute	1
Metro Physics, Inc.	1
Midland-Ross Corp.	1
Miller Research Laboratories	1
D. B. Milliken Co.	1
Mt. Vernon Co.	1
National Engineering Science Co.	1
National Water Lift Co.	1
New Hampshire Ball Bearings	1
New Mexico State University	1
North American Phillips Co., Inc.	1
Wayne B. Nottingham	1
Ohio University	1
Oklahoma Medical Research Foundation	1
Palo Alto Medical Research Foundation	1
Parker Aircraft Co.	1
Payne and Associates	1

Contractor	Number of Disclosures
Perfecting Service Co.	1
Quanta Laboratories	1
Radiation Applications, Inc.	1
Radiation Technology, Inc.	1
Recognition Equipment, Inc.	1
Reeves Institute	1
Resdel Engineering Corp.	1
Research Inc.	1
Self Organizing Systems, Inc.	1
Shell Development Co.	1
Space Craft Configuration	1
Space Craft, Inc.	1
Space Sciences, Inc.	1
Spex Industries, Inc.	1
State University of Iowa	1
Walter V. Sterling, Inc.	1
Temple University	1
Tobe Deutschmann Labs, Inc.	1
Trans-Sonics, Inc.	1
TRG, Control Data Corp.	1
Tyco Laboratories, Inc.	1
United Nuclear Corp.	1
University of Chicago	1
University of Houston	1
University of Notre Dame	1
University of Southern California	1
Vapor Corp.	1
Vidya, Inc.	1
Walter-Brunos Orthopedic, Inc.	1
Weber Aircraft	1

Appendix C

Petitions for Waiver and Action
to December 31, 1965

Contractor	Petitions	Action by Administrator Granted	Action by Administrator Denied	Withdrawn	Pending
Aerojet General Corp.	2 (1 FR)	2 (1 FR)			
Aerospace Research Associates	1	1			
Air Preheater Co.	1				1
Air Products & Chemicals, Inc.	1	1			
Air Reduction Co.	1 (BW)				1 (BW)
Allis-Chalmers Mfg. Co.	1	1			
American Cyanamid Corp.	1 (BW)				1 (BW)
American Standard	1 (BW)				1 (BW)
American Telephone & Telegraph Co.	1 (CW)	1 (CW)			
Ampex Corp.	5	5			
Avco Corp.	1				1
Baldwin-Lima-Hamilton	1			1	
Ball Brothers Research Corp.	3 (1 V)	3 (1 V)			
Barnes Engineering Co.	4	3		1	
Beckman Instruments, Inc.	8 (2 BW)	2		2 (1 BW)	4 (1 BW)
Bell Aircraft Corp.	1	1			
Bendix Corp.	4	1			3
Bolt, Beranek & Newman, Inc.	1 (BW)		1 (BW)		
Booz-Allen Research	1				1
Brown University (Prof. R. A. Dobbins)	1	1			
Burroughs Corp.	1 (BW)				1 (BW)
California Institute of Technology	20	9	3	3	5
Chicago Aerial Industries	2	2			
Collins Radio Co.	6	3	1		2
Computer Control Co., Inc.	1			1	
Consolidated Systems Corp.	2				2
Cook Electric Co.	1	1			
Curtiss-Wright Corp.	2 (1 BW)	1			1 (BW)
DeBell & Richardson, Inc.	2	2			
Douglas Aircraft Corp.	6 (1 BW)	3			3 (1 BW)
Dow Chemical Co.	1 (BW)				1 (BW)
Duke University	3	3			

Abbreviations: BW -- Blanket waiver
CW -- Class waiver
FR -- Foreign rights only
V -- Voided

Contractor	Petitions	Action by Administrator Granted	Denied	Withdrawn	Pending
Dynamics Research Corp.	1 (BW)				1 (BW)
Dynatronics, Inc.	1 (BW)				1 (BW)
Edgerton, Germeshausen & Grier, Inc.	1				1
Electric Storage Battery Co.	1				1
Electrochimica, Inc.	1	1			
Electro-Optical Systems, Inc.	7 (1 BW)	3			4 (1 BW)
Electro Radiation, Inc.	1 (V)	1 (V)			
Engineering Physics	4 (1 BW)	1		2	1 (BW)
Farrand Optical Co.	1	1			
Fenwal, Inc.	1	1			
Franklin Institute	1	1			
Garrett Corp.	1	1			
General Dynamics Corp.	2 (1 BW)	1			1 (BW)
General Electric Co.	10 (1 BW)	4			6 (1 BW)
General Mills, Inc.	4	3		1	
General Motors Corp.	2 (1 BW)				2 (1 BW)
General Precision, Inc.	1 (BW)				1 (BW)
General Telephone & Electronics Labs	2	2			
Geophysics Corp. of America	10	7			3
Globe Union, Inc.	1 (BW)				1 (BW)
B. F. Goodrich Co.	1			1	
Gulton Industries, Inc.	2	1			1
Harvard College (Prof. H.C. Ingrano, Sr.)	1	1			
Hazeltine Corp.	1	1			
Honeywell, Inc.	9 (4 BW)	1			8 (4 BW)
Merle L. Horne	1				1
Hughes Aircraft Co.	10 (7 BW)	2		1 (BW)	7 (6 BW)
IIT Research Institute	1				1
Industrial Nucleonics Corp.	2 (1 BW)				2 (1 BW)
Institute for Research Instrumentation	1				1
International Business Machines	9 (1 FR, 1 CW)	8 (1 FR)	1 (CW)		
International Electric Corp.	1	1			
Ion Physics Corp.	1 (BW)				1 (BW)
Joyce Industrial Nucleonics	1				1
Kaman Aircraft Corp.	1	1			
Kinelogic Corp.	1	1			
Kollsman Instrument Co.	3	2			1
Kulite-Tungsten Co.	1	1			
Laboratory for Electronics	1				1
A. D. Little, Inc.	2 (1 BW)	1			1 (BW)
Litton Industries	2 (1 BW)	1	1 (BW)		
Livingston Electronic Corp.	4 (1 BW)	3			1 (BW)
Lockheed Aircraft Co.	1		1		
James A. Lovelock	1 (FR)	1 (FR)			

Contractor	Petitions	Action by Administrator Granted	Denied	Withdrawn	Pending
Martin-Marietta Corp.	9 (BW)			2 (BW)	7 (BW)
MB Associates	1	1			
McDonnell Aircraft Corp.	9	8			1
Melpar, Inc.	1				1
Midland-Ross Corp.	1	1			
Midwest Research Institute	4	2			2
Hugo S. Miller	1		1		
Monsanto Co.	5	3			2
William R. Moss	1	1			
National Research Corp.	3	2			1
North American Aviation, Inc.	37 (1 BW)	16	11	4	5 (1 BW)
North American Phillips, Inc.	1	1			
Northrop Corp.	1	1			
Peninsular ChemResearch, Inc.	4	3		1	
Perkin-Elmer Co.	1 (BW)				1 (BW)
Philco Corp.	2 (BW)				2 (BW)
Princeton University	2	2			
Radiation Instrument Development Labs	2	2			
Radio Corp. of America	2 (1 BW, 1 CW)	1 (CW)			1 (BW)
Republic Aviation	1	1			
Sanders Associates	1 (BW)				1 (BW)
Mario Schaffner	1				1
G. T. Schjeldahl Co.	2	1			1
Schwarz Bioresearch, Inc.	1				1
Zac G. Shawhan	1	1			
Shell Development Co.	1	1			
Smithsonian Institute	3			3	
Southern Research Institute	4	4			
Sperry Rand Corp.	9 (2 BW)	6 (1 BW)		1	2 (1 BW)
Stanford Research Institute	6	3		2	1
Stanford University	1				1
Sylvania Electric Systems	1 (BW)				1 (BW)
Thermo Electron Engineering Co.	1				1
TRW, Inc.	14 (1 FR)	9 (1 FR)	2		3
Tyco Labs	1 (BW)				1 (BW)
Union Carbide Corp.	2 (BW)	1 (BW)			1 (BW)
United Aircraft Corp.	30 (14 BW)	8 (1 BW)	1 (BW)	6	15 (12 BW)
University of Arizona	4		4		
University of California	2	1			1
University of Illinois	1			1	
University of Iowa	1			1	
Varian Associates	5	5			
Vitro Corp. of America	1			1	
Westinghouse Electric Corp.	7 (2 BW)	3 (1 BW)			4 (1 BW)

Contractor	Petitions	Action by Administrator Granted	Action by Administrator Denied	Withdrawn	Pending
Gosnell Whittaker Corp.	1				1
Yardney Electric Corp.	2 (1 BW)	2 (1 BW)			
Totals					
121 Contractors	389*	189	28	35	137

Notes: *Included are waiver case numbers 101-492. W-477, W-486, W-491 were received after December 31, 1965 and are not included in this total.

Foreign rights only: 4 granted.
Class waivers: 2 granted, 1 denied.
Waivers voided: 2.
Blanket waivers (Section 105): 5 granted, 3 denied, 4 withdrawn, and 61 pending.

Sources: Waiver case files of ICB, NASA.

Appendix D

THE GEORGE WASHINGTON UNIVERSITY

Washington, D. C. 20006

NASA Research Project

Suite 108

2128 H St., N.W.

Dear Inventor:

This University, is making a study of NASA's patenting activities and their relations to commercial applications. As you know, one of NASA's objectives is to promote and encourage commercial spillover from the space effort. The research is sponsored by a grant from NASA.

My associate, Dr. Mary A. Holman, and I need your help to obtain factual information. As the inventor of one or more government-owned and NASA-administered patented inventions you have information that is not available from other sources. We would appreciate your answering the enclosed questionnaire. It asks about the commercial use, or the commercial potential, of your invention. It also asks for your opinions about certain aspects of NASA's patent policies.

We have tried to make the questionnaire as simple as possible because we know that you are very busy. If you cannot reply to all of the questions, please answer as many as you can, and return the questionnaire. An incomplete return is better than no response at all. If you so wish, any of your answers will be kept confidential -- not revealed outside The George Washington University. Please mark any such answers.

The results of this study will be of interest to you, to industry, to officials at NASA, and to members of Congress. Thank you for your help and cooperation.

Yours sincerely,

Donald S. Watson
Professor of Economics

Form approved.
Budget Bureau No. 104-6501

The George Washington University
Research Project: Evaluation of NASA's Patent Policies
Donald S. Watson and Mary A. Holman

Questionnaire to Inventors

Name(s) of Inventor(s) ______________________________
____

Patent Number ______________________________

Title of Invention ______________________________
____

1. Please give a brief layman's description of the invention. Please mention the field of technology and state if the invention is a material, a process, a product component, or a product.
____
____
____
____

2. Does your patented invention have potential for commercial use?
Yes______ No______ If no, proceed to Question 5.
If yes, please describe that commercial potential: ______________________________
____
____
____
____
____
____

3. Can your patented invention be commercially used without further development?
Yes______ No______
If no, please give an estimate of the development requirements:
____
____

4. Has your invention been used commercially? Yes______ No______
If yes, please describe: ______________________________
____
____
____
____
____
____

5. If your patented invention has not been used commercially, or has no commercial potential, please check the reason(s) that apply:
   a. Development cost too high ______________________________
   b. Development showed serious flaws ______________________________
   c. Invention already obsolete ______________________________
   d. Superior substitutes became available ______________________________
   e. Insufficient market demand ______________________________
   f. Technology too sophisticated ______________________________
   g. Invention for government use only ______________________________
   h. Other (please specify) ______________________________
   ____

6. Has your invention been used by NASA or by another government agency?
Yes______ No______
If yes, please describe: ______________________________
____
____
____
____
____
____

Opinions of Inventors

In recent years, there has been much public debate about incentives for disclosing new technology, about means of disseminating information on new technology, and about ways of stimulating commercial use of the new technology arising from government-financed research and development. We value your opinions on these matters. Please answer the following three questions, using additional sheets if necessary.

1. What do you think could or should be done to improve incentive programs to encourage greater disclosure and more complete reporting of the new technology coming from research financed by NASA?

   Please comment:

2. How could and should NASA improve its program for disseminating information about the inventions it owns?

   Please comment:

3. How could and should NASA increase the commercial use of inventions arising from the research it sponsors?

   Please comment:

We would appreciate any additional comments you might wish to make about NASA's patent policies, NASA's technology utilization programs, or about government patent policies in general.

THE GEORGE WASHINGTON UNIVERSITY
Washington, D. C. 20006

NASA Research Project
Suite 108
2128 H St., N.W.

Dear Licensee:

As you know, some of the things coming out of the research sponsored by the National Aeronautics and Space Administration are products used in the civilian economy. In fact, one of NASA's objectives is to promote and encourage commercial spillover from the space effort.

This University, under a grant from NASA, is making a study of NASA's patenting activities and their relations to commercial spillover. My associate, Dr. Mary A. Holman, and I need your help to obtain factual information that is not currently available.

We are writing to you because your firm has been licensed to use one or more of the inventions owned by the Government and administered by NASA. We would appreciate your answering the enclosed questionnaire. It asks for commercial use, or your estimate of the commercial potential, of the invention(s) you are licensed to use.

If you cannot reply to all of the questions, please answer as many as you can, and return the questionnaire. An incomplete return is better than no response at all. Your firm is one of the few to have had the initiative to obtain a license from NASA.

We have tried to make the questionnaire as short and as simple as possible because we know that you are very busy. If you so wish, any of your answers will be kept confidential -- not revealed outside The George Washington University.

The results of this study will be of interest to you, to industry in general, to officials at NASA, and to members of Congress. Thank you for your help and cooperation.

Sincerely yours,

Donald S. Watson
Professor of Economics

Form approved.
Budget Bureau No. 104-6501

The George Washington University
Research Project: Evaluation of NASA's Patent Policies
Donald S. Watson and Mary A. Holman

Questionnaire to Companies Licensed to Use NASA Inventions

Name of Company ______________________________

Title of Invention ______________________________

Patent Number ______________ Patent Application Serial Number ______________

1. Has your company commercialized this licensed invention? Commercialized means actual use in manufacture or sale of products, or sale of services.
   Yes ______ No ______

2. Is your company now in the process of putting the invention into commercial use within the near future? Yes ______ No ______
   If yes, approximately when? ______________________________

3. If your company has not actually used the invention commercially, what is your estimate of the probability that you will commercialize the invention in the future? Please express your probability estimate as a percentage (e.g., 10%, or 50%, or 90%): ______________

4. Has your company incurred engineering or technical development costs in its effort to commercialize this invention? Yes ______ No ______

   Costs to date: Dollar figures are desired. If, however, such figures cannot be supplied, please answer anyway; you can indicate magnitudes by giving ranges and by using words such as "slight," "moderate," and "substantial." ______________________________

   Expected future costs: ______________________________

5. If your firm has not actually commercialized the invention, please check the reason or reasons:
   a. Development cost too high ______________
   b. Development showed serious flaws ______________
   c. Invention already obsolete ______________
   d. Substitutes are available ______________
   e. Insufficient market demand ______________
   f. Technology too sophisticated ______________
   g. Other (please specify) ______________

6. Would your company have developed the invention faster or commercialized it if you had had exclusive rights to the invention? Yes ______ No ______ Please comment ______________________________

7. If you have commercialized the invention, how has your company benefited? For example, has your company had increased sales or reduced costs of production? Please describe ______________________________

If NASA has licensed your firm to use more than one invention, answer the following questions only once.

8. Please give us a brief description of your firm. Include in your answer your major product line(s) and the approximate number of your employees. ______

9. How did your company learn that the invention was available for licensing from the National Aeronautics and Space Administration? ______

We would appreciate any additional comments you might wish to make about NASA's patent policies, NASA's contracting policies, NASA's technology utilization programs, or about government patent policies in general.

THE GEORGE WASHINGTON UNIVERSITY

Washington, D. C. 20006

NASA Research Project

Suite 108

2128 H St., N.W.

Dear Waiver Holder:

This University is conducting a study that will result in an evaluation of the patent policies of the National Aeronautics and Space Administration. The research, which is under my direction, is sponsored by a grant from NASA. Dr. Mary A. Holman is Associate Investigator.

The evaluation will give close attention to NASA's waiver policy. I am writing to you because your company has been granted one or more waivers. You can provide facts that are not available from other sources.

We have already been permitted access to the information on waived inventions, including yours, that is available in NASA's files. To make a good evaluation of the waiver policy, however, we need to know more specifics, and more about expectations and incentives. We also need data on reasons for lack of commercial potential of some waived inventions. For comparison and perspective, we also would like to know about the commercial use of the patented inventions you acquired from R & D sponsored by other government agencies.

We have tried to make the questionnaire as simple as possible; we know that you are very busy. If you cannot reply to all of the questions, please answer as many as you can and return the questionnaire. An incomplete

If you wish, answers you mark as confidential will be so treated. The facts in such answers we will bury in totals and averages.

Because of the public debates on government patent policy, the results of this study will be of interest to you, to industry in general, to officials at NASA, and to members of Congress.

Yours sincerely,

Donald S. Watson
Professor of Economics

Form approved.
Budget Bureau No. 104-6501

The George Washington University
Research Project: Evaluation of NASA's Patent Policies
Donald S. Watson and Mary A. Holman

Questionnaire to Contractors Granted Waivers

The questionnaire is in six Parts. Please answer Parts I, II, and VI, and one of Parts III, IV, and V.

Contractor ____
____

Title of Invention ____

NASA Waiver Case No. __________ Patent Appl. Serial No. __________ Patent No. __________

Part I INFORMATION ABOUT THE INVENTION

1. Please give a brief description of the invention. Include in your answer a statement as to whether the invention is a product, or a component of a product, or a process or a material.
____
____
____
____

2. Has the invention ever been used by or for the government? E.g., in products or services sold to the government? Yes______ No______ If yes, please give a brief statement about the government use. ____
____

Part II STATUS OF THE INVENTION

1. The invention is now in actual commercial use by you or by others: Yes______ No______ If yes, please answer Part III below. Commercial use means use in manufacture, or sale of products and services, or licensing, or sale to foreign governments, or a combination of these. Exclude sale to U.S. government.

2. The invention has expected future commercial potential, but no commercial use to date: Yes______ No______ If yes, please answer Part IV below.

3. The invention now lacks commercial potential but has other benefits to the company. Yes______ No______ Please answer Part V below.

Part III ACTUAL COMMERCIAL USE OF THE INVENTION

Where applicable, dollar figures are desired. If, however, such figures cannot be supplied, please answer anyway; you can indicate magnitudes by giving ranges and by using words such as "slight," "moderate," and "substantial."

1. Company-financed development cost: ____________________

2. Use by contractor in his own manufacturing operations (if applicable):
   Brief description: ____________________

   Estimated reduction in cost: ____________________
   Other advantages: ____________________

3. Sale of products (if applicable):
   The invention is a product ________ or a component of one of your products ________ or a component of a product of another company ________.
   Please describe the product or component ____________________

   Sales to date: ____________________

   Expected future sales: ____________________

   The market (e.g., consumers, other companies, foreign): ____________________

4. Licensing (if applicable):
   Describe (please include any information you have about your licensees' activities):
   ____

   Income to date: ____________________

   Expected future income: ____________________

Additional remarks:

Part IV INVENTION WITH EXPECTED FUTURE COMMERCIAL USE

Please answer these questions for an invention whose commercial use has not yet occurred, but which is expected to be used in the forseeable future.

1. What is your estimate of the probability that the invention will be commercially used by the end of 1967? Please express your probability estimate as a percentage (e.g.: 10%, or 50%, or 90%).
____

2. What is your estimate of the probability that the invention will be commercially used by the end of 1970? Probability in per cent: ______________________________
____

3. Please comment on actual or expected development effort and expense ______________________________
____
____
____

4. Do you expect to use the invention in your own manufacturing?
Yes ______ No ______ Or research? Yes ______ No ______

5. Do you expect to sell the invention as a new product? Yes ______ No ______ Or as a component of one of your products? Yes ______ No ______ Or as a component of a product of another company? Yes ______ No ______ Or as part of a service? Yes ______ No ______.

Additional remarks:

Part V INVENTION LACKING ANY COMMERCIAL POTENTIAL

Answer these questions for an invention that possessed commercial potential at the time of petition but later lost its commercial potential or for an invention that yields other benefits to your company.

1. Please give a brief statement of the apparent commercial potential of the invention at time of petition.

2. Please check the reason or reasons for loss of commercial potential.
   a. Development cost too high ____
   b. Development showed serious flaws ____
   c. Invention already obsolete ____
   d. Superior substitutes became available ____
   e. Expected market failed to materialize ____
   f. Technology too sophisticated ____
   g. Too few claims allowed by the Patent Office ____
   h. Other (please specify) ____

3. If the invention itself lacked commercial potential for use in manufacture, sale of products, or licensing at time of petition, what benefits do you expect from owning the invention? (Please check one or more).
   a. Expanding the company's command over an area of new technology ____
   b. Increasing the protection of an existing product or product line ____
   c. Prestige for inventors or for the company ____
   d. Increasing the company's patent portfolio so as to show greater competence to secure future government contracts ____
   e. Other (please specify) ____

Additional remarks:

Part VI GENERAL QUESTIONS ABOUT AND FOR THE CONTRACTOR

The waiver policy can be evaluated in the light of the facts about its operation. Knowledge of the background of industry's inventive activities and information about contractors' attitudes toward the policy are also necessary for an evaluation. Please use additional sheets if necessary.

1. It seems that NASA's contractors have made relatively few petitions for waiver. What could be the cause(s)?

2. In your opinion, do NASA's new (1964) waiver regulations do more or less than the old (1959) regulations to move inventions into the stream of commerce? Why?

3. Do you have any recommendations for changes in NASA's waiver regulations and in their administration? (Please keep in mind the criteria of the Presidential Memorandum of October 10, 1963).

4. Has your company ever declined to bid on some other NASA contract because of NASA's patent policies? Yes_______ No_______. Please comment

5. How many unexpired patents from other (other than NASA) government-financed R & D does your company own?____________________
   If the exact number is not readily available, please give an estimate.
   Number:____________________ Estimated number:____________________

6. Of your company's patents acquired from government-financed R & D, what percentage has been commercially used? Again, please give an estimate if an exact figure is not available.
   Percentage:____________________ Estimated percentage:____________________

7. Of your company's portfolio of patents from company-financed research, what percentage has been commercially used?
   Percentage:____________________ Estimated percentage:____________________

Appendixes

E, F, and G

give data

on the responses to the

questionnaires

Table E--1

Replies to Questionnaires Sent to Inventors of NASA-Owned Patented Inventions

Reply	By Invention[a] No.	By Invention[a] Per Cent	By Questionnaire No.	By Questionnaire Per Cent	By Inventor No.	By Inventor Per Cent
Government employees						
Total in survey	80	100.0	139	100.0	114	100.0
Questionnaires returned	60	75.0	78	56.1	67	58.8
Completed questionnaires	59	73.8	73	52.5	63	55.3
Not completed[b]	1	1.2	5	3.6	4	3.5
Questionnaires not returned	7	8.8	34	24.5	22	19.3
Questionnaires not received[c]	13	16.2	27	19.4	25	21.9
Employees of contractors						
Total in survey	21	100.0	30	100.0	28	100.0
Questionnaires returned	14	66.7	22	73.3	20	71.4
Completed questionnaires	14	66.7	20	66.7	18	64.3
Not completed[b]	0		2	6.6	2	7.1
Questionnaires not returned	0		0		0	
Questionnaires not received[c]	7	33.3	8	26.7	8	28.6
Government employees and employees of contractors						
Total in survey	101	100.0	169	100.0	142	100.0
Questionnaires returned	74	73.3	100	59.2	87	61.3
Completed questionnaires	73	72.3	93	55.0	81	57.1
Not completed[b]	1	1.0	7	4.2	6	4.2
Questionnaires not returned	7	6.9	34	20.1	22	15.5
Questionnaires not received[c]	20	19.8	35	20.7	33	23.2

[a]Includes a reply from at least one inventor.

[b]Inventor deceased or refused questionnaire; questionnaires returned by widow or attorney.

[c]Correct addresses unknown; questionnaires returned by the U. S. Post Office.

Table E--2

Replies to Questionnaires Sent to Inventors of NASA-Owned Patented Inventions

Question One

Reply	By Invention No.	By Invention Per Cent	By Questionnaire No.	By Questionnaire Per Cent	By Inventor No.	By Inventor Per Cent
Question 1: Description of invention						
Employee inventions						
Completed questionnaires	59	100.0	73	100.0	63	100.0
Description given	59	100.0	73	100.0	63	100.0
Description not given	0		0		0	
Contractor inventions						
Completed Questionnaires	14	100.0	20	100.0	18	100.0
Description given	14	100.0	17	85.0	16	88.9
Description not given	0		3	15.0	2	11.1
Employee and contractor inventions						
Completed questionnaires	73	100.0	93	100.0	81	100.0
Description given	73	100.0	90	96.8	79	97.5
Description not given	0		3	3.2	2	2.5

Table E--3

Replies to Questionnaires Sent to Inventors of NASA-Owned Patented Inventions

Question Two

Reply	By Invention No.	By Invention Per Cent	By Questionnaire No.	By Questionnaire Per Cent	By Inventor No.	By Inventor Per Cent
Question 2: Commercial potential						
Employee inventions						
Completed questionnaires	59	100.0	73	100.0	63	100.0
Commercial potential	44	72.9	51	68.5	44	68.3
No commercial potential[a]	15	27.1	22	31.5	19	31.7
Contractor inventions						
Completed questionnaires	14	100.0	20	100.0	18	100.0
Commercial potential	8	57.1	11	55.0	9	50.0
No commercial potential[a]	6	42.9	9	45.0	9	50.0
Employee and contractor inventions						
Completed questionnaires	73	100.0	93	100.0	81	100.0
Commercial potential	52	69.9	62	65.6	53	64.2
No commercial potential[a]	21	30.1	31	34.4	28	35.8

[a]Includes inventions for which inventors said the commercial potential was remote.

Table E--4

Replies to Questionnaires Sent to Inventors
of NASA-Owned Patented Inventions

Question Three

Reply	By Invention No.	By Invention Per Cent	By Questionnaire No.	By Questionnaire Per Cent	By Inventor No.	By Inventor Per Cent
Question 3: Commercial use without further development?						
Employee inventions						
Inventions with commercial potential	44	100.0	51	100.0	44	100.0
No further development required	20	45.5	26	51.0	24	54.5
Further development required	24	54.5	25	49.0	20	45.5
Contractor inventions						
Inventions with commercial potential	8	100.0	11	100.0	9	100.0
No further development required	5	62.5	6	54.5	4	44.4
Further development required	3	37.5	5	45.5	5	55.6
Employee and contractor inventions						
Inventions with commercial potential	52	100.0	62	100.0	53	100.0
No further development required	25	48.1	32	51.6	28	52.8
Further development required	27	51.9	30	48.4	25	47.2

Table E--5

Replies to Questionnaires Sent to Inventors
of NASA-Owned Patented Inventions

Question Four

Reply	By Invention No.	By Invention Per Cent	By Questionnaire No.	By Questionnaire Per Cent	By Inventor No.	By Inventor Per Cent
Question 4: Any commercial use?						
Employee inventions						
Inventions with commercial potential	44	100.0	51	100.0	44	100.0
Commercial use[a]	0		0		0	
No commercial use	39	88.6	44	86.3	38	86.4
Do not know[b]	5	11.4	7	13.7	6	13.6
Contractor inventions						
Inventions with commercial potential	8	100.0	11	100.0	9	100.0
Commercial use	0		0		0	
No commercial use	8	100.0	11	100.0	9	100.0
Do not know[b]	0		0		0	
Employee and contractor inventions						
Inventions with commercial potential	52	100.0	62	100.0	53	100.0
Commercial use[a]	0		0		0	
No commercial use	47	90.4	55	88.7	47	88.7
Do not know[b]	5	9.6	7	11.3	6	11.3

[a]One inventor said his invention is being used on the supersonic commercial transport. Such commercial use will not materialize for several years.

[b]Includes replies marked "?" and questions left blank.

Table E--6

Replies to Questionnaires Sent to Inventors
of NASA-Owned Patented Inventions

Question Five

Reply	By Invention No.	By Invention Per Cent	By Questionnaire No.	By Questionnaire Per Cent	By Inventor No.	By Inventor Per Cent
Question 5: Reasons for lack of commercial use						
Employee inventions						
Completed questionnaires	59	100.0	73	100.0	63	100.0
Reasons known	55	93.2	66	90.4	58	92.1
Reasons not known	4	6.8	7	9.6	5	7.9
Contractor inventions						
Completed questionnaires	14	100.0	20	100.0	18	100.0
Reasons known	14	100.0	18	90.0	16	88.9
Reasons not known	0		2	10.0	2	11.1
Employee and contractor inventions						
Completed questionnaires	73	100.0	93	100.0	81	100.0
Reasons known	69	94.5	84	90.3	74	91.4
Reasons not known	4	5.5	9	9.7	7	8.6

Table E--7

Replies to Questionnaires Sent to Inventors of NASA-Owned Patented Inventions

Question Six

Reply	By Invention No.	By Invention Per Cent	By Questionnaire No.	By Questionnaire Per Cent	By Inventor No.	By Inventor Per Cent
Question 6: Government use?						
Employee inventions						
Completed questionnaires	59	100.0	73	100.0	63	100.0
Government use[a]	39	66.1	49	67.1	44	69.8
No government use	19	32.2	21	28.8	16	25.4
Do not know[b]	1	1.7	3	4.1	3	4.8
Contractor inventions						
Completed questionnaires	14	100.0	20	100.0	18	100.0
Government use	8	57.1	10	50.0	9	50.0
No government use	5	35.7	9	45.0	8	44.4
Do not know[b]	1	7.2	1	5.0	1	5.6
Employee and contractor inventions						
Completed questionnaires	73	100.0	93	100.0	81	100.0
Government use[a]	47	64.4	59	63.4	53	65.5
No government use	24	32.9	30	32.3	24	29.6
Do not know[b]	2	2.7	4	4.3	4	4.9

[a]Includes two inventions used by the Department of Defense but not used by NASA.

[b]Includes replies marked "?" and questions left blank.

Table E--8

Replies to Questionnaires Sent to Inventors of NASA-Owned Patented Inventions

Opinions of Inventors

Reply	Government Employee No.	Government Employee Per Cent	Employee of Contractor No.	Employee of Contractor Per Cent	All Inventors No.	All Inventors Per Cent
Question 1: How can NASA improve incentive programs?						
Completed questionnaires	63	100.0	18	100.0	81	100.0
Reply to question	41	65.1	15	83.3	56	69.1
No reply to question	22	34.9	3	16.7	25	30.9
Question 2: How can NASA improve dissemination of information programs?						
Completed questionnaires	63	100.0	18	100.0	81	100.0
Reply to question	41	65.1	13	72.2	54	66.7
No reply to question	22	34.9	5	27.8	27	33.3
Question 3: How can NASA widen commercial use of its inventions?						
Completed questionnaires	63	100.0	18	100.0	81	100.0
Reply to question	42	66.7	14	77.8	56	69.1
No reply to question	21	33.3	4	22.2	25	30.9
Request for additional comments about NASA's Patent Policy						
Completed questionnaire	63	100.0	18	100.0	81	100.0
Additional comments	24	38.1	5	27.8	29	35.8
No additional comments	39	61.9	13	72.2	42	64.2

Table F--1

Replies to Questionnaires Sent to Companies
Licensed to Use NASA Inventions

Reply	By Invention No.	By Invention Per Cent	By Company No.	By Company Per Cent	By Licensee No.	By Licensee Per Cent
Number in survey	46	100.0	97	100.0	107	100.0
Questionnaires returned	44	95.6	90	92.8	100	93.4
Completed questionnaires	42	91.2	84	86.6	94	87.8
Not completed[a]	2	4.4	6	6.2	6	5.6
Questionnaires not returned[b]	2	4.4	7	7.2	7	6.6

[a]These companies claimed that they requested information about the inventions not licenses to use the inventions, and do not consider themselves licensees.

[b]These firms are probably out of business. The telephone company had no business or personal listings for these licensees.

Table F--2

Replies to Questionnaires Sent to Companies Licensed to Use NASA Inventions

Questions One and Two

Reply	By Invention No.	By Invention Per Cent	By Company No.	By Company Per Cent	By Licensee No.	By Licensee Per Cent
Question 1: Commercial use?						
Number in survey[a]	46	100.0	97	100.0	107	100.0
Yes	4	8.7	3	3.1	4	3.7
No[a]	42[b]	91.3	94	96.9	103	96.3
Question 2: Is company putting invention into commercial use?						
Not in commercial use	42	100.0	94	100.0	103	100.0
In process of commercialization	6	14.3	13	13.8	13	12.6
Not in process of commercialization[c]	33	78.6	65	69.1	74	71.8
No reply	3	7.1	16[d]	17.1	16[d]	15.5

[a]Includes seven firms for which the telephone company has no business or personal listings.

[b]Includes four inventions that are commercially available.

[c]Includes three companies that claimed not to be licensees.

[d]Includes seven firms for which the telephone company has no listings and three companies that claimed not to be licensees.

Table F--3

Replies to Questionnaires Sent to Companies Licensed to Use NASA Inventions

Questions Three and Four

Reply	By Invention No.	By Invention Per Cent	By Company No.	By Company Per Cent	By Licensee No.	By Licensee Per Cent
Question 3: Probability of future use?						
Not in commercial use	42	100.0	94	100.0	103	100.0
Probability estimate	36	85.7	79	84.0	88	85.4
No probability estimate	6	14.3	15	16.0	15	14.6
Question 4: Company-financed development?						
Number in survey	46	100.0	97	100.0	107	100.0
Completed reply	41	89.1	75	77.3	85	79.4
Funds spent	a	a	33	34.0[b]	35	32.7[b]
No funds spent	a	a	42	43.3[b]	50	46.7[b]
Expected future cost	a	a	23	23.7[b]	25	23.4[b]
No expected future cost	a	a	52[c]	53.6[b]	60[c]	56.0[b]
No reply	5	10.9	22	22.7	22	20.6

[a]Not applicable to individual inventions because some are licensed to more than one company and because some companies are licensed to use more than one invention.

[b]Per cent of number in survey.

[c]Includes companies responding "no" and those leaving the question blank.

Table F--4

Replies to Questionnaires Sent to Companies
Licensed to Use NASA Inventions

Questions Five and Six

Reply	By Invention No.	By Invention Per Cent	By Company No.	By Company Per Cent	By Licensee No.	By Licensee Per Cent
Question 5: Reasons for lack of commercial use						
Not in commercial use	42	100.0	94	100.0	103	100.0
Reasons known[a]	39	92.9	92	97.9	85	82.5
Reasons not known	3	7.1	2	2.1	18	17.5
Question 6: Faster with exclusive rights?						
Number in survey	46	100.0	97	100.0	107	100.0
Completed reply	42	91.3	75	77.3	84	78.5
Yes	b	b	21	28.0	22	26.2
No[c]	b	b	54	72.0	57	67.9
Don't know	b	b	0		5	5.9
No reply	4	8.7	22	22.7	23	21.5

[a]Includes firms that claimed not to be licensees and firms for which the telephone company had no listing.

[b]Not applicable because some inventions are licensed to more than one firm and because some firms are licensed to use more than one invention.

[c]Includes firms that said they would not commercialize the licensed inventions.

Table F--5

Replies to Questionnaires Sent to Companies
Licensed to Use NASA Inventions

Questions Seven and Eight

Reply	By Invention No.	By Invention Per Cent	By Company No.	By Company Per Cent	By Licensee No.	By Licensee Per Cent
Question 7: Any benefits from commercial use?						
Actual commercial use or available[a]	8	100.0	6	100.0	8	100.0
Completed reply	7	87.5	5	83.3	7	87.5
No reply	1	12.5	1	16.7	1	12.5
Question 8: Description of firm						
Number in survey	46	100.0	97	100.0	107	100.0
Completed reply	34	73.9	50	51.5	60	56.1
No reply[b]	12	26.1	47	48.5	47	43.9

[a]Includes four inventions that are commercially available.

[b]Includes firms that claim not to be licensees and firms for which the telephone company has no listings.

Table F--6

Replies to Questionnaires Sent to Companies
Licensed to Use NASA Inventions

Question Nine and Request
for Additional Comments

Reply	By Invention No.	By Invention Per Cent	By Company No.	By Company Per Cent	By Licensee No.	By Licensee Per Cent
Question 9: How did company learn about invention?						
Number in survey	46	100.0	97	100.0	107	100.0
Completed reply	40	86.8	61	62.9	71	66.4
No reply[a]	6	13.2	36	37.1	36	33.6
Request for additional comments about NASA's patent policy						
Number in survey	46	100.0	97	100.0	107	100.0
Additional comments	16	34.8	22	22.7	24	22.4
No additional comments[a]	30	65.2	75	77.3	83	77.6

[a]Includes firms that claim not to be licensees and firms for which the telephone company has no listings.

Table G--1

Replies to Questionnaires Sent to Contractors
Granted Waivers to NASA

Reply	By Invention No.	By Invention Per Cent	By Contractor No.	By Contractor Per Cent
Number of waivers in survey	184	100.0	73	100.0
Questionnaires returned	177	96.2	67	91.8
Completed questionnaires	166	90.2	65[a]	89.1
Not completed[b]	11	6.0	2	2.7
Questionnaires not returned	7	3.8	6	8.2

[a] Includes contractors completing at least one questionnaire.

[b] Questionnaires returned with explanation for not answering questions, i.e., secrecy orders, waivers withdrawn or voided, etc.

Table G--2

Replies to Questionnaires Sent to Contractors
Granted Waivers by NASA

Part I: Information about Invention

Reply	By Invention No.	By Invention Per Cent
Question 1: Description of invention		
Completed questionnaires	166	100.0
Description given	165	99.4
Description not given	1	0.6
Question 2: Government use?		
Completed questionnaires	166	100.0
Yes	116	69.7
Description of use	111	66.7
No description of use	5	3.0
No government use	47	28.5
No reply	3	1.8

Table G--3

Replies to Questionnaires Sent to Contractors Granted Waivers by NASA

Part II: Status of the Invention

Reply	By Invention No.	By Invention Per Cent
Question 1: Actual commercial use?		
Completed questionnaires	166	100.0
Yes	21	12.7
No[a]	145[b]	87.3
Question 2: Future commercial potential only?		
Completed questionnaires	166	100.0
Yes	106	63.8
No	27	16.3
NA[a]	33	19.9
Question 3: Lacking commercial potential?		
Completed questionnaires	166	100.0
Yes	33	19.9
No	44	26.5
NA[a]	89	53.6

[a]Includes non-responses when a "yes" answer appears on either of the other questions in Part II.

[b]Includes nine inventions available for commercial use but having yet to yield income from sales or licensing.

Table G--4

Replies to Questionnaires Sent to Contractors Granted Waivers by NASA

Part III: Actual Commercial Use
Questions One and Two

Reply	By Invention No.	By Invention Per Cent
Question 1: Company financed development costs?		
Inventions in commercial use or commercially available	22[a]	100.0
Yes	17	77.2
No[b]	1	4.6
No reply	4	18.2
Question 2: Used in contractor's manufacturing operations?		
Inventions in commercial use or commercially available	22[a]	100.0
Yes	11	50.0
No	4	18.2
No reply	7	31.8
Description of use		
Inventions used in contractor's manufacturing operations	11	100.0
Description given	9	81.8
Description not given	2	18.2
Reduction in cost?		
Inventions used in contractor's manufacturing operations	11	100.0
Yes	4	36.4
No	3	27.2
No reply	4	36.4
Other advantages?		
Inventions used in contractor's manufacutring operations	11	100.0
Yes	9	81.8
No	0	
No reply	2	18.2

[a]Includes one invention that is commercially available but has not yet yielded income.

[b]California Institute of Technology stated that the development cost was borne by the licensee.

Table G--5

Replies to Questionnaires Sent to Contractors
Granted Waivers by NASA

Part III: Actual Commercial Use
Question Three

Reply	By Invention No.	By Invention Per Cent
Question 3: Sales?		
Inventions in commercial use or commercially available	22[a]	100.0
Inventions available for commercial sales	16	72.7
Not applicable	5	22.7
No reply	1	4.6
Kind of sales		
Inventions available for commercial sales	16	100.0
Products	7	43.8
Components	7	43.8
No reply	2	12.4
Description of sales		
Inventions available for commercial sales	16	100.0
Description given[b]	14	87.5
Description not given	2	12.5
Sales to date?		
Inventions available for commercial sales	16	100.0
Yes	12	75.0
No	3	18.8
No reply	1	6.2
Expected future sales?		
Inventions available for commercial sales	16	100.0
Yes	10	62.5
No	2	12.5
No reply	4	25.0
Description of market		
Inventions available for commercial sales	16	100.0
Description given	14	87.5
Description not given	0	
No reply	2	12.5

[a]Includes one invention that is commercially available but has not yet yielded income. [b]Includes references to Part I, question 1.

Table G--6

Replies to Questionnaires Sent to Contractors
Granted Waivers by NASA

Part III: Actual Commercial Use
Question Four

Reply	By Invention No.	Per Cent
Question 4: Are inventions licensed?		
Inventions in commercial use or commercially available	22[a]	100.0
Yes	13	59.1
Not applicable	3	13.6
No reply	6	27.3
Description of licensing activity		
Inventions available for commercial licensing	13	100.0
Description given	12	92.3
Description not given	1	7.7
Income to date?		
Inventions available for commercial licensing	13	100.0
Yes	7	53.8
No	4	30.8
No reply	2	15.4
Expected future income?		
Inventions available for commercial licensing	13	100.0
Yes	3	23.1
None or do not know	3	23.1
No reply	7	53.8

[a]Includes one invention that is commercially available but has not yet yielded income.

Table G--7

Replies to Questionnaires Sent to Contractors
Granted Waivers by NASA

Part IV: Inventions with Expected Future Commercial Use
Questions One, Two and Three

Reply	By Invention No.	Per Cent
Question 1: Probability of use by end of 1967?		
Inventions with future commercial potential	106	100.0
Zero	6[a]	5.7
Greater than zero	96	90.5
Do not know	2	1.9
No reply	2	1.9
Question 2: Probability of use by end of 1970?		
Inventions with future commercial potential	106	100.0
Zero	3[b]	2.8
Greater than zero	98	92.5
Do not know	4	3.8
No reply	1	.9
Question 3: Actual or expected development effort and expense?		
Inventions with future commercial potential	106	100.0
No	19[c]	17.9
Yes	51[d]	48.1
Do not know	28	26.4
No reply	8	7.6

[a]Commercial potential after 1967.

[b]Commercial potential after 1970.

[c]Includes 4 inventions being developed with government funds; and 11 inventions that require no further development.

[d]California Institute of Technology stated that substantial development cost is being borne by licensee.

Table G--8

Replies to Questionnaires Sent to Contractors
Granted Waivers by NASA

Part IV: Inventions with Expected Future Commercial Use
Questions Four and Five

Reply	By Invention No.	By Invention Per Cent
Question 4: Expect use in own manufacturing?		
Inventions with future commercial potential	106	100.0
Yes	42	39.6
No	50	47.2
No reply	14	13.2
Expect use in research?		
Inventions with future commercial potential	106	100.0
Yes	46	43.4
No	26	24.5
No reply	34	32.1
Question 5: Kinds of expected sales		
Expect to sell as product?		
Inventions with future commercial potential	106	100.0
Yes	35	33.0
No	50	47.2
No reply	21	19.8
Expect to sell as component of own product?		
Inventions with future commercial potential	106	100.0
Yes	40	37.7
No	37	34.9
No reply	29	27.4
Expect to sell as component of other's product?		
Inventions with future commercial potential	106	100.0
Yes	27	25.5
No	45	42.4
No reply	34	32.1
Expect to sell as part of a service?		
Inventions with future commercial potential	106	100.0
Yes	10	9.4
No	55	51.9
No reply	41	38.7

Table G--9

Replies to Questionnaires Sent to Contractors Granted Waivers by NASA

Part V: Inventions Without Commercial Potential
Questions One, Two and Three

Reply	By Invention No.	By Invention Per Cent
Question 1: Description of apparent commercial potential at time of petition		
Inventions without commercial potential[a]	39	100.0
Descriptions given	30	76.9
Descriptions not given	9	23.1
Question 2: Reasons for loss of commercial potential		
Inventions without commercial potential[a]	39	100.0
Reasons given	37	94.9
Reasons not given	2	5.1
Question 3: Other benefits from invention?		
Inventions without commercial potential[a]	39	100.0
Statement given	28	71.8
No statement given	11	28.2

[a]Includes 6 inventions with remote possibilities for commercial use.

Table G--10

Replies to Questionnaires Sent to Contractors
Granted Wiavers by NASA

Part VI: General Questions about and for the Contractor
Questions One, Two, Three and Four

Reply	By Invention No.	By Invention Per Cent
Number in survey	73	100.0
Questionnaires returned	67	91.8
Questionnaires not returned[a]	6	8.2
Question 1: Reasons given for few petitions for waivers		
Questionnaires returned	67	100.0
Reply	60	89.6
No reply	7	10.4
Question 2: Favor 1959 or 1964 NASA waiver regulations?		
Questionnaires returned	67	100.0
Reply	59	88.0
No reply	8	12.0
Question 3: Recommendations for changes in NASA waiver regulations		
Questionnaires returned	67	100.0
Recommendation given	57	85.0
Recommendation not given	10	15.0
Question 4: Effect of NASA patent policy on willingness to accept contracts		
Questionnaires returned	67	100.0
Reply	61	91.0
No reply	6	9.0

[a]Six contractors did not return questionnaire by July 15.

Table G--11

Replies to Questionnaires Sent to Contractors
Granted Waivers by NASA

Part VI: General Questions about and for the Contractor
Questions Five, Six and Seven

Reply	By Invention No.	By Invention Per Cent
Question 5: Any unexpired patents from government-financed R & D?		
Questionnaires returned	67	100.0
No	11	16.4
Yes	45	67.1
Do not know	3	4.5
No reply	8	12.0
Question 6: Per cent of patented inventions from government-financed R & D in commercial use		
Questionnaires returned	67	100.0
None in use	12	17.9
Some in use	35	52.2
Do not know	5	7.5
No reply	15	22.4
Question 7: Per cent of patented inventions from company-financed R & D in commercial use		
Questionnaires returned	67	100.0
None in use	4	6.0
Some in use	45	67.1
Do not know	4	6.0
No reply	14	20.9

Table H--1

Technical Evaluation of Inventions
Arising from R & D Sponsored
by NASA

Percentages of Inventions Evaluated
by Each of Six Criteria
to July 31, 1963

Action by NASA	Performance	Inventive Contribution	Government R & D Activity	Contribution to the Space Effort	Government Use	Commercial Potential	TOTAL Number of Cases Examined
Inventions not warranting patent action	51.3	87.1	65.1	54.6	74.4	21.7	456
Adverse search because of prior patents or printed publication	62.7	72.9	68.4	66.7	80.2	27.7	177
Patent applications filed	66.5	76.3	76.7	72.5	88.6	20.3	236
Patent applications abandoned	34.6	34.6	57.7	19.2	65.4	3.8	26
Patents issued	31.0	37.2	36.3	31.0	71.7	15.1	113
TOTAL	54.2	75.1	64.6	57.4	78.2	21.2	1008

Source: Files of AGP, NASA.

Table H--2

Technical Evaluation of Inventions
Arising from R & D Sponsored
by NASA

Government Use
to July 31, 1963

Action by NASA	None		Past		Continuing		Expected Future		TOTAL	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
Invention disclosures not warranting patent action	240	70.8	34	10.0	38	11.2	27	8.0	339	100.0
Adverse search because of prior patents or printed publications	10	7.0	1	.7	91	64.1	40	28.1	142	100.0
Patent applications filed	2	1.0	3	1.4	120	57.4	84	40.2	209	100.0
Abandoned patent applications	1	5.9	2	11.8	3	17.6	11	64.7	17	100.0
Patents issued	3	3.7	0	0.0	46	56.8	32	39.5	81	100.0
All inventions	256	32.5	40	5.1	298	37.8	194	24.6	788	100.0

Source: Files of AGP, NASA.

Table H--3

Technical Evaluation of Inventions
Arising from R & D Sponsored
by NASA

Commercial Potential
to July 31, 1963

Action by NASA	None		Slight		Strong		Blank or Not Available		TOTAL	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
Invention disclosures not warranting patent action	74	16.2	18	3.9	7	1.6	357	78.3	456	100.0
Adverse search because of prior patents or printed publications	14	7.9	19	10.8	16	9.0	128	72.3	177	100.0
Patent applications filed	9	3.8	26	11.0	13	5.5	188	79.7	236	100.0
Abandoned patent applications	0	0.0	1	3.8	0	0.0	25	96.2	26	100.0
Patents issued	4	3.5	9	8.0	4	3.5	96	85.0	113	100.0
All inventions	101	10.0	73	7.2	40	4.0	794	78.8	1008	100.0

Source: Files of AGP, NASA.

Table H--4

Technical Evaluation of Inventions
Arising from R & D Sponsored
by NASA

The Performance Criterion
to July 31, 1963

Action by NASA	Highly Satis-factory		Satis-factory		Partially Satis-factory		Unsatis-factory		Not Reduced to Practice		TOTAL	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
Invention disclosures not warranting patent action	25	10.7	96	41.0	45	19.2	24	10.3	44	18.8	234	100.0
Adverse search because of prior patents or printed publication	49	44.1	52	46.9	4	3.6	1	0.9	5	4.5	111	100.0
Patent applications filed	83	52.9	57	36.3	3	1.9	0	0.0	14	8.9	157	100.0
Abandoned patent applications	1	11.1	5	55.6	0	0.0	0	0.0	3	33.3	9	100.0
Patents issued	13	37.1	17	48.6	3	8.6	0	0.0	2	5.7	35	100.0
All inventions	171	31.3	227	41.6	55	10.1	25	4.6	68	12.4	546	100.0

Source: Files of AGP, NASA.

Table H--5

Technical Evaluation of Inventions
Arising from R & D Sponsored
by NASA

The Inventive Contribution Criterion
to July 31, 1963

Action by NASA	Pioneer Discovery		Substantial Advancement in the Art		Routine Improvement		No Invention		TOTAL	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
Invention disclosures not warranting patent action	5	1.3	63	15.8	219	55.0	111	27.9	398	100.0
Adverse search because of prior patents or printed publications	17	13.2	78	60.5	34	26.4	0	0.0	129	100.0
Patent applications filed	38	21.1	121	67.2	21	11.7	0	0.0	180	100.0
Abandoned patent applications	2	22.2	5	55.6	2	22.2	0	0.0	9	100.0
Patents issued	9	21.4	30	71.4	3	7.2	0	0.0	42	100.0
All Inventions	71	9.4	297	39.2	279	36.8	111	14.6	758	100.0

Source: Files of AGP, NASA.

Table H--6

Technical Evaluation of Inventions
Arising from R & D Sponsored
by NASA

The Government R & D Criterion
to July 31, 1963

Action by NASA	No Government R & D		Past (Completed)		Past (Suspended or Abandoned)		Continuing		Future		TOTAL	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
Invention disclosures not warranting patent action	43	14.5	167	56.2	54	18.2	33	11.1	0	0.0	297	100.0
Adverse search because of prior patents or printed publications	8	6.6	36	29.7	3	2.5	73	60.3	1	0.9	121	100.0
Patent applications filed	8	4.4	40	22.2	1	.6	127	70.6	4	2.2	180	100.0
Abandoned patent applications	1	9.1	2	18.2	0	0.0	8	72.7	0	0.0	11	100.0
Patents issued	3	7.3	5	12.2	2	4.9	31	75.6	0	0.0	41	100.0
All inventions	63	9.7	250	38.4	60	9.2	272	41.8	5	.9	650	100.0

Source: Files of AGP, NASA.

Table H--7

Technical Evaluation of Inventions
Arising from R & D Sponsored
by NASA

Contribution to the Space Effort
to July 31, 1963

Action by NASA	Extra-Ordinary		Major		Moderate		Minor		Incidental or Foreign		TOTAL	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
Invention disclosures not warranting patent action	0	0.0	10	4.0	42	16.9	75	30.1	122	49.0	249	100.0
Adverse search because of prior patents or printed publications	0	0.0	25	21.2	43	36.4	6	5.1	44	37.3	118	100.0
Patent applications filed	1	.6	61	35.7	64	37.4	9	5.3	36	21.0	171	100.0
Abandoned patent applications	0	0.0	2	33.3	3	50.0	0	0.0	1	16.7	6	100.0
Patents issued	0	0.0	16	45.7	11	31.5	4	11.4	4	11.4	35	100.0
All inventions	1	.2	114	19.7	163	28.2	94	16.2	207	35.7	579	100.0

Source: Files of AGP, NASA.

Table H--8

Time Lags on NASA Inventions Made by Employees

to July 31, 1963

Time Lags	Median	Mean	Number of Observations
	No. of Months	No. of Months	
Inventions not warranting patent action			
Conception and disclosure	4	15	101
Disclosure and inactivation	6	9	132
Inventions found adverse by search			
Conception and disclosure	6	13	89
Disclosure and inactivation	9	11	108
Inventions with statutory bars because of prior publication			
Conception and disclosure	24	28	10
Disclosure and inactivation	9	11	11
Patent applications filed on inventions			
Conception and disclosure	9	14	148
Disclosure and patent application	14	15	172
Patents issued on inventions			
Conception and disclosure	9	19	69
Disclosure and patent application	9	12	80
Patent application and issue	32	33	114
Abandoned patent applications on inventions			
Conception and disclosure	14	16	16
Disclosure and patent application	15	16	21
Patent application and abandonment	26	31	25
All inventions			
Conception and disclosure	8	15	431
Disclosure and inactivation[a]	7	10	251

[a]Includes inventions not warranting patent action, inventions found adverse by search, and inventions with statutory bar.

Source: AGP files, NASA.

Table H--9

Time Lags on NASA Inventions Made by
Employees of Contractors

to July 31, 1963

Time Lags	Median	Mean	Number of Observations
	No. of Months	No. of Months	
Inventions not warranting patent action			
Date contract let and conception[a]	8	11	178
Conception and disclosure	8	11	209
Date contract let and disclosure	15	19	358
Disclosure and inactivation	6	8	353
Inventions found adverse by search			
Date contract let and conception[b]	9	12	34
Conception and disclosure	9	11	41
Date contract let and disclosure	14	18	47
Disclosure and inactivation	9	10	45
Patent applications filed on inventions			
Date contract let and conception[c]	10	15	31
Conception and disclosure	11	13	52
Date contract let and disclosure	19	19	56
Disclosure and patent application	12	13	56
Time lags on all inventions			
Date contract let and conception	8	11	243
Conception and disclosure	8	12	302
Date contract let and disclosure	15	19	461
Disclosure and inactivation[d]	7	9	398

[a]Thirty-three additional inventions were conceived before contracts were let. For these, the median time lead was 3 months before the date the contracts were let.

[b]Seven additional inventions were conceived before contracts were let--with a median lead of 5 months.

[c]Eleven additional inventions were conceived before the contracts were let--with a median lead of 7 months.

[d]Includes inventions not warranting patent action and inventions found adverse by search.

Source: AGP files, NASA.