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STATEMENT OF
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BEFORE THE
SUBCOMMITTEE ON ANTITRUST AND MONOPOLY
SENATE COMMITTEE ON THE JUDICIARY
ON
GAO'S EVALUATION OF TWO PROPOSED METHODS
FOR ENHANCING COMPETITION IN WEAPONS SYSTEMS PROCUREMENT

Mr. Chairman and Members of the Committee:

I am pleased to report to you today on the evaluation you requested of two procurement methods: "Parallel Undocumented Development" and "Directed Technology Licensing". These methods were proposed to this Subcommittee during hearings last fall as possible means of increasing competition in the development, production, and sale of weapon systems and other military hard goods to the Government.

Our report is lengthy. Rather than read it here today, I suggest with your approval that it be placed in the record. My remarks now will attempt to summarize our thinking on these two proposals.

Parallel Undocumented Development, proposed by Dean Ralph Nash of George Washington University, is directed to the procurement of new weapon systems and other major hard goods. Directed Technology Licensing on the other hand, proposed by George R. Hall and the late Robert E. Johnson of the Rand Corporation, is addressed to reorders or reprocurement. Both methods were put forward for use in situations where competition has been absent or elusive.

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Directed Technology Licensing

Directed Technology Licensing seeks to nullify the monopoly power enjoyed by sole-source contractors when additional quantities of his product are reordered--usually follow-on production contracts. A contractor becomes a monopolistic sole source through the experience and know-how he gains as the developer and first producer of a unique product. A competitor can acquire the same experience and know-how on his own, but the sole-source contractor by reprocurement time has a long head start over potential competitors. Unless the contractor is grossly inefficient, he is usually well down the slope of the learning curve, i.e. he has achieved production efficiency, and has recovered most if not all of his high start up costs in his initial contract.

Directed Technology Licensing provides for a licensing clause in early development contracts. This clause would permit the Government to stage a new competition at reprocurement time, select the winner, and appoint him as licensee. The licensor, or developer-first producer, in exchange for royalty and technical assistance fees, would then provide the winner with technical assistance to help the licensee produce successfully.

The proposers of Directed Technology Licensing felt that, more often than not, the developer and first producer of a product will be the winner in the reorder contract. But he will be mindful of new competition and temper his reprocurement prices accordingly. In other words, the threat of competition will be an effective monitor of prices even if other bidders are seldom selected.

How the Technology Would be Transferred

If another bidder should win out, however, the licensor would be obliged to render technical assistance; that is, to pass on know-how. In effect, this means that the licensor's engineers and production specialists would give advice and counsel on the licensee's shop floor. In all likelihood there would have to be frequent visits back and forth between the staffs. The knowledge embodied in advanced technology hardware, for which Directed Technology Licensing is designed, can seldom be commuted by technical data, even if supplemented by telephone conversations.

Technology transfer has been a difficult and sometimes unsuccessful task for the DOD. The method has been to pass technical data from one company to another with the Government acting as transfer agent. Much of the technical data - engineering drawings, specifications and so on - is encumbered with proprietary rights and not available. Ingenious shop practices, tricks of the trade, and craftsmen's "arts" don't often show up on drawings, parts lists, process lists and other technical data.

Summary of Directed Licensing Problems

Directed Licensing appeared attractive to us at first glance as it probably did to the Subcommittee. It seemed simple to use and its objectives sound. Mainly, it would inject competition into the reprocurement of advanced hardware and let the transfer of data and know-how be the business of the licensor and licensee with very little Government intervention needed.

As we got into the study, however, a thicket of problems began to emerge. How to motivate contractors to cooperate; how to set the size of the royalty; how to avoid disclosure of trade secrets; how bidders could offer prices without full knowledge of the technology involved.

Motivating Contractors

With regard to motivating the contractors there has to be wholehearted cooperation for transfer of technology to be a success.

We would be asking, perhaps unrealistically, the licensor to help his competitor and the licensee. It is easy to visualize how anxiety over the safety of trade secrets could arise; some participants might be overly eager to learn them. A technical assistance staff in the competitor's plant will soon spot unusual tooling setups, machine adaptations or novel processes. This is how valuable trade secrets, perhaps even those not concerned with the product at hand, can be lost. For this reason, and others, potential recipient firms of technical assistance have indicated a reluctance to participate in license agreements.

In commercial licensing, the parties get to know each other in advance. In Directed Technology Licensing the licensee is identified later; a number of respondents said this would be a difficult problem with many companies.

Also, there are legal and contractual problems. The law is not entirely clear on technical assistance contracts. It would be quite difficult for the licensee to establish that the licensor's assistance was half hearted. The design of the contract would have to accommodate a range of responsibilities and liabilities among the participants.

Another problem is that the proposed licensing arrangement has an aura of compulsion. It is not like commercial licensing where parties seek each other out to collaborate for their mutual profit. The voluntary licensor may be seeking to forestall or moderate competition. The directed licensor, on the other hand, would be required to set up others in competition against himself.

Magnitude of the Fees

The royalty to be negotiated in the early development contract must be large enough to motivate the licensor and his team of subcontractors and vendors, but it must not be so large as to wipe out the competitive benefits.

If a contractor owns a unique process that can't be patented he will be reluctant to give or accept technical assistance. If the trade secret is the main stock in trade for a company, the royalty would have to be huge to cover the risk of losing this competitive advantage. If Government business is only a small part of the firm's market for the item even a large royalty will not outweigh the threat to the commercial business.

It probably would not be a "costless" arrangement for the Government, as the proposers suggest. An added cost--the royalty or risk--would no doubt be accounted in the price offerings. Each bidder's offering will contain his assessment of the probable technology loss. Owners of trade secrets are more likely to overvalue them than undervalue. Use of the licensing clause would probably motivate contractors to enlarge the proprietary contents in their technical data to forestall competition or to increase royalties.

Problems in Bidding

Directed Licensing seeks to alleviate the difficulty of transferring technology solely by drawings, specifications and other technical data. Yet this same data would be passed out to bidders at reprocurement time. If the data is inadequate for technology transfer it is probably inadequate for bidding too.

Further, if the bidders are to calculate their price offerings intelligently they would have to be aware of what kind of knowhow--trade secrets--is involved. What is the royalty paying for? Does the trade secret require a sizeable capital investment?

Research & Development

A firm exposed to another's trade secrets under license would probably be precluded by the agreement from using those trade secrets on any other work. A licensee--or licensor--who later made his own developments in the field might be subject to suit on the basis that his developments were derived from the other's trade secrets. Some companies will feel that the royalty is a poor exchange for being fenced out of a new technology.

Possible Industry Restructuring

The proposers of technology licensing feel that it will be developer firms, mainly, who will resist the technical assistance idea. Producer firms will be the ones accepting licenses; The industry would tend to segregate into developers versus producers. However, dealing as we are with high technology

industries, it is difficult to see how a producer firm, stripped of developmental functions, could be a skillful producer. He could get by without advanced scientific research, but his skills might suffer unless he has sufficient highly trained technical personnel. It seems doubtful, too, that firms will be content to remain producers only when the opportunities for patents and other strong competitive advantages are in development.

In any event, dividing an industry into developers versus producers is a basic structural change which shouldn't be undertaken lightly by the Government via a procurement method. This kind of change deserves considerable study beforehand.

Conclusions

To summarize, Mr. Chairman, there are several methods of obtaining competition for defense items, but in the reprocurement of technological hardware, it is ordinarily difficult to achieve effective competition once a company obtains a sole-source contract and, as they say in the trade, is "locked-in".

We think that the most resistance to this proposal would come from the competent firms who would fear losing their technical competitive edge--one of the principle reasons why they were selected in the first place.

The receiver of the technology would also have to be a competent firm with an existing technological base to absorb the knowhow. A competent firm, which the Government selects as licensee, may be reluctant to sign on. That firm, too, may fear for its trade secrets and R&D freedom.

There are other problems which seem to evade a workable solution. As discussed in our report, Leader Company Procurement and Second Sourcing, which are somewhat similar in design, are probably better routes to competition when the reprocurement conditions are suitable.

I would now like to discuss the other proposal made to the subcommittee, "Parallel Undocumented Development". This is pertinent to new weapon systems and other major equipment.

Before discussing the details of this proposal, perhaps I should lay out some of the considerations in weapons systems procurement. They are discussed in the procurement literature and were mentioned by the people we interviewed during the study.

The Procurement Setting

Typical weapons systems, as you know, are fighter aircraft, missiles, tanks, submarines, together with the supportive equipment for them. In the past seven years, including 1968, over $150 billion has been spent to develop and produce weapon systems (major hard goods).

It is perhaps already clear how these products make for buyer-seller relations quite unlike those of the commercial marketplace where price, product design, and the survival of an individual firm are determined by the mechanism of competition.

In weapons systems acquisition, however, there are three important differences in buyer-seller relationships.

1. The buyer represents the only market for the product and he takes the initiative in its design.

2. The buyer will at times protect the seller against catastrophic loss (to preserve the defense industry base).

3. The buyer sometimes specifies business practices to be followed by the seller. He is involved in the seller's managerial decisions.

Of course both buyer and seller are powerfully motivated. From the buyer's--DOD's-- viewpoint, superior weaponry will assure the Nation's safety. From the seller's--the contractor's--profits can be substantial or losses can be disastrous. Because of the unique product buyer and seller both must face uncertainties--uncertainties as to ultimate design, performance, quality, cost, quantity and delivery schedules.

A typical weapon system, depending upon its complexity and urgency of need takes four to twelve years to move from conception into operational inventory. During this time and after, the weapon's superiority is kept up to date by engineering changes. These conditions are very unlike those in ordinary business, as are the possible outcomes of weapons systems procurement.

The Present Contracting Approach

Presently the winning contractor for a new weapon ordinarily is selected at the beginning of engineering development. The bidders have done their preliminary design and systems analysis work, and ~~present~~ have presented their results to the responsible DOD officials.

Critics contend that the bidders' presentations, are often more speculation than substance, consisting of performance specifications, technical and management plans, models and mockups, and briefings of the DOD officials. While there will be some units of hardware backing up the plans, this procedure is what some people have called competition by "brochuremenship" or "paper competition".

On the basis of this competition, the winning contractor is ~~elected~~ selected for engineering development and production and becomes the sole source for follow-on production. This is acceptable to procurement specialists - if the major subsystems have all been designed, tested and proven, and if the weapon's union of components, or interfacing, and total design

or configuration are reasonably proven. Skilled systems analysts on the contractor and DOD staffs can handle such hardware developments. On the other hand, if the present technology is to be expanded, or if subsystems are problematic, paper analysis may not be satisfactory.

It is contended also that one ~~can't~~ cannot be sure, from paper analysis, whether some new technological advances can be accomplished. Will the fighter aircraft maneuver as required fifteen miles up? Can it really climb as fast as claimed? Is the radar really good? Will the tank require maintenance infrequently? Is the system's actual performance as cost effective as it seemed when initially designed?

It is generally agreed that systems analysis can provide good indications, but not always the full answers that should be in hand before heavy investments are made in engineering development and production.

Parallel Undocumented Development

To fill these gaps, Parallel Undocumented Development provides for demonstrable, testable hardware.

Parallel Undocumented Development (cont'd)

Competitive award and pricing ~~is to~~ would be based upon prototypes performance.

Competing contractors ~~are to~~ would be given performance requirements, rather than detailed specifications and instructions.

Only a small Government staff would work with the contractor mainly in design problem areas.

The competitors would not provide, during development, the extensive documentation for follow-on purposes - maintenance, support, training and so on. Instead, only the winner will document - after he is selected. (Undocumented is something of a misnomer; necessary documentation will be done and the balance deferred, not omitted entirely.)

This kind of "austere" development - scant documentation and little Government intervention - is intended to provide a freer climate for new design approaches and innovations. The contractors should feel challenged to do their best. The competition should be ~~livelier~~ more intense.

Parallel Undocumented Development (cont'd)

Parallel Undocumented Development ~~strategy~~ approach emphasizes developmental prototypes. A developmental prototype is a full-size, working system or integral subsystem, not necessarily complete, but in a state sufficient to demonstrate that the concept is practicable, and that it is cost effective.

Prototyping for the purposes of Parallel Undocumented Development is an event in the early development process. Its purpose is to check out anticipated uncertainties, and locate hidden ones. It is built after the large unknowns have been resolved by system analysis. If there are few or no uncertainties ahead, there is no need for prototypes, of course.

Austerity

This feature of Parallel Undocumented Development calls for each contractor to set up a small task force of engineers and skilled shop people for design and development of the prototype. The crew would work with performance specifications only and would be given free reign to try new approaches and find novel solutions.

The Government monitoring staff would be small, and would aid the task force principally on design problems.

Deferral of Documentation

The kinds of documentation which the Government now requires from developers' vary in scope and volume among the services. The intent, however, is the same: to anticipate problems of maintenance, quality, support, training, reprocurement and other ancillary purposes.

Deferral of Documentation is suggested to encourage concentration on the development job itself. On the basis that documentation is expensive, obtaining it from the winner only would reduce the cost of its development by the true competitors.

Now I would like to discuss the disadvantages and advantages of Parallel Undocumented Developments.

DISADVANTAGES

The main difficulties appear to be time and cost, although there are others cited in our report.

Some say that prototype cons truction, management, and testing are extras that must be added to already extensive development time. Several prototypes of a new weapon are necessary. They must be tested exhaustively and evaluated over weeks and months.

Cost of Prototypes

Critics say that prototypes are costly, because they add to development time, for one thing. Construction of a prototype can require months of work, it is said, and testing may add a year or more to development time. High-priced contractor and government staffs are retained while prototypes are tested and evaluated.

In addition, if the prototype is built with "soft" tooling, a reinvestment must be made in "hard" for the production line tooling. Conversion from soft to hard tools presents problems, too. If hard tools are used to prototype, design changes may be quite costly.

Parallel Undocumented Development calls for two or more prototypes and thus an increased outlay of R&D money. It would involve additional appropriations for R&D and difficult funding decisions.

ADVANTAGES

Some of the advantages to Parallel Undocumented Development are said to be in the same areas as the alleged disadvantages. The question of time is a good example.

The Time Dimension

Those in favor of prototyping argue that the military at times overstate the urgency of programs; that urgency in development is one of the leading causes of cost overruns. This invites concurrency, or production simultaneous with development. Concurrency, it is said, seeks to anticipate technological accomplishment - that is, to predict chance outcomes.

Production in advance may either "freeze" a premature design, or create inventories of superseded parts. Substantial concurrency is acceptable only in the face of dire emergencies.

Urgency invites "telescoping" or the paralleling of planning events best done in sequence. Telescoping may result in skipping over or short-cutting events such as component reliability tests, environmental tests, and other qualifying steps.

Then too, it is contended, time may be saved through prototyping because proven hardware should boost confidence in the design. Decision makers should then feel confident enough to expedite a program rather than linger over repetitive assurances and drawn out testing. If the design is approved, production commitments can be made with a higher confidence that substantial design changes will not appear later to cause further delays.

Cost of Prototypes

Those in favor of prototyping admit that some extra R&D investment would be necessary but counter that the benefits of competitive performance and pricing outweigh the added initial cost. Prototypes furnish much better price visibility, so much so that huge overruns due to the tenuous cost estimating of the present method should decrease. Contractors would not be forced as at present to price out their development and production costs before critical unknowns have been dealt with.

Then too, prototypes are cheap in that multiple designs can be checked out quickly - for the price of ushering one problematic concept all the way

through Engineering Development and initial production effort. It should be easier, too, to back off from questionable design concepts before heavy investments are made. Further, if a very expensive failure can be avoided by early tests of hardware the cost of prototyping could be trivial in comparison. Reevaluation at the prototype stage has to be a good deal cheaper than when you have a whole wing in the air or a tank battalion in a field.

Sustained Competition

Another advantage claimed for Parallel Undocumented Development is that it would improve competition. It would not be perfect of course, but probably would be closer to market place conditions than has generally been present in weapons systems acquisition. It is reasonable to expect that contractors will behave competitively. They should seek, as in commercial work, to excel in manufacturing economy. Similarly they should strive for superiority of their product in terms of reliability, reduced maintenance, and operating cost effectiveness.

Proposers of Parallel Undocumented Development argue, too, that sustaining the competition provides valuable insurance. If one of the design approaches must be discarded late in development, an alternative is available at approximately the same stage. On the other hand, if only one design approach reaches substantive development and then fails, a new start must be made which may add several years to the program.

Prototype testing, it is added, would provide the DOD and the Congress flexibility at a key milestone decision point. The DOD can get a timely second look at hardware before the contractor and Government find themselves overcommitted. Mission objectives can be re-evaluated in light of new or changing threats and accelerating technology. More than one design approach to a mission can be explored and checked out.

It is felt, too, that comparing different sets of plusses and minusses of the competing designs can have salutary effects. Another point made is that lifetime costs--many times development cost or even

production cost--will often justify sustaining at least two competitive approaches until there is real assurance that the weapon will perform its assigned mission.

Documentation

Opinion on documentation requirements are quite divergent. Practically all of our non-Government respondents contrast the sparse documentation which accompanies private R&D programs. Some people on the Government side, feel that the documentation pendulum has now swung too far. Guesses about documentation range from 20 percent to over 50 percent of development costs, but there is no hard information available. Deferral of this documentation is proposed because the winning design cannot be identified until development competition is concluded. Documentation by losing contractors, it is contended, is a waste. Also, early data about procurement maintenance, support, training, are wasteful, because the final system is not yet visible and the design changes are practically certain to occur.

Mr. Robert A. Frosch, Assistant Secretary of the Navy made the point in a talk this past March.

> "* * * doctrine says that one considers * * * maintainability, reliability, operability, etc., from the very beginning of the process. This is a vast waste of time and effort * * * it is certainly ridiculous to have a complete plan for the logistics of the maintenance of a ship that has not yet been designed * * *. I have seen overruns in expenditures and unnecessary effort generated by * * * a complete maintenance and reliability plan for what was no longer the design, and had not been the design for three months * * *."

Industry executives maintain that competent engineers, by nature, design for maintenance, reliability, and operability and that documentation at such an early stage diverts them from the central job of development.

Conclusions

Mr. Chairman, after seeking out and evaluating many different views on both sides of this issue, we believe that in the final analysis, the defense effort would be better served by more extensive product competition at least through the initial more critical testing phases. We believe that such competition could provide more effective management of weapons programs in terms of performance and what they should cost.

We recognize that sustaining competition through dual development programs is costly at the beginning and requires difficult funding decisions. This would also increase the problem of deciding priorities for funds both within the military departments and between defense and other programs.

We were told that when looking back on certain programs that it is easy to recognize the merits of parallel development. It is quite difficult, however, to demonstrate beforehand the savings in cost and time that may be realized.

To sum up, Parallel Undocumented Development appears to us to be a useful strategy for acquiring certain kinds of weapon systems. While the expertise of those in the Defense Department would be needed to select weapons to apply this strategy, we believe that the weapons selected should meet these three criteria:

1. Those weapons that would push state of the art frontiers by new or significantly modified systems; unusual interfacings; novel and untried configurations, or uncertain performance requirements.

2. Those that have good prospects for volume production; and

3. Those for which a low to moderate ratio of development cost to total cost is expected.

An example would be a new advanced fighter or other weapon that will be needed in substantial quantity over a period of years and will remain in the defense inventory 15 to 20 years or more. Competition could reduce costs in future outlays of billions of dollars, but if competition is not present through initial development, it is forever lost.

There are programs, Mr. Chairman, now in early development and under consideration by the Armed Services Committees which may be candidates for competitive prototyping under austere conditions. Such programs include the F-15 fighter aircraft, Subsonic Cruise Armed Decoy (SCAD), and AX close support aircraft.

The extent to which these and other programs should be carried through competitive prototyping (as opposed to a fully integrated systems development) is a matter of considerable technical judgment. Where the situation is unclear, appropriate congressional committees may wish to obtain such judgments from independent experts both from within and outside the Defense Department.

Mr. Chairman this concludes my statement. My staff and I shall be happy to answer any questions the Subcommittee may have.