COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

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The Honorable John C. Stennis
Chairman, Armed Services Committee
United States Senate

Dear Mr. Chairman:

In accordance with your October 4, 1973, request and discussions with your office, we reviewed five Department of Defense (DOD) major weapon systems developed under competitive prototype contracts.

Your request referred us to your committee report 93-385 which expressed a concern with wide disparities in awards to contractors competing in prototype development because such disparate awards might penalize a contractor which has the foresight to invest its own funds in anticipation of a requirement for development of a new weapon system. The report stated that DOD may need to examine the criteria, policy, and procedures of the Armed Services Procurement Regulations and other directives to insure that the source selection process is applied uniformly and equitably. The report suggested using competition in follow-on procurement as an alternative to competitive prototyping, if planned requirements are large enough.

On the basis of this and many previous reviews of weapon systems, we have concluded that competitive prototyping has considerable merit as an acquisition strategy for certain programs because it

--permits testing and evaluation before a production decision is made and

--enables contractors and procuring agencies to make better cost estimates for production units than would otherwise be possible.

Competitive prototyping has the added advantage of introducing competition into both the technical and cost areas. Although some items can be developed on a sole-source basis, with competition being obtained for follow-on production, this technique can have serious limitations because many systems are designed by contractors which have their own particular expertise and production methods in mind. The transfer of this know-how to another contractor can be extremely difficult and/or expensive.

There were a number of reasons that would justify reasonable cost differentials in amounts paid to competing contractors for prototypes. Among these were (1) previous investments in research and development, (2) different design concepts, (3) prior experience and availability of test equipment, and (4) differing labor and overhead rates. Generally, the differences had been examined in detail by DOD before the contracts were awarded.

Although our review indicated that competitive prototyping has certain advantages over other acquisition strategies and that cost differentials may be warranted, we found no guidance or criteria available to DOD managers on these two areas. We believe this is a matter which requires DOD's attention.

None of the five programs we examined (1) were in the category of such major programs as the Air Force's B-1 bomber with huge developmental costs that effectively limited the program to a single prototype contractor or (2) involved primarily fully developed, off-the-shelf components that would have made possible sufficient definitization for initial competitive procurement of the desired end item. Four of the programs concerned proposals sufficiently different in design to justify competitive prototyping. In our opinion, the fifth program, UTTAS, which involved more limited design differences, seemed to be a questionable candidate for competitive prototyping; it appeared to have potential for obtaining competition in follow-on procurement. Program officials, however, were convinced that the program qualified on the basis of (1) maintainability and reliability requirements which could best be assessed by testing competitive prototypes and (2) anticipated savings in production and operating costs.

Disparities in contract amounts

DOD has no criteria to assist managers in determining the amount of differences between dual awards that would be acceptable. The differences between contract awards for the five programs we reviewed are shown below.

Program	Higher award	Lower award	Differences Amount	Differences Percent
		(thousands)		
UTTAS (utility tactical transport aircraft)				
Boeing-Vertol	$ 91,300			
Sikorsky		$ 61,900	$29,400	47
AAH (advanced attack helicopter)				
Hughes Aircraft Co.	70,300			
Bell Helicopter Co.		44,700	25,600	57
XM1 tank				
General Motors Corp.	87,000			
Chrysler Corp.		68,100	18,900	28
A-X aircraft				
Fairchild-Hiller Corp.	41,100			
Northrop Corp.		28,800	12,300	43
SES (surface effect ship) (100 ton)				
Aerojet-General Corp.	15,000			
Bell Aerospace Co.		11,800	3,200	27
Total	$304,700	$215,300	$89,400	41

Final costs for the UTTAS, AAH, and XM1 programs will not be known for some time, but the SES contracts are nearing completion. Since initial SES contract awards in January 1969, contract amounts have increased to $29.4 million and $27.5 million, respectively, which narrows the $3.2 million difference to $1.9 million. The A-X program contracts--which are fixed-price contracts--are complete, and initial contract amounts have increased about $0.7 million each. Program officials said that Fairchild, recipient of the higher A-X award, realized a profit of about $2 million while Northrop spent about $7 million more than the contract amount. In Northrop's case, use of a fixed-price, rather than a cost-reimbursable, contract apparently reduced Government costs by about $7 million.

We reviewed contractor proposals and subsequent awards and found a variety of reasons for differences in the estimated costs of competing contractors. One basic reason is that contractors proposed prototypes with design differences; other reasons were:

--For the UTTAS program, Sikorsky proposed a less complex design, had more research and development experience with similar helicopters, and required fewer new test fixtures than Boeing-Vertol did. (The Source Selection Evaluation Board (SSEB) found

that Sikorsky would charge $0.3 million for use of existing facilities and Boeing-Vertol would charge $3.2 million for use and acquisition of test fixtures.)

--For the AAH program, Bell Helicopter had greater prior helicopter experience and required less tooling compared with Hughes' greater subcontracting and greater design effort to achieve a smaller and lighter prototype.

--For the XM1 program, General Motors proposed higher labor and overhead rates than Chrysler did.

--For the A-X program, Fairchild proposed higher direct labor, overhead, and other costs which more than offset Northrop's proposed higher materials and subcontractors costs.

--For the SES (100 ton) program, cost differences were attributed to Aerojet subcontracting for more items and higher labor rates on the west coast and to Bell Aerospace's use of a Government-owned facility.

Investment in research and development before prototype contracts

The military services contracted with various firms for preliminary design studies for some of the programs reviewed. On the SES program, Aerojet, Bell Aerospace, and General Dynamics Corporation received $975,000; on the UTTAS program, Boeing-Vertol and Sikorsky received $878,000; and on the A-X program, General Dynamics Corporation, Grumman Aircraft Engineering Corporation, McDonnell Company, and Northrop received $925,130. On the XM1 program, 12 contracts--totaling $12,373,057, which included 7 contracts to Chrysler and General Motors--were awarded for studying a new tank and for developing candidate tank components meeting the moderate-risk criteria.

Eight contractors involved in four programs invested varying amounts of their own funds before the prototype contracts were awarded. Below are the amounts reported by the prototype contractors as having been invested by the Government and by the contractors for research and development relating to the prototype systems. The amounts shown include sums spent under the contractors' independent research and development programs.

Program	Estimated Investments in Research and Development			
	Lower award		Higher award	
	Government and contractor	Contractor	Government and contractor	Contractor
	(thousands)			
UTTAS	$ 2,825	$ 836	$ 1,953	$ [a]
AAH	21,800	7,600	1,000	700
XM1	3,047	--	6,293	--
A-X	5,370	3,513	1,700	781
SES	[b,c] 2,784	[a]	[b] 1,664	166
Total	$35,826	$11,949	$12,610	$1,647

[a]Contractors did not provide data.

[b]Includes amounts related to 100-ton and 2,000-ton ships. As of February 27, 1974, DOD planned to issue requests for proposals for additional design and development of subsystems associated with 2,000-ton ships.

[c]Also includes unspecified amounts related to air cushion vehicles.

The above schedule shows that the Government and the contractors had large investments in research and development preceding the competitive contract awards. In addition, contractors had made investments in varying amounts in facilities that could be used in performance of the new Government programs.

On the AAH and A-X programs for which data was furnished, the contractors that received lower awards had invested more of their own funds in research and development than had the contractors which received higher awards. Although disparate awards may appear unfair to the contractors which invested their own funds before the awards were made, such investments may give these contractors an advantage in the competition for source selection. In any event, we believe that the advantages to the Government from competitive prototyping warrant its use under appropriate circumstances.

Source selection process

In accordance with DOD's procedures for procuring major weapon systems, the military services designated SSEBs to establish evaluation criteria,

conduct written and oral discussions, evaluate proposals, and report their findings to a Source Selection Advisory Council for the five programs. The Source Selection Authority used the results of these findings and other pertinent data to make the final award.

We found that, for each of the five programs, awards were made to contractors which received the highest and next-highest ratings by the SSEBs. Examination of procurement and related records, as well as discussions with responsible service officials, showed that the proposals were extensively reviewed and evaluated for such factors as engineering design (technical), cost, and management. We noted that design-to-a-cost limitations were imposed on all programs except the SES.

Benefits of competition

DOD has no specific criteria or guidelines to select particular weapon systems programs for competitive prototyping. We found no formal comparative study or analysis of the possible acquisition strategies of competitive prototyping versus single prototyping with competition in follow-on production. DOD program managers informed us that they sought to obtain the benefits of competition by having dual contractors develop the weapon systems for the five programs.

The Development Concept Papers (DCPs), key decisionmaking documents employed for all new major programs, contained little or no rationale as to the acquisition strategy used for the five programs. The only consideration given to this point appeared in the UTTAS program DCP which pointed out that a possible savings in production cost of 5 percent would recover the cost of an additional prototype contract. Although we found no similar language in the approved DCPs for the other four programs, DOD has reported savings from competition. For example, in hearings before the Senate Appropriations Defense Subcommittee on DOD appropriations for 1965, the Secretary of Defense stated that, from analyses of a large number of cases in which price competition was obtained, DOD concluded that, on the average, 25 cents of each dollar of procurement converted from sole-source to price competition was being saved.

The SES (100 ton), A-X, and XM1 program contractors used different propulsion systems and had other differences which indicated technological uncertainties to justify dual prototyping. The XM1 and AAH programs follow predecessor programs which used single contractors for development. The AAH program contractors are using the same engine, but program officials state that, because of design differences, one contractor will produce a prototype which emphasizes maneuverability to escape enemy fire while the other contractor will produce a prototype which emphasizes armor for survivability. Additionally, the House Appropriations Committee's November 11, 1971, report indicated a preference for dual prototyping of the XM1.

The UTTAS prototypes, although using the same engine, do have some differences, but these appear to be the least significant in the five programs. UTTAS seemed to be a questionable candidate for competitive prototyping and appeared to have potential for obtaining competition in follow-on procurement. UTTAS program officials, however, believed that there would have been a large cost for technical data, possibly incomplete, to obtain a second source for production and that a lengthy delay would have occurred in qualifying a second source. It is questionable whether a delay would be critical for this program and, although there may be some question as to the desirability of using the alternative competition in follow-on production, second sourcing has been used, for example, with B-47s in the Korean War and, more recently, with Minuteman Guidance and Control Systems.

CONCLUSIONS AND RECOMMENDATION

Our report to the Congress, "Evaluation of Two Proposed Methods for Enhancing Competition in Weapons Systems Procurement," (B-39995, July 14, 1969) stated that we believed competitive prototyping had merit as an acquisition strategy. We observed that the acquisition strategy to be used is the one that best fits the kind of article to be acquired, its particularities and the degree of risk involved; that any strategy currently popular tends to be used indiscriminately; and that there should be a decision guide to assist in selecting the appropriate acquisition strategy. We believe that these conclusions are still valid. We also believe that the acquisition strategy of obtaining competition in follow-on procurement has merit and should be used where feasible, particularly if a sole source was used in the development phase.

The Commission on Government Procurement report expressed the view that added expenditure of research and development moneys to bring a wider span of system solutions into competition can be expected to have a great leverage effect on ultimate system performance and on the vast majority of program costs that will be incurred later.

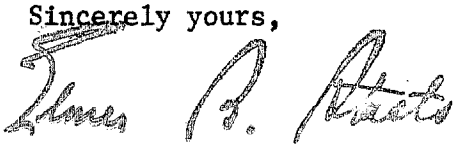
To help insure the use of the right acquisition strategy, we recommend that DOD implement the suggestion made in our 1969 report that DOD develop a carefully designed decision guide to (1) identify the various acquisition strategies, (2) lay out the various features and characteristics of each, and (3) describe the most practical procurement situations for their use. The guide should contain criteria or factors to be considered by decision-makers to enable them to determine whether the additional cost of a second prototype contractor is warranted, including the justification for the differentials between competitive contracts. We believe the criteria should provide any special guidance needed as to the appropriate type of contract to use; that is, cost or fixed price. The criteria should permit flexibility to be responsive to various program circumstances and should address such factors as technological risks, number of production units, anticipated savings in follow-on production, urgency of need, successes or failures with predecessor programs, and others.

We examined available records and held discussions with officials at DOD and Service headquarters; 1 Navy, 1 Air Force, and 3 Army program offices; and 10 contractor locations. Although we did obtain the data we needed for our examination, Army officials advised us that information on proposed costs in four contract awards involved confidential contractor data which, if disclosed, would prejudice competitive procurement. Because of the importance of proper use of the various acquisition techniques, we plan future audit work in this area.

As agreed with your office, we have requested comments from the Secretary of Defense on matters contained in this report. We plan to forward his comments with our additional views, if warranted, and report to you on the three other items relating to research and development contained in your October 4, 1973, letter.

We are sending copies of this letter to Chairmen of the House and Senate Committees on Appropriation and Government Operations and of the House Armed Services Committee; the Director, Office of Management and Budget; and the Secretaries of Defense and of the Army, Navy, and Air Force.

Sincerely yours,



Comptroller General
of the United States