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IN REPLY REFER TO:

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November 13, 1970

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Rear Admiral Levering Smith
Director, Strategic Systems Project Office
Naval Materiel Command
Department of the Navy
Crystal City, Building 3
Washington, D.C. 20360

Dear Admiral Smith:

On July 21, 1970, Jim Brucia and Jack Woosley of our office met with you and members of your staff to discuss the results of our trial "should cost" review at Westinghouse Electric Corporation, Sunnyvale, California. At this meeting, and in a later discussion with your Mr. A. W. Martin, it was indicated that the results of our review might be of some value in negotiating follow-on production contracts for Poseidon launcher and handling equipment, as well as in seeking corrective action of certain contractor management deficiencies.

This letter is being forwarded to you as a final summary of our work at Westinghouse. With the exception of our findings related to the allocation of general and administrative expense, which were discussed with the cognizant Government auditors at Westinghouse, we have synopsized below the scope of our review and each of the observations which were included in the outline provided you at our July 21 meeting.

BACKGROUND

The objectives of our review at Westinghouse were to (1) evaluate the efficiency and effectiveness of the contractor's operating practices, (2) examine into the reasonableness of costs, and (3) identify conditions which in our opinion precluded the Government and contractor from establishing a fair and reasonable contract price.

[Results of Trial Review]

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Our review approach was to first select negotiated contracts for launcher and handling equipment which could be used as vehicles to review the contractor's overall operating practices. Contracts selected for review were for the production of tactical launcher equipment and reloaded gas generators:

Tactical Launcher Equipment	Reloaded Gas Generators
N00030-68-C-0218	N00030-67-C-0133
N00030-69-C-0138	N00030-68-C-0304
N00030-70-C-0099	N00030-70-C-0083

After selecting the above contracts we evaluated the efficiency of Westinghouse's operations which related to each of the line items of cost. For example, in the area of material and subcontracting we evaluated the contractor's procurement system for (1) purchase order processing; i.e., material control methods, receiving and inventory methods, etc., (2) source selection; i.e., reasonableness of single and sole-source procurements, etc., and (3) pricing of subcontracts. Similar evaluations were made for the remaining line item costs, with emphasis being placed on efficiency, effectiveness, and equity of distribution of general and administrative costs between the operating divisions at the Sunnyvale plant.

In addition to reviewing the contractor's day-to-day operations we also attempted to ascertain the effect of Government procurement practices on contractor efficiency and costs. In this regard we were concerned with the effect on costs of (1) annual procurements and (2) concurrency of design and production contracts for Poseidon launcher and handling equipment. Each of our observations are discussed in detail in the sections which follow.

EFFECT OF ANNUAL PROCUREMENTS ON CONTRACT COSTS

The Strategic Systems Project Office has followed the practice of purchasing Poseidon launcher and handling equipment from Westinghouse on an annual basis. Our review of documents made available to us indicated that significant dollar savings could have been realized in material procurements and labor efficiency had recent requirements of the program been procured under a single contract, or under multiyear contracts with options for future years. For

example, a Westinghouse study in June 1969 indicated that as much as $6 million could have been saved on material purchases if equipment requirements for fiscal years 1970 through 1973 were procured on a multiyear basis with funds committed during fiscal year 1970 and then funded incrementally by fiscal year.

We also noted that launcher and handling equipment production rates are established by Westinghouse on the basis of fiscal year requirements. These production rates are set to decline over the requirement period. In January 1970, Westinghouse indicated that reductions in its production rate from 8 to 4 tubes per month would result in a decrease in labor efficiency of about 50 percent.

EFFECT OF CONCURRENCY OF DESIGN AND PRODUCTION ON CONTRACT COSTS

Although production work for Poseidon launcher and handling equipment has been in progress since 1968, the design contract for this equipment is not scheduled for termination until December 1970. We recognize that it is often impractical to cut off design effort and proceed directly into production without some overlap. However, we believe that such concurrency under this program may have materially effected the ability of the Navy to evaluate the reasonableness of the contractor's proposed costs.

For example, we were told by Westinghouse officials that concurrency of design and production resulted in increased planning estimates in order to allow for unforseen design changes made during production contracts. Such costs were not identified as such, and it appears unlikely that the Navy was able to isolate these costs and evaluate their impact on the contractor's proposal. Furthermore, because design changes may effect tasks which apply to a design contract as well as a production contract, we were told that the contractor often finds it difficult to determine the benefiting contract and, therefore, often arbitrarily segregates the costs incurred.

DIRECT LABOR

Manufacturing labor

Our review of direct labor was concentrated in the areas of (1) use of learning curves as an estimating technique and (2) adequacy of data available to Westinghouse officials for purposes of measuring

efficiency, controlling contract costs, and estimating future costs on follow-on contracts. Our observations in these areas indicated that improvements can be made that will affect not only the effectiveness of Westinghouse management, but also the ability of cognizant Government audit and administrative agencies to effectively evaluate the contractor's performance and follow-on contract proposals.

Our observations on these areas are as follows:

Learning curves

Review of three cost-plus-incentive-fee contracts that have been awarded to Westinghouse for Poseidon launcher and handling equipment showed that Westinghouse has not used learning curve theory in proposing direct labor hours. We were told that because Westinghouse did not have sufficient historical data, its direct labor hour proposal for the fiscal year 1968 and 1969 contracts were on the basis of engineering estimates. For the fiscal year 1970 contract, Westinghouse used engineering estimates which were factored both by the use of actual history from the fiscal year 1968 contract and by judgment.

Based on our review, it appears that the use of learning curve theory in proposing the direct factory labor hours for the fiscal year 1968 and 1969 contracts would have been difficult, but not impossible. On the other hand, we believe sufficient historical data was available prior to negotiation of the fiscal year 1970 contract to enable a reasonably accurate and reliable use of learning curve theory.

In order to determine the reasonableness of using learning curve theory for the fiscal year 1970 contract, we selected the launch tube, support ring, and the insulated canister for analysis. These items (excluding the normal packaging and shipping) accounted for about 54 percent of the proposed direct labor hours. Using labor hour history (fiscal year 1968 contract and several ships of the fiscal year 1969 contract) that was available to Westinghouse at the time of negotiations for the fiscal year 1970 contract, we were able to determine that Westinghouse was experiencing a definite learning pattern for the items analyzed. The following table indicates the differences between the Westinghouse proposed hours, the hours negotiated, and the hours predicted by use of learning curve theory.

Item	Labor Hours (1) Proposed 1/	(2) Negotiated 2/	(3) Based on learning curve 3/
Launch tube	86,240	75,800	52,490/61,830
Support ring	57,634	52,800	26,922/30,592
Insulated canister	6,166	5,660	3,014/ 3,434

From discussions with Westinghouse personnel we also learned that the direct labor hours for the proposed fiscal year 1971 contract were not estimated by the use of a learning curve. In this instance, we were told that for items we reviewed the estimates were primarily projected by using the accumulated average of the fifth boat (ten boats of history were available) of the fiscal year 1969 contract. From this point a flat (straight) line was drawn to represent learning that would be experienced and hours that would be incurred. This procedure assumed that there will be no learning on units to be produced under the fiscal year 1969 and 1970 contracts and units to be produced under the proposed fiscal year 1971 contract. At the time of our review, this contract had not been negotiated. Accordingly, we do not know what hours the Government will accept during negotiations.

Other observations in the area of manufacturing labor

Our review of direct factory labor also identified several other areas within the Westinghouse manufacturing operation which appear to us to be in need of improvement if there is to be an efficient use of production labor and a reliable labor hour reporting and control system.

1/ Packaging and shipping hours have been excluded.

2/ Labor hours were negotiated on a lump sum basis. Accordingly, we apportioned the difference between the total hours proposed and negotiated over each line item.

3/ First set of figures based upon unitary learning curve theory. Second set of figures based upon accumulated average learning curve theory.

Need for management data

Westinghouse management, because of its decentralized management philosophy and lack of concurrent and adequate factory reporting, is not always aware of potential problem areas until they occur. We found that the Westinghouse labor reporting system does not provide management with information on items that must be reworked, work in process, or productivity of the various work centers. Such information is normally considered essential to managing an effective and efficient manufacturing operation.

Uncontrolled labor and material charges

Labor and material charges for end items that must be reworked because of defective material or workmanship, engineering changes made through "G" letters, and "foreman requisitions" are made against the original shop order. Accordingly, management is often not aware of, nor do they now have a tool to control, the cost associated with items that must be reworked.

Work-in-process

Complete and accurate information is not available to provide information as to the amount of work in process. As a result, management does not have an effective measurement of incurred costs vs. productivity, and it is not until the end of a contract that an accurate measurement of labor performance can be made.

Measurement of efficiency

Westinghouse management, up to this point in time, has not believed it necessary to measure the efficiency of its manufacturing organization. It has been their procedure to let the factory foremen determine the efficiency of his organization on the basis of a work center's ability to deliver items prior to the "need" date. Because of these procedures, management may not always be aware of ineffective or inefficient work centers until bottlenecks occur.

One common method of measuring efficiency is through the use of accurate time standards for various labor operations. We found that although Westinghouse has established standards (engineered, except for machining operations) for each labor operation, these standards are neither accurate--when related to actual time expended on an

operation--nor are they used for purposes of measuring labor efficiency or estimating direct labor hours. For those operations reviewed by us, actual hours expended significantly exceeded the standard hours set for the operation.

Engineering labor--reporting system

Westinghouse's labor reporting system does not provide for an accumulation of engineering labor hours by task. In such an environment the Government is unable to effectively measure benefits derived from dollars expended, evaluate the reasonableness of the contractor's proposal, or identify recurring vs. non-recurring engineering effort. We had the following additional observations:

- Engineering change proposals lack financial cost control. There appears to be no formal evaluation of the potential cost of factory and engineering charges for these changes.

- Engineering "G" letters allow for immediate shop action and have not been sufficiently controlled to prevent disruption to normal flow of work. This situation could lead to possible overloading of the shop.

MATERIAL

Our observations in the material area primarily concerned: (1) the reasonableness of Westinghouse's profit on contracts for the reloading of gas generators; and (2) the opportunity for improvement in Westinghouse's material estimating procedures and practices, including documentation of make-or-buy decisions.

Gas Generators

In our review of contracts awarded to Westinghouse for reloaded gas generators, we noted that the major cost element was for subcontracts awarded to Hercules Incorporated for the actual reloading of the generator. For example, as shown in the table below, our review of the Polaris fifth and sixth buys and the Poseidon first buy of reloaded gas generators revealed that the estimated Westinghouse in-house effort (material, factory and engineering labor, and other miscellaneous costs) totaled about $283,700, whereas the Hercules efforts totaled about $2.9 million.

Contract Number	Date	Hercules Effort	Westinghouse Effort	Westinghouse Fee
N000306700133	1/30/67	$ 668,800	$102,000	$ 51,900
N000306800304	10/ 8/68	343,800	20,000	24,500
N000307000083	8/22/69	1,920,000	161,700	150,000
		$2,932,600	$283,700	$226,400

The contracting officer in computing the applicable Westinghouse fee rate for these contracts followed the weighted guidelines as called for in ASPR 3-808. However, as shown above, the fee that Westinghouse was awarded on these contracts ranged from 51 percent to 123 percent of the costs associated with its own in-house efforts. Our review of the negotiation memorandums indicated that this situation was primarily due to the weight assigned to the subcontracting effort under the weighted guidelines approach to computation of fee.

In view of Westinghouse's minimal responsibility in the reloading of gas generators - Government representatives at the subcontractor's plant are responsible for quality inspection and final acceptance, after which the generators are shipped directly to the Navy using activity - we question the reasonableness of the fee awarded Westinghouse. Furthermore, we believe that consideration should be given to (1) moving the Hercules subcontract below the line for fee computation - that is, excluding it entirely from the base upon which fee is computed (much the same as the motors for the Polaris missile), or (2) direct Government procurement of reloaded gas generators from Hercules.

Material estimating system

In reviewing documentation underlying the material proposed in the fiscal year 1969 contract we noted the following:

- There is a need for more and better documentation of make-or-buy decisions. Currently, there is no requirement that minutes be maintained of make-or-buy committee meetings.

- There is a need to make the material estimating system more responsive to changes in make-or-buy decisions. We have found instances where Westinghouse proposed costs for these items as part of the bill of materials although it was intended that the items be made by Westinghouse. We were told that these omissions were due to poor internal communication. Such omissions hinder the Government in making a thorough and effective evaluation of the contractor's proposal.

As you know, our office has assured the contractors participating in this trial review that their names would not be made public, and this letter should not be shown or released for purposes other than official review and comment.

We would appreciate being advised of the actions that have been or will be taken on our observations. I would also like to take this opportunity to express my sincere appreciation for the great value obtained from the team during this review. If you have any questions, or would like to discuss our work at Westinghouse in greater detail, please feel free to call me at 412-555-6100.

Very truly yours,

A. M. CLAVELLI

A. M. Clavelli
Regional Manager

cc: Asst. Director, DD--J. Stolarow