REPORT TO THE CONGRESS

Opportunity To Reduce Costs And Improve Aircraft Through Prompt Processing Of Engineering Change Proposals

B-152600

Department of Defense

BY THE COMPTROLLER GENERAL OF THE UNITED STATES

JAN. 20, 1971

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

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To the President of the Senate and the
Speaker of the House of Representatives

This is our report on the opportunity to reduce costs and improve aircraft through prompt processing of engineering change proposals by the Department of Defense. Our review was made pursuant to the Budget and Accounting Act, 1921 (31 U.S.C. 53); the Accounting and Auditing Act of 1950 (31 U.S.C. 67); and the authority of the Comptroller General to examine contractors' records, as set forth in contract clauses prescribed by the United States Code (10 U.S.C. 2313(b)).

Copies of this report are being sent to the Director, Office of Management and Budget; the Secretary of Defense; and the Secretaries of the Army, Navy, and Air Force.

Elmer B. Staats

Comptroller General
of the United States

COMPTROLLER GENERAL'S REPORT TO THE CONGRESS

OPPORTUNITY TO REDUCE COSTS AND IMPROVE AIRCRAFT THROUGH PROMPT PROCESSING OF ENGINEERING CHANGE PROPOSALS
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D I G E S T

WHY THE REVIEW WAS MADE

Although precise information is not available, the General Accounting Office (GAO) has estimated that the total cost of engineering changes for the Department of Defense ran between $390 million and $410 million during fiscal years 1967 and 1968. In view of such sizable expenditures, GAO has inquired into the efficiency and economy of the practices and procedures followed by the three military services in processing engineering change proposals.

FINDINGS AND CONCLUSIONS

Engineering changes are frequently made to military aircraft to improve their safety, performance reliability, or maintainability. The need for such changes is usually discovered as a result of experience with some of the models that are already in operation or under test. For example, statistics showed that the flight-crew escape mechanism for three types of Navy aircraft being used by the operating forces did not work well at low speed and zero altitude; therefore engineering change proposals were initiated to improve the performance.

Such changes may be originated by either the Government or the contractor; but in either case the plan for a change, in the form of an engineering change proposal, must be approved by the military service that is responsible for the aircraft before the contractor is authorized to make the change. (See p. 5.)

Usually, some aircraft are in production while the proposed engineering change is being evaluated. Delays in processing the change proposal can increase the number of unchanged aircraft completed and delivered to the operating forces. Once those aircraft are delivered to the users, the change could be delayed for months or years or never be made at all. Moreover, making such changes after production is generally more expensive. (See p. 6.)

GAO examined 547 engineering change proposals implemented on 11 types of aircraft by the military services during fiscal years 1967 and 1968, to see whether extensive delays in processing the changes had occurred. In making its evaluation, GAO used a standard established by the Department

of Defense. That standard allows 45 days for evaluating routine change proposals. GAO found that the length of time for processing the 547 engineering changes averaged 131 days, or nearly three times as long as the standard allowed. (See p. 8.)

From the 547 change proposals, GAO selected for further review 184 on which it appeared most likely that delays had served to increase costs. Partly because contractors' records were often incomplete or inaccurate, GAO could not determine the significance of the delays for many of the 184 changes. GAO estimated, however, that in 42 cases additional costs caused by delays in processing the engineering change proposals could total as much as $3.7 million if all planned changes were made. (See p. 10.)

Delays in processing change proposals can deny the advantages of the change to the aircraft users for substantial periods of time or, in some cases, permanently because aircraft lacking the change may be 1 to 3 years away from their next overhaul (the most practical time to implement the change). Even then, the overhaul period is sometimes curtailed for reasons of urgency, leaving insufficient time to make the change. (See pp. 10 and 11.)

Among the causes for delay were

--ineffective monitoring by project offices of evaluations by reviewing staffs,

--insufficient direction for contractors from the military services as to the kind and extent of data to be submitted,

--the reliance on a single, overall time standard in lieu of time standards for each individual organization concerned in the evaluation,

--the reviewing staffs' practices of processing change proposals sequentially rather than concurrently,

--duplicate reviews of change proposals, and

--lengthy processing of change proposals by groups not under the control of the group managing the project. (See pp. 13 to 22.)

The advantages of reducing the time for processing engineering change proposals are important enough to warrant a concentrated management effort. (See p. 23.)

RECOMMENDATIONS OR SUGGESTIONS

GAO suggested that the Secretary of Defense designate a group in the Department of Defense to establish procedures for effective control of the

processing of engineering change proposals and to monitor the implementation of these controls by the military services. GAO also suggested specific actions that it believed would reduce processing time. (See p. 23.)

AGENCY ACTIONS AND UNRESOLVED ISSUES

The Department of Defense agreed that the advantages of reducing processing time for change proposals warranted increased management effort. The Department stated that each of the military services had established procedures for providing effective controls over the timeliness of the processing of change proposals, or had such procedures in a late stage of development, and that an audit of current practices for controlling engineering change proposals was under way. The Department stated also that a group would be formed, on an ad hoc basis, to review procedures, and that any deficiencies found would be corrected. (See p. 24.)

GAO recommends that the Secretary of Defense monitor actions planned for improvement of the processing of change proposals, to ensure that the actions are carried out effectively and are achieving the desired objectives. (See p. 25.)

GAO plans to inquire into the effectiveness of the new controls.

MATTER FOR CONSIDERATION BY THE CONGRESS

GAO is bringing this matter to the attention of the Congress because of its expressed interest in matters affecting the cost, timeliness, and effectiveness of military weapons systems.

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CHAPTER 1

INTRODUCTION

The General Accounting Office has reviewed the practices and procedures followed by the Departments of the Army, Navy, and Air Force in processing engineering change proposals for aircraft being produced for the Department of Defense (DOD). The scope of our review is presented on page 26.

Generally, the military departments procure a specific type or model of aircraft over a period of several years, purchasing a portion of the total quantity each year. As experience is accumulated on aircraft in operational use, it is common practice to make changes to both completed aircraft and those in production to improve their safety, performance, reliability, or maintainability. Another reason for such changes is to provide the capability to perform missions not originally contemplated for the aircraft. Although precise information showing the total cost of making these changes was not available from the agency's records, we estimated that between $390 million and $410 million was spent by the DOD in fiscal years 1967 and 1968 to make changes in aircraft in production. This amount does not include the cost of incorporating changes on aircraft already in service.

The changes necessary to modify aircraft are called engineering changes. Under existing policy, engineering changes should not be made unless they offer significant benefit to the Government. More specifically, engineering changes are limited to those which (1) correct design deficiencies, (2) significantly improve operational effectiveness, (3) significantly reduce costs, or (4) prevent slippages in an approved production schedule. Falling within these criteria are changes which either eliminate safety hazards or improve the reliability, performance, or maintainability of equipment.

Following are examples of such changes:

The design of the Navy's A-6A aircraft was modified while it was in production to provide for the installation of a 20 mm. gun pod on each of four wing stations on the aircraft. The change was made to improve the aircraft's attack capability.

Engineering changes were to be made to various configurations of three Navy aircraft (A-6, F-4, and F-8) to provide a better flight-crew escape mechanism after statistics revealed that the original mechanism did not work well for ejections at low speed and zero altitude.

When the CH-53A cargo helicopter was first sent to Southeast Asia, it was found that the fine-grained, exceptionally hard sand in the area was wearing out the teflon bearings in the helicopter engines very rapidly. To extend the life of the bearings, an engineering change was made that involved installation of devices designed to remove the particles of sand from the air taken into the engine air intake ducts.

Engineering changes may originate with either the Government or the manufacturer. Before the contractor may begin implementation of the change, however, the change must be evaluated, approved, and funded by the Government. Requests for approval of changes, which are called engineering change proposals, are prepared by the manufacturer and submitted to the appropriate offices of the military services for approval. Our review dealt with the processing of these proposals by those Government organizations having the responsibility for evaluating and approving them. Because of the importance of timeliness in evaluating and processing engineering change proposals, we were primarily concerned with the effectiveness of management in achieving timely performance of this function.

A list of principal officials responsible for activities discussed in the report is included as appendix III.

CHAPTER 2

DEPARTMENT OF DEFENSE POLICY PROVIDES FOR TIMELY PROCESSING OF ENGINEERING CHANGE PROPOSALS

To maintain control over the design of an aircraft they are purchasing, the military services require that all proposals for changes to aircraft under production be approved by officials of the appropriate military service before the change is made. Since the aircraft are in production, delays in processing the change proposals can result in some of the aircraft being produced without the changes. This is costly because it generally is more expensive to make the change after the aircraft have been completed and delivered to the operating forces. Moreover, making such changes after production tends to overload the already overworked repair and overhaul organizations of the military services.

The problem of delays in processing engineering change proposals can be particularly significant for aircraft because most aircraft manufacturers produce aircraft in production "blocks." Usually, all aircraft produced in a block are identical. Changes are implemented in production on a block basis since breaking into an ongoing production block involves additional cost. Therefore, a few days' delay in processing a change proposal may result in missing an entire production block, which in turn could result in having to implement the change after production on a sizable number of aircraft, often over 100.

Recognizing the importance of timely processing of engineering change proposals, DOD has established specific time standards and priorities to minimize the processing time for engineering change proposals. The directive issued by DOD concerning time standards for processing engineering changes provides that the changes be categorized by priority as either "emergency," "urgent," or "routine." The directive provides further that an emergency proposal be processed within 24 hours, an urgent proposal within 15 days, and a routine proposal within 45 days, following receipt. Although these processing time standards were not issued until after the change proposals covered in our review had

been processed, the standards were essentially a codification of previously issued instructions of the individual military services. These instructions were more stringent than the time standards issued by DOD. For consistency, we have used the more lenient DOD-wide standards for comparing actual and standard processing times in this report. Our review did not include an evaluation of the reasonableness of the time standards provided in the DOD directive.

CHAPTER 3

EXTENSIVE DELAYS IN PROCESSING ENGINEERING CHANGE PROPOSALS

We found that extensive delays had occurred in processing engineering change proposals. We determined the processing time for all the 547 engineering change proposals approved during fiscal years 1967 and 1968 for the 11 aircraft listed below.

Navy:
- F-4 fighter aircraft
- A-6 attack aircraft
- CH-53 heavy cargo helicopter
- A-7 attack aircraft
- CH-46 cargo helicopter

Army:
- UH-1 utility helicopter
- CH-47 cargo helicopter
- CH-54 heavy lift helicopter

Air Force:
- T-38 trainer
- A-37 attack aircraft
- C-141 transport aircraft

These 547 engineering change proposals included 292 processed by the Naval Air Systems Command, 180 by the Army Aviation Systems Command, and 75 by the Air Force Aeronautical Systems Division. The average processing time for these 547 changes was 131 days, or 86 days in excess of the standard DOD established for routine changes.

Processing time varied considerably among the three services. For example, change proposals processed at the Naval Air Systems Command averaged 158 days; at the Army Aviation Systems Command, 103 days; and at the Air Force Aeronautical Systems Division, 92 days. At these locations, we found that about 19 percent of the change proposals were processed within the 45-day time limit established by DOD for a routine change. Moreover, about 57 percent of the change proposals took 91 days or more to process. An

analysis of processing time at these organizations is as follows:

	Percent of engineering change proposals processed in				
	45 days or less	46 to 90 days	91 to 180 days	181 to 360 days	Over 360 days
Naval Air Systems Command	9	21	39	26	5
Army Aviation Systems Command	27	24	34	15	0
Air Force Aeronautical Systems Division	37	32	19	9	3
Overall	19	24	34	20	3

Within each service separate project offices had been established for monitoring the procurement of each individual aircraft. In more detailed comparisons of change proposal processing times, we found that there were also wide variations in processing time among the aircraft project offices within a particular service. In a review of selected cases at the aircraft project offices, we found that the variations in the processing time of engineering change proposals were basically attributable to varying degrees of managerial control and to the processing methods being applied. Further comments on these controls and methods and the improvements we consider necessary are presented in subsequent chapters.

CHAPTER 4

EFFECTS OF DELAYS IN PROCESSING

ENGINEERING CHANGE PROPOSALS

By reviewing a selected number of engineering change proposals, we estimated that processing delays could result in additional costs of as much as $3.7 million if all changes were made and found that operational units had been denied the benefits of the changes for substantial periods of time.

We selected, from the 547 proposals mentioned previously, 184 in which it appeared most likely that the delays might have resulted in additional costs or other adverse effects. Because contractors' records were often incomplete or inaccurate, we could not determine the effect of many of the delays. In 42 cases, however, we were able to determine from the contractors' records that six or more aircraft had not received the change because of the delay, and we were able to calculate the cost of installing the change later than had been planned by the contractor. Several of these cases involved over 100 aircraft. Moreover, since the contractors often anticipate delays in estimating which production aircraft will receive the change, it is possible that prompt processing of these change proposals could have enabled the contractors to make the changes to an even greater number of aircraft during production.

PROCESSING DELAYS CAN RESULT IN ADDED COST

In evaluating the effects of engineering change proposal processing delays, we calculated that additional costs of as much as $3.7 million would be incurred by the Government if all planned changes were made. This cost would be attributable to the fact that the contractors were not able to make the 42 changes as they had originally planned. A description of these change proposals, the number of aircraft missing the change during production, and the related increased cost is presented in appendix I.

On an individual-change basis, the estimated additional cost resulting from processing delays varied widely. We estimated that, at one extreme, an additional cost of about $250 would be incurred to install switches on seven helicopters as a result of engineering change proposal processing delays. At the other extreme, additional costs of about $1 million would be incurred for installing attitude indicators and remote-control gyroscopes in 231 helicopters that could have received the change during production if the change proposal had received timely processing. We estimated that additional costs would exceed $50,000 on 17 of the 42 delayed changes and would exceed $100,000 on nine of the 42.

OPERATIONAL FORCES DENIED BENEFITS BECAUSE OF DELAYS IN PROCESSING CHANGES

Where changes are not made to aircraft during production, the changes may not be incorporated on "missed" aircraft for a long period of time and, in some instances, may never be made. Under these circumstances, delays in processing can have a significant impact on operational use of the aircraft.

DOD officials informed us that, for several reasons, aircraft leaving the contractor's plant without the change may remain without the change for substantial periods of time. In the first place, changes are normally made during the aircraft's scheduled overhaul or rework which, in the case of the Navy, is performed on the basis of cycles which vary from 12 to 37 months. The changes cannot ordinarily be made until this overhaul or rework period is reached.

Secondly, we were informed by one DOD official that sometimes, for reasons of urgency, changes which were planned for certain aircraft during overhaul were not made because the overhaul period was too short. Many Navy operational aircraft have an active service life of only 6 or 7 years; therefore a combination of processing delays and insufficient overhaul time could result in an aircraft's not having the benefit of an improvement for the greater part of its useful life.

Furthermore, the change may never be made. Changes made after production are funded from a different source than changes made during production. Therefore, a change that has been approved during production but not made because of processing delays must compete with other changes for funds, and funds are often limited. Also, because of the extent of work required, it is not practical to make a change after production. We were informed of one delayed change proposal which required extensive rewiring of the aircraft. Although this change could have been carried out during production, it was not practical to make it after the aircraft was completed. Consequently, the operational users will never have the benefit of the change on a number of aircraft.

CHAPTER 5

IMPROVED PROCEDURES NEEDED TO REDUCE TIME REQUIRED TO PROCESS ENGINEERING CHANGE PROPOSALS

Although each of the military services had standards for what was considered timely processing of engineering change proposals, none of the services had established the procedural steps necessary to effect adherence to these standards. On pages 8 and 9 we cited statistics which showed that the length of time the services took to effect an engineering change proposal, of the 547 we reviewed, averaged three times that allowed by the DOD-wide standards adopted after our review. These standards were more lenient than those which the services had in effect at the time these changes were processed.

In view of the services' failure to secure adherence to processing time standards, we inquired into the actual procedures followed by the three services, to ascertain what might be done to expedite the processing of engineering change proposals. Our review showed the following areas in which improvement appears possible.

DOD-wide:
- Monitoring of actual performance to ensure compliance with time standards.
- Instructions for contractors on the kind of data needed for evaluation of proposals.

Air Force and all but one Navy project:
- Breakdown of overall processing time standards into segments to guide groups in processing engineering change proposals.

Navy:
- Processing of change proposals on a sequential or concurrent basis.
- Duplicate reviews.

Air Force:
- Delays because of reviews by units outside the project management group.

Details of each of the areas in which we believe improvements are needed are presented below.

ACTUAL PERFORMANCE NOT SUFFICIENTLY MONITORED

Our review showed that with one exception the project offices did not systematically keep track of the time required by each organizational level for evaluating engineering change proposal processing; thus, management had insufficient means of monitoring to see that actual performance was commensurate with established standards. The status and historical records on engineering change proposals generally showed the change number, the title, and the dates of various events such as receipt, approval, and change order release but, except for one instance, did not show essential information needed to evaluate processing delays. The one project office (Air Force's T-38 Project Office) which had maintained adequate information records had been doing so for about 6 months prior to our review.

Because the chronology of processing individual change proposals was not available in most cases, we traced and documented, to the extent possible from existing records, the chronology of processing the changes included in our review. In doing this, we noted one instance where the misrouting of a change proposal was not discovered for 70 days. A proper monitoring system should have led to the discovery of the misrouting much sooner, and the resultant delay would have been appreciably reduced.

Furthermore, we believe that, to determine whether goals are being met, management needs reports on actual performance. Although each activity we reviewed has some type of reporting, none appears to provide the type of information that we believe is needed by management to sufficiently evaluate actual performance. We found that:

--the monthly reports which the Army Aviation Systems Command prepared showed the number of engineering change proposals on hand at the beginning and end of the month but did not show how many proposals exceeded processing time standards.

--the Air Force Aeronautical Systems Division report did show the number of proposals exceeding established time limits but did not show the extent of the delays or other data which would be necessary to adequately appraise performance in meeting time standards.

--at the Naval Air Systems Command, a report on engineering change activity had been prepared for fiscal year 1966. After that, however, there had been no reporting by the Command. The 1966 report showed the volume in numbers and in dollar value and categorized the change proposals by type and priority. The report, however, did not show information concerning processing delays.

It is our view that, to be meaningful, these reports should show the volume of engineering change proposals in numbers and dollar value; the categorization by priority and type; the percentage and number of proposals exceeding established goals; the extent of processing delays based on established standards; the points where delays occur; and, most important, the reasons for the delays. Such information would be sufficient to alert management to significant deviations from established processing time standards and to permit appropriate corrective measures.

It is our opinion that the ineffective reporting procedure has apparently resulted in management's not being alerted to the significance and extent of processing problems. Moreover, there is insufficient information for management to pinpoint problem areas and take corrective action. We believe that, if a meaningful reporting system had been in existence, the chronic processing problem might not have been allowed to persist as long as it did.

CONTRACTORS NOT ADEQUATELY INSTRUCTED ON THE KIND OF DATA NEEDED FOR EVALUATION OF PROPOSALS

Prior to our review, the military services had established military standards governing the development and preparation of engineering change proposals. It was the intent of the services that these standards would provide for uniform documentation; ensure that complete and accurate data were included in each change proposal; and, thereby, permit a complete evaluation, normally without the need for recourse to the contractor for additional data.

The standards, although providing explicit guidelines for preparation of these proposals, did not define the depth of information to be provided. In recognizing that the magnitude of cost and the extent of technical complexity were factors which determined the amount of information to be provided, the military services generally left to systems commands and project offices the task of expanding upon the standards to ensure that information of appropriate range and depth for evaluation was provided.

We found that the weapons systems commands and the project offices, in general, had not tailored these standards to the peculiarities of their equipment nor their organizational approach to the processing of change proposals. The extent of direction to the contractor usually amounted to no more than a contract clause stipulating that appropriate military standards be adhered to in preparing and submitting change proposals. The depth of the information to be provided apparently was left to the judgment of the contractor. Furthermore, we found little evidence that specific direction had been provided to contractors on an individual basis.

At every activity we visited that was responsible for approving change proposals, we found that some delays had occurred because the proposals did not contain sufficient data for prompt evaluation and decisionmaking. Lack of recordkeeping on the processing of changes precluded our determining the full extent of the delays in each processing step and identifying all instances where lack of data was

a delay-causing factor. Responsible officials assured us, however, that the lack of sufficient data was a frequently recurring problem.

We found that in several instances processing of change proposals had been delayed until further testing was completed. It appeared that in each instance tests had not been requested until after the proposal was submitted. DOD standards provide only that sufficient testing be performed. The extent of tests required for prompt and complete evaluation in these cases apparently was to be decided by the reviewers at the time of the evaluation.

In several other instances, processing of change proposals was delayed until the contractor furnished detailed blueprint drawings although the standards did not specifically require that detailed drawings accompany the proposed change. Configuration management officials--those having responsibility for control of the aircraft design--stated that detailed drawings were not needed in most cases but might be necessary on certain types of change proposals.

We found further that processing of change proposals was delayed while contractors performed additional engineering effort. In one case the Air Force wanted a change in a fuel shutoff valve but had not fully defined its criteria for the valves. Consequently, after the change proposal was submitted, the contractor was required to redesign the shutoff valve and resubmit the change proposal. In another case when the Air Force submitted a change proposal, it did not notify the contractor that corrosion preventative measures were required as a part of the change. As a result, additional information from the contractor was required. We believe that these two cases illustrate instances in which specific direction could have been provided on an individual basis, preventing delay.

We believe that substantial delays in processing change proposals would be avoided if contractors were provided with sufficient direction delineating the information required for effective evaluations.

Subsequent to the period covered by our review, DOD issued a military specification setting forth information

requirements for change proposals for all types of equipment. This specification becomes a part of the contract for such equipment. The specification, which replaced standards previously adopted for a similar purpose by each of the services, is somewhat more specific as to information requirements. Nonetheless, it is our opinion that the specification is still not sufficiently specific to ensure submission of necessary data. This is particularly true because the specification covers all types of equipment and does not address itself to the informational needs peculiar to specific types of equipment such as aircraft.

TIME LIMITS NOT BROKEN DOWN INTO SEGMENTS

To encourage prompt processing of change proposals, two of the three military services not only had established overall time standards for processing change proposals but, in addition, had provided that time standards be established for each group charged with evaluating change proposals. In view of the numerous separate evaluations on change proposals, it seems that the most effective control would be achieved when time limits are established for each group having evaluation responsibilities. Configuration management officials have agreed that time limits on engineering change evaluations serve as a standard for determining that delays exist and act as disciplines motivating personnel to minimize inactivity and indecision. Time limits can also serve as a basis for systematic follow-up by management on engineering change proposals in process to determine reasons for delays and to expedite completion of the evaluation.

Although both the Army and the Navy had requirements for establishing time limits for each processing group, we found that only the Army Aviation Systems Command project offices and one Naval Air Systems Command project office (A-6 Project Office) had established time-limit criteria for functional groups, such as engineering, logistics, and production, that participated in the review process. The groups in the remaining Naval Air Systems Command project offices and those of the Air Force Aeronautical Systems Division (the Air Force had established no time limitations for functional groups) had only the overall processing goals set by the services to guide them.

We believe that the lack of time limits at the review level permitted inactivity and indecision which added to the engineering change proposal processing time. That this may be the case is illustrated by a test performed by one configuration manager. He stated that, for a number of change proposals, he convened a meeting of evaluating personnel within 10 days after having received each of the proposals. At these meetings all aspects of the change proposals were discussed and the proposals were acted upon immediately thereafter. The proposals, which experience showed might normally have taken more than 45 days to process, were approved within 20 days. In view of his experience, the configuration manager concluded that much of the delay in processing proposals was attributable to inactivity or indecision. Other configuration managers also said they felt that much of the delay in processing proposals was due to paper shuffling, routing practices, or inactivity.

We believe that processing delays could be reduced if time limits were applied and enforced at the appropriate organizational level. Where such time limits are not in effect, we feel that there is no pressure, sense of urgency, or obligation put on the individual evaluations. We believe also that, because the overall time limit of 45 days for a routine change proposal is unrelated to the individual processing steps to which a change proposal is exposed and because the time limit is applicable to such a wide scope of evaluation, the individual evaluator has no comprehension of how he fits chronologically into the framework. We believe that imposing time limits on all evaluating groups would accomplish this.

DOD apparently was in general agreement with this view. The Department's time standards for processing change proposals, issued subsequent to the period covered by our review, provided that specific time limits for individual groups involved in processing change proposals be established.

CONCURRENT PROCESSING OF CHANGE PROPOSALS WOULD REDUCE PROCESSING TIME

The processing of an engineering change proposal involves an evaluation of the proposal by different divisions of the appropriate DOD organization, with regard to their

specific areas of responsibility. When each of these evaluations is performed concurrently, the total processing time is as long as the evaluation requiring the most time. When evaluations are performed in sequential order, the total processing time is the sum of the individual evaluation times. Since there are many evaluations of a change proposal, it follows that evaluation of a proposal in sequential order will result in longer processing time.

For example, in one case a change proposal was in processing for 84 days before it was approved. Fifty-nine of these days were spent in the sequential processing cycle. The longest period that any group in this cycle had the proposal was 17 days. We believe that concurrent processing of evaluations could have saved 42 days.

In comparing total processing times of the Naval Air Systems Command, where evaluations are sequentially processed, with those of the Air Force Aeronautical Systems Division and the Army Aviation Systems Command, where they are processed concurrently; we found that, on the average, it took the Navy about 66 days more than the Air Force and 55 days more than the Army to process a change proposal. The proposals were reviewed from the same aspects at all three procurement activities, and the items undergoing review were generally comparable. We believe that, partly because of the time consumed in the sequential routing and review procedures, processing at the Naval Air Systems Command is more lengthy.

Although processing instructions followed by the Naval Air Systems Command require that change proposals be processed expeditiously, the instructions do not explicitly require that the proposals be processed concurrently. We believe that the instructions should require concurrent processing of change proposals, when possible, as an aid toward minimizing processing time.

ELIMINATION OF DUPLICATE REVIEWS

We believe also that minimal processing time can result when each individual reviewer, as a normal practice, performs only one evaluation of the proposed change. Duplicate

processing not only lengthens the total processing time but also increases the workload of the reviewer. This in turn can cause delays in processing other proposed changes.

The processing systems in existence at the Air Force Aeronautical Systems Division and the Army Aviation Systems Command do not appear to contain duplicate processing. Normally, each reviewing element performs an evaluation of the proposed change and prepares formal comments. The comments are then submitted to a configuration manager, and the various reviewing elements do not participate in the processing again unless technical advice is solicited in the approval process.

At the Naval Air Systems Command, the normal processing procedure requires each reviewing element to evaluate the proposed change at least twice. The reviewing elements perform evaluations of the proposal submitted by the contractor and then informally submit comments to an equipment design engineer. At the completion of his evaluation, the engineer prepares a condensed version of the proposed change and routes it to each of the reviewing elements for a second evaluation. The condensed version normally contains the same data shown in the basic change proposal.

Our review indicated that duplicate processing was adding to delays at the Naval Air Systems Command. In an analysis of 40 proposed changes, we calculated that the average total processing time was increased by 33 days due to the second evaluation. We believe that elimination of duplicate processing could substantially decrease processing time.

DELAYS CAUSED BY REVIEWS BY UNITS
FROM OUTSIDE PROJECT MANAGEMENT GROUP

In the Air Force the responsibilities for supply management and other functions are separated from the project management group that approves change proposals. All supply aspects of a proposed change are thus evaluated and acted upon by the activity responsible for supply management. Also, unlike the other services, the Air Force requires operational commands to participate directly in the processing of the proposal. Air Force configuration management

directives provide that each of the commands evaluating change proposals establish and maintain a formal evaluation board. The board meets periodically to review and act upon the proposed changes.

Our review of selected change proposals at the Air Force Aeronautical Systems Division indicated that delinquent processing by activities other than the project management group was a primary cause of delay. For example, we found that delays ranging from 36 to 221 days had occurred on selected change proposals at one Air Force Aeronautical Systems Division project office, primarily because of delinquent processing at a command having responsibility for other functions. One responsible project official stated that Air Force Aeronautical Systems Division project offices had no control over the processing by other activities. A representative of one of these other activities mentioned that generally a review was not begun until word was received from the Air Force Aeronautical Systems Division that the change proposal had been found technically acceptable. This amounted to sequential processing and substantially delayed completion of the review process.

CHAPTER 6

GAO PROPOSALS AND AGENCY COMMENTS

GAO PROPOSALS

In a draft of this report, we advised DOD that delays in the processing of change proposals appeared to be the rule rather than the exception. We advised DOD further that we believed management action to reduce processing time to the minimum and secure compliance with its standards was warranted because the advantages of reducing processing time--reductions in expenditures and better equipped aircraft--seemed so significant that it was well worth concentrated management effort to attain more timely processing.

In the draft report, we also suggested steps to achieve more timely processing of engineering change proposals. We suggested that the Secretary of Defense designate a group in DOD to establish procedures for effective control of the processing of engineering change proposals and to monitor the implementation of these controls by the military services. We suggested further that matters to be considered should include the establishing of:

1. Time standards for processing change proposals, broken down into segments, to guide individuals and groups functioning in the evaluating cycle.

2. A system of recording enough information on the actual performance of evaluating groups to provide management a means of periodically evaluating how actual performance compares to established standards.

3. Reviews by project officials to determine, for each aircraft type, specific data to be furnished by contractors for evaluating change proposals applicable to the aircraft.

4. Standardized procedures that will provide for concurrent reviews of engineering change proposals and eliminate duplicate processing.

AGENCY COMMENTS

The DOD responded to our draft report in a letter from the Deputy Assistant Secretary of Defense (Installations and Logistics) dated June 30, 1970, a copy of which is included as appendix II. The Deputy Assistant Secretary agreed that the advantages of reducing the processing time for engineering change proposals warranted increased management effort to ensure more timely processing. He stated that the military departments had devoted considerable management attention this past year to all aspects of configuration management, especially to the processing of engineering change proposals, and that each of the departments had established, or had procedures in a late stage of development to establish, effective controls over the timeliness of processing change proposals.

The Deputy Assistant Secretary stated that a formal internal audit, then underway, to evaluate the configuration management programs of the departments would include an audit of the then-current practices for controlling engineering change proposals. He stated also that, in view of these actions, DOD did not plan to form a group, such as we had suggested, to establish additional DOD-wide procedures for controlling and monitoring engineering change proposals. He indicated, however, that a group would be formed, on an ad hoc basis, to review specific procedures developed by the military departments and that action would be taken to correct any deficiencies found.

CHAPTER 7

CONCLUSION AND RECOMMENDATION

We believe that the advantages of reducing the time for processing engineering change proposals are important enough to warrant a concentrated management effort to attain more timely processing.

The action being taken by DOD of developing and implementing controls over processing time seems to be responsive to our suggestions and, if the controls are appropriate and are effectively carried out, it should significantly improve the timeliness of engineering change proposal processing. We plan to inquire into the effectiveness of DOD's new controls after the actions, which it has taken and plans to take, have been completed.

We recommend that the Secretary of Defense monitor actions planned for improvement of the processing of engineering change proposals, to ensure that the actions are carried out effectively and are achieving the desired objectives.

CHAPTER 8

SCOPE OF REVIEW

Our review included an examination of DOD policies, procedures, and practices for processing engineering change proposals. At aircraft procurement activities of the Army, Navy, and Air Force and at associated contractor locations, we analyzed pertinent records and interviewed officials responsible for processing engineering changes. Our review was conducted between January 1968 and September 1969 at three procurement activities and nine aircraft contractor locations.

We developed engineering change proposal chronologies of events; computed processing times; compared actual processing times with established standards to determine delays; determined extent and significance of delays; ascertained reasons why delays occurred; evaluated the reasons in terms of authenticity; and determined what action management was taking to preclude recurrences. We also measured the impact of engineering change proposal processing delays in terms of the increased implementation costs and the user benefits denied when the delays prevented the incorporation of engineering changes on aircraft during production.

APPENDIXES

DELAYED CHANGE PROPOSALS RESULTING IN ADDITIONAL COST

Aircraft project	Engineering change proposal number	Description of engineering change proposal	Aircraft missing change	Estimated increased cost resulting from making change after production
UH-1	275	Add engine air induction screen and install particle separator	40	$ 62,200
UH-1	288	Improved swashplate assembly	288	10,190
UH-1	278	Provide a secondary source of hydraulic power to collective and cyclic boost cylinders	51	46,333
UH-1	279	Improve serviceability and reliability of the collective and rotating control system	51	133,722
UH-1	285R	Install AN/ARC 54 FM communication equipment in lieu of AN/ARC 44	53	69,012
UH-1	349	Add additional roof access step	678	37,493
AH-1	363	Improved taillight	85	34,467
UH-1 and AH-1	310	Improved method for connecting the engine fuel inlet hose	155	7,170
UH-1 and AH-1	371R2	Improved hydraulic air filter system	868	131,415
AH-1	378	Improved hydraulic system lockout valves	259	74,799
AH-1	390	Relocate UHF-VHF and FM antennas	97	24,193
AH-1	398	Improved SAS pylon compensation network	94	37,431
AH-1	366	Improved attitude indicator and remote control gyroscope	231	1,052,205
AH-1	380	Improved capacity main rotary inverter	84	30,660
CH-47	484	Provide added drainage for fuselage	32	7,680
CH-47	495	Deletion of VCR audio-padding from the interphone junction box	58	1,740
CH-47	526	Improved N-2 actuator	73	193,209
CH-47	533	Increase torquemeter indicator damping	37	28,305
T-38	135DR	Motor operated fuel shutoff valve	87	43,061
T-38	187D	Phase revision elimination primary ADI sphere system	36	6,696
T-38	199D	Canopy safe warning system improvements	12	12,986
T-38	203D	Aileron control system improvement	76	20,501
T-38	204D	CAM flap control detent modification	34	8,697
T-38	205D	Nose wheel steering circuitry bearings	20	10,231
T-38	209D	Installation of rudder servo input shaft duct seal	21	1,533
A-6A	276	Installation of two point oil quantity gauging systems	20	84,392
A-6A	470	Improvement of airborne moving target radar	85	290,428
A-6A	475	Provide TACAN-IFF separation	19	51,433
A-6A	486	Installation of beacon radar	101	142,107
A-6A	495	LABS IP LAY down bombing	74	111,311
A-7B	27	Modification of wing leading and trailing edge flap controls	57	296,373
A-7A and B	29-1	Canopy handle change and wingfold addition	57	10,597
A-7B	29-6	Addition of rain removal hot caution light	196	43,857
A-7A	29-14	Provision for AWW-2A fuel function control unit	57	19,495
A-7A	22	Installation of additional armor	57	88,610
A-7A	31	APQ-116 radar change	73	70,937
A-7A and B	33	Increase range turbine inlet temperature indicator	104	85,134
A-7B	44	Addition of communication equipment--Juliet 28	81	276,358
CH-46	370	Installation of lock on/lock off altitude hold switch automatic trim system control panel	7	249
CH-53	6046	Incorporation of the range extension configuration	24	1,002
CH-53	6062E	Incorporation of remote topping	18	3,912
CH-54	8057	Installation of improved control rod assembly and strut assembly	6	264
			4,556	$3,662,388

APPENDIX II

ASSISTANT SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301

30 JUN 1970

INSTALLATIONS AND LOGISTICS
AR

Mr. C. M. Bailey
Director, Defense Division
U. S. General Accounting Office
Washington, D. C. 20548

Dear Mr. Bailey:

This is in response to your letter of April 29, 1970, to the Secretary of Defense which forwarded copies of your draft report, "Opportunity to Reduce Costs through Prompt Processing of Engineering Change Proposals," (OSD Case #3112).

We agree that the advantages associated with reducing the processing time for engineering change proposals warrant increased management effort to assure more timely processing. The Military Departments have devoted considerable management attention this past year to all aspects of configuration management, especially to the processing of engineering change proposals.

Each of the Departments has now established, or has procedures in a late stage of development to establish, effective controls over the timeliness of processing change proposals. A formal internal audit now under way to evaluate the configuration management programs of the Departments will specifically include audit of current practices for controlling engineering change proposals.

In view of these actions it is not planned to form a group to establish additional Defense-wide procedures for control and monitoring of engineering change proposals at this time. However, a group will be formed on an ad hoc basis to review specific procedures developed by the Military Departments. Action will be taken to correct any deficiencies found.

Sincerely,

Glenn W. Gibson

Glenn W. Gibson
Deputy Assistant Secretary of Defense

PRINCIPAL OFFICIALS

OF THE DEPARTMENT OF DEFENSE AND THE

DEPARTMENTS OF THE ARMY, NAVY, AND AIR FORCE

RESPONSIBLE FOR THE ADMINISTRATION OF ACTIVITIES

DISCUSSED IN THIS REPORT

	Tenure of office	
	From	To
DEPARTMENT OF DEFENSE		
SECRETARY OF DEFENSE:		
Melvin R. Laird	Jan. 1969	Present
Clark M. Clifford	Mar. 1968	Jan. 1969
Robert S. McNamara	Jan. 1961	Feb. 1968
DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING:		
John S. Foster, Jr.	Oct. 1965	Present
ASSISTANT SECRETARY OF DEFENSE (INSTALLATIONS AND LOGISTICS):		
Barry J. Shillito	Feb. 1969	Present
Thomas D. Morris	Sept. 1967	Jan. 1969
Paul R. Ignatius	Dec. 1964	Aug. 1967
DEPARTMENT OF THE ARMY		
SECRETARY OF THE ARMY:		
Stanley R. Resor	July 1965	Present
ASSISTANT SECRETARY OF THE ARMY (INSTALLATIONS AND LOGISTICS):		
J. Ronald Fox	June 1969	Present
Vincent P. Huggard (acting)	Mar. 1969	June 1969
Dr. Robert A. Brooks	Oct. 1965	Feb. 1969

PRINCIPAL OFFICIALS

OF THE DEPARTMENT OF DEFENSE AND THE

DEPARTMENTS OF THE ARMY, NAVY, AND AIR FORCE

RESPONSIBLE FOR THE ADMINISTRATION OF ACTIVITIES

DISCUSSED IN THIS REPORT (continued)

	Tenure of office	
	From	To
DEPARTMENT OF THE NAVY		
SECRETARY OF THE NAVY:		
John H. Chafee	Jan. 1969	Present
Paul R. Ignatius	Aug. 1967	Jan. 1969
Charles F. Baird (acting)	Aug. 1967	Aug. 1967
Robert H. B. Baldwin (acting)	July 1967	July 1967
Paul H. Nitze	Nov. 1963	June 1967
ASSISTANT SECRETARY OF THE NAVY (INSTALLATIONS AND LOGISTICS):		
Frank Sanders	Feb. 1969	Present
Barry J. Shillito	Apr. 1968	Jan. 1969
Vacant	Feb. 1968	Mar. 1968
Graeme C. Bannerman	Feb. 1965	Feb. 1968
DEPARTMENT OF THE AIR FORCE		
SECRETARY OF THE AIR FORCE:		
Robert C. Seamans, Jr.	Feb. 1969	Present
Harold Brown	Oct. 1965	Jan. 1969
ASSISTANT SECRETARY OF THE AIR FORCE (INSTALLATIONS AND LOGISTICS):		
Phillip Whittaker	May 1969	Present
Robert H. Charles	Nov. 1963	May 1969

U.S. GAO Wash., D.C.