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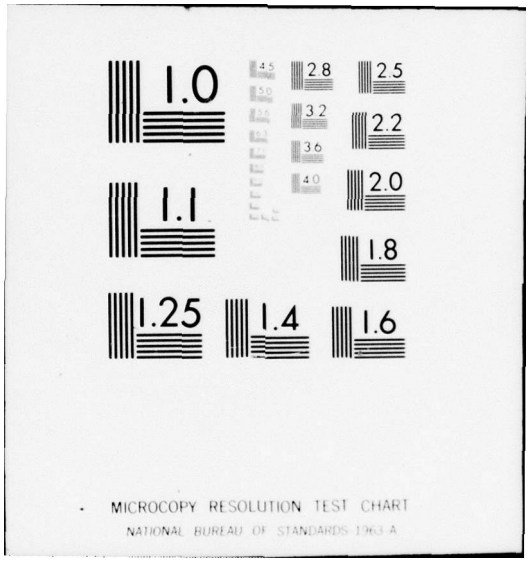
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DEFENSE SYSTEMS MANAGEMENT COLLEGE

PROGRAM MANAGEMENT COURSE
INDIVIDUAL STUDY PROGRAM

IMPACT OF COMPETITIVE PROCUREMENT ON CONFIGURATION CONTROL

STUDY REPORT PROJECT
PMC 77-1

Fred Garza Jr.
GS-13 DNC

FORT BELVOIR, VIRGINIA 22060

IMPACT OF COMPETITIVE PROCUREMENT

CONFIGURATION CONTROL

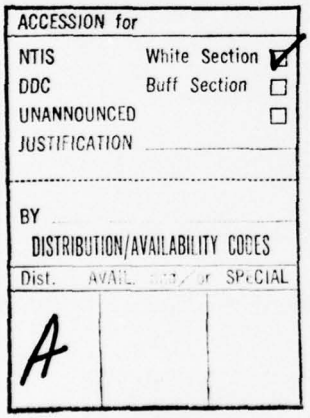
Study Report Project

Individual Study Program

Defense Systems Management College

Program Management Course

Class 77-1



by

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May 1977

Study Project Advisor
LT. COL. J.D. ARCIERI

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) IMPACT OF COMPETITIVE PROCUREMENT ON CONFIGURATION CONTROL		5. TYPE OF REPORT & PERIOD COVERED Student Project Report 77-1 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) FRED GARZA JR.		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS DEFENSE SYSTEMS MANAGEMENT COLLEGE FT. BELVOIR, VA 22060		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS DEFENSE SYSTEMS MANAGEMENT COLLEGE FT. BELVOIR, VA 22060		12. REPORT DATE 77-1 13. NUMBER OF PAGES 39
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

UNLIMITED

DISTRIBUTION STATEMENT A
Approved for public release;
Distribution Unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

DEFENSE SYSTEMS MANAGEMENT COLLEGE

STUDY TITLE:

Impact of Competitive Procurement on Configuration Control

STUDY PROJECT GOALS:

To identify configuration control problems which surfaced after a competitive procurement and discuss their causes as well as describing the corrective actions taken to correct them.

To identify the lessons learned and provide recommendations so that individuals which may be involved in a similar program may avoid or minimize the impact of such problems.

STUDY REPORT ABSTRACT:

The purpose of the report is to provide insight into the configuration control problems that can occur after a competitive procurement. The report discusses the configuration control problems experienced by the 5"/54 MK 45 Lightweight Gun System Program Office as a result of a competitive procurement. Specifically the problems areas discussed include Configuration Identification, Change Control and Configuration Status Accounting. The configuration control procedures formulated and implemented to correct the problems identified are also discussed.

The report concludes with the lessons learned and make appropriate recommendations. The lessons learned were that competitive procurement:

1. Can have a significant impact on a Program Configuration Control
2. Impacts the Production Baseline
3. Change Control procedures
4. Configuration Status Accounting

The report will be of interest to individuals involved in Configuration Management.

KEY WORDS: Configuration Management

NAME, RANK, SERVICE	CLASS	DATE
FRED GARZA, JR. GS-13, DMC	PMS 17-1	May 1977

EXECUTIVE SUMMARY

The purpose of this report is to identify configuration control problems resulting from lack of configuration management and how these problems were compounded by a competitive procurement.

The problems discussed are associated with the 5"/54 Caliber MK 45 Lightweight Gun (LWG) System Program. As background, the report includes a brief description and relevant history of the 5"/54 MK 45 LWG System. The report identifies the many configuration problems which surfaced while preparing for and after a competitive procurement. The decision to go to a competitive procurement was made by the Assistant Secretary of the Navy (I&L) before the developer had delivered the first production system.

The major problems discussed in the report are those which resulted from the lack of identification of a production baseline, numerous documentation changes, processing of Engineering Change Proposals (ECPs) and failure to have a status accounting system. Although all these problems would have surfaced eventually, the award of the competitive contract to a second source made them much more complicated and their impact on cost was significantly increased. The report also describes the configuration procedures which were formulated and implemented to resolve these problems.

The report concludes that the establishment of a good Configuration Management Program early in the life cycle of a program is essential. The Configuration Management Program should be established in accordance with appropriate Department of Defense Instructions e.g. NAVMATINST 4130.1A, MIL-STD-480, etc. Accordingly if such a program does not exist, the program

is not ready for competitive procurement. Any savings that may be expected from such a procurement may be eroded due to the cost of correcting configuration problems.

The lessons learned and appropriate recommendations are provided in order that similar configuration control problems under similar conditions may be avoided or minimized.

ACKNOWLEDGEMENTS

I would like to thank Lt. Col. Joseph D. Arcieri, of the faculty of the Defense Systems Management College, for acting as my Study Project Advisor. In addition, I would like to thank Mr. D. E. Crockett who provided valuable data required for the preparation of this report.

TABLE OF CONTENTS

SECTION I

INTRODUCTION

Purpose of the Study Project

The purpose of this paper is to identify the impact competitive procurement had on configuration control.

Specific Goals of the Project

The specific goals of the project included (1) documenting the impact competitive procurement had on a program that did not have an established Configuration Management Program, (2) identification of configuration problems that surfaced and how they were complicated by the award of a production contract to a second source and (3) the configuration management procedures formulated and implemented to resolve these problems.

Definitions

Configuration - The functional and/or physical characteristics of hardware/software as set forth in technical documentation and achieved in a product. (3:41)

Configuration Item - An aggregation of hardware/software, or any of its discrete portions, which satisfies an end use function and is designated by the Government for configuration management. (3:41)

Configuration Management - A discipline applying technical and administrative directions and surveillance to (1) identify and document the functional and physical characteristics of configuration item, (2) control changes to those characteristics and (3) record and report changes processing and implementation status. (3:42)

Configuration Identification - The approved or conditionally approved technical documentation describing configuration items at designated points in their life cycle. (3:41)

Configuration Change Control - The systematic evaluation, coordination, approval or disapproval, and implementation of all approved changes in the configuration item. (3:41)

Baseline - A configuration, identification and documentation or a set of such documents formally designated and fixed at a specific time during a configuration item's life cycle. (3:41)

Configuration Status Accounting - The recording and reporting of the information that is needed to manage configuration effectively. (3:42)

Engineering Change - An alteration in the configuration of a configuration item or items, delivered, to be delivered, or under development, after formal establishment of its configuration identification. (3:42)

Engineering Change Proposals (ECPs) - A term which includes both a proposed engineering change and the documentation by which the change is described and suggested. (3:43)

Retrofit - Incorporation of an engineering change (at any level) in accepted or in-service items. (3:44)

Data Source

The data used in the preparation of this report was obtained from Program Office documents, personnel, and the Program Office support activity at the Naval Ordnance Station, Louisville, Kentucky (NAVORDSTA, Louisville) and my personal experience as the Project Engineer on the 5"/54 Caliber MK 45 Gun Program.

Organization of the Report

The report consists of the five sections. Section I consists of appropriate introductory remarks, including definition of terms used throughout the report. Section II provides a description of the 5"/54 Caliber MK 45 Gun System and relevant history/milestones of the program. Section III defines the configuration control problems which surfaced in preparing for a competitive procurement and after award of a production

contract to a second source. Section IV describes the configuration control procedures formulated and implemented to establish and maintain configuration control in the program. Section V contains the lessons learned and recommendations.

SECTION II

BACKGROUND

System Description

The 5"/54 Caliber Gun System MK 45 Mod 0 is a fully automatic lightweight (50,000 lbs.), shielded, single barrel weapon that fires existing 5"/54 ammunition at a rate of sixteen (16) to twenty (20) rounds per minute to ranges of 26,000 yards. The gun system was developed for installation in DD-963, CGN-36/38 and LHA-1 class ships. It will deliver rapid, accurate fire against aircraft, surface craft and shore targets.

The MK 45 consists of two major functional component groups. One set of functional components are the below deck items which include the control panel, ammunition loader drum, fuze setter and ammunition hoist. These components deliver the ammunition to the above deck component group which loads the ammunition, aims the gun, fires the ammunition and ejects the empty powder cases. The above deck components include the shield, slide, gun barrel and power drives. The MK 45 Mod 0 Gun System design utilizes the latest state-of-the-art concepts to improve performance, reliability, maintainability and safety.

Program History

The MK 45 Mod 0 Gun System was developed in response to the requirements set forth in Specific Operational Requirement (SOR) 12-04 issued on 20 March 1963. A design and development contract which included delivery of one (1) prototype was awarded in April 1964. The prototype system was

delivered and installed at the Naval Weapons Laboratory, Dahlgren, Virginia (NWH, Dahlgren) in June 1967 for Technical Evaluation. This evaluation is comparable to the DT-II testing required under Full Scale Engineering Development today. After successful completion of the evaluation test in June 1968, in September 1968 the prototype was installed in the USS NORTON SOUND (AVM-1) in order to undergo its Technical and Operational Evaluation. "The MK 45 prototype successfully completed these evaluations and was approved for service use by the Chief of Naval Operations in July 1970." (7:1) To date four production contracts, three (3) to the designer and one (1) to a second source have been awarded for a total ninety-eight (98) systems. These contracts were awarded in September 1968, August 1971, February 1972 and November 1975. Deliveries of MK 45 Mod 0 systems commenced in August 1971 and are scheduled to be completed in October 1978.

These systems have been or will be installed in new construction CGN-36, CGN-38, DD-963 and LHA-1 class ships. In addition, eight (8) of the systems being procured will be installed in Iranian DD-993 class ships. Three of the systems procured are training systems. Two of them are presently being used for operation, maintenance and fleet refresher training. Of the shipboard systems the first two were installed on the CGN-36 in August 1973.

SECTION III

PROBLEM DEFINITION

Before Second Source Selection

"Due to the production lead time (three (3) years) and the requirement to have systems dockside as early as August 1971, approval to issue a production contract prior to completion of Operational Evaluation of the prototype system was authorized by the Assistant Secretary of the Navy (Installation & Logistics)." (7:3) Consequently a cost plus incentive fee contract for twenty-five (25) systems was awarded to the development contractor in September 1968. The contract authorized the contractor to make Class II Engineering Changes without Government approval. Although the local Defense Contract Administration Service Office (DCASO) had to approve the classification, many changes classifed as Class II would have been Class I had the contract not been a cost plus type contract. For example, to expedite changes the contractor, who at the time was the designated design agent, would classify as many changes as he could as Class II and not worry about cost since he would be reimbursed per the contract (cost plus). However, if he had been under a Fixed Price contract, he would have had to submit any changes having cost impact as Class I in order to get reimbursed for their implementation. Therefore as a result of the many Class II changes that were incorporated into the systems, the Program Office was not aware of the true configuration of each system.

"To compound this configuration problem, upon successful completion of the Operational Evaluation in March 1970 (by the MK 45 Mod 0 Gun System

Prototype) the Naval Ordnance Systems Command (NAVORDSYSCOM) was directed by the Assistant Secretary of the Navy (I&L) to formally advertise the impending procurement of fifty-four (54) MK 45 Mod 0 Gun Systems for the DD-963 class shipbuilding program." (7:1)

"Consequently, Production documentation package was assembled and the NAVORDSTA, Louisville was tasked in April 1970 to conduct a producibility review of the available documentation." (6:1) "However due to the large number of the system drawings, approximately 10,000, and the limited funds available for such a review only a sample of 3,187 drawings were reviewed." (6:1)

"For the competitive procurement the two steps formally advertised method was selected and on 6 November 1970 a notice was published in the Commerce Business Dailey announcing the upcoming procurement." (7:1) "The documentation review was completed in December 1970, and the request for technical proposal was completed in January 1971." (6:1) Subsequently, on 12 February 1971 the first step of the procurement, a Request for Technical Proposal (RFTP) was issued. "This was followed by a bidders conference on 11 and 12 March 1971." (7:1) At the bidders conference the prospective bidders were informed, after questioning the suitability of the data package, that the NAVORDSYSCOM warranted the data package and that the system production units should be built to the documentation provided. The NAVORDSYSCOM decision was based on two major facts, (1) that the developer was producing to this data package and was ready to deliver the first system and (2) that approximately one third of the drawings had just been reviewed." (2)

"On 4 June 1971 copies of drawings which had been changed, as a result of the documentation review were provided to all prospective bidders." (6:2)

"However, approximately 1,000 additional drawing changes were not provided due to pressing requirements to get under contract so that shipbuilder's dockside delivery requirements could be met." (1)

"Only two companies submitted technical proposals, one was the developer who by this time had been awarded two production contracts for a total of thirty-two (32) systems. Both technical proposals were evaluated and considered satisfactory, therefore, both companies were issued Invitations for Bids on 20 July 1971." (1) "Accordingly on 25 August 1971 a firm fixed price contract for approximately $46M was awarded to the second source contractor." (7:1) "Their bid was $15M lower than that of the developer/prime contractor." (7:1) At this point due to lower cost it appeared that the decision to go to competitive procurement had been a good one.

During Production

As was noted before, a review of 30% of the system drawings was conducted. This review precipitated many drawing changes and due to lack of time some of the revised drawings could not be incorporated into the bid package. "In addition, numerous drawing changes resulting from ECPs which were in process when the bid package was assembled had occurred during the eighth month period between issue of the request for proposal and contract award." (7:2) All these changes affected both contractors, however, the impact to each was different. In the case of the developing contractor these changes were not incorporated into all his systems because systems being produced at his plant were in various stages of manufacture.

In some cases incorporation of these changes would have required assembled units to be disassembled, thus impacting the delivery schedule.

In other cases it was determined that it was not cost effective to incorporate the change during manufacture because of the cost of changing production processes, documentation, inspection procedures, etc. Accordingly many changes were retrofitted after delivery on the developer's system without having to pay for these costs. However in the case of the second contractor incorporation of these changes early in the contract was not as costly because he had not procured raw materials, manufactured or assembled units and was just preparing his production documentation. Consequently the cost of incorporating these changes was optimized. Based on the fact that changes were being incorporated at various production phases, the configuration of many systems being delivered even from the same contractor were different. This meant that the Navy now had two contractors producing the "same" system to baselines that were different. Since the Program Office did not have an established Configuration Status Accounting System at this time the differences in these configurations were unknown. (It had become apparent after the award of the competitive contract that such a system was required, therefore the Program Office had tasked (in November 1971) the NAVORDSTA, Louisville to develop such a system).

Since the second contractor was supposed to build to the drawings, he generated numerous questions regarding the documentation as he progressed into production. These questions involved such things as tolerances, quantities of materials, location of holes, etc. As a result of these questions it was discovered that there were many documentation deficiencies in these area. In some cases what had happened was that the developer's

manufacturing personnel on the line were aware of these deficiencies and had made the necessary changes on the production line without notifying the engineers. Consequently more drawings and contract changes had to be made to correct these deficiencies. The total cost impact is not known to this day. Since the cost to correct these deficiencies is not known, it cannot be determined whether it would have been more cost effective to conduct a complete documentation review prior to contract award.

Another problem encountered was that even after award of the competitive contract the developer remained as the design agent and had authority to approve Class II ECPs. The resulting documentation changes from these Class II ECPs when incorporated into the second source contract became Class I ECPs because of their impact on cost. In accordance with MIL-STD-480 any change that affects cost is a Class I ECP. "To correct the problem of Class II ECPs to the prime contractor being Class I to the second source, the prime contractor's contract was amended and his authority to approve Class II ECPs removed." (6:4) Subsequently new procedures for processing ECPs were established. These procedures are discussed in Section IV.

As was noted before, the first production system from the developer was delivered to the Navy one week after the award of the competitive contract. During the installation and checkout of this system and during initial operation several design deficiencies were uncovered. These deficiencies resulted in approximately 100 ECPs." (7:2) Had this occurred before award of the competitive contract all the resulting documentation changes could have been made and incorporated into the data package prior

to contract award. This would have resulted in less cost since the competitive contract would not have to be modified. Consequently only changes resulting from these ECPs which could be incorporated into the production contracts with minimum disruption to production and without affecting schedule were incorporated into both contracts. The remaining changes were scheduled for incorporation into systems after delivery via retrofit. Again because these changes could not be incorporated on every system because of impact on cost and schedule the problem became one of configuration status accounting.

After Delivery

ECPs continued to be generated during production and after delivery, and their incorporation into specific systems varied depending on where they were in the manufacturing process. In each case an analysis was conducted to determine where and when an ECP should be incorporated. In many cases it was determined that it would be more cost effective to retrofit the change than to modify the production contracts. Consequently, systems were coming off the production lines with different configurations and with deficiencies that had to be corrected prior to the systems becoming operational. In addition, all the changes generated after the first system became operational had to be identified as Ordnance Alterations (ORDALTS) and their installation monitored. Accordingly the hardware for these changes had to be procured under separate contracts. To assure that all required changes were incorporated into systems prior to delivery it was apparent that an effective configuration management program was required.

The efforts and actions taken to accomplish this are described in Section IV.

Summary of Problem

As has been discussed there were many factors and events that contributed to the many configuration control problems of the 5"/54 MK 45 Lightweight Gun (LWG) Program. Many of these problems which are summarized below may not have been prevented but their impact could have been minimized if a Configuration Management Program had existed prior to the competitive procurement.

Summary of Problems

I. Before second source selection the following events contributed to some of the MK 45 Mod 0 LWG System Program configuration problems.

   A. No Configuration Management Plan was prepared prior to award of the first production contract.

   B. A firm production baseline was not established.

   C. Lack of control over documentation changes made by the development contractor, who was also the design agent.

   D. Decision to compete the procurement of systems without a suitable data package.

   E. Incomplete documentation review.

   F. Approximately 1,000 drawing changes resulting from the documentation review were not incorporated into bid package due to lack of time.

II. After award of the competitive procurement contract, the following factors contributed to the configuration control problems.

   A. The production baseline for each contractor was different and unknown.

   B. Numerous documentation changes to correct deficiencies found by second contractor had to be made.

C. Numerous documentation changes classified as Class II ECPs by the prime contractor became Class I to the second contractor.

D. These changes, in the form of revised drawings, had to be provided to the second source and increased the contract cost.

E. Over 100 ECPs resulting from design deficiencies uncovered during the first installation and checkout were required.

F. Some changes were incorporated into mounts during production, others required retrofit.

III. After delivery of systems the following configuration problems existed.

A. The same changes were not incorporated into both production contracts due to cost, i.e. cheaper to retrofit.

B. Changes after the system was operational had to be identified as ORDALTS and hardware procured under separate contract.

SECTION IV

CORRECTIVE ACTIONS

"To correct the many configuration problems that had surfaced in preparing for and after the award of the competitive procurement, the Program Office in NAVORDSYSCOM designated the NAVORDSTA, Louisville as the Design, Configuration, Data Management, Integrated Logistics Support, and In-Service Engineering agent for the 5"/54 Caliber MK 45 Mod 0 Lightweight Gun System." (9:1) One of their specific tasks was to prepare a Configuration Management Plan. This plan was to establish the MK 45 Mod 0 LWG System Configuration Management policy including the specific steps required to provide the necessary level of configuration identification, control and status accounting throughout the life cycle of the system. This task was issued to NAVORDSTA, Louisville in April 1972. Although, in general, the procedures established are not unique, however, some special procedures had to be established because two contractors were involved. These procedures are described in the following paragraphs.

Configuration Identification

One of the requirements of configuration management is to establish configuration identification. This was one of the tasks NAVORDSTA, Louisville had to accomplish. "To accomplish this NAVORDSTA, Louisville established a production baseline based on all changes approved up to January 1973." (10:4) Subsequently they recommended that NAVORDSYSCOM freeze the configuration baseline for each production contract and not issue changes until the production baseline for each contractor had been identified. "Consequently,

each contractor was requested to submit a baseline representing the documentation they were producing to." 10:4) It was requested that these baselines be provided on computer tapes. This was necessary to identify the difference between the two contractor "baselines" as well as the difference between the production baseline established by NAVORDSTA, Louisville. "This effort commenced in January 1973 and was completed in December 1973." (10:4) Several factors caused this effort to take longer than anticipated. One was the difference in computers used by each contractor and NAVORDSTA, Louisville. This required converting each computer tape to the one compatible with the NAVORDSTA computer. "This had to be done before the difference in the baselines could be automatically identified. Another was that manual checks of the data had to be conducted to verify the accuracy of the information provided." (10:1)

In addition to the two production baselines and the NAVORDSTA baseline, a fourth baseline was established and identified as the operational baseline. This baseline represented the configuration of the first operational systems. Any changes made to this baseline were in the form of ORDALTS. The differences between this baseline and the two production baselines represented the changes that had to be made to the hardware prior to it becoming operational.

Having identified the baselines to which each contractor was producing to as well as knowing the operational baseline provided the necessary basis for establishing effective configuration change control and status accounting.

Configuration Change Control

The success and depth of change control depends on the degree to which the baselines established identify and define systems and the detailed procedures used to process changes. Each baseline should be controlled through an established change control process. This process requires that all program participants:

> (1) process changes in accordance with MIL-STD-480; (2) use a comprehensive review cycle capable of determining the total impact of a change; (3) utilize a Configuration Control Board (CCB) for approving or disapproving proposed changes to the established baselines; (4) issue reports on the status of changes; and (5) implement or accomplish authorized changes. (10:A3-9)

Having established the baselines for the program, a configuration control procedure to maintain them had to be formulated. Several steps were taken to achieve this, they included contract modifications, regarding the processing of ECPs and meetings with the contractors, plant representatives, NAVORDSTA, Louisville and NAVORD Program personnel.

It was determined that to establish and maintain configuration control would require limiting Class I ECPs to only those offering substantial benefit to the Navy and those required to correct safety, compatibility and major design deficiencies. It was also determined that a uniform processing and evaluation procedure for ECPs from both contractors should be established. Consequently, a contract change was issued to the developer's contract invoking the use of MIL-STD-480 in lieu of ANA Bulletin 445. In addition, this change removed his authority to approve Class II ECPs.

The procedures established for processing ECPs are described in Appendix A. For Class II ECPs the NAVORDSTA, Louisville was delegated

approval/disapproval authority. In addition, the plant representatives had to concur in classification on both Class I and II ECPs. To expedite the decision on Class II ECPs the procedure established required that approval/disapproval be provided within three working days after receipt by the NAVORDSTA, Louisville. It was believed that if the change was a true Class II ECP it should not take more than three days to evaluate. For any approved Class II ECPs the NAVORDSTA, Louisville had to determine whether the change was mandatory for all systems and had to establish an implementation plan if required. Class I ECPs were processed in accordance with MIL-STD-480. The in depth technical evaluations for these ECPs were conducted by the NAVORDSTA, Louisville. To accomplish these evaluations a Configuration Control Board (CCB) was established at the NAVORDSTA, Louisville to assure that a complete and systematic evaluation of all ECPs was conducted. These evaluations were conducted prior to making a recommendation to the Program Office. All Class I ECPs submitted to the Program Office for approval were reviewed by the NAVORDSYSCOM CCB. Prior to submission to the NAVORDSYSCOM CCB a decision had to be made as to where, when and how the change was to be implemented, e.g. during manufacture, after delivery, etc. To make this decision a systematic analysis was conducted. The decision analysis process included answering the following questions:

A. Is it desirable to install the change during production?

    1. If it is:

        a. Should it be incorporated into both production lines?

        b. Can it be done without affecting the delivery schedule?

        c. Is this the most economical means?

d. Will change kit be GFE?

e. How many systems can be modified?

2. If it isn't, what are alternatives?

a. After acceptance but prior to shipping?

b. After shipment?

c. After installation?

B. Is it desirable to install the change after acceptance but prior to shipping?

1. If it is:

a. Should it be incorporated at both contractors?

b. Can it be done without affecting the delivery schedule?

c. Is this the most economical means?

d. Will change kit be GFE?

e. How many systems can be modified?

C. Is it desirable to install the change after shipment?

1. If it is:

a. Should it be incorporated prior to system installation?

b. Should it be incorporated during system installation?

c. How many systems will be modified?

d. Who will install change?

e. Has approval from Ship Program Manager and Shipyard been obtained?

f. Is this the most economical means?

2. If it isn't, what is the alternative?

a. After installation?

D. Is it desirable to install after system installation?

a. How many systems will be modified?

b. Who will install change?

c. Can it be done while the ship is still in the construction phase?

d. If not, are other funds available for installation?

If it was determined that it was best to incorporate a change during production, the appropriate contract(s) were modified and the production baseline updated. When it was determined that changes should be incorporated after acceptance but prior to delivery, a task under a services contract was issued to the contractor(s), but no change was made to the production baseline only to the individual system baseline. All changes incorporated after delivery were made by Navy field representatives either during or after system installation. When changes were made, the individual system baselines were updated using the Configuration Status Accounting System.

Configuration Status Accounting

The traceability of configuration baselines and their subsequent changes is accomplished through Configuration Status Accounting. Although the status accounting system established for the MK 45 Mod 0 LWG System is typical, it was complicated by having to establish two production baselines as well as an operational baseline. The status accounting system provides the facilities to record, store, correlate and report configuration management information at the established Configuration Identification

level throughout the equipments life cycle. The established status accounting system consists of manual and computer based procedures consisting of a baseline data file and change proposal file which:

A. Record and report all technical data describing a baseline configuration of each system.

B. Record and report the impact of approved ECPs to the baseline, identify total effectivity and traceability of accomplishment.

C. Report as-built, as installed, and/or as modified hardware unit configurations.

D. Serve as a technical/management information system for control of engineering technical data, change implementation planning and correlation of logistic support elements to hardware configuration identification.

"The Baseline Identification file of the accounting system is designed to record: (1) all engineering and support documents describing systems/equipment characteristics; (2) relate these documents (part numbers, drawings, specifications, etc.) to each application (next higher assembly) within the system/equipment; (3) identify the initial baseline revision levels of the documents." (11:7) This data serves as a static fixed package from which the impact of changes can be measured. (11:8) "Due to ECPs, ORDALTS, Waivers/Deviations and other actions this file cannot be considered as reflecting either a specific system or current design configuration." (11:8) Consequently the change proposal file is used as a means for recording proposed and approved changes, and with the baseline file permits the definition of the latest production and operational baselines as well as the configuration baseline of any given system. (11:8) It also

identifies the differences in the baselines of each system so that changes required to any given system to bring it up to an operational baseline are known. (11:8) Subsequently the quantities and type of hardware that must be procured as part of the change/retrofit kits are identified. By knowing which systems require retrofitting of (certain ECPs) a plan, as shown in Appendix B, for accomplishing the retrofit could be formulated and monitored. The ability to identify the difference in each system configuration was essential in resolving the MK 45 LWG configuration control problems and assuring that at a selected point in time each system was configured to the latest configuration baseline. Consequently without a Configuration Status Accounting system it would have been almost impossible to accomplish this.

Summary

To overcome the many configuration problems that plagued the MK 45 LWG Program, a Configuration Management Program had to be established which included: (1) Configuration Identification through the identification of the production baselines for systems being produced by each contractor, (2) a Configuration Change Control procedure that limited changes only to those that were essential and required a systematic evaluation of each change to determine the impact on the overall program and (3) a Configuration Status Accounting system that identified all deviations from established baselines and their implementation status.

The Configuration Management Program established to support the MK 45 LWG Program is working and has provided the means for establishing

and maintaining the configuration control essential to have a successful program.

Based on the configuration control problems experienced on the MK 45 LWG Program and the actions required to correct them, several lessons were learned. Recommendation based on the lessons learned are provided so that these problems may be avoided or minimized in future competitive procurements.

SECTION V

CONCLUSIONS AND LESSONS LEARNED

Competitive procurement can have a significant impact on configuration control and should not be considered unless a well established Configuration Management Program exists. The problems discussed in this report occurred due to the lack of configuration management prior to the award of a competitive procurement. The conclusions offered here are in the forms of lessons learned and recommendations. The lessons learned and recommendations are provided so that under similar circumstances the same mistakes can be avoided or minimized through proper planning.

Lessons Learned/Recommendations

Lesson Learned: Competitive procurement can have a significant impact on a Program's Configuration Control.

Recommendation: Prior to considering a competitive procurement a well established Configuration Management Program which has (1) identified and documented the functional and physical characteristics of each configuration item i.e. baselines, (2) established a procedure for controlling the change to those baselines and (3) provided a means of recording and accounting for the implementation status of the changes must exist. The entire configuration management process should be addressed in detail in a Configuration Management Plan.

Lesson Learned: Competitive procurement impacts the Production Baseline. Before awarding a competitive contract any difference in the production baseline used in the request for proposal and that of a contract still in production must be known. Differences in these baselines could be a result of changes from approved ECPs which were not incorporated into the production contract due to impact on cost or schedule. In addition, any changes approved after the award of a competitive procurement will probably be incorporated into the second contract and not in the original contract because there is likely to be less of an impact early in the contract. In other words the second contractor has probably not procured, manufactured or assembled the affected parts. Therefore the fact that each contract will be in different phases of production the affect of changes on their baselines will be different. Accordingly these differences must be known so that appropriate retrofits can be planned and accomplished before the systems become operational.

Recommendation: Be aware that because of changes the production baselines for each contractor will probably be different. Initially this difference could be eliminated by freezing the baseline to that represented by the documentation in the request for proposal. However, if changes were processed after award and the prime was still in production, the effectivity of the changes would be different (due to the fact that each contractor will be in a different stage of production) thus resulting in two different baselines.

Lesson Learned: Competitive procurement affects change control procedures. When there is only one contractor producing an item, it is usually not difficult to classify Class I and II ECPs. In addition, it is not too difficult to assess the impact on cost or determine when to implement it. This, however, is not the case if two contractors are in production at the same time. A change that may be Class II to one contractor can easily be a Class I to another. Two factors that may contribute to this are the types of contract and what stage in production the second contractor is in, e.g. he may have already assembled all the units affected.

Recommendation: Establish a procedure for processing ECPs which analyze the complete impact any change will have on each contract. Be very critical in reviewing ECPs and only accept those which are required to correct safety, compatability and major design deficiencies.

Lesson Learned: Competitive procurement impacts configuration status accounting. Configuration Status Accounting systems record configuration of systems at any point in time and accounts for the status of change implementation. For programs having only one production contract this system accounts for one production baseline and the change made to that baseline under these conditions the process is not very complicated if an accounting system is established early in the program. However, the status accounting process becomes more complex when two contractors are in production. As discussed above in all probability two production baselines will have to be accounted for. In addition, if the contractors are in different stages of production the effectivity and implementation of changes will vary, thus resulting in many more systems coming off production line with different configurations. Thus the outstanding changes for each of these systems must be known so they may be retrofitted and system brought up to the latest established configuration.

Recommendation: Establish a Configuration Accounting System that can trace configuration baselines and their subsequent changes. Such a system should exist in a program irregardless of how many contractors are in production. Utilize this system to plan the procurement and retrofit of required changes.

APPENDIX A

5"/54 Caliber MK 45 Mod 0

Gun System

Change Control Procedures

Reference Specifications:

(a) MIL-STD-480 (Configuration Control - Engineering Changes, Deviations and Waivers)

(b) NAVORDINST 4130.10 (Configuration Control Board; establishment of

(c) OR-3 (Preparation of Ordnance Alteration (ORDALT) Instructions)

(d) NAVORDINST 4130.4 (Configuration control for initiation, proposal, and implementation of NAVORD ORDALTS for non-expendable ordnance in Surface Warfare Weapons Systems)

1. Class I Engineering Change Proposals (ECPs):

a. Class I ECPs as defined by reference (a), shall be submitted by the contractor on DD Form 1692 in accordance with reference (a). The Contractor via the ACO will distribute the Class I ECPs as follows:

Original and seven copies - Naval Ordnance Systems Command

Two copies - Naval Ordnance Station, Louisville, Code 50311

Two copies - Administrative Contracting Officer (ACO)

Supporting Data as defined by reference (a) paragraph 4.8.7 shall be distributed as follows:

Two copies - Naval Ordnance Systems Command

Two copies - Naval Ordnance Station, Louisville, Code 50311

b. In accordance with reference (b), seven calendar days after initial distribution of a Class I ECP the Administrative Contracting

Officer (ACO) will forward comments/recommendations to NAVORDSYSCOM on whether or not to proceed with the ECP review. NAVORDSTA, Louisville Code 50311 will forward, within five working days after receipt, recommendations to NAVORDSYSCOM on whether or not to proceed with the review of the ECP.

c. If a decision is reached to proceed with the ECP review, the ACO will review the ECP and forward, within twenty calendar days after initial distribution, comments and recommendations to NAVORDSTA, Louisville Code 5031 and NAVORDSYSCOM. The ACO's comments should include a review of the cost estimates contained in the ECP.

d. NAVORDSTA, Louisville will review the ECP, the ACO comments and forward, within thirty calendar days after initial distribution, recommendations to NAVORDSYSCOM. NAVORDSTA, Louisville will review the ECP from the engineering viewpoint and determine the effect of the ECP on the entire MK 45 Lightweight Gun Program.

e. NAVORDSYSCOM will review the ECP, ACO comments and NAVORDSTA, Louisville comments, and based on the acceptability of the ECP, approve or disapprove the ECP. NAVORDSYSCOM will notify the Contractor, ACO and NAVORDSTA, Louisville of the disposition of the ECP and if approved initiate the necessary contract modifications to implement the ECP. Figure 1 provides a flow chart for processing Class I ECPs. Once a Class I ECP has been approved, an ORDALT if applicable will be prepared in accordance with reference (c) and it will be implemented according to reference (d).

1. Class II ECPs

a. Class II ECPs as defined by reference (a) will be submitted by the contractor on DD Form 1692, page 1, in accordance with reference (a). The contractor via the ACO will distribute the Class II ECP and supporting data as follows:

Two copies - Administrative Contracting Officer

Two copies - Naval Ordannce Station, Louisville, Code 5031

b. The ACO will review for concurrence in classification all Class II ECPs submitted by the contractor, and NAVORDSTA, Louisville will approve/disapprove all Class II ECPs within 3 working days after receipt of the ECP. Approval by NAVORDSTA, Louisville, the Design Agent, is necessary because a Class II change under one contract may be a Class I change for another contract. Non-concurrence by ACO in classification would require the contractor to resubmit the ECP as a Class I ECP if consideration for approval is still desired. NAVORDSTA, Louisville will be responsible for ensuring that a Class II change is a Class II change for all MK 45 gun mount manufacturing contracts. If the proposed Class II change does, not apply to both contractor, the change should be disapproved. Any change disapproved may be resubmitted as a deviation request in accordance with the contracts. Deviation approval may be granted if there is no impact on interchangeability with the second contractor and beneficial to the Government.

c. If a Class II ECP has been approved, NAVORDSTA, Louisville will determine if the ECP is a mandatory change for all MK 45 gun mount manufacturing contracts or an optional change to be incorporated into the gun mount at the discretion of the contractor. For a flow chart on processing of Class II ECPs, see Figure 2.

FLOW CHART FOR CLASS I ECPs

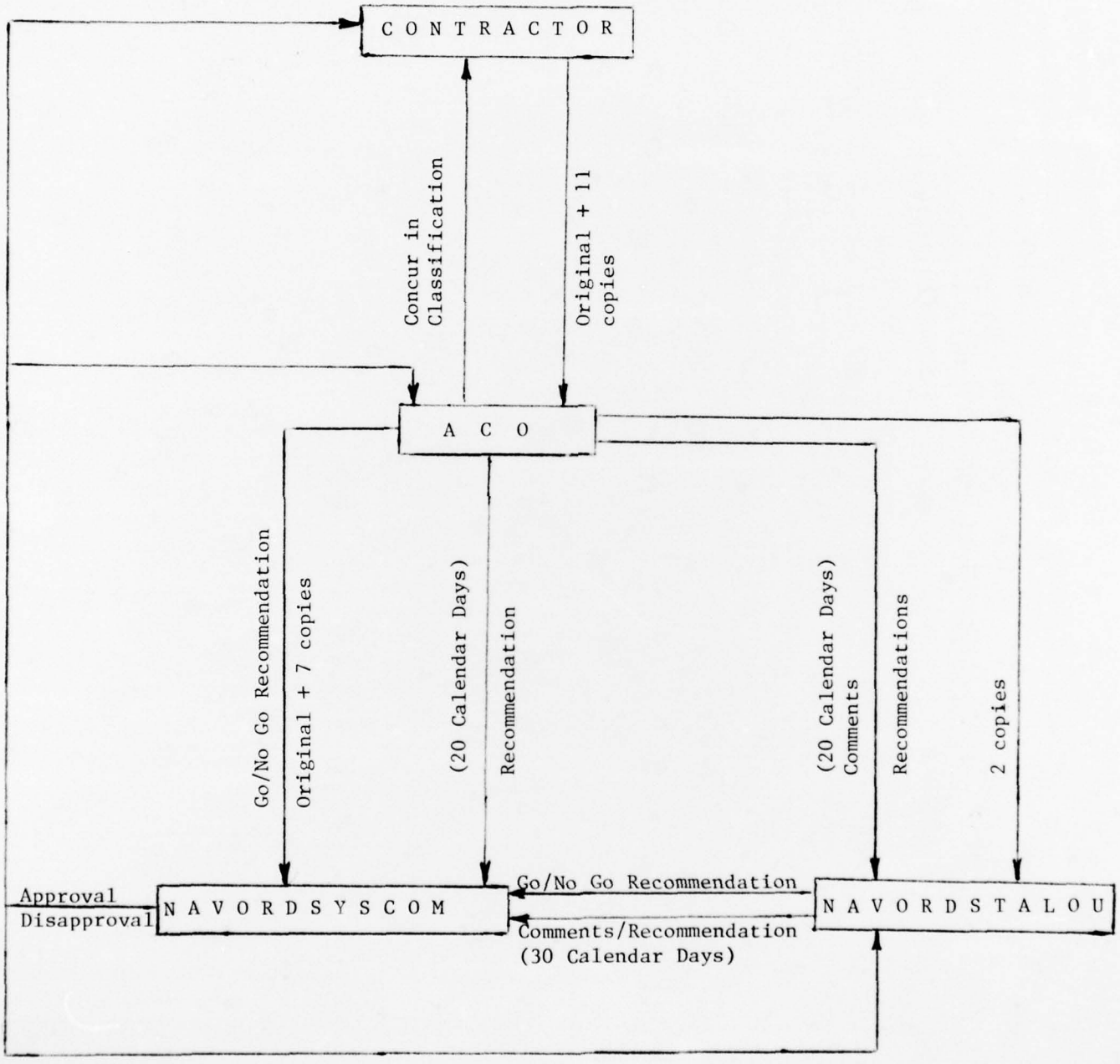

FIGURE 1

FLOW CHART FOR CLASS II ECPs

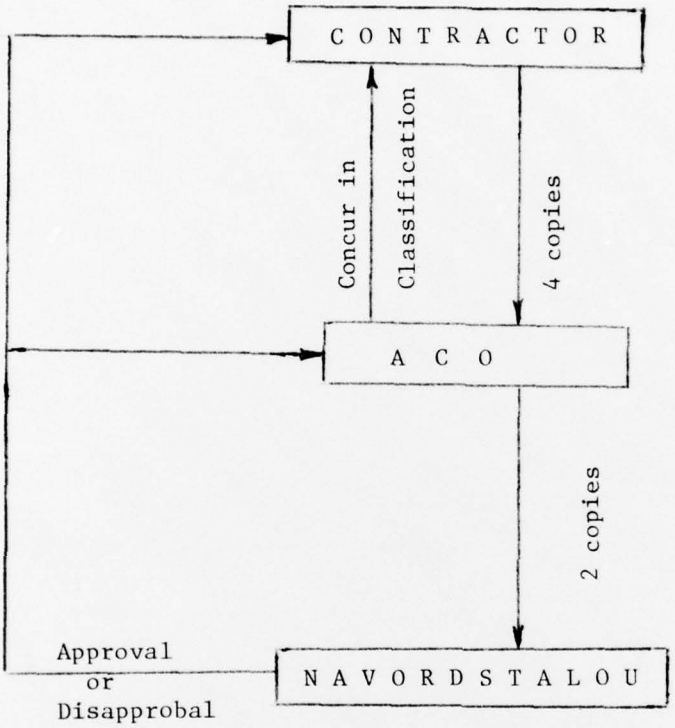

FIGURE 2

ECP BACKFIT PLAN

DLGN 37 ECP	MOUNT 13668 STATUS
1048	Scheduled PSA
1056	
2042	
2051	
1070	Scheduled at Installation
1074	Completed
1075	
1083	Scheduled PSA
1085	During Installation
1088	Scheduled PSA
2004	Completed
2006	Completed
2009	Scheduled PSA
2010	
2012	
2035 (Parts 3-C,D,E only)	Completed
2035 (Remainder)	Scheduled PSA
2039	During Installation
2044	Completed
2046	Completed
2056	Scheduled PSA
2062	Completed
2067	Completed

ECP BACKFIT PLAN

FCDSTC DAM NECK ECP	MOUNT 13669 STATUS
1056	*Completed*
2042	
2051	
1075	Completed
1083	Completed
1085	To be accomplished at NOSL
1088	Completed
2004	To be accomplished At NOSL
2006	
2009	Completed
2010	
2012	
2035	To be accomplished At NOSL
2039	
2044	Completed
2046	To be accomplished At NOSL
2056	
2062	
2067	

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