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Total Quality Management Case Study in a Navy Headquarters Organization

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13. ABSTRACT *(Maximum 200 words)*

This report documents the efforts of Fleet Support and Field Activity Management (AIR-04), Naval Air Systems Command, to implement Total Quality Management (TQM). It describes AIR-04's TQM implementation plan and its selection of the engineering change proposal (ECP) as the first process to undergo continuous improvement using TQM methodology. The report chronicles the development of a TQM Executive Steering Committee and Quality Management Board (QMB), the education and training process, and the selection of the ECP process for analysis. Results of data analyses by the QMB are presented along with a description of continuing efforts. Recommendations concern process definition, work prioritization, Just-in-Time training, emphasis on immediate results, and documentation of future actions.

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FOREWORD

This report was prepared by the Navy Personnel Research and Development Center (NAVPERSRANDCEN) to document its involvement in Total Quality Management (TQM) efforts undertaken by the Naval Air Systems Command, specifically by the Assistant Commander for Fleet Support and Field Activity Management (AIR-04), RADM J. F. Calvert. Researchers from NAVPERSRANDCEN acted as trainers and consultants to AIR-04 during FY89, aiding in implementation of TQM within AIR-04 headquarters.

This report documents the work of AIR-04 as it progressed through the early stages of TQM implementation, beginning with the establishment of an Executive Steering Committee and a Quality Management Board (QMB). It describes how a work process was eventually selected for investigation and the changes in the process that resulted from that analysis.

The authors worked closely with the QMB members in writing this report and wish to express their appreciation for the time each member gave to this effort.

The authors also wish to recognize RADM Calvert for his dedicated commitment to TQM and his support of the researchers throughout this period; CAPT C. E. Jones III, former AIR-04 TQM Coordinator, for his assistance during all phases of this work; and Mr. Paul Kovalsky, Chair for the Engineering Change Proposal (ECP) QMB, who gave generously of his time and knowledge to aid in the authors' understanding of the ECP process and the work completed by the QMB. Without their help, this report could not have been written.

Questions regarding this work can be directed to Mr. Tracy D. Pope, Head, Acquisition Management Division, Code 162, Navy Personnel Research and Development Center, San Diego, California 92152-6800, (619) 553-7696 or AUTOVON 553-7696 .

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SUMMARY

Effective implementation of Total Quality Management (TQM) to improve quality and productivity is based upon the philosophy and management principles of W. Edwards Deming, a statistician often credited with guiding the Japanese economic recovery after World War II. RADM J. H. Kirkpatrick, formerly Assistant Commander for Fleet Support and Field Activity Management (AIR-04), Naval Air Systems Command, developed an interest in TQM and committed himself to integrating it within his group. In February 1989, RADM J. F. Calvert took over the leadership of this effort as the new Assistant Commander for AIR-04. To aid them in this work, the Navy Personnel Research and Development Center provided education, training, and consulting services to AIR-04 during FY89.

A TQM Executive Steering Committee (ESC) was formed by RADM Kirkpatrick. During its education process, the members identified several work processes that could serve as pilot projects in process improvement. The engineering change proposal (ECP) process was selected as the first process to change, and a Quality Management Board (QMB) was chartered to oversee the change process. The QMB's effort to improve the ECP process is documented in this report.

Data were collected on the length of time involved from AIR-04's receipt of the ECP to approval or disapproval of the change. Statistical control charts were useful in identifying some *out-of-control points* (special cause variation[1]) in the process, and remedies were recommended by the QMB. Revised charts then indicated the process was in "statistical control," that is, variation attributed to special causes had been removed, leaving only common cause variation.

Flow charting of the process indicated areas where concurrent review of the ECP would be beneficial, a change involving minimal additional expense. This change is being implemented and new data will be collected to measure its effect.

The QMB is moving into a second round of the Plan-Do-Check-Act cycle. The QMB has learned from its experience that timeliness, while important, is not the first priority for an ECP. More important is financial and schedule executability, completeness and accuracy of the documents, and clarity of implementing instructions. Focus will be on these areas in the coming months.

Management must address work prioritization. TQM team (ESC/QMB/PAT) work may require substantial amounts of time for implementation efforts to be successful. People may

[1]Special causes refer to variables outside of the system. They have an isolated and statistically unpredictable influence on outputs. Special causes are often "local" to a specific operation, machine, or lot of material. Common causes are those variables that arise from the system itself and influence overall performance in a statistically predictable fashion.

need to be excused from other responsibilities to meet the TQM implementation requirements. As TQM is fully integrated into the workplace as a management philosophy, there should be fewer problems associated with work priority.

Education of QMB members requires management direction. The concept of Just-in-Time (JIT) is important in training here. Training should occur just prior to the time when it is needed. And, for those receiving extensive training, the sequence of the courses is important.

In summary, AIR-04 and the ECP QMB have done an admirable job implementing TQM. They have plotted a new course and demonstrated great commitment to pursuing continuous improvement. False starts and unpredictable delays will undoubtedly occur along the way; however, the lessons learned will be invaluable in the continuing TQM effort.

CONTENTS

INTRODUCTION

Effective implementation of Total Quality Management (TQM) to improve quality and productivity is based upon the philosophy and management principles of W. Edwards Deming. Although some private sector companies, such as Hewlett-Packard and Nashua Corporation, have demonstrated successful application of his principles and methodologies, there are only a few government agencies to date that have moved ahead with the same degree of commitment.

RADM J. Kirkpatrick, former Assistant Commander for Fleet Support and Field Activity Management (AIR-04), Naval Air Systems Command (NAVAIRSYSCOM or NAVAIR), committed his organization to implementing this management approach. He was succeeded in February 1989 by RADM J. F. Calvert. To aid AIR-04 in its undertaking, the Navy Personnel Research and Development Center (NAVPERSRANDCEN or NPRDC) provided them with TQM awareness and implementation training as well as consultation services. During FY89, NPRDC researchers worked closely with AIR-04 management as implementation efforts began.

TQM Infrastructure

An organizational infrastructure based on cross-functional teams is basic to NPRDC's TQM implementation model. An Executive Steering Committee (ESC) exists at the highest level of the organization. This is the policy-making board and consists of the highest ranking executives within the organization. It is a permanent board whose job is to direct the quality improvement effort. The ESC charters Quality Management Boards (QMBs) (one or more) to work on significant work processes within the organization. This tier generally consists of middle managers who have "ownership" of a process. The QMBs are also permanent, established to ensure continuous improvement. The QMBs charter Process Action Teams (PATs), selecting members from among workers who work in and have knowledge of the process. These teams will disband once they provide the QMB with the data necessary for continuous improvement efforts.

This case study documents the work completed during FY89 by AIR-04's first QMB and the first process chosen for continuous improvement, the engineering change proposal (ECP) process.

Organizational Overview

NAVAIR provides the fleet and operational forces with aviation weapons systems and equipment. Headquartered in Washington, D.C., NAVAIR has approximately 48,000 military and civilian employees with an annual operating budget of over 16 billion dollars. The headquarters staff encompasses 23 functional areas and employs approximately 3,400 people.

AIR-04, a NAVAIR headquarters subordinate group, has 16 functional areas employing about 600 employees. The AIR-04 mission is to support the fleet and be world leaders in the life

cycle support of naval aviation weapons systems. Both NAVAIR and AIR-04 recognize the fleet as their ultimate customer.

AIR-04 TQM IMPLEMENTATION

ESC Development

The ESC was formed in January 1988. Members include the Assistant Commander, AIR-04; Deputy Director, AIR-04A; Deputy Assistant Commander for Logistics, AIR-41; Deputy Director, AIR-41A; Deputy Assistant Commander for Field Activities, AIR-42; Deputy Director, AIR-42A; Deputy Assistant Commander for Depots, AIR-43; and Deputy Director, AIR-43A.

NPRDC provided the ESC with educational sessions that initially focused on top management's "new job" in TQM. Sessions were devoted to the (1) rationale and necessity for writing a mission statement and guiding principles; (2) description and rationale for the QMB structure; (3) short-term (1-2 years) training requirements for TQM; (4) NPRDC's process improvement model (PIM), which expands Deming's PDCA cycle;[1] and (5) the short-term pilot projects approach, which includes a methodology for selecting a process.

Process Selection

Following the training session on process selection, each member was asked to bring a list of candidate processes to the next ESC meeting. Through group consensus, a final list was developed. It included:

- o technical directives
- o bulletins and airframe changes
- o budget development
- o contractor support service contracting
- o employee professional development
- o development of requests for proposals
- o engineering change proposals
- o communication and distribution system
- o travel orders and close-out vouchers
- o government-furnished equipment management

[1]Based on the scientific method, Deming's Plan-Do-Check-Act (PDCA) cycle provides a systematic approach to problem solving that is basic to NPRDC's TQM implementation and process improvement models.

The ESC members agreed that the process problem(s) cited in this first list had to be solvable, while the processes themselves had to be visible, important, and cut across internal AIR-04 organizational boundaries.

From this list of candidates, a process was selected for attention, again by group consensus. This time the most important consideration was whether or not AIR-04 controlled a major portion of the process. Those processes that were under AIR-04 control were then rated individually and anonymously by the ESC members as either High (4), Medium (3), or Low (2), based on the following questions:

1. Could the process problem be solved or improved in a reasonable length of time?
2. Was it measurable?
3. Could improvement be made in less than one year?
4. Does the process have visibility throughout the organization?
5. How important is this process to our operation?

Once the rating was complete, final selection was by secret ballot. The group reached strong agreement on its first choice, that of the engineering change proposal (ECP) process.

Thus, 9 months after being formed, the AIR-04 ESC created its first QMB to tackle this first process. The ECP process was chosen because of its importance and visibility, both internally and externally. The ECP process is complex and requires significant time for approval. AIR-04 was particularly interested in time reduction and streamlining the approval process.

Establishment of the ECP QMB

The AIR-04 ECP QMB was officially established in November 1988, and ultimately assigned a charter signed by AIR-04 RADM J. F. Calvert. AIR-04A Deputy Director Paul Harner was named the linkpin between the AIR-04 ESC and the AIR-04 ECP QMB. He recommended that Paul Kovalsky, AIR-411A, be named Chair because of his knowledge and resourcefulness. The ESC supported this choice. The ECP QMB Chair then selected a board member from each of the AIR-04 functions, based on their knowledge of and experience with the ECP process. These functions are AIR-4104, AIR-410C, AIR-41223A, AIR-41831F, AIR-41723, AIR-433A, AIR-55211. Two AIR-04 logistics interns were assigned data analysis. This Board also includes one voluntary member from AIR-05 (engineering) who coordinates efforts between AIR-04 and AIR-05. In the spring 1989, a facilitator from AIR-4183 was selected by the ECP QMB Chair from a list of trained and available NAVAIR facilitators. Members are listed in Appendix A.

Coordination Between NAVAIR and AIR-04 ECP QMB

NAVAIR initiated formal TQM implementation organization-wide in October 1988, with the establishment of its ESC. As a result, the commander-level ESCs (e.g., AIR-04) were designated as "Group QMBs" whose functions are to charter QMBs and provide resources within their groups. In January 1989, the NAVAIR ESC chartered four QMBs, one of which focused on the ECP process. The NAVAIR ECP QMB included the Chair and two other members of the AIR-04 ECP QMB, as well as representatives from AIR-05 (engineering) and AIR-102 (configuration management and aircraft modification). This QMB has policy-making responsibility and authority for the entire ECP process in NAVAIR, with Group QMBs responsible for processes within their own groups.

QMB Education

All QMB members attended a 1-day awareness and 1-day implementation seminar conducted by NPRDC at AIR-04. NAVAIR training was provided by the Paul Hertz Group; it included a 3-day TQM awareness/implementation seminar, a 5-day executive orientation program, and facilitator training. Some of the QMB members had only the NPRDC training, while others had both NPRDC and Hertz training.

The Paul Hertz Group approach for process improvement embraces five stages: 1) create a positive environment; 2) identify process objectives; 3) identify measurement characteristics; 4) manage process variation; and 5) improve the process. In the Hertz process improvement model, management is largely responsible for Stage 1, creating a positive environment. This is comparable to Deming's Principle 8, Drive Out Fear. (See Appendix B for a list of Deming's 14 Principles.) A Process Improvement Team (equivalent to the QMB in the NPRDC model) then concentrates on the remaining four stages and passes through four "summits" (identified with each stage) in reaching its goal--an improved process. These four stages are similar in concept to the Deming PDCA cycle, which is the foundation of the NPRDC implementation and process improvement models.

ENGINEERING CHANGE PROPOSAL (ECP) PROCESS

ECP Process

An ECP is a proposal for a configuration change to existing operational equipment, including aircraft, engines, missiles, and components. These changes can be for increased safety, improved operations, or general improvement efforts. The ECP process itself is a complex administrative procedure that crosses several functional areas. While most of the functional areas are located at NAVAIR headquarters in Washington D.C., two are located in Philadelphia: technical publications at the Naval Aviation Technical Service Facility (NATSF)

and supply at the Aviation Supply Office (ASO). This necessitates moving the ECP package from one location to the other and back again. The instructions for ECP processing are found in NAVAIRINST 4130.1B, 23 April 1986.

Generally, a change request that generates an ECP will originate in NAVAIR. However, unsolicited ECPs may be generated by the contractor, field activities, or fleet commands. Prior to requesting a formal ECP, the requester must carefully evaluate all ramifications of the change, including:

1. The relative merit of the proposed change versus no change.

2. The work hours, downtime, technical competence, and level or type of facilities required to accomplish the change.

3. The man-hour backlog to incorporate already approved changes.

4. The effect on spares, repair parts, existing retrofit kits, data, and publications.

5. The effect on delivery schedules.

6. The effect upon human factors, personnel training, training equipment, and training devices.

7. The effect on existing support equipment (SE) and test equipment or the need for design, development, and procurement of new SE.

8. The availability of funds.

9. The safety risk assessment of hazard severity and probability of occurrence. Risk assessment results in a classification of either Category I (catastrophic) or Category II (critical).

Change proposals are evaluated in terms of outcome. Do they (1) correct deficiencies, (2) make a significant effectiveness change, (3) effect a substantial life cycle cost savings, (4) prevent slippage in an approved production schedule, or are they (5) identified as value engineering change proposals (VECPs)? VECPs are the result of a review designed to identify potential cost savings measures. Special consideration is given to those changes identified as safety changes (Code S) that have been identified as Category I or II hazardous conditions.

An ECP is received by AIR-1022B (Configuration Management/Aircraft Modification Division) and routed through the Change Control Board (CCB) secretariat for recording and distribution to the cognizant NAVAIR headquarters group or program management office, which may accept the change and issue a decision memorandum (DM) or decline the change in writing, stating its reasons for denial. Once a DM is received by the action codes, they begin a detailed

evaluation of the proposed change and prepare the required CCB change request forms, implementation schedules, and financial summaries. The cognizant AIR-05 Assistant Program Manager (Systems & Engineering) (APM (S&E)) or the cognizant design engineer and cognizant AIR-04 Assistant Program Manager, Logistics (APML) are responsible for directing the review and evaluation of ECPs. Concurrent evaluation takes place within AIR-05 and AIR-04.

AIR-04 Processing

AIR-4113 is the central receiving point for ECPs within AIR-04. It coordinates review among AIR-04 groups to ensure that each proposed change is evaluated by all affected AIR-04 codes. The APML conducts a preliminary review to determine whether affected fleet support areas are adequately addressed. If so, the cognizant AIR-04 agent will be notified so a DM can be expedited. The APML then staffs the proposed change and coordinates with AIR-05 counterparts, affected AIR-04 codes, and support activities. A cost and funding summary and a milestone chart are prepared with input from the support activities. Each change to a weapons system must be adequately supported at the time the first changed items reach the fleet. Unsupportability is grounds for disapproval of an ECP.

A minimum of 120 calendar days from receipt of an ECP at NAVAIR headquarters is normally required to process and implement routine priority ECPs.

AIR-04 ECP QMB ACTIVITIES

The AIR-04 ECP QMB first began meeting and documenting the ECP process at the end of September 1988, although the formal charter was not dated until November and not received by the QMB until March 1989 (Appendix C). Difficulties in convening the QMB arose in December and January because the Chair was involved in a contract source selection evaluation and was away from AIR-04 for lengthy periods of time.

Two-Phase Strategy for Process Improvement

A two-phase process was endorsed by the AIR-04 Group QMB (formerly the AIR-04 ESC) for process improvement. First, the ECP QMB would identify and remove special causes, or those causes of variation that can be addressed by the workers in the process, for example, waste and complex procedures. Secondly, it would identify common causes, or those variations within the process that can be addressed only by management, and implement changes to improve the system. This two-phase strategy is endorsed by both Deming and TQM proponents, that is, bring the system into statistical control by eliminating special causes before introducing system changes.

The ECP QMB initially tried to review the ECP process for aircraft, engines, missiles, and components. Its charter specifically defines the process as one that spanned "NAVAIR

receipt of the ECP to NAVAIR approval of the change; concentration will be on that portion of the process that goes thru [*sic*] AIR-04." The QMB's charter identified excessive lengths of time for AIR-04 ECP approval as the problem, but specific time goals were not established.

The QMB found that review of the entire ECP process was too broad in scope and encompassed too many variables. The facilitator helped the Board to begin thinking in a narrower vein and to focus its efforts on just one component of the process. The members reduced the scope of their vision to airframe change proposals, which represent the greatest percentage of the modification budget. They also reduced the time frame to that period bounded by receipt of the ECP by AIR-04 to approval of the cost/funding summary and milestone chart (CF/MS).

Preliminary Data Analysis

The QMB spent some time identifying the process. They identified people, machines, methods, materials, environment, input, and output. The process customers and managers and expectations of each were identified, as were key individuals (Appendix D). During this phase, members reviewed all pertinent instructions, reviewed the aircraft modification (MOD) process training material, conducted interviews with AIR-04's mini-Change Control Board (CCB) members, observed some CCB meetings, and attended operational, safety, and improvement program (OSIP) training. Following that data collection effort, the QMB briefed the AIR-04 Group QMB.

The Board collected and analyzed time data from the AIR-04 Modification Management Information System (MODMIS) data base, ECP status sheets, and OSIP training course test results. In addition, they conducted structured interviews with APMLs, logistics managers (LMs), and logistic element managers (LEMs). The interview questions are listed in Appendix E.

The last five ECPs to exit the system each month between October 1984 and March 1989 were selected as the sample base from which to collect historical time data; that is, the number of days expended from receipt of the program manager's DM to approval or disapproval of the ECP. Means and ranges were computed for each month's data and plotted on a run chart. Visual examination of these data revealed four "high" spikes. Further investigation indicated these "spikes" were caused by ECPs that had been cancelled or disapproved without prejudice, but were not removed from the MODMIS.

The QMB informed the Configuration Management and Aircraft Modification Division (AIR-102) of these data entry problems; AIR-102, in turn, implemented a formal process change to the MODMIS. This change requires all program managers to review open ECPs on a regular basis and to provide an action plan for all ECPs that exceed the planned CCB dates. This should result in reducing the mean time ECPs remain in the approval process, including the time spent in AIR-04. However, it is dependent on the program managers' responsiveness in updating the

information sent to AIR-102. This step is consistent with initial process analysis procedures, whereby a process may be "cleaned up" when obvious complexities or redundancies become evident.

After the four "spiked" data points were removed from the data base, new monthly means, ranges, and control limits were computed. These data are displayed in Table 1. The complete control chart can be found in Appendix F.

Table 1
Comparison of Run Chart Data

	Days	Range
Mean Time	89/85[a]	145/127[a]
UCL[b]	158	269
LCL[b]	12	0

[a] Before change/After change.
[b] The upper control limit (UCL) and lower control limit (LCL) were not computed until the "spiked" data were removed.

A second problem surfaced very early in the data-gathering stage. ECPs have approval channels in both AIR-04 and AIR-05; however, AIR-05 did not use the AIR-04 MODMIS data base to track the ECP process. Therefore, it was impossible for AIR-04 to know whether a delay was in AIR-04 or in AIR-05.

This problem had also been addressed by NAVAIR's Acquisition Improvement Team (established before the current TQM implementation effort and still in place). As a result of the work of these two groups, a recommendation was made to make AIR-04's MODMIS the NAVAIR standard data base to be used by all NAVAIR groups and commands. This was mandated by VADM J. B. Wilkinson (Commander, NAVAIR) in Acquisition Bulletin #11, dated 9 May 1989. This standardization will streamline the process and aid in identification of systemic problems.

These two examples readily identify the types of special causes that can be corrected, resulting in reduced waste and a streamlined process. Coordination and implementation of the recommendations were accomplished with minimal difficulty because of those members who link AIR-04's QMB and NAVAIR's ECP QMB.

Identification of Common Causes

From the flow charts developed, the AIR-04 ECP QMB was able to identify areas where concurrent review of the ECP could take place, notably, between Support Equipment Logistics Management Division (AIR-417) and Support Equipment Division (AIR-552) (Appendices G and H). This constitutes a change to the process, not elimination of a special cause. The basic thrust for this effort is to bring AIR-552 directly into the AIR-04 ECP process, similar to all other elements of Integrated Logistics Support (ILS), which should reduce processing time within AIR-417. To measure its effects, the Board will collect new historical baseline data through implementation of the change. This new data will help the Board measure both the effects resulting from elimination of special causes and from system changes.

CONTINUING EFFORTS

Establishment of a Process Action Team (PAT)

Using NPRDC's process improvement model as a guide, the AIR-04 ECP QMB chartered a Process Action Team (PAT) in August 1989. A candidate for the PAT Chair was proposed by the QMB Chair and was ratified by the QMB members. Although the Chair does not currently work in the process, selection was based on the candidate's knowledge and previous experience with the ECP process. The Chair also is a former member of AIR-04's CCB. Individual PAT members were selected by the PAT Chair.

Initial responsibilities of the PAT are to validate the data received in the interviews conducted by the QMB. They will also review recently approved CCB cost and funding and milestone charts to determine if comments made regarding quality and executability of ECPs are valid. They will define criteria by which each ECP should be judged. These recommendations will be reviewed by the QMB. However, the main thrust of the PAT will be to evaluate and improve AIR-04's ability to implement changes once approved.

Identification of Other ECP-Related Issues

Using the Hertz Group exercise for customer identification, the QMB identified customers and managers and their expectations. They then ranked the expectations in order of priority. In doing this, they discovered that timeliness, the problem they were working on, had the lowest priority, ranking fifth in a group of five expectations. It was preceded by the need for clear, implicit instructions (#4); for complete and accurate ECPs received from the contractor (#3); for ECPs that meet the requirements (#2); and for ECPs that are executable, both financially and in terms of scheduling (#1). In a brainstorming session, the QMB developed a list of 10 actions that contribute to an ECP that fully meets all five expectations. From that list, they identified which ones supported each of the five expectations and rank-ordered them for each of the five expectations.

It became apparent to the AIR-04 ECP QMB that concentrating on timeliness was too narrow a focus. The QMB feels the more important issues are those that contribute to an accurate, "doable" ECP. These issues are:

1. Improved training in the planning and preparation of CCB documentation.
2. Reviewing for correctly formatted ECPs submitted to AIR-04.
3. AIR-04 OSIP coordination.
4. Current processing within divisions, for example, PMA-205.
5. Improved coordination between common system and aircraft personnel.

Concentrating on those issues should result in less rework and should also reduce time from receipt to approval.

New measurement characteristics are being explored by the QMB to determine how to measure changes in dimensions other than time. This leads the group directly into the next round of the PDCA cycle, central to NPRDC's concept of continuous improvement.

CONCLUSIONS AND RECOMMENDATIONS

Process Definition

In the beginning, the ESC had little guidance or directions for proceeding, nor did it have an external facilitator to help it begin the implementation process. Although this may pose problems, the experience seems to be typical and may be a necessary part of the implementation process. Perhaps only after some months of learning about TQM theory and its application to the daily work processes can serious implementation efforts get underway.

The AIR-04 ECP QMB charted new waters. It was the first QMB chartered by AIR-04 or by NAVAIR. As such, there was little profound knowledge available to aid members in this undertaking. Their charter stated that they should review the process from receipt of the ECP at NAVAIR to the approval or disapproval of the ECP, with emphasis on the AIR-04 functions. This was a false start because the entire process is much too large and complex to be readily analyzed at one time. Once this was recognized, the Board concentrated on only one type of ECP, airframe. NAVAIR's ESC also addressed the problem of dealing with a large complex process and subsequently established Group QMBs to oversee the entire system, with lower-level QMBs established for particular areas.

Work Prioritization

Management must address work prioritization. Initially, TQM team (ESC/QMB/PAT) work may require substantial amounts of time for implementation efforts to be successful. People may need to be excused from other responsibilities to meet the TQM implementation requirements. As TQM is fully integrated into the workplace as a management philosophy, there should be fewer problems associated with work priority.

Education and Training

Members expressed concern about being selected for a QMB before receiving adequate training. They did not think the 1-day awareness and 1-day implementation seminars conducted by NPRDC provided sufficient training to understand fully their roles as QMB members.

The AIR-04 QMB facilitator attended three TQM training sessions, including a Deming 4-day seminar, before attending facilitator training. This was considered optimal by the facilitator. He felt the "light turned on" during that fourth training session, and he could readily see the applicability of TQM to the Department of Defense environment. He noted that some people in his class had not received a firm foundation in TQM before going to the facilitators' course.

Just-In-Time (JIT) is a concept that should be used in planning training so that training occurs at a time when it is most useful. For example, training should precede assignment to a particular role, such as membership on a QMB or PAT.

These issues can only be addressed by management. Monitoring the TQM training received by each employee and ensuring that the proper sequence of courses is followed are ongoing management tasks.

Emphasis on Immediate Results

Understandably, NAVAIR and AIR-04 are anxious to be on-board with TQM and to make measurable improvements to their processes in support of customer requirements. At the same time, too much emphasis on bottom line or measurable process improvement led QMB members to express a fear that nothing had changed. They felt pressure to produce "something."

Process improvement is an ongoing, long-term effort. Certainly, as people become more familiar with the TQM tools and methodology, front-end activity will proceed more smoothly and results may be evident earlier. However, in these first efforts, heavy emphasis on rapid change of the process does not foster TQM thinking.

Documentation

The Air-04 ECP QMB charter includes a directive to write a case study of its process improvement effort. This report is the first installment and is the result of close collaboration between the AIR-04 ECP QMB and NPRDC. For future documentation, the QMB should select a secretary or recorder to maintain a record of actions taken. The official record should include all flow charts, diagrams, statistical computations, control charts, etc., that are completed for the process. These are important tools for tracking completed work.

In summary, AIR-04 and the ECP QMB have done an admirable job implementing TQM. Two special causes were identified and changes implemented to prevent their reoccurrence, thus streamlining the overall process. A system change was also implemented, involving the concurrent review of documents by AIR-417 and AIR-552, a change that should have a positive impact on the time it takes AIR-04 to approve an ECP. Data to support that assumption will be collected over the next few months.

AIR-04 has plotted a new course and demonstrated great commitment to pursuing continuous improvement. False starts and unpredictable delays will undoubtedly occur along the way; however, the lessons learned will be invaluable in the continuing TQM effort.

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APPENDIX A

ECP QMB MEMBERSHIP

APPENDIX A

ECP QMB MEMBERSHIP

Paul Kovalsky, AIR-411A (Chair)
Bruce Doubleday, Facilitator
Jerry Beck, AIR-4104
Keric Hopkins, AIR-41831F
Marlene Montilla, AIR-410C
Paul Ritter, AIR-55211
Robert Schultz, AIR-41223A
Ginger Toucher, AIR-41723
Ed White, AIR-433A

Cindy Taylor, Logistics Intern
Mike Taylor, Logistics Intern

APPENDIX B

DEMING'S 14 PRINCIPLES OF MANAGEMENT

DEMING'S 14 PRINCIPLES OF MANAGEMENT

1. Create constancy of purpose towards improving products and services, allocating resources to provide for long-range needs rather than short-term profitability.

2. Adopt the new philosophy for economic stability by refusing to allow commonly accepted levels of delays, mistakes, defective material, and defective workmanship.

3. Cease dependence on mass inspection by requiring statistical evidence of built-in quality in both manufacturing and purchasing functions.

4. Reduce the number of suppliers for the same item by eliminating those that do not qualify with statistical evidence of quality; end the practice of awarding business solely on the basis of price.

5. Search continually for problems in the system to constantly improve processes.

6. Institute modern methods of training to make better use of all employees.

7. Focus supervision on helping people do a better job; ensure that immediate action is taken on reports of defects, maintenance requirements, poor tools, inadequate operating definitions, or other conditions detrimental to quality.

8. Encourage effective, two-way communication and other means to drive out fear throughout the organization and help people work more productively.

9. Break down barriers between departments by encouraging problem solving through teamwork, combining the efforts of people from different areas such as research, design, sales, and production.

10. Eliminate use of numerical goals, posters, and slogans for the work force that ask for new levels of productivity without providing methods.

11. Use statistical methods for continuing improvement of quality and productivity, and eliminate work standards that prescribe numerical quotas.

12. Remove all barriers that inhibit the worker's right to pride of workmanship.

13. Institute a vigorous program of education and retraining to keep up with changes in materials, methods, product design, and machinery.

14. Clearly define top management permanent commitment to quality and productivity and its obligation to implement all of these principles.

APPENDIX C

NAVAIR QMB CHARTER

NAVAIR Quality Management Board (QMB)
Charter# 04-01

The following QMB is officially chartered by AIR-04 GRP QMB to work on the following process using Total Quality Management (TQM) techniques and methodology:

Process Description:

Engineering Change Proposal (ECP) process from NAVAIR receipt of the ECP to NAVAIR approval of the change; concentration will be on that portion of the process that goes thru AIR-04. Problems seem to be the length of time it takes for ECP's to get approved.

Date of Commencement November 1988

Chairperson Paul Kovalsky Code AIR-411A Phone 692-3212

Board Members (name/code)

Jerry Beck/4104	Ed White/433A
Marlene Montilla/410C	Paul Ritter/55211
Robert Schultz/41223A	Mike Taylor/Intern
Kerry Hopkins/418	Ginger Toucher/41723

Resource Sponsor (upper link-pin) Paul Harner Code 04A Phone 692-2690

Facilitator Mr. Bruce Doubleday Code 4183 Phone 692-8182

Reviewing Authority AIR-04 GRP QMB

Last Review 2/14/89

This QMB is linked to the following QMB 00-02 Link-pin Paul Kovalsky

In the execution of this assignment, the QMB is authorized to charter one or more Process Action Teams (PAT) to collect data and assist in analysis requirements. The following PAT's are active:

PAT#1 Date Commenced _____ Chairman _____ Code _____

Phone _____

PAT#2 Date Commenced _____ Chairman _____ Code _____

Phone _____

Reviewing Authority

APPENDIX D

AIR-04 ECP PROCESS AS DEFINED BY THE QMB

AIR-04 ECP PROCESS
AS DEFINED BY THE QMB

Process Boundaries/Title:

Start Point: Receipt of ECP in AIR-04 (410C)
End Point: CCB Board Decision
Process Title: AIR-04 Aircraft ECP Process

Process People:

AIR-410C APMLs
AIR-433 AIR-412
AIR-417 AIR-552
PMA-205 NATSF
ASO

Process Machines:

MODMIS (Computer)
Typewriters/Word Processors
Copy Machines
Calculators

Process Methods:

Matrix Review/Sign-off
Control Board Review/Approval
Matrix Routing
Configuration Control Manual (4130.1B)
MODMIS Program Software
MIL-STD-480

Process Materials:

Forms: 13050/2 (CCB MAT)
13050/2C (Change Requirement for SE)
13051/3 (C&F Summary)
13051/5 (Milestone Chart)

PMA Decision Memo
APML Implementation Letter
TYCOM Approval Letter/Form

Process Environment:

High Density Office Space
High Individual Workload
Limited Staffing
Competing Priorities
Travel Commitments
CWS

Poor Internal Routing/Mail System
Diverse Physical Locations of Reviewers (i.e., ASO)
Limited Conference Room Space
Limited Storage Space

Process Input:

Receipt of ECP
Decision Memo from PMA

Process Output:

CCB Approval/Disapproval
Completed Form 13051/3 (C&F)
13051/5 (Milestones)
TYCOM Concurrence
Implementation Assignments

Process Statement:

Title: AIR-04 Aircraft ECP Process

Components: People
Materials
Machines
Environment
Methods

Input: Receipt of ECP/PMA Decision Letter

Output: LEMs Products into CCB Formats

Value Added: Screens out/Resolves:

Technically Unsound ECPs
Unsupportable ECPs
Nonaffordable ECPs

Ensures:

Identification of Required Resources
Identification and Assignment of Implementing Actions

Process Customers (i.e., customers who are going to have to do something: they will receive an action item, not a finished product):

PMA
APML
PCO/ACO
Class Desk
AIR-514
AIR-102
AIR-552/417
PMA-205

ASO
NATSF
AIR-412
AIR-43/NADOC/NAMO

Process Managers:

APMLs
AIR-412
PMA-205
AIR-552/417
ASO
NATSF
AIR-410C
AIR-43/NADOC/NAMO

Customer Expectations:

	PRI
Requirement (meets a need)	1
Decision (approval)	2
Accurate	2
Complete	4
On time (CCB Date)	5

Manager Expectations:

	PRI
Decision	1
Accurate	1
On time (CCB Date)	3
Complete	3
Executable (funding)	3

Key Individuals:

APMLs
AIR-410C
AIR-412
AIR-552/417
PMA-205
ASO
NATSF

Measurement Characteristic:

Time

APPENDIX E

INTERVIEW QUESTIONS

INTERVIEW QUESTIONS

1. What is your involvement in the OSIP [operational, safety, and improvement program] process and planning for ECP processing in general?

2. What are your procedures for processing ECPs? Please discuss the following:

    a. ECP planning/coordination meetings with PMA, Class Desk, Prime Contractor, and Field Activities.

    b. Preparation of Cost & Funding and Milestone charts.

    c. ECP routing and chops through AIR-04.

    d. Interface with LM/LEMs for processing ECPs (ECP team meetings).

3. How do you track status of ECPs from receipt through implementation?

4. How does ECP processing fit with your priority of workload?

5. What would you recommend we do to improve the ECP process?

APPENDIX F

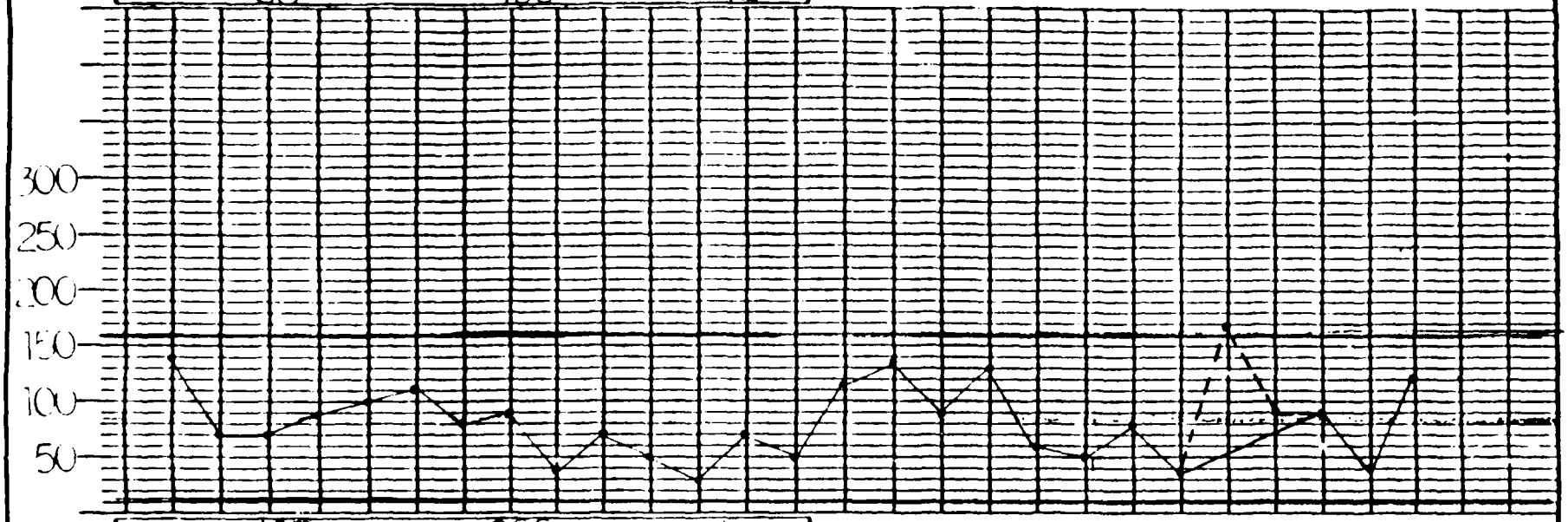
CONTROL CHART

CONTROL CHART

	OPERATION: ACCB ECP PROCESSING TIME	
DATES: 10/84 - 12/86	CHARACTERISTIC: RECEIVED 04 - CF/MS SIGNED	SAMPLE SIZE/FREQUENCY: MONTHLY BY DECISION DATE

$\bar{R}$ - Average R - 85 UCL - $\bar{\bar{X}} + A_2\bar{R}$ - 58 LCL - $\bar{\bar{X}} - A_2\bar{R}$ - 2

AVERAGES (X BAR CHART)



$\bar{R}$ - Average R - 127 UCL - $D_4\bar{R}$ - 269 LCL - $D_3\bar{R}$ - 0

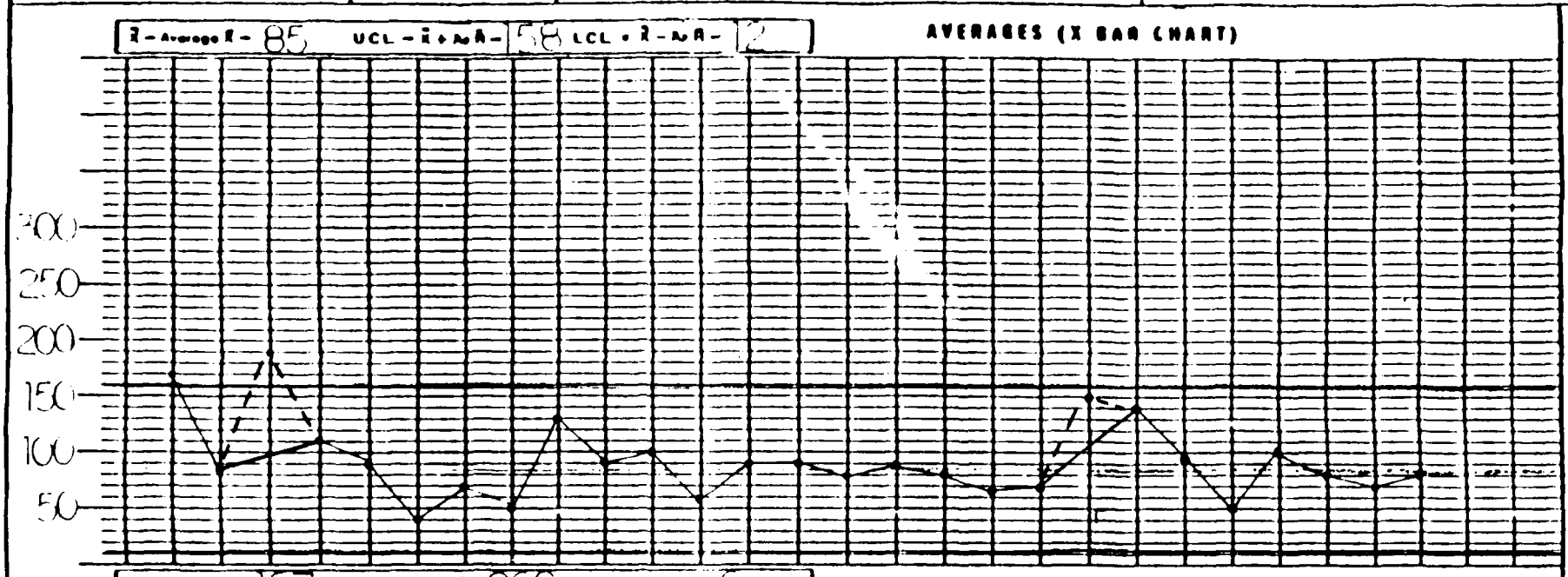
RANGES (R CHART)

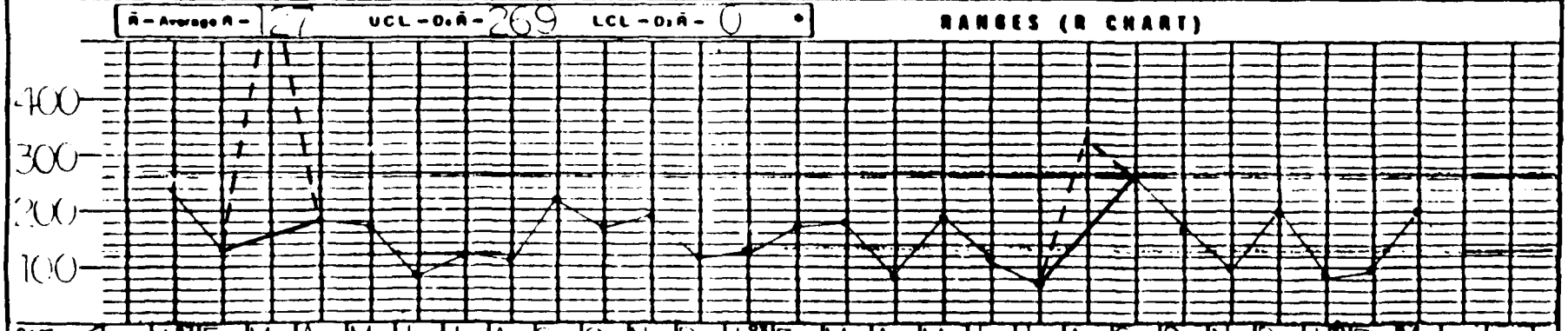
DATE / TIME	OCT 84	NOV	DEC	JAN 85	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN 86	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
SUBGROUPS 1	170	52	119	83	75	17	47	85	23	66	115	1	40	71	104	147	76	141	118	88	80	63	161	1	64	9	243
2	102	50	42	67	65	127	55	77	50	81	49	25	145	1	45	76	146	111	84	21	95	42	407	25	101	56	70
3	172	33	64	55	142	115	127	86	25	99	1	51	54	61	98	220	99	72	30	37	45	1	72	71	74	45	71
4	134	81	76	196	140	188	57	1	85	96	73	21	94	58	92	92	70	134	40	55	135	70	74	75	88	44	139
5	126	132	64	63	81	112	100	192	27	28	18	54	51	50	239	135	71	205	42	43	47	1	126	280	130	57	97
SUM																											
$\bar{X}$ - AVG OF SUBGROUPS	142	69	73	93	101	112	77	88	42	74	51	30	77	48	116	134	92	133	63	49	80	35	188	90	91	42	124
R - RANGE OF SUBGROUPS	74	100	77	141	77	171	80	191	62	71	114	53	105	70	194	144	76	133	88	67	90	69	581	279	60	48	173

F-1

CONTROL CHART

OPERATION: ACCB ECP PROCESSING TIME
CHARACTERISTIC: RECEIVED 04 - CF/MS SIGNED
DATES: 1/87 - 3/89
SAMPLE SIZE/FREQUENCY: MONTHLY BY DECISION DATE





DATE / TIME	JAN 87	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN 88	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN 89	FEB	MAR
1	55	35	17	60	64	70	65	1	238	70	49	34	45	74	192	59	91	61	127	174	46	71	102	111	87	88	204
2	202	86	253	206	74	3	137	111	22	143	49	120	55	1	14	55	40	51	57	103	173	11	1	129	47	31	87
3	161	102	1	19	215	44	112	1	109	1	130	1	99	160	104	61	63	127	49	23	292	56	42	216	42	68	34
4	127	38	118	141	43	14	14	117	216	70	82	28	178	41	44	153	194	72	49	106	32	178	56	19	94	126	67
5	294	164	568	134	65	83	44	35	62	168	235	106	95	172	48	135	1	12	68	354	156	161	43	63	133	24	1
SUM																											
R̄ - AVG OF RANGES	168	85	282	112	92	43	74	53	129	90	109	58	94	90	80	93	78	65	70	152	140	95	49	108	81	67	79
X̄ - GRAND AVG	239	129	567	187	172	80	123	116	216	167	186	119	133	171	178	98	193	115	78	334	360	167	101	197	91	102	208

F-2

APPENDIX G

ECP FLOW CHARTS

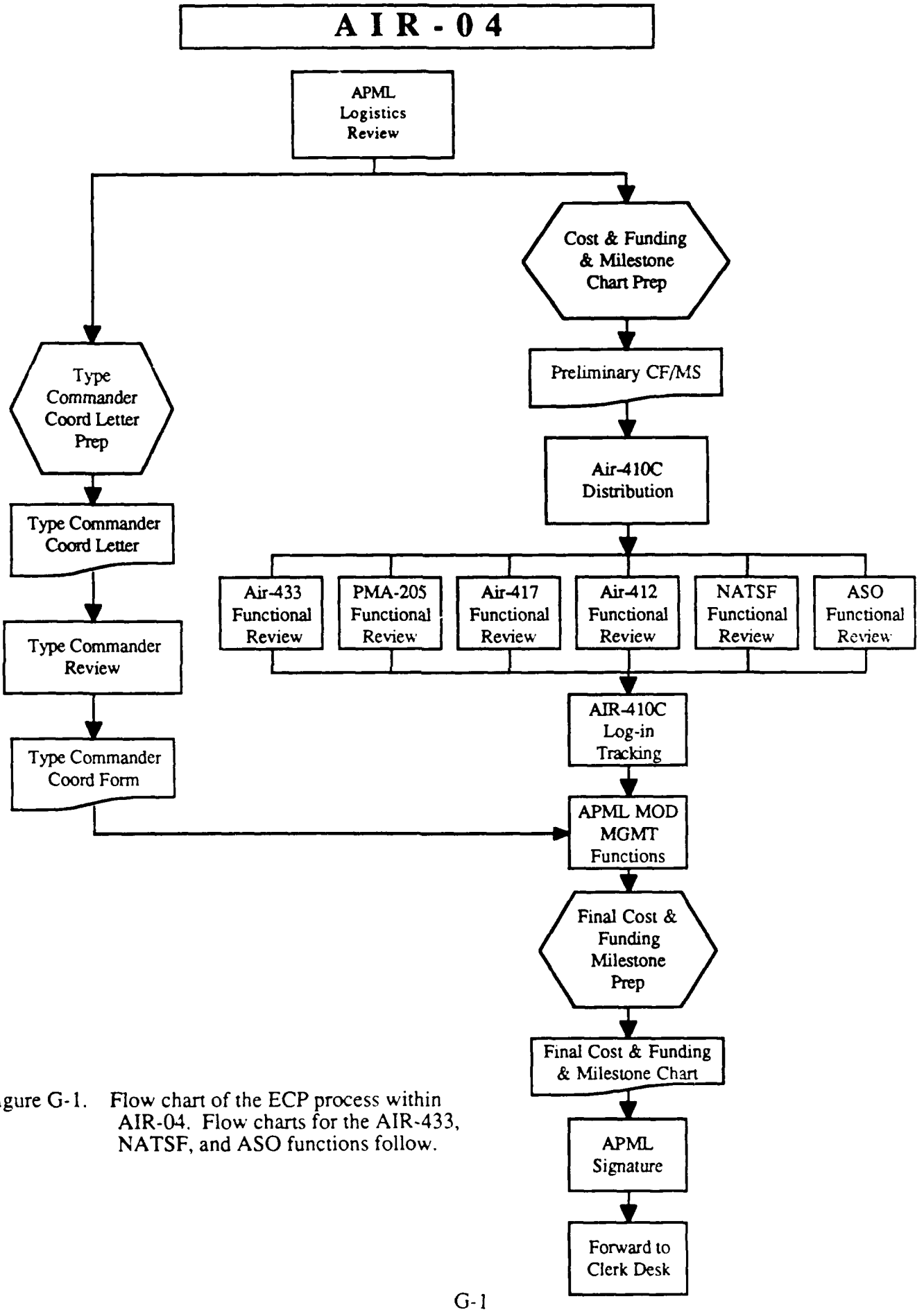


Figure G-1. Flow chart of the ECP process within AIR-04. Flow charts for the AIR-433, NATSF, and ASO functions follow.

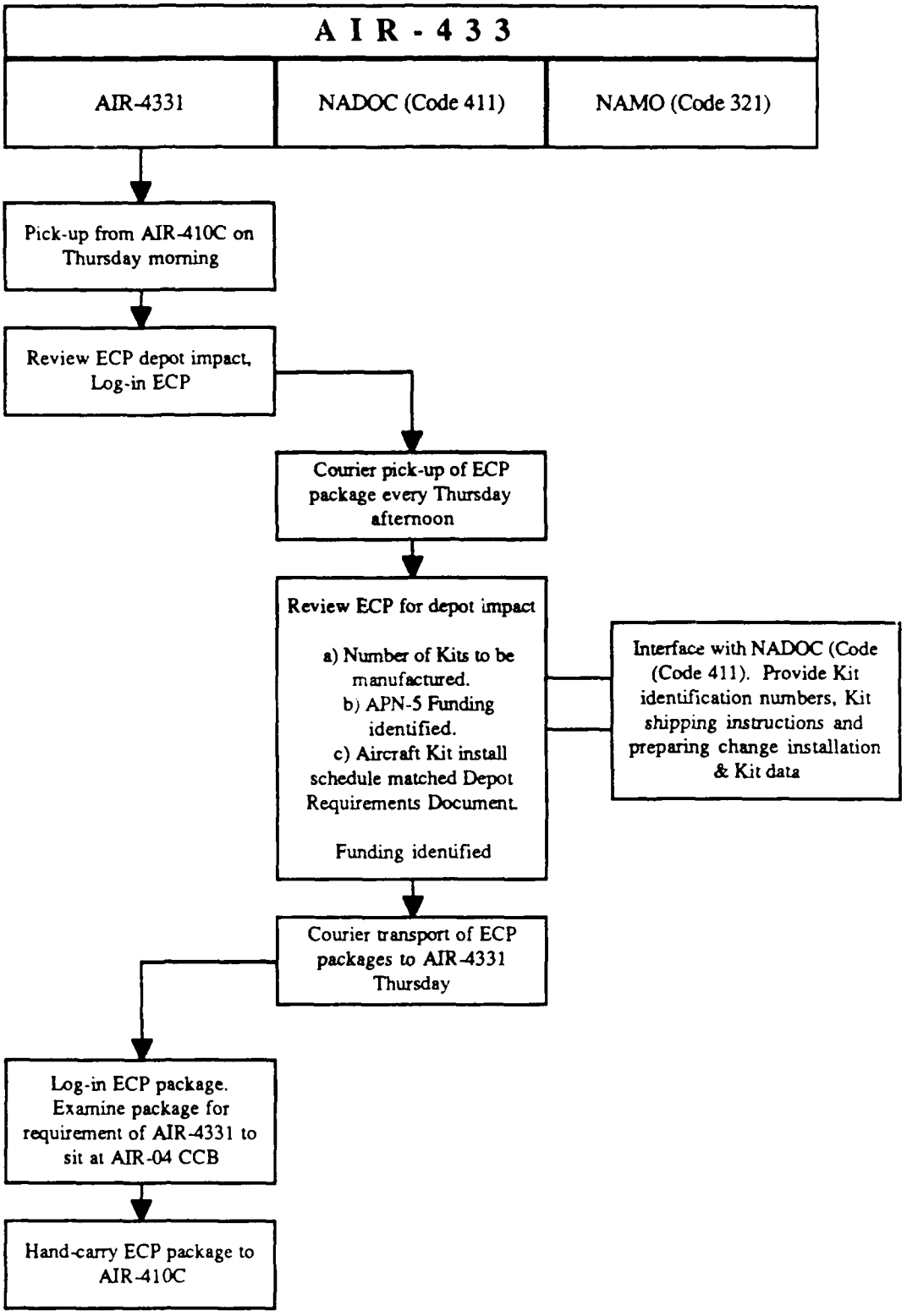


Figure G-2. Flow chart for the AIR-433 function.

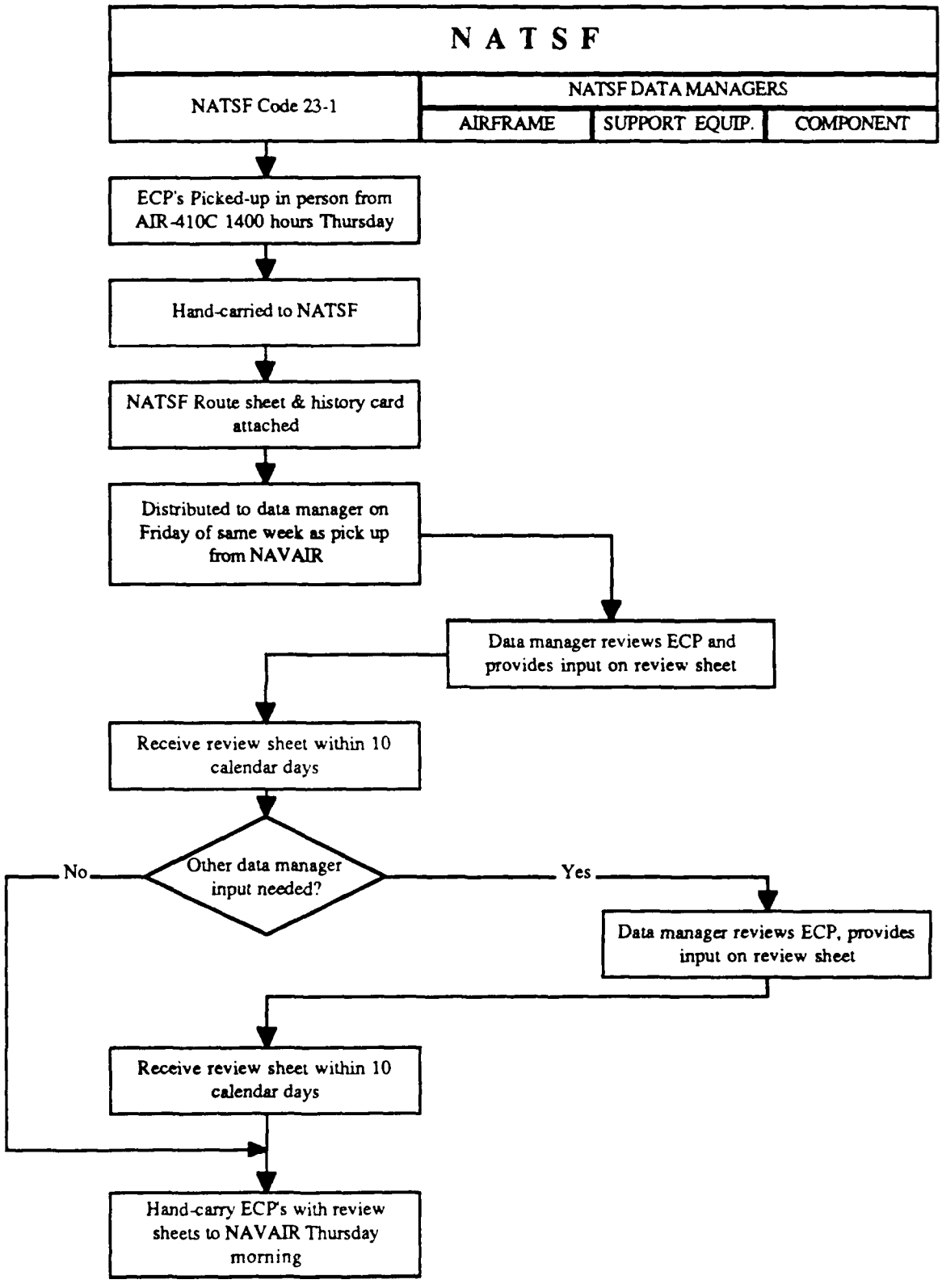


Figure G-3. Flow chart for the NATSF (Naval Aviation Technical Service) function.

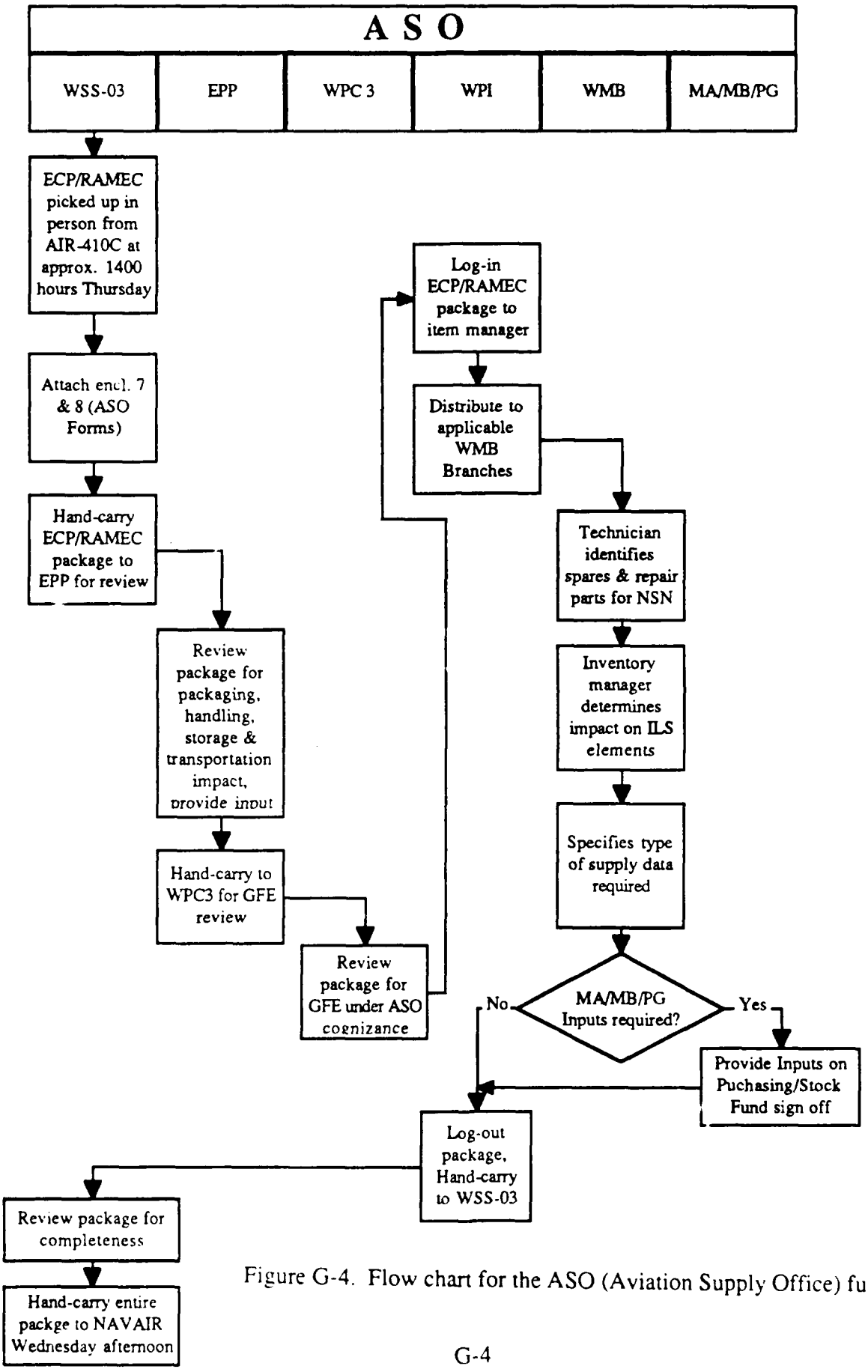


Figure G-4. Flow chart for the ASO (Aviation Supply Office) function.

APPENDIX H

SUPPORT EQUIPMENT PROGRAM MEMORANDUM OF AGREEMENT (SEPMOA)

13600
AIR-417/AIR-552

SUPPORT EQUIPMENT PROGRAM MEMORANDUM OF AGREEMENT (SEPMOA)

From: AIR-417/AIR-552

Subj: SUPPORT EQUIPMENT PROGRAM ENGINEERING CHANGE PROPOSAL PROCESSING; POLICY, PROCEDURES AND RESPONSIBILITIES FOR

Ref: (a) NAVAIRINST 4130.1B
(b) NAVAIR Manual 00-25-300

Encl: (1) AIR-417/AIR-552 ECP Flow Diagram (Overview)

1. Purpose. This SEPMOA establishes policy and procedures for the processing of Engineering Change Proposals (ECPs) between AIR-552 and AIR-417 prior to submission to the Change Control Board and in accordance with references (a) and (b).

2. Background. Currently ECPs are parallel routed from AIR-410C through other AIR-04 codes such as AIR-418, AIR-412 and AIR-417. To date, AIR-552 has not been included in this routing procedure. Since AIR-552 is the Logistics Element Manager for SE for AIR-410, the inclusion of AIR-552 in the routing vice AIR-417 would provide the Acquisition Manager information, such as the Cost and Funding and Milestone Charts, on which to base SE acquisition decisions for the respective modification.

3. Scope. This SEPMOA applies to all aircraft, component, and engine ECPs which are processed through NAVAIR, excluding RAMECs.

4. Policy. AIR-552 and AIR-417 are responsible for timely and effective processing of ECPs that are routed through the NAVAIR organization. They ensure that essential support functions and tasks are identified, approved and funded in a consistent and systematic manner.

5. Definitions. The following definitions apply:

a. Functional Acquisition Managers (AMs)--Individuals in AIR-552 with specific functional/commodity/program element area acquisition management responsibilities for SE.

b. Weapon System Assistant Program Manager Logistics (APML)--Individuals in AIR-04 with overall systems integrated logistics support responsibility for a given weapon system.

c. APML/Logistics Manager (APML/LM)--Individuals in AIR-417 with integrated logistics support management responsibilities for SE, whether they are commodity managers or program element managers.

d. Support Equipment Project Officers (SEPOs)--Individuals in AIR-552 with responsibility to manage the overall support equipment program for a given weapon system.

e. Avionics Support Officers (ASPOs)--Individuals in AIR-552 with responsibility to manage the avionics support equipment program for a given weapon system.

f. Configuration Manager (CM)--Individuals in AIR-417 and AIR-552 with responsibility as focal points for all ECPs processed in their respective codes. They are the AIR-417 and AIR-552 representatives to the CCBs. AIR-552CM will attend the AIR-04 "mini-board" prior to the afternoon CCB in order to sustain continuity of information flow and report on status of 05 ECPs.

6. Procedures/Responsibilities: Within the guidelines of references (a) and (b), and expanding on the enclosure (1) overview, the following procedures will apply:

a. AIR-552 will replace AIR-417 in the routing chain from AIR-410C which is in concert with the established Logistics Element Manager (LEM) concept.

b. AIR-552 CM will receive the ECP copy that contains the cost and funding (C&F) and milestone (MS) pages prepared by AIR-410 APML.

c. AIR-552 CM will log in ECP and staff the ECP through the applicable AM/SEPO/ASPO for a given system.

d. The AIR-552 AM/SEPO/ASPO will concur on the C&F/MS or make necessary changes and prepare the NAVAIR 13050/2C sheet, which identifies the costs associated with the acquisition/modification of SE, if SE impact is identified. Upon completion of the NAVAIR 13050/2C sheet, the AM/SEPO/ASPO will attach it to the ECP and forward the ECP to the AIR-552 CM, notating the proper routing on the route sheet of the applicable AIR-417 APML/LM.

e. The AIR-552 CM will log-out the ECP to the AIR-417 CM and hand carry the package, including the NAVAIR 13050/2C sheet, to the AIR-417 CM.

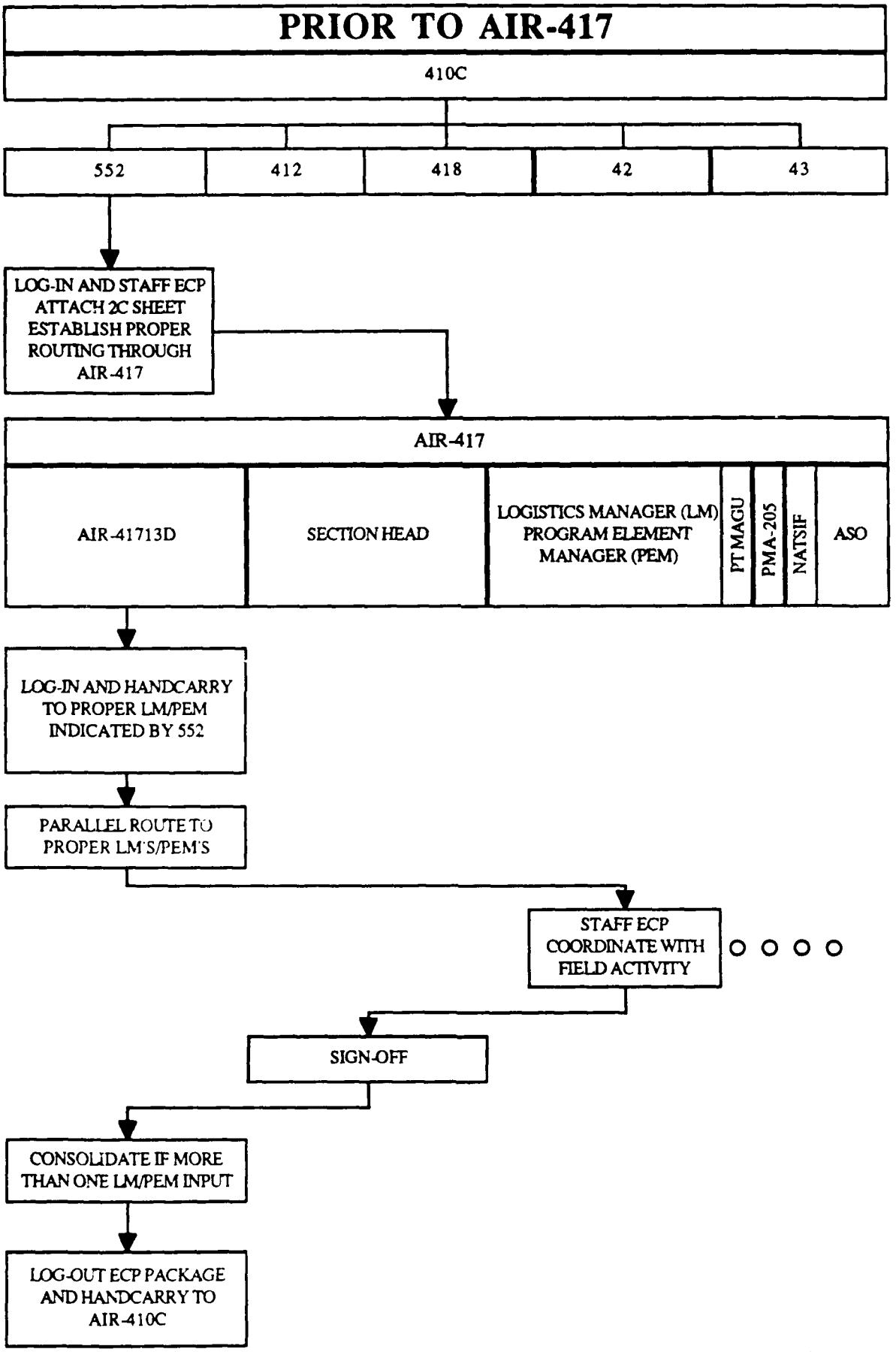
f. The AIR-417 CM will log-in the ECP and staff through the annotated codes on the route sheet. If more than one code is necessary for staffing, (i.e., more than one piece of SE), the AIR-417 CM will make copies of the route sheet, ECP cover sheet, C&F/MS and parallel route to AIR-417 codes. The AIR-417 CM will retain complete ECP package. If only one AIR-417 code is on route sheet, the AIR-417 CM will log in the ECP and hand carry ECP package to proper APML/LM.

g. The applicable AIR-417 APML/LM will staff the ECP, providing logistics input on the SE as outlined by the NAVAIR 13050/2C sheet. This will include inputs from field activities and LEMs, if required.

h. After staffing is complete, the AIR-417 APML/LM will return the package to the AIR-417 CM, who will consolidate the inputs for the parallel routed ECPs on the master ECP, log-out and hand carry the consolidated package to AIR-410C. For ECPs that are not parallel routed, the AIR-417 CM will log-out the package and hand carry to AIR-410C.

T. W. Rogers
Cdr, USN

C. R. Munsey
Capt, USN


PRIOR TO AIR-417
410C
552
412
418
42
43
LOG-IN AND STAFF ECP ATTACH 2C SHEET ESTABLISH PROPER ROUTING THROUGH AIR-417
AIR-417
AIR-41713D
SECTION HEAD
LOGISTICS MANAGER (LM) PROGRAM ELEMENT MANAGER (PEM)
PT MAGU
PMA-205
NATSIF
ASO
LOG-IN AND HANDCARRY TO PROPER LM/PEM INDICATED BY 552
PARALLEL ROUTE TO PROPER LM'S/PEM'S
STAFF ECP COORDINATE WITH FIELD ACTIVITY
SIGN-OFF
CONSOLIDATE IF MORE THAN ONE LM/PEM INPUT
LOG-OUT ECP PACKAGE AND HANDCARRY TO AIR-410C

Enclosure (1)

DISTRIBUTION LIST

Commander, Naval Air Systems Command
Assistant Commander, Fleet Support and Field Activity Management (AIR-04) (5)
Defense Technical Information Center (DTIC) (2)