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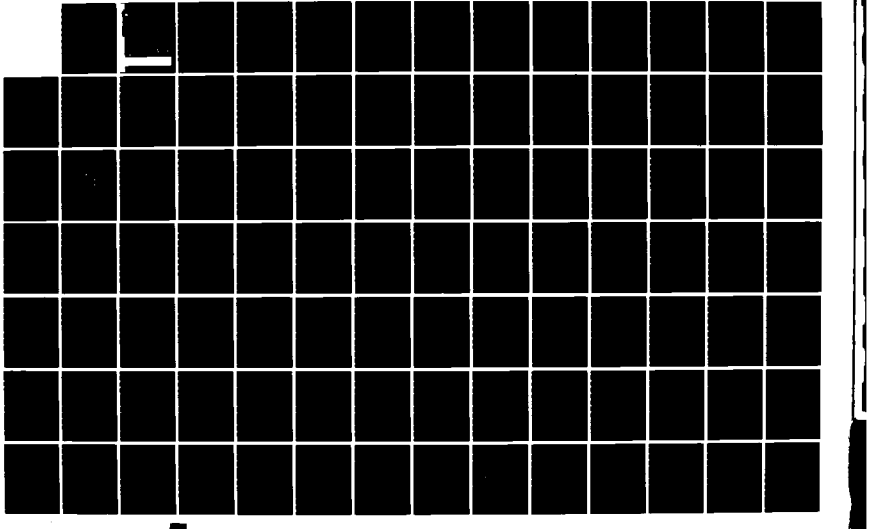

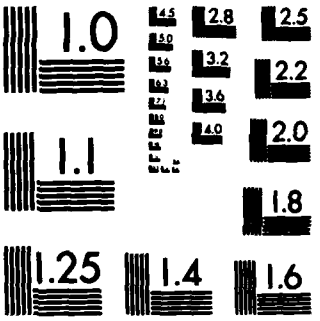

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Technical Report: NAVTRAEQUIPCEN 82-M-1131-1

FLEET PROJECT TEAM PARTICIPATION IN MAJOR AVIATION TRAINING DEVICE DEVELOPMENT, ACQUISITION AND SUPPORT

John P. Charles
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Final Report June 1984

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

A survey and analysis of the Fleet Project Team support requirements was conducted. A survey of typical team functions was completed. An analysis of the procedures involved in major aviation training device acquisition and support was conducted. Feasible solutions to Fleet Project Team problems in supporting trainer life cycle design, development, operation and modification/update were developed and recommendations made.

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EXECUTIVE SUMMARY

A series of studies of major aviation simulator instructor console designs undertaken by the Naval Training Equipment Center in 1982, revealed a variety of operating and utilization problems. The reports concluded that many of these problems should have been detected and solved during the development cycle. The reports also concluded that many of them resulted from the lack of critical inputs and actions by the Fleet Project Teams (FPTs).

As a consequence, the Commander Naval Air Force, United States Pacific Fleet initiated an effort through the Naval Training Equipment Center to identify the guidance and support required by the teams to effectively fulfill their functions. The project involved the analysis of typical FPT operations and major aviation training device acquisition and support procedures and the development of feasible solutions to enhance FPT functioning. The F-14 and E-2 FPTs at the Naval Air Station Miramar, California were utilized as representative FPTs.

FPT FUNCTIONAL PROBLEMS

The duties of the FPT as outlined in the implementing instruction (OPNAV INSTRUCTION 1551.7B "Fleet participation in development, acquisition and acceptance of major training devices") were reviewed in terms of typical FPT operations. The conclusion was reached that the FPTs did not and could not complete the roles and functions outlined as currently organized. The major problems outlined (pages 15-19) included:

a. The FPT's organization, authority, and responsibilities are not defined. As a result a variety of organizations and functional modes exist, none of which is truly effective in ensuring user inputs to the trainer life cycle development and support procedures.

b. The FPTs are not routinely invited to the trainer meetings, conferences, or reviews outlined in the instruction or provided the relevant documentation.

c. With some notable exceptions, a military assignment to a FPT is typically for about one year. This is insufficient time for the personnel to gain the experience required, especially since no documentation in the form of guides or handbooks are available which outline the tasks and procedures involved.

d. In the absence of objective user requirement inputs over the years, the trainer acquisition procedures have become highly hardware and software oriented. This further compounds the task of inputting user requirements for the FPT since they are expected to translate user requirements into engineering and design terms. They have neither the training, the experience nor the time to perform this task.

TRAINER ACQUISITION/SUPPORT PROBLEMS

The trainer definition, acquisition and support procedures were reviewed relative to FPT functions and user requirements. Each of the three phases involved, precontract, trainer development, and trainer support, were analyzed in an effort to isolate the areas and problems which constrained effective operation of the FPT.

The precontract award phase is concerned with the statement and analysis of the training requirement. It includes the development of the operational requirement, the completion of the training situation analysis or problem analysis, the development of the military characteristic or functional specification, the preparation of the detailed specification and the selection of the development contractor. A variety of problems (pages 20-24) were found which directly impact FPT functioning, most of which have serious ramifications since they directly affect the functions of the team in the following trainer life cycle phases. Predominant among these problems are:

a. The FPT is often not established until late in the phase, often after the Military Characteristic (MC) has been promulgated.

b. The critical problem or training analysis which forms the basis for the MC is rarely completed to the level required to meaningfully incorporate user requirements.

c. User inputs, especially in terms of constraints and at least conceptual training, utilization and manning plans, training system needs and objectives outlines, and performance criteria or goals are not identified or formatted and are not specifically addressed except in the training situation analysis which is rarely completed.

The development phase begins with the award of the development contract and ends with the acceptance of the trainer. It is the period specifically addressed by the OPNAV Instruction. It includes such user critical events as the Configuration Report review and approval, mock-up, detailed design review, documentation review, Navy Preliminary Evaluation (NPE), and acceptance tests. The analysis concluded that the success of the development phase in terms of user requirements was in large, determined by the level of completion of the events in the pre-contract phase. When marginally completed, the burden on the FPT during the development phase is significantly expanded. With the FPT's limited time available for the task, restricted travel funds, and typical short period of assignment (as a collateral duty), the successful input of fleet and user requirements is compromised. Among the major problems identified (page 25-30) were the following:

a. The FPT is not routinely invited to important design reviews, progress reviews, and related conferences and meetings.

b. The FPT does not typically develop and consolidate user input data to guide the design or to evaluate the results. These data include installation and manning constraints, utilization concept, relationship to the total training system, preliminary or prototype training syllabi, training criteria and objectives, trainee input characteristics, and instructor/operator qualifications nor is guidance or assistance provided to the team to accomplish these user critical tasks.

c. Tests and evaluations are not conducted to user requirements utilizing an objective test plan. As a result, the FPT is utilized primarily to appraise the fidelity of the simulation, not the capabilities of the trainer or their relation to the training needs and requirements. In the absence of an objective test plan and criteria, the results are dependent on the experience and personal preferences of the FPT member. With the short assignments involved, this often results in different personnel performing subsequent evaluations often with conflicting results.

The operation and support phase begins with the acceptance of the device and ends when it is retired. The tasks are primarily concerned with the modifications and updates to the device and quality and configuration control. Serious problems in FPT support to this phase were found (pages 30-35).

a. The basic problem is that the FPT is not chartered to function during this phase. The governing instructions established the team only to the point of the acceptance of the trainer. However most teams were found to continue their operation as the need for their input is recognized.

b. In general, all of the data and design deficiencies in the previous phases impact on the tasks of the FPT in this phase.

c. The detailed syllabus is seldom developed until this phase. As a result the syllabus is typically based on "what" the trainer can be used for in the training program rather then on the trainer's capabilities or the original design objectives. The FPT is charged with the responsibility of developing the syllabus. Since the trainer technical documentation is hardware/software oriented, the FPT members (generally different from those involved in the development phase) are hard pressed to identify the original training objectives or the training capabilities of the device.

d. Trainer modifications and updates are primarily concerned with weapon system changes, not training requirements. The changes rarely address the impact on training except in terms of downtime and configuration relation to the aircraft involved. As a result, the FPT is typically relied upon to

develop and implement the training changes which result, both for the trainees and for the instructor or operators,after a device change has been implemented.

e. Trainer revalidation and certification does not address training capabilities or requirements nor is an objective test plan and or meaningful criteria employed. The FPT typically assists and subjectively "validates" the training capability.

f. Trainer Minimum Essential Subsystem Matrix (MESM) and trainer mission descriptions do not address training functions. No disciplined approach to trainer MESM development exists. Thus the task rests on the FPT by default.

PROPOSED SOLUTIONS

The proposed solutions were summarized under three areas, FPT organization, FPT tasks, and major aviation training device acquisition and support procedures. In general the proposed solutions (pages 39-50) are:

a. Develop and promulgate definitive instructions which formalize the organization and responsibilities of the FPT throughout the life cycle of the training device,

b. Develop procedural guides for the FPT which define and outline the "what, when and how" of the tasks involved and above all, the contingency options when an antecedent event is not or is ineffectively completed.

c. Direct the full implementation of existing trainer acquisition and support procedures related to user requirements.

Specific conclusions and recommendations were developed (pages 55-57).

In general it was concluded that the FPT represents a reasonable means of implementing user inputs and participation in the life cycle events of major aviation training devices. However, effective operation of the Fleet Project Teams will depend on clarifying their organizational structure and responsibilities, providing the clerical/administrative support required and providing detailed FPT functional guides or handbooks which clearly outline the what, when, and how of the FPT tasks and functions. In addition, the rigorous implementation of the existing trainer acquisition and support procedures which address user requirements and involvement in the life cycle of the training device is needed. Major changes to the approach are not required.

SUMMARY

A series of reviews of training device Instructor Operator Consoles undertaken by the Naval Training Equipment Center in 1982 and 1983 revealed a wide variety of problems. The studies concluded that many of them might have been prevented had the Fleet Project Team (FPT) been more effective in addressing user requirements and needs during the acquisition and support of the device. As a result, the Commander Naval Air Force, United States Pacific Fleet initiated a project through the Naval Training Equipment Center, to identify the problems involved and to develop feasible solutions related to enhancing the effectiveness of the FPTs.

The project involved three basic tasks, (1) the survey of typical FPTs on the West Coast, (2) the analysis of the major training device acquisition and support process, and (3) the development of feasible solutions to enhance the effectiveness of the FPTs. The F-14 and E-2 FPTs at the Naval Air Station Miramar were utilized in the survey in addition to data collected from other FPTs during the previous trainer studies. Existing instructions, handbooks, "standard operating procedures" and interviews with involved personnel were utilized to isolate and structure the problems. The acquisition and support process was analyzed based on existing instructions as well as from discussions with personnel intimately familiar with the procedures as implemented.

The results revealed that the FPT effectiveness was constrained by a wide variety of problems including the following:

a. The FPTs organization, administration and chain of command are not well defined.

b. Critical front-end analyses are often not completed to the level required for FPT functioning.

c. The FPTs are not routinely invited to attend trainer development meetings and conferences requiring user inputs or provided relevant trainer documentation.

d. Insufficient clerical and administrative support is available for the effective functioning of the FPTs.

e. Technical support, especially in the human factors area, is not available to the teams.

f. Neither the functions required of the FPT or the relationship of these functions and tasks relative to the trainer life cycle process are well defined and no effective guidance for

the teams exist.

g. The FPTs have no formal status after the trainer is accepted.

The review of the trainer acquisition and support process revealed that although the system is structured to incorporate user inputs, the typical implementation limits these inputs and consequently constrains the users appraisal of the trainer during its development. The problems include:

a. The precontractual documents including the functional specification are generally hardware and software oriented and do not address the training function.

b. Tests and evaluations are concerned with simulation fidelity and hardware and software, not operational requirements or user needs and constraints.

c. Critical user inputs such as syllabi and utilization concepts are not readily incorporated.

d. Requirements documents and supporting analyses including functional specifications and test/evaluation criteria are not updated when functional and characteristics changes are made to the trainer.

e. Trainer capabilities are not related to training objectives or syllabus implementation so that a meaningful Minimum Essential Subsystem Matrix (MESM) can be developed.

f. The impact of trainer changes on the training program especially to instructor and operator training, are not fully evaluated.

g. Validation and certification of operational trainers does not include training requirements and capabilities.

The solutions developed were:

a. Formalize the FPT organization and locate the teams under the Functional Wing (Training Device Division).

b. Develop detailed FPT guides which define the what, when, and how for the tasks to be performed.

c. Fully implement the existing trainer acquisition and support instructions and procedures, especially the user related tasks and functions.

d. Establish the FPT for the operational life of the trainer.

PREFACE

The author wishes to acknowledge the assistance and cooperation of the Navy personnel who directly and individually contributed to the study. The success of any survey project is a direct result of the undocumented effort of the personnel at the operational level who devote time and effort to provide the data required. In particular, the contributions and efforts of the following personnel were particularly helpful in the completion of the study.

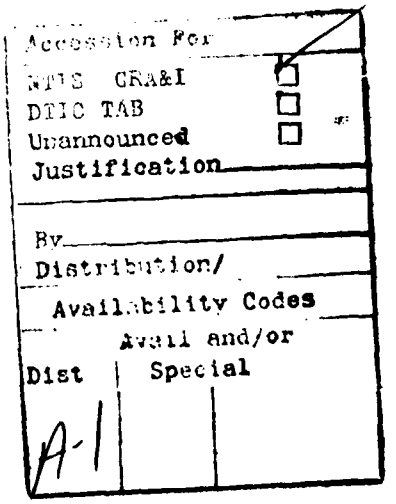
Mr. J. Bolwerk, Staff, Commander Naval Air Force, United States Pacific Fleet, who sponsored and coordinated the effort, provided data on the role of the type commander in trainer acquisition and support and most importantly, reviewed and criticized the analysis and conceptual solutions as they were developed.

CDR Carl Snodgrass, Training Department, Commander Fighter Airborne Early Warning Wing Pacific who coordinated the surveys and visits to the F-14 and E-2 Fleet Project Teams.

Chief W. Jones, Staff, Commander Naval Air Force, United States Pacific Fleet, who not only assisted in locating data required for the study but provided a knowledgeable source of training device support procedures and problem areas.

Mr. Frank Shughart, Naval Training Equipment Center Field Engineering Office, Naval Air Station Whidbey Island, WA who provided time and effort to review historical problems in the operation of FPTs and to discuss the problems associated with the various solutions developed.

The cooperation of all of the personnel who were contacted during the study and contributed time, information, ideas, and critical review is gratefully acknowledged.



FOREWORD

This is the fourth of a series of reports of human engineering analyses of training devices sponsored by the Human Factors Laboratory of the Naval Training Equipment Center. The first three reports (NAVTRAEQUIPCEN 80-M-1083-1, 81-M-1121-1, and 82-M-0767-1) were concerned with aviation training devices and work in progress extends those analyses to typical equipment for the training of surface, subsurface, and land operations. In general, the reports document problems of design which affect the operational use of training equipment.

The present effort represents a departure from our design-oriented analyses in that the operation of Fleet Project Teams was studied. These teams play an important role in the definition of training equipment, and here a variety of the problems they face are discussed and solutions for these problems are presented.

G. L. Ricard

G. L. RICARD
Scientific Officer

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SECTION I

INTRODUCTION

BACKGROUND

A series of studies [1], [2], [3], of simulator instructor console designs undertaken by the Naval Training Equipment Center (NAVTRAEQUIPCEN) in 1982, revealed a variety of operating and utilization problems. Most of these could have been detected and corrected during the development cycle. The studies pointed out that many of the problems resulted from the lack of critical inputs from the Fleet Project Teams (FPT). They ranged from the lack of explicit statements of user requirements to the need for critique and evaluation of design efforts relative to these requirements.

As a consequence, the Commander, Naval Air Force, U.S. Pacific Fleet (COMNAVAIRPAC) initiated an effort through the NAVTRAEQUIPCEN to identify the guidance and support required by the FPT to fulfill their user functions and enhance their effectiveness. The project involved the analysis of the FPT's operations in the acquisition and acceptance of major training devices, especially in the area of training requirements and Instructor Operator Station (IOS) implementation. The objective was to identify problem areas including support requirements, and to identify and describe feasible solutions.

The F-14 and E-2 Fleet Project Teams at the Naval Air Station (NAS) Miramar were utilized as the primary data sources.

HISTORY

The importance of incorporating user requirements in weapons system design is as old as the Navy itself. However as systems and the development process have grown more complex, the task of identifying and structuring these needs, especially in the

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1. Charles, John P. Device 2F119 (EA-6B WST) Instructor Console Review. Technical Report NAVTRAEQUIPCEN 81-M-1083-1, Naval Training Equipment Center, Orlando, FL, November 1982.

2. Charles, John P. Device 2F112 (F-14A WST) Instructor Console Review. Technical Report NAVTRAEQUIPCEN 81-M-1121-1, Naval Training Equipment Center, Orlando, FL (in press).

3. Charles, John P. Device 2E6 (ACMS) Air Combat Maneuvering Simulator Instructor Console Review. Technical Report NAVTRAEQUIPCEN 82-M-0767-1, Naval Training Equipment Center, Orlando, FL (in review).

training area, has become not only equally complex, but of critical importance to ensuring system operational effectiveness.

The need for fleet involvement in device test and evaluation was recognized by the Chief of Naval Operations (CNO) in 1965 and an instruction was issued outlining "fleet participation in predelivery evaluation and acceptance of major aviation training devices....to insure that the end product satisfies the stated training requirement."[4]

CNO subsequently broadened the instruction in 1974 and again in April 1977, to include user involvement throughout the development process. It directed the type commanders to form "project teams" as required and outlined the tasks and functions for the team. The instruction also pointed out the necessity for close coordination and cooperation between all agencies and commands involved from the fleet squadrons to the type commanders and acquisition activities and for validation of the trainers capabilities at various points in its life cycle.

The type commanders implemented the concept and issued instructions for establishing the teams. The Commander Naval Air Force, Pacific Fleet incorporated the guidance in an instruction on aviation training aids.[5] The instruction directed the designation of members for the FPTs, directed the chairman to submit reports on the proceedings of all meetings involving FPT members and assigned a report symbol. It also directed the Functional Wings to budget and fund the travel for the FPT.

In 1981, the Office of CNO (OPNAV) queried the type commanders about the possible need for a handbook "to indoctrinate fleet representatives in the Navy's fundamental acquisition policies and procedures."[6]

The Commander Naval Air Force Pacific Fleet reviewed the problem and concluded that the guidance contained in the

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4. Department of the Navy. OPNAV INSTRUCTION 1551.7 Fleet Participation in Development and Acceptance of Operational Flight/Weapon System Trainers (OF/WSTs) and Other Major Aviation Operational Training Devices. Office of the Chief of Naval Operations, 27 August 1965.

5. Department of the Navy. COMNAVAIRPACINST 10170.2 Aviation Training Aids; information and policies concerning. Commander Naval Air Force Pacific Fleet, 2 July 1982.

6. Department of the Navy. Office of the Chief of Naval Operations letter to the Type Commanders Fleet Project Team (FPT) Duties serial 596/409590 dated April 14 1981.

"Training Systems Guide" issued by the Naval Training Devices Center [7] could form the basis for the required handbook.[8]

PROBLEM AREA

The overall life cycle of the training simulator including the design and development process must be considered in developing techniques and specifications to preclude the repetition of the types of problems isolated in the surveys conducted, as well as to enhance IOS designs. In addition, current and projected manning concepts must be taken into account.

The trainer life cycle can be logically subdivided into three phases, Phase I - Precontract Award, Phase II - Development, and Phase III - Operation.

The major events in Phase I are outlined in Figure 1 in an event flow chart. As can be seen, it includes seven major events beginning with the statement of the Operational Requirement (OR) and ending with the selection and award of the development contract.

The major events in Phase II, the development phase, are outlined in Figure 2. These events begin with the initial orientation conference and continue through mock-up review, project and data reviews, tests and evaluations and concludes with the acceptance of the trainer.

The major events in Phase III, the operational phase, are outlined in Figure 3. They are primarily concerned with the modification and update of the trainer during its lifetime to meet changes in training requirements as well as to incorporate weapon system modifications.

In summary, the life cycle of a training simulator includes a variety of events which guide and control the characteristics of the device. It is the objective of this project to identify the user related problem areas, to outline feasible solutions to preclude reoccurrence of defects and deficiencies such as those isolated in the surveys of existing devices, and to enhance the overall functioning of the FPTs in the simulator design development and support system.

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7. Department of the Navy. NAVTRADEV P-530 Training Systems Guide. Naval Training Equipment Center, Orlando, FL, November 1980.

8. Department of the Navy. Commander Naval Air Force, U.S. Pacific Fleet letter to Chief of Naval Operations. Fleet Project Team (FPT), Duties. Serial 3141/2712 dated 5 May 1981.

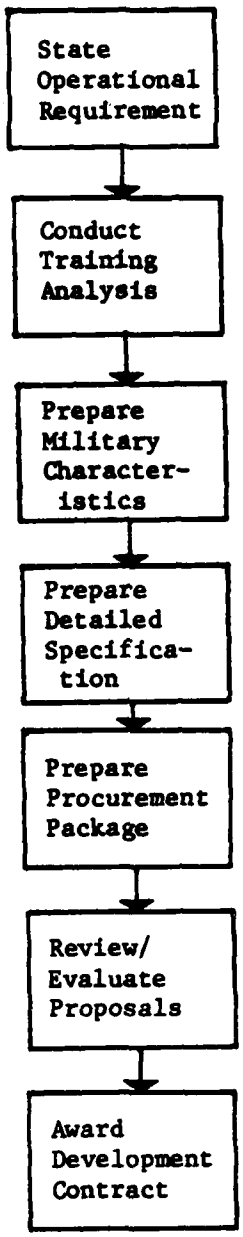

Figure 1. Precontract award phase major event flow.

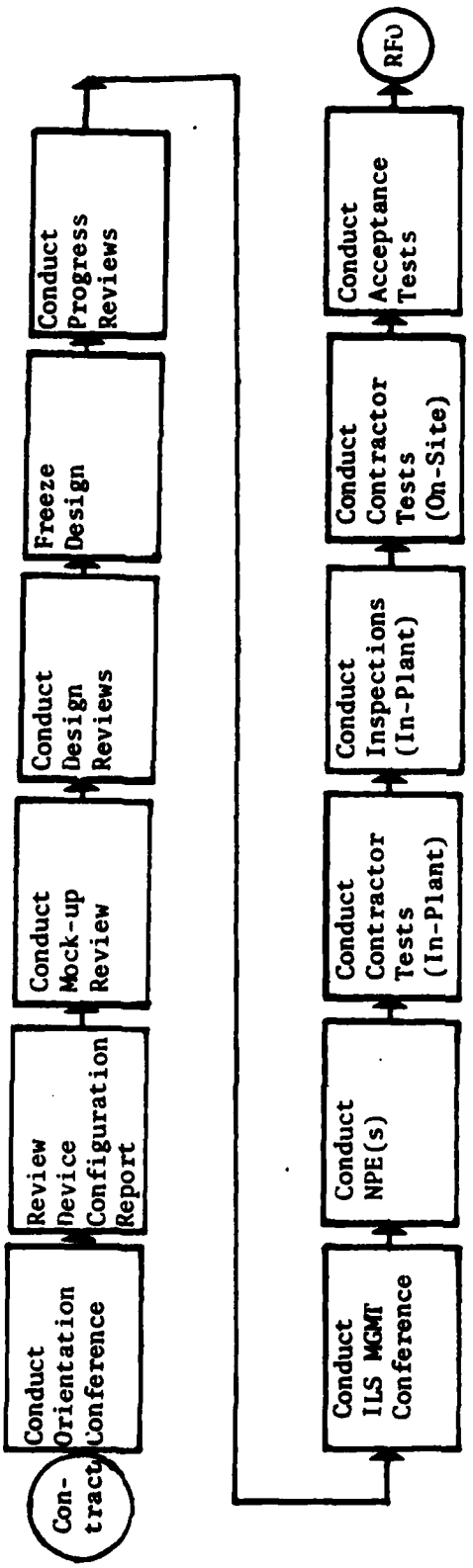

Figure 2. Development phase major event flow.

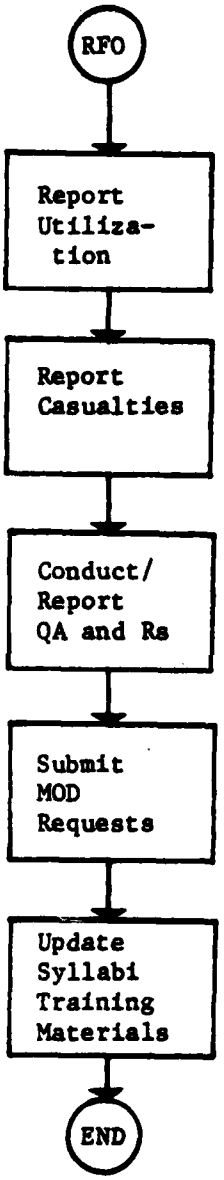

Figure 3. Operation phase major events.

SECTION II

APPROACH

Five tasks were structured to conduct the project. These tasks were:

a. Task 1. Review past and current activities of FPTs to identify existing methods of operation.

b. Task 2. Review typical trainer technical acquisition documentation including procurement documents, test and evaluation reports and relevent conference and meeting reports.

c. Task 3. Analyze data to identify problem areas.

d. Task 4. Develop feasible solutions.

e. Task 5. Document the effort.

The objective was to isolate those areas where the FPT functions were either insufficiently defined or the guidance and support provided to the FPT was inadequate to permit them to perform the required functions. Once identified, feasible solutions in terms of guides, procedures, instructions and other support means could be conceptualized and structured for development.

SECTION III

RESULTS

GENERAL

The results will be reviewed in terms of the tasks which were completed, i.e., the review and analysis of FPT functions and representative operations, the review and analysis of trainer life cycle procedures including acquisition and support and the structuring of feasible solutions.

FPT ORGANIZATION AND FUNCTIONING

The review of FPT organization and functioning will be structured in terms of the current governing instructions and then related to typical FPT operations and problems involved.

ORGANIZATION. The governing instruction on the organization and composition of the FPT (OPNAV Instruction 1551.7B) directs that:

a. CNO will establish the team and its chairman on the recommendation the trainer device development and acquisition activity (TDD/AA) - "the activity (or command) having direct technical and contractual responsibility and authority to develop and/or acquire a specific training device, unless otherwise designated,"

b. The member's duty station will provide travel funds to attend conferences, reviews, tests and inspections,

c. Personnel selected "within limitations" should be assigned from initial development through delivery and ready-for-training (RFT) acceptance.

The FPT is defined in the OPNAV Instruction as a "group of knowledgeable representatives from the fleet or other user and interested non-user activities, consisting of qualified military and/or civilian personnel designated by cognizant commands." The basic function "...is to assist and advise the training device development and acquisition activity in development, acquisition, and acceptance of specifically assigned training devices."

The detailed role, functions, and duties of the FPT are outlined in Enclosure (1) to the OPNAV Instruction and are duplicated in Appendix A for information. Three functions are identified. These include:

a. Act as an advisor to the TDD/AA during the development, acquisition and acceptance of the training device.

b. Act as a reviewer, inspector and tester to validate projected trainer capabilities at "certain points in the development program" as requested by CNO to ensure that the device meets stated training requirements.

c. Assist the TDD/AA in developing qualitative and quantitative training objectives for incorporation in the military characteristics (MC).

As will be pointed out, in the following paragraphs, the functions are not and cannot be achieved to the level of excellence required. The reasons reflect both problems in the implementation of the FPT concept and in the development process utilized for training devices.

FLEET PROJECT TEAM DUTIES. Each of the major duties or tasks assigned to the FPT by the OPNAV Instruction and the problems involved in fulfilling them will be reviewed. The problems are based on the survey of typical FPTs. It is important to point out that the OPNAV instruction identifies them as duties which the FPT "may" perform.

a. Maintain a correspondence file for the device.

Problem: No dedicated clerical or administrative support is provided to the members of the FPT other than that available within the squadron offices of the members. These offices generally have limited clerical support at best. As a result, trainer development correspondence is typically and necessarily maintained as a "push-back stack" in an available file drawer. Time is generally not available to index the material or to verify that required documents have been received.

b. Attend/participate in conferences, reviews and meetings including at least:

(1) Training Situation Analysis (TSA) Review,

(2) Military Characteristic (MC) Review,

(3) Performance Specification Review,

(4) Technical and Mock-up Review,

(5) Design Freeze Review,

(6) Integrated Logistics Support (ILS) Review,

(7) In-plant Inspection, Test and Checkout,

(8) On-site Inspection, Tests, and Checkout,

(9) Determination of Trainer Ready-For-Training (RFT).

Problem: Of the FPT data reviewed, none of the members appear to have been involved in the first three events, i.e., the TSA, MC and specification review. The primary reason appeared to be that the FPTs were not formed until after the MC and the specification had been promulgated. The TSA could not have been reviewed since it typically had not yet been completed. Moreover, as will be pointed out in the review of the development process, the MC and specifications are not generally in a format which can be meaningfully reviewed by operational personnel. FPT members generally attend the remaining meetings as well as some of the progress and program review meetings. The NAVTRAEQUIPCEN Field Engineering Representative (FER) or a representative from the Fleet Aviation Specialized Operation Training Group (FASOTRAGRU) generally attends the Integrated Logistics Support (ILS) Review as a member or as a technical representative of the team.

c. Submit meeting reports.

Problem: Trip reports were filed by the FPT member(s) of the teams reviewed. However, the format and content varied considerably since no format is defined. Furthermore, since little feedback, much less acknowledgement of the reports, is apparently ever received, little impetus to detailed reporting exists.

d. Provide unified guidance to the TDD/AA on requirements.

Problem: With limited time for the task, no experience in training requirements development and no guidance as to what is required or how it should be done, the FPT members generally provided little input on training requirements. As will be discussed in the review of the development process, the problem is not unique since training requirements, per se, are seldom addressed directly in the device development process. The guidance provided by the FPT is typically limited to the characteristics of the weapon system and its operation and employment.

e. Develop the training syllabus.

Problem: With limited time available, with limited experience and with no guidance or technical support, the FPTs rarely developed the required detailed syllabus prior to RFT or ready-for-operational training (RFO). Even a "test or trial syllabus" which would be useful (and necessary) in mock-up evaluation and other inspection and tests as well as in engineering data review, is seldom developed. Of all the tasks required of the FPT, this is one of the most critical since it provides the criteria for tests of the design effort in terms of actual training requirements.

f. Assist in developing performance acceptance criteria.

Problem: The FPT members do not have the time nor the experience or technical skills to accomplish this important task. As will be pointed out in the review of the development process, performance acceptance criteria (other than weapon systems performance criteria) are seldom developed or utilized in the evaluation of a training device. No meaningful evaluation of the device in terms of training requirements is possible without training objectives related performance criteria.

g. Provide the TDD/AA data on current system operational data in writing.

Problem: The operational experienced aircrew FPT members are well equipped to provide data on the operational utilization of the weapon system, both in terms of procedures and tactics. The Fleet Readiness Squadron (FRS) members are particularly oriented to these needs from the FRS training program point of view. However, they rarely have time to "poll" fleet squadrons for such data or to consider in the required detail, the problems raised by the differently configured systems in existence and operational. While the trainer is baselined to a particular system configuration, system operations data relative to training requirements may not be so constrained. Finally, to provide such operationally based data and in writing without knowledge of the TDD/AA's existing information "data base" presents an almost insurmountable problem for the FPT with limited time available for the task.

h. Coordinate management with the TDD/AA to avoid legal contractual problems.

Problem: The FPT members are generally inexperienced in trainer contract procedures. Briefings by the TDD/AA or knowledgeable Navy personnel are not provided. No useable guidance exists. Yet the FPT members are expected to interface with the contractor and to provide them data as well as to evaluate the product. Furthermore, the contractor developer, while requesting technical data from the FPT, often solicits comment on design. This can place the FPT member in a potentially difficult spot if he is not aware of the contractual pitfalls involved.

i. Perform system maneuvers on the trainer to determine performance relative to the Trainer Performance Acceptance Criteria and stated training requirements and provide written reports to the TDD/AA.

Problem: Meaningful acceptance criteria and training requirements are rarely developed. Thus the FPT is forced to evaluate the trainer solely in terms of fidelity to the operational system, and generally to subjective criteria, since

no quantitative or even qualitative criteria have been developed. Since different FPT members are often involved at the various inspection and test points, no common baseline for the evaluations exists. This can and does lead to conflicting results over time.

j. Recommend RFT when the trainer is deemed ready.

Problem: Since no training performance criteria (or objective training requirements) are generally available, the FPT readiness decision must necessarily be based on the hardware oriented procurement specification and on an "evaluation" of simulation fidelity. In short, the FPT is placed in the undesirable position of certifying that the hardware provided will meet the operational training requirements when they have not been isolated or stated, much less quantified in terms of time-to-train to specified performance objectives.

k. If the trainer is not RFT, prepare written list of discrepancies to TDD/AA and concerned commands.

Problem: No meaningful criteria typically exist to conduct the RFT or RFO evaluation. Thus there is also no valid means for identifying discrepancies other than fidelity defects. The FPTs therefore evaluate and report fidelity discrepancies.

l. The chairman of the FPT shall consolidate the outputs.

Problem: A variety of FPT organizations were found to exist. For some weapon systems, a single FPT exists to support all of the major trainers involved; in others, a separate team with its own chairman, exists for each major training device. Where a single FPT exists, different members are typically assigned to each major device. Regardless of the organization, chairing an FPT is a major if not full-time task, especially during the trainer design and evaluation stages. Yet it is performed as a collateral duty. As a result, three alternative modes of operation were found to exist, namely, the chairman "becomes" the FPT and performs most of the tasks; the chairman relegates the responsibility to an active member; or no effective consolidation of FPT position is undertaken. The latter is often the only feasible solution, especially in the absence of any involvement in the development and review of the OR, the MC or specification and any meaningful TSA data.

The problem is further compounded by the fact that membership on the FPT rarely exceeds 12 months with shorter "tours" not unusual. FPT assignment has not generally been considered a prestigious collateral duty although some significant exceptions were found.

m. Analyze and forward other trainer user comments, problems and requirements.

Problem: Until the device is operational, inputs from other users are rare. The FPT members do not have the time to solicit other user's requirements or the training or experience to evaluate and consolidate them. Fleet Squadrons rarely have the time to spend on the development of trainer requirements or to "come up to speed" on the objectives or the characteristics of the device.

n. FPT members shall apprise their command of the need for timely relief with detailed turnover of the duties.

Problem: Within the typical turnover constraints, the FPT members accomplish this duty. However, there is an overall lack of definition of the detailed FPT tasks involved, no detailed guidance, no training program, and no source of assistance. Thus the turnover is constrained by the FPT program support limitations and tends to perpetuate the problems and shortcomings which arise during its existence.

o. "Chairman of the FPT ensures that all members of the team remain aware of the development and acquisition of the training device and that subsequent changes are properly promulgated for appropriate action on each member's part."

Problem: Lack of time and supporting materials and demanding primary duties constrain the chairman in completing this task.

TRAINER PROCUREMENT PROCEDURES

The typical major aviation training device procurement and operational support procedures utilized by NAVTRAEQUIPCEN were analyzed to identify problem areas for the FPT. As discussed in the Introduction, the life cycle logically divides into three phases, namely:

a. Phase I. Pre-contract Phase - extends from conceptual requirement to the selection of the development contractor and award of the contract.

b. Phase II. Trainer Development Phase - extends from contract development award to trainer acceptance at the training site.

c. Phase III. Trainer Support Phase - extends from acceptance date to trainer retirement or removal from the training program.

The major events and responsible command/activity were identified for each phase and then analyzed. The problems presented by each of the major events in the trainer life cycle relative to the FPT functioning were isolated and the results are reviewed in the following sections.

The major activities/commands involved are defined in OPNAV Instructions 1551.7B as follows:

a. Cognizant Sponsor - A Deputy Chief of Naval Operations (DCNO) or Director of a Major Staff Office (DMSO) responsible for a specific warfare area of operational readiness that a training device supports. For major Navy aviation training devices, this is the Deputy Chief of Naval Operations (Air Warfare).

b. Training Agent - A bureau, command or headquarters exercising command of and providing support to a major increment of the Department of the Navy's formalized training effort such as Commander in Chief, Pacific Fleet.

c. Cognizant Commander - A type commander such as Commander Naval Air Force, United States Pacific Fleet.

d. Training Device Development and Acquistion Activity (TDD/AA) - The activity/command having direct technical and contractual responsibility and authority to develop and/or acquire a specific training device, unless otherwise designated by the cognizant sponsor, such as the Naval Air Systems Command or the Naval Training Equipment Center.

e. User Administrator - The command/activity responsible for the administrative control of the training conducted utilizing the device, such as a functional air wing.

PHASE I TASKS. Figure 4 outlines the major tasks which occur in Phase I and are presented in a flow chart along with identification of the documentation involved. In addition, the responsible agency is indicated. The solid lines indicate primary action flow; the dashed lines indicate review and coordination actions. Each of the major tasks will be reviewed.

a. Promulgate Operational Requirement (OR). The preparation and promulgation of the OR by the CNO is the first event in the life cycle of a major training device. Inputs can come from a wide variety of users. The OR is normally reviewed by the training agent and by the cognizant commander in the case of major aviation training devices.

Problem: Since the FPT has not yet been established, the OR cannot be reviewed by the team. In actual practice, an OR for a trainer for an operational weapon system may be reviewed and inputs generated by an existing FPT even though they may not constitute the FPT which will be established for that trainer.

b. Establish FPT. Once the OR is approved, the planning and the assignment of TDD/AA occurs. At this point, the recommendation for the establishment of the FPT should be

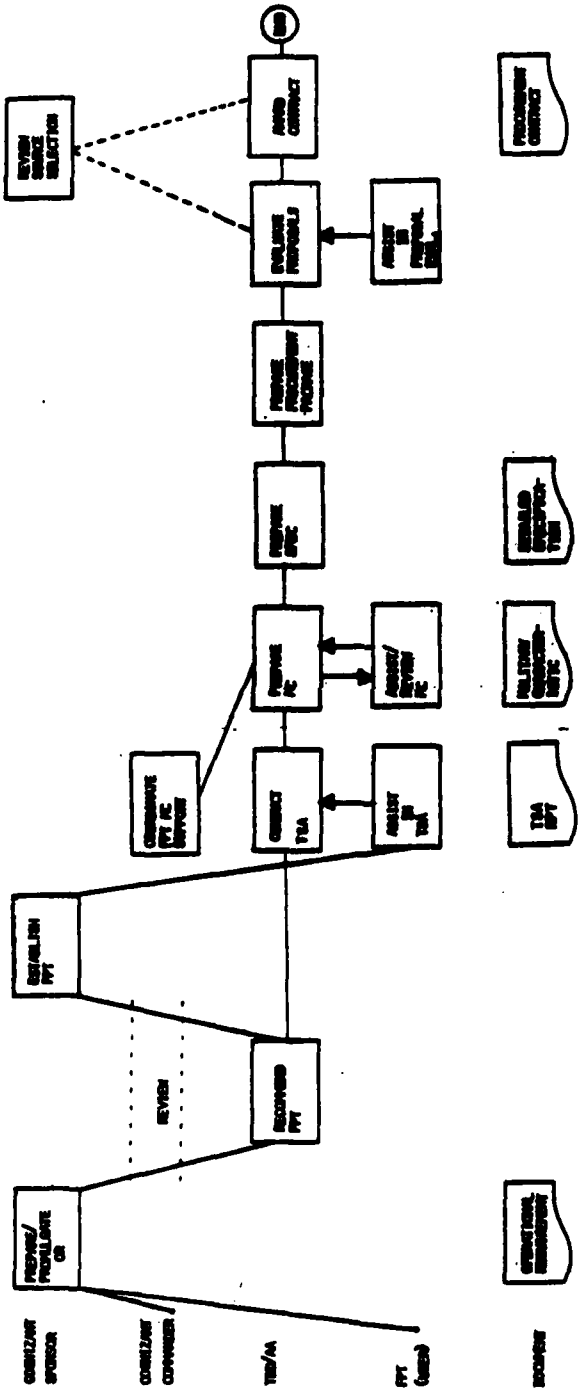

Figure 4. Phase I task flow.

received by CNO, the team established and the chairman designated.

Problem: Although the FPT should be established shortly after the TDD/AA is designated, it apparently seldom occurs at this point even though OPNAV Instruction 1551.7B directs the TDD/AA to recommend the formation of the team and to include membership recommendations "to provide for the earliest participation of the FPT in the formulation of the training capability." It appears that the FPT has in the past, often been established after the MC has been promulgated and in some cases after the specification has been prepared. The existing NAVTRAEQUIPCEN Instruction 1551.7B also directs that the cognizant program office will ensure that the team is established "during the conceptual phase of the project (i.e., Military Characteristic preparation period)."

c. Training Situation Analysis. The TSA should be conducted prior to preparation of the MC and it provides the basic data for the MC. As outlined in NAVTRAEQUIPCEN Instruction 3910.4A,[9] the MC identifies a trainer "...that represents a cost/training-effective solution to a training need as derived from a training situation analysis (formal/ empirical)."

Problem: Although in theory, the FPT is critical to the TSA which is in turn essential to development of the MC and the specification, the FPTs in the past, at least, do not appear to have been extensively involved in the TSAs as done. This has most likely occurred either because the team was formed too late or because the TSA was completed without FPT input. The latter appears to be a likely possibility since, as pointed out in Enclosure (4) to NAVTRAEQUIPCEN Instruction 3910.4A, "It is unlikely that (NAVTRAEQUIPCEN personnel) will have access to a formal systematic TSA in the day-to-day work effort of preparing MC's. Therefore the training/education specialist acting as an analyst, will conduct an informal front end analysis (empirical) as part of the process of preparing an MC. The front-end analysis is informally conducted, based on the judgement and experience of the analyst. Properly conducted, the results are valid."

d. Prepare the Military Characteristic. The MC is a functional specification for the trainer addressed in the OR. As discussed above, it is based on TSA data and should reflect the total training system involved. The outline format for the MC is contained in Appendix B. The major sections of the MC address:

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9. Department of the Navy. NAVTRAEQUIPCEN INSTRUCTION 3910.4A. Functional Statement, Functional Description; Mini-Military Characteristics, and Detail Military Characteristics; instructions and responsibilities for. Naval Training Equipment Center, Orlando, FL, 18 February 1977.

Section I. Summary - identifies the training requirement in terms of purpose, the operational situation and the origin of the requirement.

Section II. Training Analysis - summarizes the results of the TSA including training objectives and training requisites and rationale.

Section III. Device Description - describes the functional characteristics of the proposed device, i.e., the capabilities required to accomplish the training. It includes data on constraints, availability, utilization, reliability and maintainability goals.

Section IV. Device Support - describes the conceptual Integrated Logistics Support plan.

Section V. Evaluation Plan - outlines a plan to evaluate the trainer relative to the requirements of the MC.

Problem: In theory, the MC is a functional specification; in practice, the document is hardware and software oriented. The training analysis section of the MC is very brief and generally contains none of the data outlined in the specified format (see Appendix B). In the absence of the training analysis data, the device description is generally a list of controls and displays desired for the crew station(s) and is contained in the functional requirements subsection. The evaluation plan section is generally brief and places the burden on the FPT to ensure that the device meets the "training requirements." In summary the typical MC is not a functional specification and where the required TSA efforts have not been completed, it represents subjective estimates of the device hardware requirements and their configuration. While the FPT could review the document for technical accuracy, they generally have little information (unless it is developed by them) for evaluating the actual functional requirements for the training device. Similarly, the lack of training performance requirements data precludes the definition of any meaningful evaluation plan.

e. Prepare Trainer Specification. The trainer specification becomes the key contractual document in terms of the trainer's characteristics. The basic format used for the document is Military Specification MIL-T-23991, "Training Devices, Military; General Specification For" and for aviation trainers, as modified by the special guidance such as contained in Military Specification MIL-T-82335(TD), "Trainer, Fixed Wing, Flight; General Specification For." The FPT is apparently rarely involved in the review of the trainer specification unless major perturbations in the training system definition process have occurred and delayed the promulgation of the specification.

Problem: The detailed specification represents a critical document in the acquisition of a trainer. Its format is hardware and software specific and as such is largely meaningless to the fleet user unfamiliar with trainer hardware/software and detailed acquisition documents. In the absence of supporting documents stated in user's terminology, the specification could only be reviewed by the FPT in terms of accuracy relative to weapon system configuration and performance. There is literally no possibility of appraising the potential effectiveness of the proposed trainer in terms of training requirements, much less establish that the trainer can meet the operational training requirement. In theory, the specification is derived from training requirements as stated in the OR and outlined functionally in the MC. As pointed out, such data are seldom found in these documents. Thus the FPT in effect, has little meaningful data to review and critique during the precontract phase of the acquisition process. It also results in the FPT having little data against which to objectively evaluate the training capability of the device, since these objectives do not form part of the acquisition documentation.

f. Evaluate Proposals. FPT members are rarely directly involved in the evaluation of contractor proposals. None of the relevant instructions address this task as part of FPT functions and duties.

Problem: Although responding primarily to the trainer specification, most technical proposals also include a rationale for the proposed solution to the design problems. Many of the design problems are training oriented, e.g., training features such as initialization, freeze, replay, and reset, performance monitoring and recording, debriefing, instructor displays and controls, and syllabus programming. These data could be evaluated by the FPT, especially if the front-end training analysis data had been developed and was available.

Summary. The tasks in Phase I - Precontract Award, are concerned with the statement and refinement of the operational needs of the users, i.e., the Fleet Readiness Squadron and/or fleet squadrons. Although the instructions governing FPT organization and functions direct their establishment early in the trainer acquisition process, such is seldom the case based on the FPTs reviewed. The necessary front-end analysis are seldom completed to the level required to develop a definitive functional specification. As the essential inputs to each step in the process are omitted, the outputs become less meaningful to the FPT members and provide them less and less data on which to make meaningful inputs. By the time the proposals are delivered, the guiding documents are almost solely hardware and software oriented with little possibility of the FPT performing any meaningful review short of weapon system configuration accuracy checks and inputting subjective and personnel preferences.

PHASE II TASKS. Figure 5 outlines the major tasks which occur in Phase II, the Trainer Development Phase. The figure relates the documentation involved and the FPT involvement as outlined in the implementing instructions and the Fleet Project Team Guide.[10]

The tasks are presented in a flow chart format which in general depicts the sequence involved, although several tasks such as progress and program reviews are repeated during the phase. Since the tasks and documentation are tailored to each acquisition program, the flow identified in Figure 5 is generic. Each of the tasks will be briefly reviewed and FPT related problems outlined.

a. Conduct Post-Award Conference. The conference is concerned primarily with the orientation of the contractor to administrative procedures and to a review of contractual requirements.

Problem: The FPTs are not directly involved in this conference. It appears that FPTs seldom attend these conferences. However, the meeting could provide a needed orientation to the FPT.

b. Review/Approve Device Configuration Report. The Preliminary Device Configuration report is one of the first major design documents submitted by the contractor for TDD/AA review and approval. It outlines the proposed trainer configuration and layout. Appendix C is the table of contents of a typical preliminary trainer configuration report. As can be seen, the report includes considerable design detail and when approved, is a major determinant of the design of the trainer, especially in terms of the instructor console, trainee station(s) and basic trainer characteristics. The report is generally finalized and accepted after the mock-up review. The report also contains human factors data. Appendix D is a typical human factors section from this report. As can be seen, it provides little data of use to the FPT or the design effort.

Problem: As noted in Figure 5, FPT involvement in the review and approval of the report is optional and at the discretion of the TDD/AA. If the FPT is not involved, a major design effort which impacts directly on the ultimate user is completed without their input. The results can and have directly affected trainer effectiveness as found in the IOS surveys, especially where the front end analyses have been minimal. If the FPT is involved in the review, then the effectiveness of their inputs is a direct function of the team's prior involvement in the Phase I tasks as

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10. Department of the Navy. Fleet Project Team Guide. Naval Training Equipment Center, Orlando, FL, March 1982.

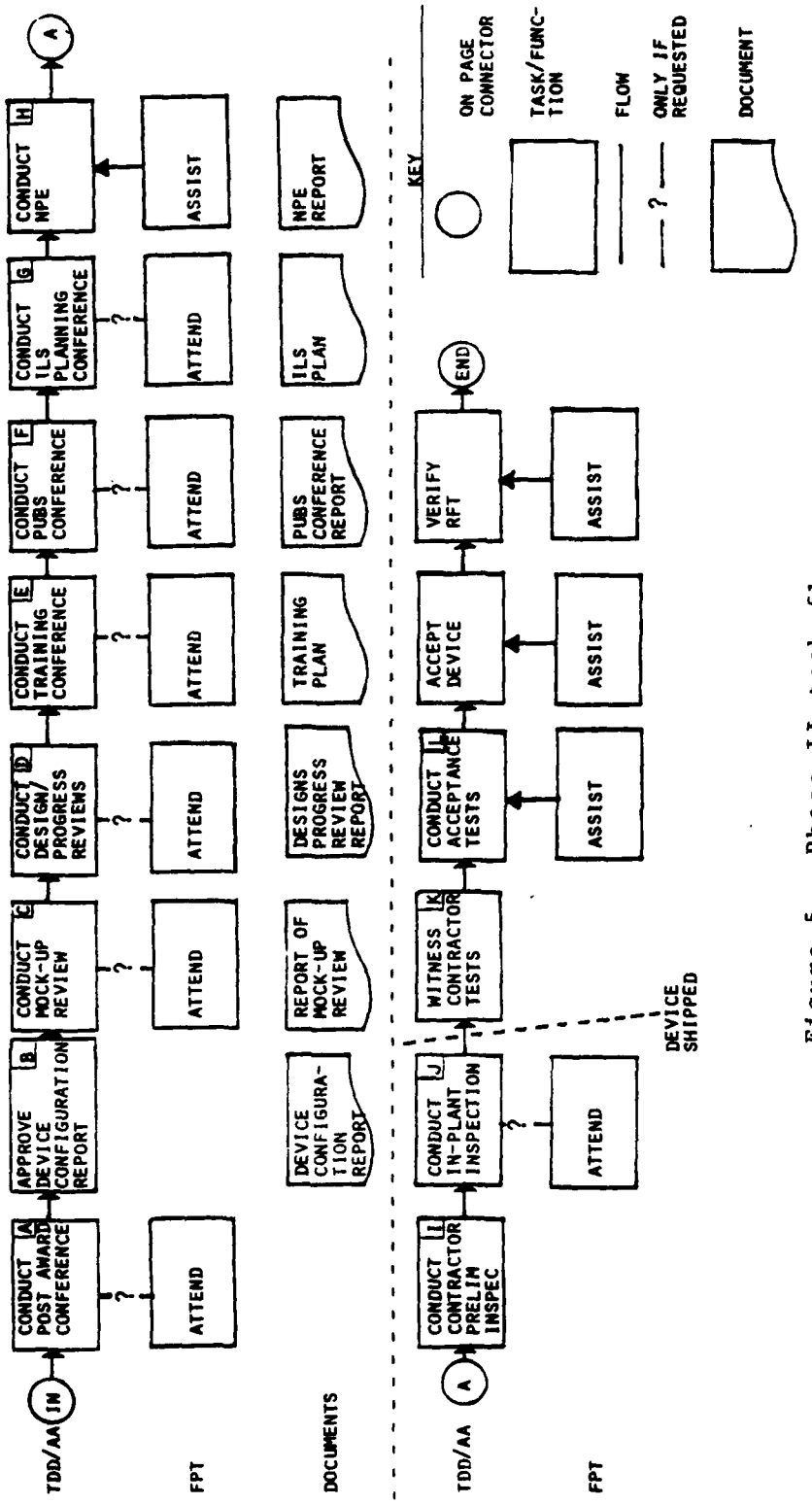

Figure 5. Phase II task flow.

well as their preparation efforts relative to the content of the configuration report. Unfortunately the necessary time and effort are generally not compatible with primary duties, especially in a Fleet Readiness Squadron. Futhermore, although the human factors considerations are of direct concern to the user, there are no useable criteria available to the FPT for evaluating this material.

c. Conduct Mock-Up Review. The mock-up review is a major milestone in acquisition since once the mock-up is approved, the physical layout of the consoles and stations is effectively frozen. The significance is outlined in the discussion of the scope of the mock-up review outlined in the governing instruction. As stated, this establishes the operational suitability of the configuration with respect to training, operability, accessibility, function, human engineering, and personnel efficiency and comfort as well overall compliance with the detailed specification and related documents.[11]

Of the FPTs surveyed, all had been represented at the mock-up reviews and had prepared reports on the results.

Problem: Two problem areas exist for the FPT relative to the mock-up review. First, although the governing instruction addresses the importance of the FPT at the mock-up review, they are not explicitly included as either members or technical advisors. They could be included as "qualified representatives of the type commander (cognizant commander)" and as such could be a board member. This does not necessarily place the FPT in a user representative role. Secondly, the effectiveness of any member or advisor at a mock-up review is a direct function of the preparation completed prior to the review itself. The need for preparation becomes critical when the Phase I tasks have been marginally completed and/or where the FPT involvement has been minimal. As pointed out earlier, the time and effort required for preparation for the mock-up review are generally not available for FPT members. In addition, the relevant data are generally not readily available at FPT offices. A Pre-Mock-up Review Meeting is held at the Naval Training Equipment Center to review the scope of the mock-up, the preliminary Configuration Report, the relevant portions of the specification and related drawings and data. However the meeting is only for the NAVTRAEQUIPCEN mock-up personnel.

d. Conduct Progress and Design Review meetings. These meetings are held to review the contractors efforts prior to design freezes and approval of design data. In addition they

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11. Department of the Navy. NAVTRAEQUIPCEN Instruction 1551.8B. Training device mock-up reviews; policies and procedures for. Naval Training Equipment Center, Orlando, FL, 3 January 1982.

provide the opportunity to review in depth the development approach and design rationale as well as to ensure that the contractor understands correctly the training objectives and operational requirements and milieu. Attendance at these meetings by the FPTs surveyed appeared to be sporadic.

Problems: Several problems exist for the FPT in terms of the progress and design review meetings, especially the latter (it appears that the FPT seldom attend progress review meetings). The problems include limited travel funds, frequent changes in team members, lack of notification of meetings and inadequate time and material to prepare for the team members. Limited travel funds appear to restrict FPT attendance to "critical" meetings. Since FPT military members typically change about every year, a member may attend only two or three meetings during his assignment. Primary duties provide little time to prepare for the meetings. The guidance to the TDD/AA compounds the problem since the FPT attends only when requested, i.e., "Upon request, (FPT) attends conferences..... provides comments relative to design and MC requirements." Thus FPT involvement appears to be more of a consulting role when required, rather than as a routine participant in the meetings.

e. Conduct Training Conference.

f. Conduct Publications Conference.

g. Conduct ILS Conference.

These conferences are typical of the technical meetings conducted during the development of a trainer. The meetings revolve about draft documents which when approved, govern the contractor's effort in that area. With the exception of the ILS conference and related maintenance and support type of meetings which are normally attended by the Field Engineer Representative (FER) for the FPT, the remainder of the meetings appear to be sporadically attended because of travel costs, time requirements, and preparation problems.

Problem: Many of the technical conferences and meetings address issues of major concern to the users. This is especially true of the training and publications conference which address the contractor's training program and the trainer documentation such as the utilization and operator's manuals. Knowledge of contractual requirements, proposed plan and actual user needs is essential to ensure an effective end product. Again the FPT members seldom have the travel funds, the draft documents, the contractual requirements or the time to prepare for the conferences. The high probability of change of FPT membership during the review and approval cycle further compounds the problem for the FPT. Appendix E is a sample Contract Data Requirements List. It illustrates the magnitude of the documentation review task.

h. Conduct Navy Preliminary Evaluations (NPE). These evaluations are conducted to establish the training functional capability of the trainer as early as possible in the development process, as well as to verify required system fidelity and evaluate changes incorporated. FPT attendance at the NPEs appears to be routinely requested by the TDD/AA.

Problem: An effective NPE requires relevant criteria and a meaningful test plan to assess trainer performance relative to that criteria. Unfortunately, it appears that the required plan is never developed. In the absence of a definitive test plan, the FPT members involved in the NPE are forced to evaluate the training device in terms of fidelity of weapon system simulation, literally regardless of whether it is relevant to the function of the trainer or required for the training which will be implemented. The problem reflects not only the lack of essential training and requirements analyses beginning with the development of the MC, but also the lack of time and manpower at the FPT level to develop a plan in the absence of these analyses. Again the problem is compounded by the frequent change of FPT personnel since different personnel may be involved in each NPE conducted. Since much of the NPE must be subjective in the absence of objective criteria and plans, the impact on the device by different evaluators can be deleterious.

i. Conduct Contractor In-Plant Inspections. These inspections are observed and verified by contract administrative personnel and the FPT is not involved.

j. Conduct Government Preliminary In-Plant Inspections. These tests are conducted to verify that the device meets contractual requirements and specified training requirements sufficiently to permit shipment of the device. The tests are conducted in accordance with the trainer test procedures and results report (TTPRR) which defines the detailed testing required to verify specification compliance and system/subsystem operation. FPT participation in these tests is typically requested and utilized for subjective tests of the fidelity of the weapon system simulation.

Problem. Although one of the purposes of the inspections is to evaluate training capability, the TTPRRs do not define either the objectives, the test plan or the criteria to be employed. The problem is compounded by the fact that the FPTs apparently rarely receive the TTPRR or have time or the knowledge to critically review the document prior to approval.

k. Conduct Contractor Final Inspection (On-Site). These tests like the contractor in-plant tests are accomplished to verify that the device meets the specification and is ready for Navy Acceptance testing. The tests are monitored by the FER. FPT participation is neither required nor requested.

1. Conduct Acceptance Testing. The final and critical test and evaluation of the device is accomplished at the training site. The FPT participates in the same manner as for the NPE. The end result of the tests is the certification of ready-for-training.

Problem: A definitive and objective plan for testing the device to user needs is rarely developed. The lack of definitive criteria and a training evaluation plan becomes particularly acute since attempts are generally made to implement some type of training syllabus, even if only a preliminary testing syllabus. Thus, it at this point that the lack of initial requirements analysis and the failure to develop training requirements, test plans and a meaninful syllabus all impact on the task of the FPT in making their input to the evaluation and acceptance decision.

Summary. Phase II in the life cycle of the training device delivers the device on which the training program will be implemented by the using commands and activities. The phase begins with the output of the Phase I effort which if marginally or inadequately completed, essentially precludes any chance of optimally completing Phase II. The FPT's involvement in Phase II is essential to the development of an effective trainer, especially if the Phase I effort is defective in terms of user inputs and front-end analyses. When the latter occurs, the burden on the FPT is significantly expanded. This is especially true when invitations to important design meetings are not proffered, where technical and development data are not provided, and above all, where briefings on the procedures and objectives are not available.

PHASE III TASKS. Phase III is concerned with the support and modification/update of the trainer during its life cycle following certification of RFT or acceptance for operational training. Figure 6 outlines the basic tasks involved in this period which relate to and impact the FPT and its functions. Although shown in the form of a flow chart, the tasks during this phase occur somewhat independently, primarily as a function of weapon system changes, changes to training needs, and trainer hardware and software improvements.

Phase III presents a basic problem for the FPT since the team has no formal status based on the implementing OPNAV instruction (OPNAV Instruction 1551.7B). The instruction provides for the functioning of the team only up to acceptance of the device. Thus the team ceases to formally exist once the trainer has been declared RFT. However, all of the teams surveyed have continued to function, especially in the area of trainer modification and update, and the "TDD/AA" for these tasks has continued to use the FPTs for user inputs to these efforts.

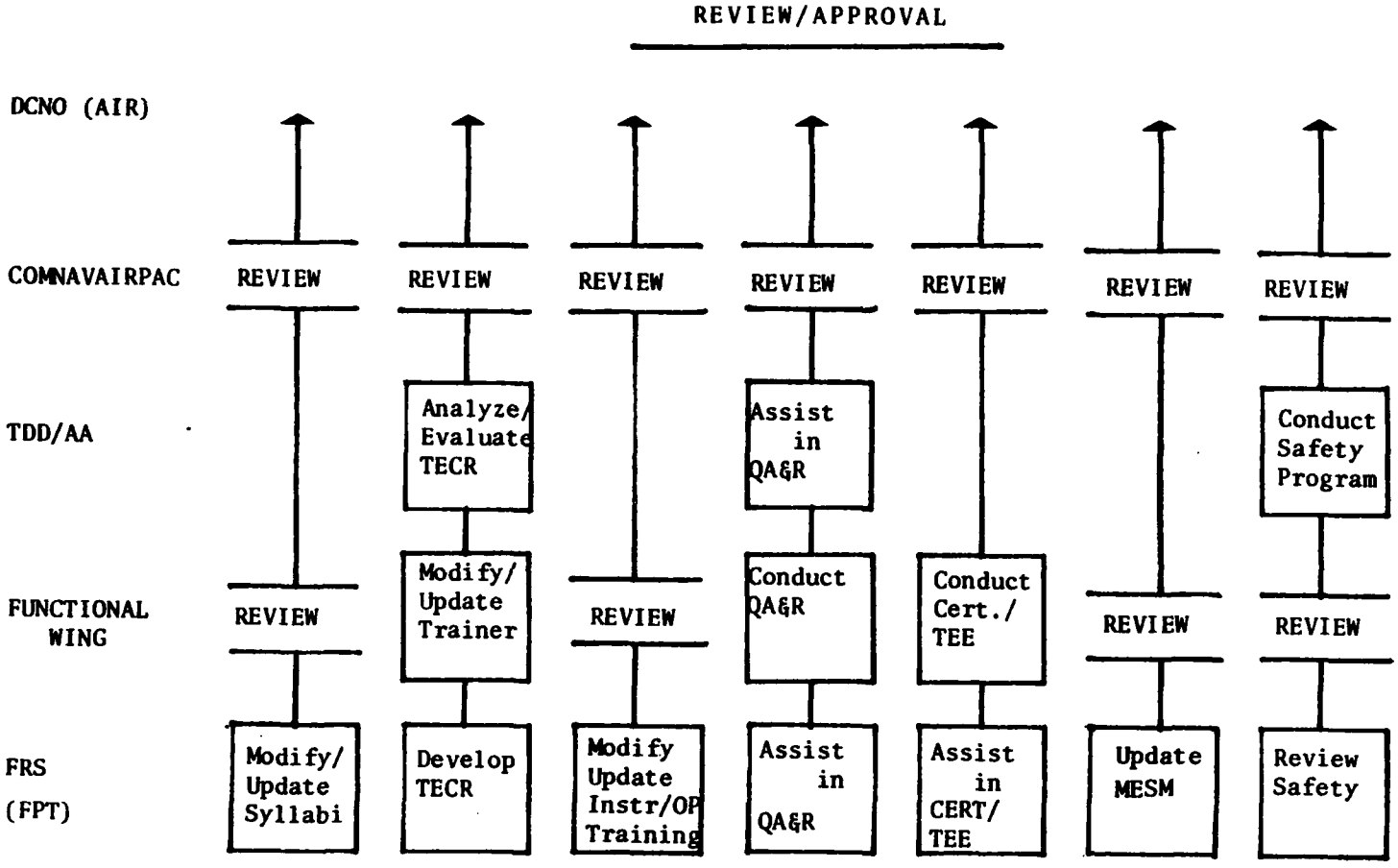

Figure 6. Phase III task flow.

Therefore the discussion which follows reflects the typical operation of the FPT during this phase even though the team is not chartered as such.

a. Modify/Update Syllabi. A variety of factors may generate a requirement to modify or update training syllabi. These include weapons system changes, tactics changes, changes to training assets, and changes to the training approach. The syllabi which may be affected include the FRS syllabi for all categories of training, fleet squadron syllabi and wing and type commander readiness training requirements. Although the FPT is most directly concerned with the FRS syllabi, the interactive nature of all the training syllabi which utilize the trainer requires that the FPT at least consider the total training requirement and assist in the development process.

Problem: Detailed training syllabi are seldom developed until the trainer is RFT and is in fact being utilized in support of the training program. Thus the syllabi are developed after the fact and out of necessity, rather than from the requirement or through training analysis. As pointed out, the problem follows from the deficiencies in Phase I and Phase II efforts, especially the lack of training requirements analysis in the Phase I effort. Although the developer is generally required to develop a "demonstration" syllabus for inclusion in the utilization and operation manuals during the Phase II effort, this "syllabus" is developed to demonstrate the system and facilitate discussion of trainer operation. It generally does not reflect a detailed analysis of operational training requirements nor does it relate to the readiness training objectives as such. Thus there are few data available on which to base syllabi changes other than hardware changes and tactics changes. While these generate the need, they do not define or provide the means for structuring the related training syllabus. The FPT has neither the time nor the experience nor the training to support the required syllabus modification effort, especially with the overall lack of background supporting data. The result is generally a "patch" approach which over time and multiple patches, results in a syllabus which is increasingly difficult to relate to training objectives and training system capabilities and constraints, much less to optimize trainer usage to meet training requirements.

b. Modify/Update Trainer. The need for updating or modifying the trainer results from a variety of factors including weapon system changes, trainer performance enhancement programs, training technology and methodology improvements, and syllabus implementation changes. Instructor and other manning changes can also necessitate trainer modifications, especially to the IOC.

The variety of changes and procedures for implementation are outlined in NAVTRAEQUIPCEN Instruction 4720.1H.[12] A change is defined as any modification which alters the configuration of the equipment. Two types of changes are structured, a Logistics Support Training Equipment Change - to enhance supportability, and a training characteristic training equipment change (TCTEC) - to "alter, enhance, expand or reduce the functional characteristics of the trainer." The two interact, but the latter is of direct concern to the FPT. Change requests can be initiated at the local level through the use of the training equipment change request (TECR), form 6ND NTEC-4720/2. A copy of the form is contained in Appendix F. The form is submitted via the Naval Training Equipment Cognizant Field Activity for evaluation. It is then reviewed by the Training Equipment Change Control Board (TECRB) at the Naval Training Equipment Center where the decision or recommendation for implementation are made. The results are then forwarded to the Naval Air Systems Command for approval and funding. Weapon system changes can also result in trainer modifications. The procedures are outlined in a Naval Air Systems Command Instruction.[13] Training equipment changes are issued through the cognizant field activity (CFA) for implemention. The FPTs surveyed were all directly involved in the generation and prioritizing of training change requests including changes resulting from weapon system engineering changes.

Problem: Any change to the functional characteristics of a trainer should result in a modification to (or at least review of the impact on) the MC and updating of the training analyses and related documentation. Of the changes reviewed during the survey, none had involved such action. The problem was even further complicated by the lack of original training analysis to support the MC and trainer design. Thus the FPT's analysis and review of the changes were necessarily done on the basis of individual experience and subjective evaluation of the impact on the training program. The review was necessarily operational weapon system and hardware oriented.

The review and evaluation by the CFA for trainer characteristic changes are to be done "from the standpoint of training effectiveness to determine the impact upon the ability

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12. Department of the Navy. NAVTRAEQUIPCEN INSTRUCTION 4720.1H. Field requests for changes to training devices and simulators under the inventory management of the NAVTRAEQUIPCEN (Cognizance Symbol "20"); procedures and information concerning. Naval Training Equipment Center, Orlando, FL, 6 July 1981.

13. Department of Navy. WEAPONS TRAINING DIVISION INSTRUCTION 10. Configuration control for aviation training equipment. Naval Air Systems Command, Washington, DC, 13 February 1981

of the training equipment to satisfy its training objectives" (NAVTRAEQUIPCEN Instruction 4720.1H). The CFA is not staffed to conduct training or training effectiveness analysis and thus depends on the user's inputs. Therefore, changes are rarely evaluated in terms of training requirements since the requirements documents are not reviewed or updated; in terms of effectiveness since little data exist and none is generated, or in terms of the impact on the training program since no analysis is done. Thus, although the onus is placed on the user (typically the "unconstituted" FPT), there is no data or support available to them to complete the task. As a result most changes are hardware updates and logistics support improvements with the impact on training and training requirements neither defined nor established.

c. Modify/Update Instructor/Operator Training. Changes to the trainer, especially in characteristics, will generally result in the need to change the training program for the instructors and the operators. While these training programs are managed by the user's training department, the need to modify the program based on trainer changes must come from the change initiating and review group which includes the FPT as the operational representatives.

Problem. Since trainer characteristics changes are seldom analyzed, as pointed out in (b.) above, the impact on instructor and operator training programs is rarely identified or documented in advance of hardware or software implementation. In addition, documentation relative to the problem may not be completed, at least in time to meet the training requirement created by the change. The FPTs surveyed rarely had time to address this area nor was the data available to them to assess the impact on instructor or operator training. As a result, the instructors and operators (and the training departments) were typically left with the problem of handling the impact of the change on their own.

d. Conduct Quality Assurance and Revalidation (QA&R) Inspections and Trainer Certifications. QA&Rs are defined in OPNAV Instruction 5220.9 [14] and COMNAVAIRPAC Instruction 5220.1.[15] They are scheduled by the type commanders.

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14. Department of the Navy. OPNAV Instruction 5220.9C Quality assurance and revalidation of training devices. Office of CNO, Navy Department, Washington DC, 22 April 1977.

15. Department of the Navy. COMNAVAIRPAC Instruction 5220.1C. Quality Assurance and Revalidation (QA&R) Program for Training Devices; policy and procedures for. Commander Naval Air Force, United States Pacific Fleet, Naval Air Station, North Island, CA, 30 May 1972.

Certification requirements are defined in OPNAV Instuction 10171.5.[16]

Although not identified as members of the inspection and certification teams, the FPTs surveyed all assisted (or were directly concerned) in the conduct of the inspections and certifications. Although the primary concern of the QA&R is the material state of the trainer, it also addresses training operational status as well as requirements for modernization and operational safety, and the identification of other deficiencies.

Problem: Revalidation of the trainer implies that criteria exist. While some hardware and software criteria may be available, trainer performance criteria relative to training objectives rarely exist as was pointed out in the Phase I and Phase II results. Thus the FPT members are typically required to verify that the trainer's training capability has not deteriorated or changed. With no objective or documented criteria, the validation must necessarily be based on personnel experience and be subjective in nature. The problem is further compounded by the short tenure of the FPT's operational member which can result in each QA&R being conducted by a different member.

e. Review and Update the MESM. The MESM identifies the trainer subsystems essential to complete the training events. Initially developed by the contractor, it is reviewed periodically and whenever a change is made to the syllabi or to the characteristics of the trainer. The FPTs surveyed were, in large, responsible for the development of the detailed MESM in connection with the development and modification of the training syllabus. The MESM is defined and issued in an OPNAV Instruction.[17]

Problem: The trainer MESM cannot be meaningfully developed until the detailed syllabus is created. This seldom occurs until Phase III. Thus the FPT is relegated the task. Since a detailed training analysis is seldom completed as part of the Phase I (or Phase II) effort, the development of the MESM must necessarily be based on FPT member expertize and knowledge of the system. The

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16. Department of the Navy. OPNAV INSTRUCTION 10171.5. Certification of major aviation training devices. Office of CNO, Navy Department, Washington, DC, 9 November 1976.

17. Department of the Navy. OPNAV INTRUCTION 5442.4.Aircraft, Training Devices and Support Equipment Material Condition Delfinitions, Mission-Essential Subsystems Matrices, and Mission Descriptions. Office of CNO, Navy Department, Washington, DC, September 28, 1981.

limited time available to the operational members to perform FPT tasks coupled with the short tour typically involved results in the FPT making educated guesses as to what the MESM should include for the training events. Trainer documentation is of little help since it is not oriented to identifying subsystem functional capability relative to training, much less to unspecified training objectives. Appendix G contains a sample trainer MESM and related mission description. It illustrates the problem of trying to identify trainer subsystem status, syllabus events, and percentage training mission which can be completed.

f. Review/Update Safety Program. Although safety considerations are addressed during the acquisition and operation of the device through specifications and standards and a safety program conducted by the Naval Training Equipment Center, the FPT, as users, can detect and evaluate safety problems during the day to day operations of the trainer. This is particularly important where unforeseen operating modes or conditions are implemented to meet training needs. The addition of extra instructors for example, occurs frequently. Additional equipment and materials can also be introducedv.

Problem: The FPT members will rarely have had any safety training or experience, especially in terms of simulation equipment. Thus they will essentially be unaware of the need or the requirements for warnings, emergency egress, emergency lighting, and control of hazardous materials, much less how to identify and analyze potentially dangerous failures of training subsystems. A review of the trainers surveyed in terms of safety pointed out the need for a continuing review of the operational safety problems of trainers. Although instructions address the problem [18], an "on-site" and continuing operational review of the trainer and its utilization is essential to detect and appraise safety problems.

Summary. Phase III is concerned with the operational period of the trainer. Although the FPTs are not currently chartered to operate after trainer acceptance, most FPTs continue to function based on the obvious need for fleet inputs throughout the life of the training device. This ranges from the need for assisting in the periodic validation of the trainers performance to modification and change definition and specification. It is particularly important in maintaining the currency of the MESM and the training syllabus, both for the aircrew and for the instructor and operator staff. Finally, the need for continuing evaluation of the operational safety of the trainer is necessary.

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18. Department of the Navy. NAVTRAEQUIPCEN Instruction 5100.5B. NAVTRAEQUIPCEN Training Equipment Safety Program: implementation of. Naval Training Equipment Center, Orlando, FL, 5 October 1982.

PROBLEM ANALYSIS SUMMARY

The review and analysis of the functioning of the FPT in the acquisition and operation of aviation training devices within the Commander Naval Air Force, United States Pacific Fleet revealed that a wide variety of problems exist and constrain the effectiveness of the teams. The major problems and deficiencies in the FPT organization and functions and related problems in the trainer acquisition process will be summarized.

FPT FUNCTIONAL PROBLEMS. Both organizational and functional problems will be summarized.

a. The FPTs do not have the administrative and clerical support required to perform the functions outlined in OPNAV Instruction 1551.7B.

b. The FPTs are not routinely invited to attend all of the meetings outlined in the OPNAV instruction nor are they provided (or routinely requested) to review the relevant documentation for the meetings.

c. Reporting requirements are poorly defined in terms of content and responsibilities. Feedback to the FPT is largely nonexistent.

d. Training analyses critical to trainer functional specification are seldom completed to the level required for the development and evaluation of an effective trainer. These include front-end training system analysis, as well as the analyses necessary to develop the training syllabi, training performance criteria, and training effectiveness evaluation plans and criteria.

e. The FPT members cannot effectively perform their tasks related to trainer evaluation in the absence of the analyses outlined in (d.) above.

f. Fleet squadron requirements are seldom input. The FPTs, as presently constituted, have neither the time nor the procedures to solicit and consolidate all user requirements.

g. The high rate of turnover of FPT members coupled with the lack of user related documentation often results in inconsistent and conflicting user inputs to the trainer acquisition and support process.

h. The effectiveness of the FPT contributions are limited by their lack of training, experience, and briefings on trainer acquisition procedures, trainer technology and trainer-training methodology.

i. No human factors training system expertise is included in the FPT nor is any support readily available to the team. Yet many of the serious problems identified in the trainer surveys were the direct result of failure to apply existing design standards and guides, much less, conduct basic human engineering design efforts.

j. The FPT has no formal status after the device is accepted. Yet user inputs are important throughout the operational life of the trainer, especially in defining and evaluating changes and modifications.

ACQUISITION/SUPPORT RELATED PROBLEMS. These problems reflect the interface which the FPT must establish to input user requirements into the trainer acquisition and support events.

a. The FPT's involvement in the requirements setting phase of trainer acquisition is minimal. The FPT is seldom established until after the MC has been developed.

b. Training analyses are rarely completed to the depth required to structure training requirements or develop a meaningful functional specification.

c. In the absence of explicit training requirements documentation, the procurement specifications become hardware and software weapon system simulation (not training) oriented.

d. In the absence of training requirements documentation, the FPT's evaluations of the trainer during development and acceptance are necessarily directed to fidelity of weapon system simulation, not training effectiveness or training capability.

e. The FPT is not identified as a "member" of key reviews and meetings, especially the mock-up review.

f. The FPT's effectiveness at reviews, conferences, inspections and evaluations is limited by the lack of briefings and documentation relevant to the event. The lack of supporting data such as the training syllabi, training objectives and criteria, and instructional and manning concepts, further constrains their effectiveness at these events. The frequent turnover of FPT members compounds the problem in the absence of briefings and documentation.

g. The technical documentation which should be reviewed by the FPT to ensure that training requirements and system simulation requirements are met is extensive. The time required for effective review of the documents far exceeds that available to the typical FPT member.

h. Human factors analyses which are essential to ensure an effective and efficient user interface are rarely completed. In

addition the FPT has no experience or training in evaluating the efforts nor is the necessary effort well defined in user meaningful terms.

i. Trainer test plans and criteria are trainer subsystem and component performance oriented with essentially no reference to training capability or performance.

j. The FPT is generally relied upon for the acceptance and RFT decisions (given specified hardware and software performance). In the absence of training requirements, the FPT's decision is generally made on the basis of fidelity of simulation, not training capability and acceptability.

k. Development of an effective MESM is constrained by the lack of detailed syllabi, training performance criteria and definitive interface data between trainer subsystems performance and syllabus event requirements.

l. Trainer changes are not evaluated in terms of their impact on training requirements or training effectiveness. This results in part from the lack of development and documentation of training requirements and objectives throughout the trainer acquisition and operational life.

m. Requirements documents and supporting analyses are not modified or updated even when functional changes and modifications to the trainer are proposed and implemented.

n. The impact of trainer changes on instructor and operator training programs is seldom evaluated nor included in the change "package" when involved.

o. Validation and recertifications of the trainers do not directly include training capabilities, primarily since objectives and criteria have not been developed. Thus, as with the inspections and evaluations during the development phase, the FPT is forced to utilize simulation fidelity criteria, not user training requirements and effectiveness criteria.

FEASIBLE SOLUTIONS.

The third major task involved the structuring of feasible solutions to increase and enhance the effectiveness of the FPTs. The problems in the functioning of the teams and the related problems in the acquisition and support of the trainer were reviewed and grouped into three solution areas.

a. Organizational Problems,

b. Task Problems,

c. Trainer Acquisition and Modification Procedures

Problems.

In general the proposed solutions to the three areas are:

a. The formulation and promulgation of definitive instructions which formalize the organization and responsibilities of the FPT and its relationship to the training device life cycle and the activities and commands involved, i.e., the organization problem,

b. the development of FPT procedural guides which outline the events which will occur during the life cycle of a trainer, the objectives involved, the FPT tasks, contingency actions, sources of assistance and the development of FPT training manuals and guides to acquaint the new FPT member with the job involved, i.e., the task problem,

c. the identification of changes to the trainer acquisition and support process required to more effectively utilize the FPT and incorporate user requirements, i.e., the acquisition/support system problem.

ORGANIZATIONAL PROBLEM SOLUTIONS. The implementing OPNAV Instruction clearly states the need for providing user (and other interested and involved activities) inputs to the training device acquisition process. It established the FPT as the vehicle to accomplish it. However, the specifics essential to the implementation of the objectives were not developed and issued. Thus the FPT "exists" but without a formal structure or defined procedures to effectively operate. As a result, a variety of FPT "organizations" are in operation, reporting is varied in terms of content, frequency, form, and signature policy, lines of communication and responsibility are not defined, and scope and authority are not established. The solutions involve both the delineation of the organization required and its "modus operandi."

Figure 7 outlines a proposed organization chart for the FPTs. It locates the FPT and the Chairman at the Functional Wing with members being assigned as required from other commands and activities. The proposed organization capitalizes on the recently created Training Device Division within each of the Functional Wings in COMNAVAIRPAC. The Division is responsible for managing the Contractor Operation/ Maintenance of Simulators (COMS) program. It includes a Contracting Officer's Technical Representative (COTR) for each training device/suite in addition to the officer head of the Division. The division is also responsible for developing and reviewing the MESM and in general, is responsible for the utilization, accountability, custody and scheduling of the trainers. Thus it provides a logical "home" for the FPT and in addition, should have available the clerical and administrative support for the team.

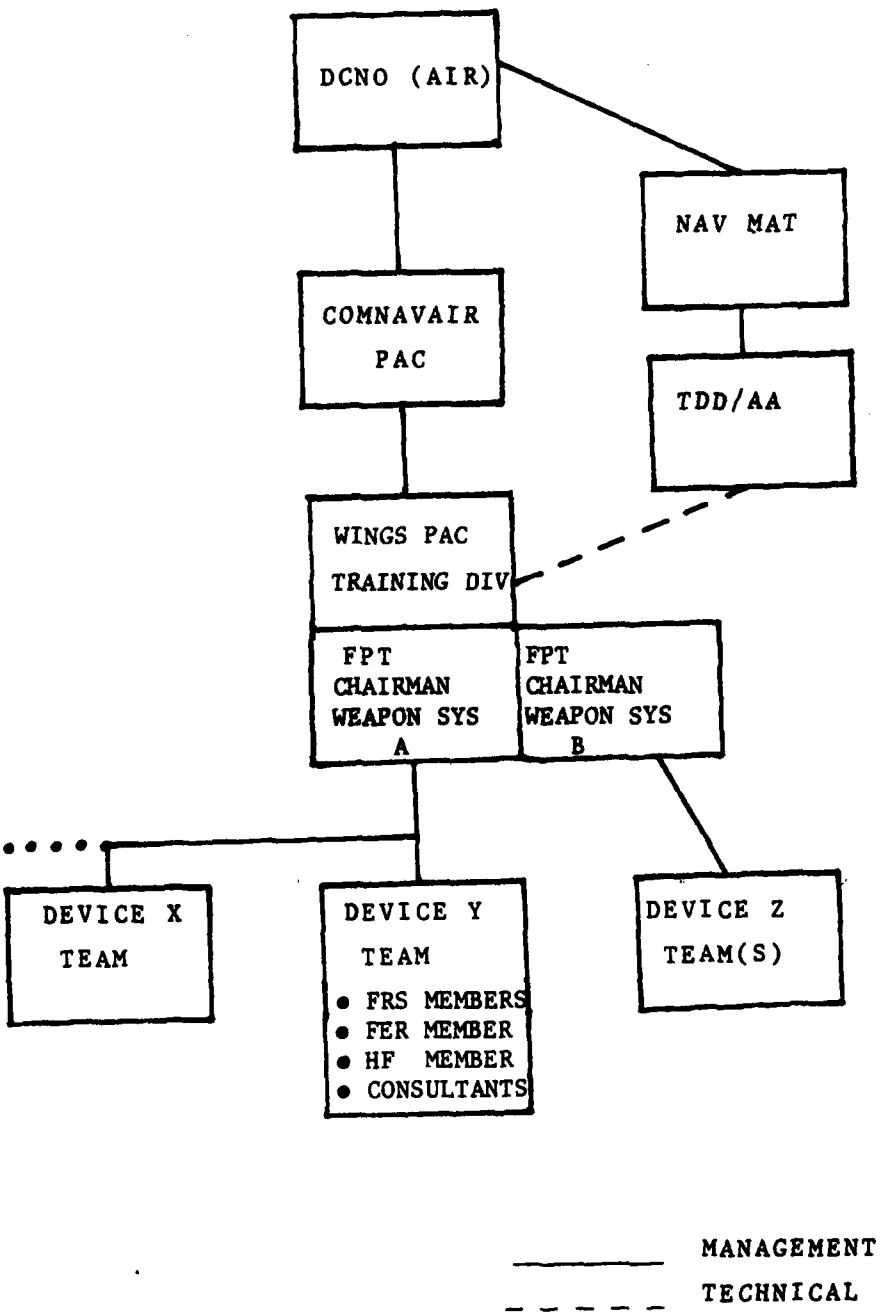

Figure 7. Proposed FPT organization chart for COMNAVAIRPAC.

The additional members shown include operationally experienced aircrew for the user/operational input, an engineer for hardware and software technical support, a human factors engineer for training systems analysis and human interface technical support and other consultants as required and available. In most cases, the aircrew members will probably be on collateral duty from the FRS and the engineer will be a FER from the NAVTRAEQUIPCEN Field Engineering Office or the COTR. The human factors engineering support, unless additional billets can be made available, could be provided through a collateral duty assignment for Navy Aerospace Experimental Psychologists (2300 designator). Six officers are located on the west coast, one at NAS Miramar, two at the Naval Personnel Research and Development Center, two at Pacific Missile Test Center, Pt. Mugu, and one at the Naval Post Graduate School in Monterey. The billets are in reasonable proximity to the Functional Wings Pacific with the exception of the COMMATVAQWINGPAC located at NAS Whidbey Island. Similar billets are available to support the FPTs within the Commander Naval Air Force United States Atlantic Fleet (COMNAVAIRLANT) organization.

To implement this approach, a COMNAVAIRPAC and COMNAVAIRLANT Instruction is required which identifies at least the following:

a. Functional Wing implementation actions,

b. FPT organizational structure and composition,

c. FPT tasks, functions and responsibilities,

d. FPT reporting requirements and formats,

e. relationship with FASOTRAGRUPAC/LANT and involved Detachments, NAVTRAEQUIPCEN Field Engineering Offices, Fleet Readiness Squadrons, trainer TDD/AA and the NAVTRAEQUIPCEN.

In addition, requests for support for the teams from the NAVTRAEQUIPCEN Field Engineering Offices and from the involved commands for the Navy Aerospace Psychologists support must be initiated.

FUNCTIONAL SOLUTION. The general conclusion regarding FPT functions in trainer acquisition and support is that the required inputs are not defined nor are means and techniques available (to the FPT) to input user requirements. The proposed solution is to develop guides specifically designed to identify each input action required of the FPT during the three phases of the trainer's life cycle.

Although the OPNAV instruction creating the FPT outlines an extensive involvement for the teams, in actual practice, the input is limited as pointed out in the review of the tasks for the three phases of the life cycle of a trainer. The major

problem stems from the lack of objective definition of operational training requirements (and constraints), development of trainer functional requirements, analyses of these requirements to identify training objectives and the subsequent translation of them into design specifications and evaluation criteria.

A second analysis of the task flows for the three phases was therefore conducted to identify what was needed to permit the FPT to provide the required inputs, even if the prerequisite analyses were not completed to the depth indicated. Figure 8 reviews the Phase I tasks and identifies the data involved at the different levels including that which is required by the FPT to perform the user input function. Figures 9 and 10 do the same for Phase II and Phase III.

It is clear that a separate detailed procedural guide will be required for each of the phases to assist the FPT members in completing the tasks involved. In addition to identifying the input requirements and the supporting data involved, the guides must treat the contingencies which can arise when the supporting analyses and data are not developed or provided to the FPT. As pointed out, the lack of definitive requirements and training analyses occurs frequently in training device acquisition and support.

The event guides should, in addition to outlining the basic acquisition events, review the function of the event, the FPT actions required, the documentation involved and the reporting required. Problem areas should be highlighted. Sample FPT inputs should be presented. A preliminary outline for the guides follows.

Volume I. FPT Precontract Events Guide. The events outlined should include at least the following:

a. Operational Requirements drafting and review procedures stressing the importance of isolating operational training objectives and identifying design and implementation constraints,

b. TSA objectives, procedures, techniques and outputs, including the interface between the analysts and the operational subject matter experts (SME) and the contingency tasks required when the TSA is not completed to the depth required for trainer specification,

c. preliminary syllabus preparation including training concept and relationship to the overall operational and/or planned training system,

d. MC review, stressing the functional characteristic of the document and the criticality of user stated training objectives and requirements,

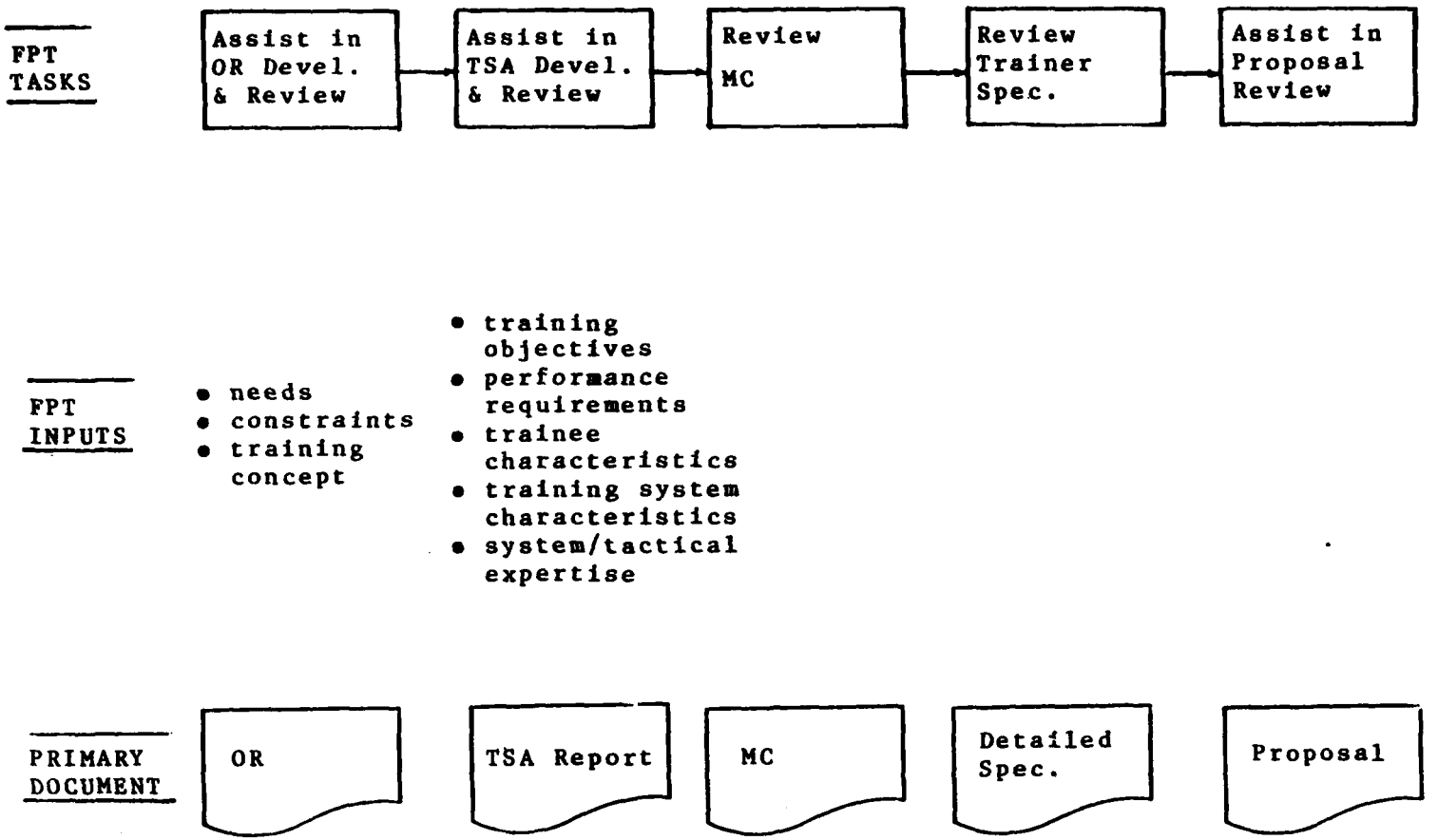

Figure 8. Proposed FPT task flow Phase I.

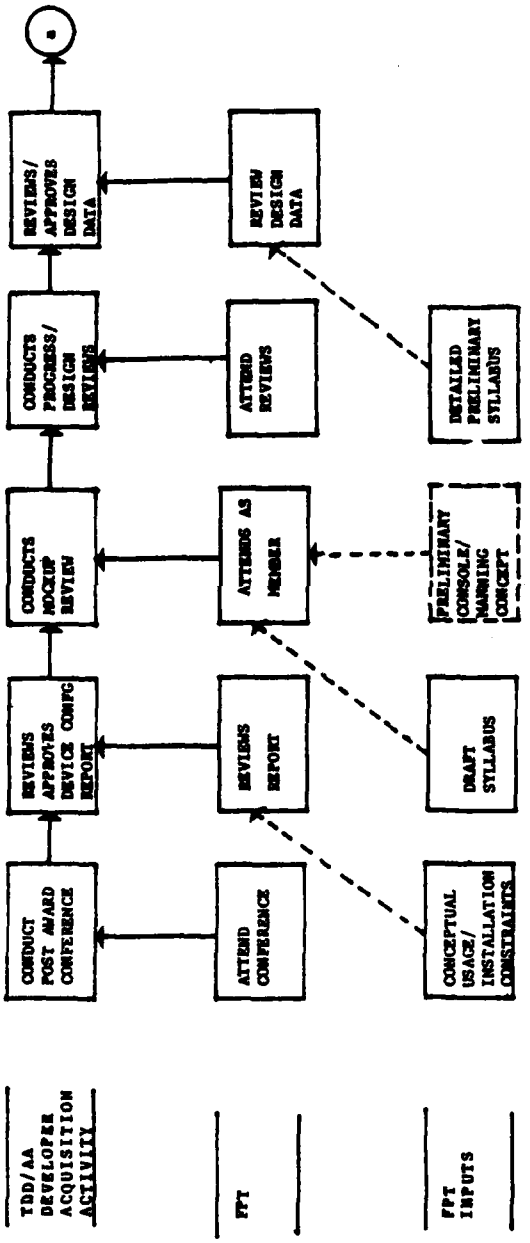

Figure 9. Proposed task flow Phase II (page 1 of 3).

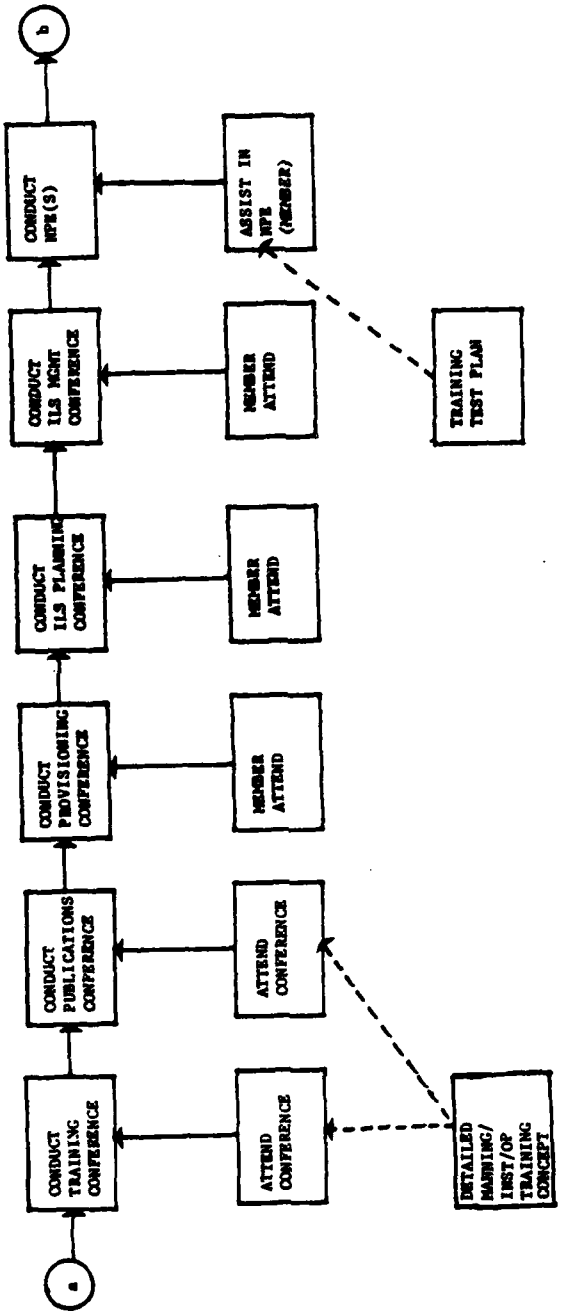

Figure 9. Proposed task flow Phase II (page 2 of 3).

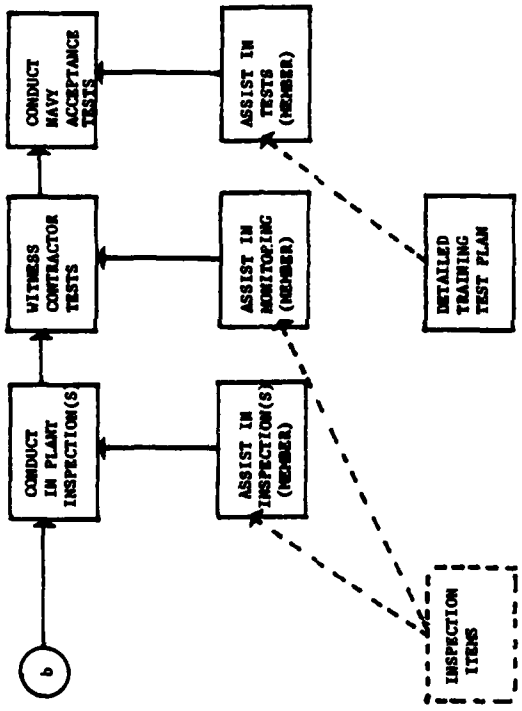

Figure 9. Proposed task flow Phase II (page 3 of 3).

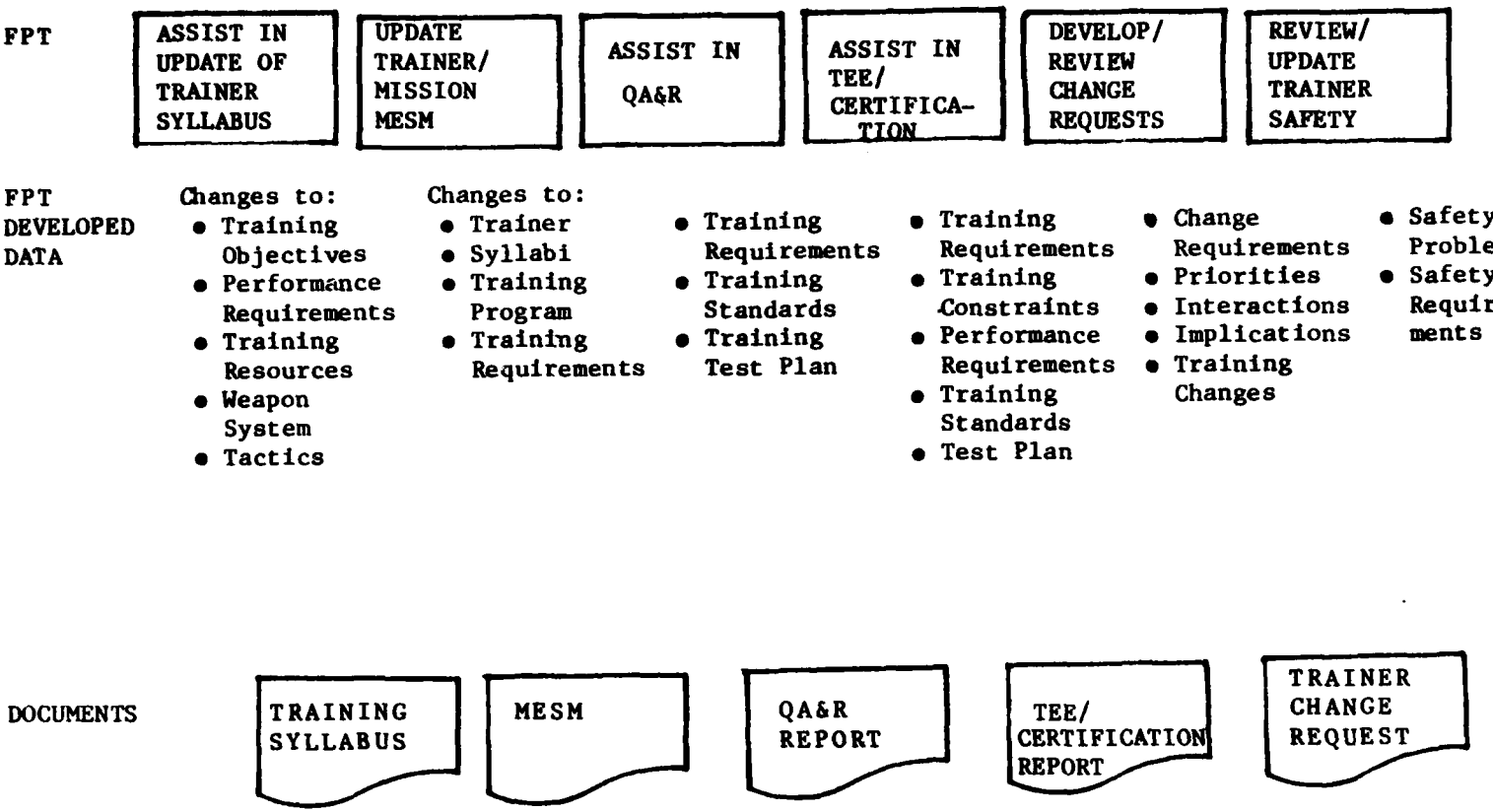

Figure 10. Proposed FPT task flow Phase III.

e. detailed specification review and the relationship to user requirements,

f. technical proposal review stressing the consideration of the proposals understanding of the operational problem and the design rationale presented.

The volume must also provide "recovery" plans for the FPT to implement when the team is created late in the phase such as after the MC has been developed.

Volume II. FPT Development Event Guide. The events outlined should include and stress at least the following:

a. preliminary device configuration report review and the need for the prior development of a user's installation and operation conceptual plan,

b. mock-up review attendance and the need for prior preparation of a manning and operating concept and a preliminary or sample training syllabus for use at the Mockup Review as well as for briefing of the FPT members attending on the mockup review procedures and relevant specifications and standards,

c. review of the Report of the mock-up review and the final device configuration report, stressing the significance of the approval on subsequent design and implementation and the importance of critical review of the human factors analysis of the user interface, especially the instructor console,

d. attendance at design and progress reviews stressing the role of the FPT in ensuring that the developer understands the operational requirement, the operational system configuration (trainer baseline) and operational employment as well as the training objectives for the device,

e. review of design data stressing the criticality of the FPT's review in terms of operational requirements and training inputs,

f. attending the Training Conference, the Publications Conference, the ILS Management Conference and related meetings, stressing the primary FPT task of inputting the user's needs and ensuring understanding of the operational training problem and the operational system including manpower (quantitative and qualitative) and time constraints,

g. conducting the NPE and stressing the importance of the development of a detailed evaluation plan which includes training evolutions as well as fidelity checks,

h. assisting in the Navy preliminary (in-plant) and final

(on-site) inspections, again stressing the ultimate importance of an objective test plan which has been related to the procurement specifications but contains the requirements to establish RFO/RFT,

i. acceptance of the device and establishing RFT, stressing the contractual and operational problems involved and the significance of RFO/RFT certification.

In addition, the guide must contain samples of the plans and reports required of the FPT, especially test plans, event preparation check lists, sources of technical assistance, and procedural forms such as "mock-up chits" and evaluation unsatisfactory/deficiency reports.

Volume III. FPT Operation and Support Phase Event Guide. Although the events involved are shown in a flow chart format in Figure 10, the Phase III events are repetitive in nature depending on the weapon system and training changes and validation requirements. The events include:

a. assisting in the update of the training syllabi stressing the need to update training objectives and requirements including the MC, evaluating training assets in terms of changes, updating performance criteria and incorporating tactics changes,

b. updating trainer MESM and mission descriptions stressing the importance of reflecting trainer subsystem modifications and training requirements impacts on subsystem-mission requirements,

c. assisting in the QA&Rs stressing the need for including training standards and requirements in an objective test plan,

d. assisting in effectiveness evaluations and certifications, again stressing the importance of an objective test plan and criteria as well as updated training criteria and training objectives,

e. develop and review trainer change requirements/requests in terms of training priorities, training system interactions, and support implications,

f. review and update trainer safety requirements and procedures taking into account the impact of trainer changes on safety.

A major consideration in Phase III guidance must be the problem of FPT input continuity in the face of FPT member turnover and the requirement for consolidated user input rather than personnal preference and unique experience preferences.

ACQUISITION/SUPPORT SYSTEM SOLUTION. Two general problems dominate the area. First, the basic analyses vital to FPT

functioning in the trainer acquisition and support processes are seldom completed to the level required, and second, the FPTs are not fully and formally integrated into the development and support procedures involved. The two problems obviously interact, e.g., the analyses cannot be conducted without user inputs and involvement.

The existing instructions and guides for the development of trainers basically identify the required analyses, especially the critical front-end analyses. However, they do not outline the end products or the procedures in sufficient detail to ensure the required effort is completed. This is particularly true in terms of FPT inputs and involvement. As a result, the FPT is effectively unable to input the required data or to evaluate the effectiveness of the effort in terms of operational requirements and needs.

Again, the existing instructions and guides encourage the active involvement of the FPT in the definition and acquisition process but fail to provide a consistent system for achieving it. The ipso facto functioning of the FPT during the trainer operational phase must be formalized.

Figures 8, 9, and 10 outline the major events in the acquisition and support processes for an aviation training simulator and identify those which should routinely require FPT involvement. Although some modifications to existing acquisition instructions will be required to ensure this involvement, the basic requirements have been stated in existing instructions. However, the required participation in the operational phase must be defined and incorporated in the relevant instructions. Since a variety of instructions are involved, it is proposed that the required FPT functions be initially directed by COMNAVAIRPAC as part of the instruction establishing the proposed FPT organization outlined in Figure 7. This will both expedite the implementation of the FPT in Phase III and provide a test bed to evaluate the results of the approach.

SECTION IV

DISCUSSION

GENERAL

The necessity of providing and incorporating user requirements and constraints into the design, development and operational support of training devices is clearly recognized. The FPT concept to support this requirement was initiated in the mid-1960s. The objective was to capitalize on current weapon system and operational training expertise such as could be found in the Fleet Readiness Squadrons as well as in the Fleet Squadrons.

Unfortunately, the implementation of the concept has not produced the effectiveness required. The analysis has highlighted two major problems. First, the organizational structure and guidance for the teams have in large, proven to be at best, marginally effective and are inconsistent in terms of results. Second, the existing acquisition and operational support procedures were not designed to respond to or readily utilize user requirements and constraints, especially when stated in operational or user terms.

ORGANIZATION PROBLEM

The requirement for establishing the FPT issued by CNO and implemented by the type commanders, while creating the teams, failed to address the problem of lines of communication, authority, and most importantly, the command structure and organization. Thus the teams which have been created exhibit a wide variety of modes of operation and organization. In general, they have all been handicapped by the situation and with few exceptions, have had difficulty in not only establishing user inputs, but in even identifying when and how to accomplish the task.

The results and analyses indicate that there is need for:

a. establishing and maintaining the teams for the full life of the trainer, i.e., from concept to retirement,

b. a formal FPT organization with clearly defined lines of communications and operating procedures,

c. at least minimal clerical and administrative support,

d. defined responsibilities throughout the trainer life cycle,

e. clearly defined interfaces with other commands and

activities involved in trainer definition, development and support,

f. technical assistance in the areas of human factors system engineering, training software, training hardware and training techniques,

g. guides and manuals which define the what, when and how of the FPT tasks and functions during the life cycle of the trainer,

h. recognition that during at least certain periods in the trainer life cycle, events occur which demand concentrated effort and time of the FPT members.

The collateral duty staffing approach compounds the problem by limiting the time and effort any member can expend on FPT tasks and functions. However, since collateral duty from the FRSs (and Functional Wings) appears to be the only feasible method of ensuring current operational system and training experience, the required solution involves establishing the structure of the teams and providing them the assistance required to perform the job effectively and then ensuring that the acquisition and support procedures provide for accepting user inputs in operational terms, not design or engineering terms.

The solution outlined which establishes the team under the Functional Wings should solve the primary problems of providing a legitimate "home" for the team as well as providing at least minimal clerical and administrative support. A COMNAVAIRPAC and a COMNAVAIRLANT Instruction which establishes this structure and which charters the FPTs for the life of the trainer will be required. The organization outlined in Figure 7 is a feasible solution and should provide the structure required. A similar approach may be indicated for the surface and subsurface warfare areas.

PROCEDURAL PROBLEMS

The procedural problems identified and analyzed are twofold, and although they interact, involve different solutions. One problem is concerned with the FPT's procedures for inputting user requirements and monitoring and evaluating the implementation; the other is concerned with the acquisition and support procedures relative to incorporation of user inputs. Neither can be effective without both solutions, i.e., there is no point in establishing effective means of generating user requirements if they cannot be incorporated and vice versa, no point in establishing explicit requirements if they cannot be input. Although, in general, it may appear that both currently exist, the data clearly indicate that such is not the case.

Thus while the originating instructions recognized the need

for user inputs, they failed to recognize that a major part of the problem, if not the core of the problem, is in the nature of the trainer acquisition and support procedures themselves. Since the existing system was not responsive to user needs, creating a centralized source of user inputs, while necessary, could not solve the problem unless definitive means for incorporating the inputs was also established. As a result, the FPTs in general, are forced to act more as a committee or as consultants with the effectiveness largely dependent on capabilities and tenacity of individual members. This has tended to create "one-man" FPTs. While, some have been effective, the results tend to reflect a narrow range of inputs and often personal preferences rather than consolidated fleet training needs and problems.

FPT INPUT PROCEDURES. The three phases outlined for the trainer life cycle involve a wide variety of analytical design and evaluative design and implementation actions. Not all require user input or involvement. Unfortunately, the results reveal that those which are or should be dependent on user interaction, are not well defined nor is the user routinely alerted to the occurrence of these actions. Of even greater importance, the required actions of the FPT are not clearly identified in any existing documentation. As the results indicate, the end situation created is one in which:

a. the FPT may not be aware of the next event in the phase,

b. the FPT may not be aware of the action required of them by the event,

c. the TDD/AA is not always aware of the requirement or necessity for user input to the event,

d. the event process is not designed to accept user inputs in user/operational terms.

As a result, the incorporation of user inputs was found to be typically limited to:

a. validation of fidelity of weapon system simulation,

b. "consultant" type of actions, often reflecting personal experience and preferences.

The FPT guides outlined should provide at least initial guidance to the FPT in terms of what occurs in the trainer life cycle phase and what inputs the FPT should make. The development of the guides should also result in the standardization of user inputs which will contribute to the solution of the second part of the problem, i.e., the incorporation of user inputs into the acquisition/support task involved.

ACQUISITION/SUPPORT PROCEDURES. The results have shown that the

procedures involved in the various tasks in the definition, design, development, test and support of training devices are not structured to readily accept user inputs in user/operational terms. As a result, the FPTs are generally forced to translate their requirements into engineering and acquisition terms. The FPT members are neither trained nor experienced in this area. The problem becomes critical for those key events in the life cycle which are dependent on user inputs, e.g., functional specification, configuration and mock-up review, test and evaluation and MESM development. Although in theory, operational needs are routinely input to the trainer development and support process, it is clear that the required analysis and integration of results does not always occur. For example, it was not unusual to find that the MC and detailed specification had been developed without an analysis of the training requirement or development of performance requirements. Similarly, test plans and objective criteria which reflect operational training requirements are not routinely developed.

Although, the modification of trainer acquisition/support procedures documentation will be required eventually, the proposed plan is to initially enhance FPT functioning through clarifying their organization and responsibilities and through the structuring of their inputs to meet trainer life cycle process requirements. As pointed out in the results section, the initial requirements and training analyses and documentation essential to the incorporation of user inputs, are identified in existing instructions, specifications, and standards. Therefore enhanced FPT functioning, coupled with effective implementation of the existing requirements, should produce a major improvement while avoiding any major disruption to the acquisition/support procedures. These results can then provide a sound basis for the identification of other changes required and the refinement of the FPT support requirements.

SECTION V

CONCLUSIONS AND RECOMMENDATIONS

The general conclusion reached was that while the FPT concept offers a feasible and viable means of providing current user inputs to training device definition, acquisition and support, the existing implementation of the concept severely constrains its effectiveness. Although the analysis was conducted within COMNAVAIRPAC, the results are considered to be equally applicable to COMNAVAIRLANT and other type commanders since the problems of FPT functioning should be similar. It is particulary true in respect to COMNAVAIRLANT since the same trainer devices are used in both COMNAVAIRPAC and COMNAVAIRLANT and a single FPT generally exists for each trainer. Thus although the following conclusions and recommendations are directed towards a solution within COMNAVAIRPAC, the approach, when proven effective should be applicable Navy wide.

Modifications to the OPNAV implementing instruction will eventually be required. However, it is considered that a demonstration of the effectiveness of the solutions proposed should be established before any permanent or major changes are initiated. Therefore, the following specific conclusions and related recommendations were developed with a view to a prototype solution within COMNAVAIRPAC.

Conclusion 1. The existing instructions do not adequately delineate either the organization or functioning of the FPT.

Recommendation 1. Prepare and promulgate a COMNAVAIRPAC Instruction establishing the FPT within the Functional Wings, preferably as part of the Training Device Division, and identifying the composition of the team. The team should include a Chairman from the Wing and additional qualified aircrew members from the Fleet Readiness Squadron. Required clerical and administrative support and travel funds should be provided by the Wing.

Conclusion 2. The FPT must be functional throughout the life cycle of the training device.

Recommendation 2. The COMNAVAIRPAC should direct the establishment of the FPT when the OR is being staffed (and prior to the preparation of the MC) to continue until the device is declared excess and retired.

Conclusion 3. The FPT's inputs to the acquisition and support tasks and events are neither identified or structured.

Recommendation 3. The COMNAVAIRPAC should prepare and promulgate with the new FPT implementing instruction, expanded

FPT tasks and functions related to the major trainer acquisition and support events.

Conclusion 4. The typical FPT member has no experience or training in training device acquisition and support procedures or in the analysis and development of the required user inputs. He is typically rotated with three years regardless of trainer program status and often is assigned for only one year to the FPT as a collateral duty.

Recommendation 4. Detailed FPT guides should be developed which identify the events involved and their function, the inputs required of the FPT and how they should be developed, relevant formats and samples and contingency actions which can be taken if the required data or support are not available to complete the action. A separate guide for each of the three phases of the trainer life cycle is required. In addition a general introductory guide to FPT functions, objectives, responsibilities and authority, training device life cycle events, sources of support and assistance and relevant instructions, standards, specifications and handbooks should be developed.

Conclusion 5. The FPTs require technical advisors or consultants in the areas of training hardware, training software, and human factors engineering. Since full time engineering support is not required, nor is the objective of the FPT to conduct engineering, the requirement can be met through existing resources in these areas. Sources of hardware and software support include the NAVTRAEQUIPCEN Field Engineering Offices located at the training base and the COTRs located in the Wing Training Device Division. Human engineering and training analysis support could be requested of the uniformed Navy Aerospace Experimental Psychologists (designator 2300).

Recommendation 5. Requests for the support of the FERs and the Aerospace Psychologists should be initiated by the COMNAVAIRPAC. Since continuity will be critical to the effectiveness of these "on-call" support personnel, the requests and implementation should provide for continued support from specified individuals for at least major phase of the acquisition and support phases of the trainer life cycle.

Conclusion 6. Critical training system and training operations analyses are frequently bypassed or not completed. Thus the basic data on which the trainer or changes to it should be based, are not developed. As a result, the FPT is essentially unable to either evaluate the design effort or test and evaluate the trainer or change and supporting documentation for the device is either not generated or updated.

Recommendation 6. Approval of the OR, the MC, and TECRs by the COMNAVAIRPAC should be contingent upon the development of at least the minimum essential data to justify the functional

requirement involved whether it be the MC, the training plan, the MESM, the syllabus or the change request.

Conclusion 7. The FPTs are not routinely involved in user "concerned" trainer acquisition and support events including conferences, program reviews, and briefings and design data review and approval.

Recommendation 7. The COMNAVAIRPAC should identify at least the routine events which the FPTs should attend throughout the life cycle of a major training device.

Conclusion 8. Trainer test and evaluation plans do not address the training function. As a result, training devices are tested and evaluated in terms of fidelity of simulation to an unspecified criteria with no evaluation of primary effectiveness or usability until after the trainer has been accepted.

Recommendation 8. The COMNAVAIRPAC should direct that no trainer test and evaluation involving training capabilities be conducted by FPTs until a detailed test plan which addresses the relevant training objectives and capabilities along with related performance criteria (in addition to other involved test objectives) has been developed and forwarded for approval.

Conclusion 9. Critical user inputs to trainer acquisition and support events are often missing or ineffective. These include such basic data as usage and manning concept, advanced and test syllabi, user implementation and support constraints, training concept, training goals and utilization requirements and/or projections, publication requirements, and device training concept and requirements. While the FPT guides should identify and structure the necessary FPT inputs, changes to trainer acquisition and support instructions must eventually be made to ensure that the inputs and related events are completed before the process can continue.

Recommendation 9. The COMNAVAIRPAC should develop and forward for review and implementation as milestones, a list of critical user inputs and related trainer acquisition and support events and procedures.

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INSTRUCTIONS

OPNAV INSTRUCTION 1551.7 Fleet participation in development, acquistion and acceptance of major training devices

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COMNAVAIRPAC INSTRUCTION 5220.1 Quality Assurance and Revalidation (QA&R) Program for Training Devices; policy and procedures for

COMNAVAIRPAC INSTRUCTION 10170.2 Aviation training aids; information and policies concerning

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NTEC INSTRUCTION 3910.4 Functional Statement, Functional Description, Mini-Military Characteristics, and Detail Characteristics; instructions and responsibilities for

NAVTRAEQUIPCEN INSTRUCTION 4720.1 Field requests for changes to training devices and simulators under the inventory management of the NAVTRAEQUIPCEN (Cognizance Symbol "20"); procedures and information concerning

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MIL-T-29053 Requirements for Training System Development

MIL-T-23991 Training Devices, Military; General Specification For

MIL-M-82376 Manuals, Technical; Operation and Maintenance For Training Devices

MIL-T-82335(TD) Trainer, Fixed Wing, Flight; General Specification For

INSTRUCTIONS

OPNAV INSTRUCTION 1500.8 Preparation and implementation of Navy Training Plans for new developments

OPNAV INSTRUCTION 5220.9 Quality assurance and revalidation of training devices

COMNAVAIRLANT INSTRUCTIOIN 10171.2 Aviation Training Aids/Devices; Information and Policies Concerning

COMNAVAIRPAC INSTRUCTION 1500.6 Submission and review of formal training course curricula

NTEC INSTRUCTION 1551.7 Fleet participation in development, acquisition and acceptance of major training devices

NAVTRAEQUIPCEN INSTRUCTION 4790.2 Trainer Improvement Program; responsibilities and instructions for

FASOTRAGRUPACINST 3620.1 Simulator Mission Capability and Utilization Reporting Procedures

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COMNAVAIRPAC to Distribution List, 27 January 1983, Contractor Operation/Maintenance of Simulator (COMS) Program:

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Ricard, G. L., Crosby, T. N. and Lambert, E. Y. Workshop on Instructional Features and Instructor/Operator Station Design for Training Systems. Technical Report NAVTRAEQUIPCEN IH-341, Naval Training Equipment Center, Orlando, FL, October 1982.

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APPENDIX A

FLEET PROJECT TEAM'S ROLE, FUNCTIONS AND DUTIES

[*From* OPNAV INST 1551.7B, 22 April 1977]

APPENDIX A
FLEET PROJECT TEAM'S ROLE, FUNCTIONS AND DUTIES

[From OPNAV INST 1551.7B, 22 April 1977]

1. The role, functions and duties of the Fleet Project Team follows:

a. Role. To assist the Training Device Development/ Acquisition Activity in operational training matters concerning the development, acquisition, acceptance, and introduction of training devices.

b. Functions.

(1) To act in an advisory capacity to the Training Device Development/Acquisition Activity during the development, acquisition and acceptance of the training device.

(2) To act as reviewer, inspector, and tester, as requested by the Cognizant Sponsor or the Training Device Development/Acquisition Activity in order to validate projected trainer capabilities at certain points in the development program to ensure that the end product satisfies the stated training requirements.

(3) To assist the Training Device Development/Acquisition Activity in developing qualitative and quantitative training objectives for incorporation in the military characteristics document.

c. Duties of the FPT may include the following:

(1) Maintain a correspondence file for the device.

(2) Attend and actively participate in appropriate conferences, reviews and meetings which should include as a minimum the following:

(a) Training Situation Analysis Review
(b) Military Characteristics Review
(c) Device Performance Specifications Review
(d) Technical and Mock-up Reviews
(e) Design Freeze Reviews
(f) Integrated Logistics Support Review
(g) In-Plant Preliminary Inspection, Test, and Check-out
(h) On-site Final Inspection, Tests and Check-out
(i) Determination of Trainer Ready-for-Training Status

(3) Report in writing the results of conferences, reviews and meetings, emphasizing comments or direction given and decisions made. Provide copies of the report to the Training Device Development/Acquisition Activity, Cognizant Commander, Training Agency, Chief of Naval Operations (Cognizant Sponsor) and to the appropriate chain of command.

(4) Provide unified guidance to the Training Device Development/Acquisition Activity on the requirements of Command(s) concerned. Unresolved changes to the device shall be submitted to the Chief of Naval Operations (Cognizant Sponsor) for resolution.

(5) Develop the training syllabus in which the device will be used. Submit training syllabus related to aviation devices to CNO (Cognizant Sponsor) for approval. Training syllabus related to other devices may be approved by the applicable Training Agent.

(6) Assist the Training Device Development/Acquisition Activity in the development of trainer performance acceptance criteria which will be used to determine the acceptability of the trainer as RFT.

(7) Inform the Training Device Development/Acquisition Activity in writing of known changes in procedures, tactics, planned operating environment, training concept, syllabus, and training plans which may have an effect on the trainer capabilities and/or delivery date. Provide operational data to Training Device Development/Acquisition Activity when requested.

(8) Coordinate training device management with the Training Device Development/Acquisition Activity in order to avoid legal implications concerning contractual matters.

(9) Perform operation mission profile maneuvers on the trainer to determine device performance relative to trainer performance acceptance criteria and stated training requirements, and provide a written report to the training device development/ acquisition activity.

(10) Recommend validation of RFT to the appropriate Training Agent when the trainer is RFT in every respect.

(11) Prepare a list of trainer deficiencies which, if corrected, would make a non-RFT device ready-for-training. Submit the original document to the Training Device Development/ Acquisition Activity with copies to all Commands and agencies concerned.

(12) Chairman of the FPT resolve all differences of opinion with the team and act as spokesman for the team in dealing with the Training Device Development/Acquisition

Activity.

(13) Receive, evaluate and relay to the Training Device Development/Acquisition Activity comments and recommendations from the operational units and/or Training Support Agencies on definitive problem areas related to the training device which adversely affect user training plans and programs.

(14) Fleet Project Team members, in the case of reassignment, ensure that their commands are apprised of the need to appoint a replacement and ensure that the replacement is brought up-to-date on all past and planned proceedings. It shall be the responsibility of the departing member to notify all concerned of his replacement.

(15) Chairman of the FPT ensure that all members of the team remain aware of the development and acquisition of the training device and that subsequent changes are properly promulgated for appropriate action on each member's part.

APPENDIX B

DETAIL MILITARY CHARACTERISTICS FORMAT

[From NAVTRAEQUIPCENINST 3910.4A, 18 February 1977]

NOTE: Minor deviations are permissable when warranted by unusual situations. Deviations should be judiciously exercised.

DETAIL MILITARY CHARACTERISTICS

FOR

(DEVICE TITLE AND NUMBER)

NOTE: A Military Characteristics is the product, resulting from a training analysis, which describes a medium to solve a training problem. If the training analysis identifies more than one medium, a separate MC will be prepared for each.

I. SUMMARY

NOTE: The purpose of this section is to identify the training requirement for which this document is being prepared.

A. Purpose of the Device

- Summarily describe the training purpose of the device.

B. Operational Situation

- Briefly describe the military subject, system or subsystem to provide the reader an understanding of its function. For a non-weapons system training problem, describe the tactical/training situation which creates the training need.
- Briefly describe the difficulties, hazards, non-availability, cost, impact, etc., of using operational equipment for training in the achievement of the training objectives.

C. Origin of Requirement

- Cite correspondence which requested development of a device and/or a solution to a training problem.
- Cite results of any trips, conferences, Fleet Project Team meetings, and activities which contributed to the development of this document.
- Cite the source document, when available, which provided the behavioral objectives.
- Cite other significant correspondence, documents, etc., which contribute and relate to defining the requirement.
- Cite any funding, scheduling, and facilities restrictions which may impact the capabilities and/or design of the proposed device.

II. TRAINING ANALYSIS

NOTE: The purpose of this section is to document the findings of a Training Situation Analysis which substantiates the need for the training medium identified in this MC.

A. Training Situation Analysis (TSA)

NOTE 1: The analytical method for the conduct of a Training Situation Analysis identified in reference (d). One of the findings of a formal analysis is the identification and determination of the optimum media to support a training program based on the achievement of behavioral objectives. Therefore, it is a relatively simple procedure to extract from the report the information needed for a particular medium to satisfy the requirement of an MC format.

NOTE 2: It is unlikely that N-2211 or N-231 personnel will conduct or have access to a formal systematic TSA in the day-to-day work effort of preparing MC's. Therefore, the Training/Education Specialist acting as an analyst, will conduct an informal Front End Analysis (empirical) as part of the process of preparing an MC. The Front End Analysis is informally conducted, based on the judgement and experience of the analyst. Properly conducted, the results are valid.

NOTE 3: Performing a Front End Analysis is not a rote process, but requires the exercise of flexibility, inventiveness and initiative by the analyst. In the implementation of a Front End Analysis, factors to be considered are:

The objective of the analysis is to validate the requirement for the device based on the achievement of behavioral objectives.

Start the analysis by determining what the trainee is required to do at the completion of the training cycle or program (Terminal Behavioral Objective (TBO)).

Knowing the TBO (his job); what tasks make up his job? Make up a listing. Be practical in the listing of tasks; stay at a level which is workable and is understandable to both you and the Fleet representative. Don't let it become a quagmire.

With the complete and valid listing of tasks, perform a task analysis. Determine the tasks for which training will be provided in the medium described in this document. Remember, in most cases the medium will support only a segment of training in the overall training program or cycle; i.e., it will be used in the tenth-twelfth week of a twenty week course or it will be used for 40 hours in a 200 hour syllabus. If the medium supports the entire course or training cycle then all are training tasks. In either case, develop the applicable Specific Behavioral Objectives (SBO's). This is done by adding task performance standards and conditions to the task itself. For example: Adjust the carburetor so that the engine will idle at 500 rpm (task) while performing engine tune up procedures (condition). This will be done with 100% accuracy (standard). The above is a performance SBO. It is a behavior required in performance of his job. Further analysis is made to classify the behavior as cognitive or psychomotor, level of difficulty/ criticality of tasks, etc.

Consider now the student qualifications. A judgement is made whether we are concerned with his entry level qualifications to the course or his cognitive and psychomotor skills he has acquired and already possesses up to the point of training in the device; i.e., in the tenth week of the course, or both.

NOTE 4: In the case of multiple trainees such as a team trainer, the procedure for developing TBO's and SBO's is basically the same. They would be done for each individual of the team. The additional procedure would be to develop a team TBO and SBO. In certain situations, such as a long span of training, interim TBO's may be helpful.

NOTE 5: The above NOTES are an attempt to assist the analyst in performing the training analysis portion of the MC. No attempt is made to address all the intangibles inherent in an analytical process.

- o Describe in summary form the process used and actions taken to perform the TSA.

- o Describe the Terminal Behavioral Objective(s) the trainee is required to have at the completion of the training.

- o Describe the Specific Behavioral Objectives the trainee is required to perform in his job for which training will be addressed in the device.

- o Describe the trainee entry qualifications and/or cognitive and psychomotor skills already possessed, prior to training in the device.

B. Training Objectives

NOTE: Training objectives are the objectives to be achieved by the trainee by learning and/or training in the device. The differentiation between SBO's and training objectives is that SBO's are the performance behaviors required for the trainee to do his job; while training objectives are the behaviors to be achieved in the device in order to ultimately do his job. In many situations the training objectives will have a lesser condition and standard than the SBO since it is not possible to train to the SBO condition and standard due to the limitations of the device. Transfer of training may be, and in many situations is less than a 1:1 ratio. The training objectives are addressed to the human (trainee) in the system and not to the device. For example, (at the completion of training in the device the trainee "will be able to ...," or "will ..."). The objectives are presumed to be preceded by the phrase within the parentheses and need not be written.

- o Describe the training objectives. State the performance, conditions, and standards that will actually be achieved in training in the device.

C. Training Requisites

NOTE: The information for this area is or should be a fall out of the training analysis.

- Describe the anticipated or existing training program in which the device will be utilized. Identify where training will be conducted, types and numbers of trainees, and length of course. Describe the training program as to whether training is formal, informal, individualized, team, etc.

- For an existing training program or a formal curriculum, describe how the device will be integrated into the program and how the behavioral objectives will be achieved through training.

- For an anticipated training program describe an optimum training sequence for utilizing the device based on the progressive achievement of behavioral objectives, using a building block approach.

- State the recommended number and duration of mission, sessions, and/or time, based on analysis each trainee is required to utilize the device to achieve the required objectives.

- State the rationale for the number of devices (trainee stations) based on number of students to be trained, hours required per trainee, utilization of device per day/week/year. A suggested formula for determining number of required trainee stations follows:

$$\frac{\text{No. of Trainees Per Year}}{\text{Training Hours Per Day}} \times \frac{\text{No. of Hrs. Req. Per Trainee}}{\text{Training Days Per Year}} = \text{Basic No. of Trainee Stations}$$

$$\text{Basic No. of Trainee Stations} + \text{10\% Basic Trainee Stations For Trainee Fluctuation} + \text{10\% Basic Trainee Stations For Trainee Changing Position} = \text{Trainee Stations Required}$$

- Describe the types of instructors/operators to be used including their qualifications and prerequisites for assignment. Indicate any special training required.

D. Rationale

- Identify the alternatives considered (if any), such as use of operational equipment, other training equipment, on-board training, etc., and why the selected device is best from the standpoint of meeting the behavioral objectives based on training/cost-effectiveness. Include specific cost comparison data where appropriate.

III. DEVICE DESCRIPTION

NOTE: The purpose of this section is to describe the functional characteristics of the proposed device so that all readers of this document can visualize its physical configuration and its capability to accomplish the training to achieve the required behavioral objectives. Emphasis is placed on the "what," what capabilities are required and not on "how." The functional characteristics must be developed in sufficient detail to enable the project team to prepare the follow-on documents; i.e., Design Approach, Specification, and realistic cost and scheduling information for planning, programming, and budgetary.

A. Functional Characteristics

- In the first paragraph provide a summary of the general characteristics of the device to give the readers a general idea of its capabilities and physical configuration. Include a line drawing or artist concept of the proposed device.

- Define the specific requirements for the device in terms of numbers and types of trainee stations, instructor/operator consoles, training procedures, training modes of operation, environmental variables, and tactical environment to be simulated.

- Define specific performance parameters of the device such as own-ship sensors, numbers and types of targets, altitudes, number of problems, number and types of signals, weapons, tolerances, point out those areas of training criticality, such as complex concepts, dexterity, time frames, stress, maximum ranges, and distractions.

- o Specify the degree of realism of trainee station displays, panel layouts, accuracy of readout information, motion characteristics, etc., to meet the training objectives.

- o Specify trainee equipment required and degree of simulation for each system/subsystem of the device.

  - o Itemize operational systems/subsystems being simulated or activated.

  - o Identify specific controls, instruments, indicators, etc., and specify degree of simulation.

  - o Identify specific failures and malfunctions to be simulated and introduced into the training device.

- o Define specific performance capabilities of the device such as degree of automation, student scoring, critique, debriefing and evaluation. Identify the type data required at and the capabilities of the instructor station.

B. Constraints

- o Describe the physical characteristics of the training site and the peculiarities of the training situation which will affect the engineering design of the trainer.

  - o State whether a permanent or portable installation, providing size, strength, and entry which will constrain shape, size, weight, density and packaging of the device.

  - o State whether device must be designed for ready disassembly/reassembly because of training site entry limitations, etc.

  - o State requirement for power, air conditioning, and transportation.

  - o State environmental conditions which will affect device such as dust, vibration, humidity, hot/cold, and wind.

- o State ambient lighting conditions in the classroom or in the field.
- o State any unusual requirements for electromagnetic interference/electromagnetic compatibility (EMI/EMC) protection.
- o State any other unusual facility or plant requirements.
- o Indicate any personnel hazards which could be associated with the device.

C. Availability and Utilization

- o Describe the goals for device availability and utilization.
- o State the number of hours/day, days/week, weeks/year the medium is required for training to meet the curriculum. State medium life expectancy (e.g., ten years before requiring major modernization; 20 years, etc.).
- o Identify any expected periods of unusually high or unusually low utilization (e.g., prior to deployment, phased schedules, dependent upon other device input/output).
- o Identify system operational modes required (if known) and consider the use of available alternate systems to continue the training period if one system or subsystem fails. Examples: If the sonar system fails, can the tactical exercise be continued with visual and/or radar information? Are there phases or portions of training more critical to the end result than others? Are there some parts of the system more heavily used than others and, therefore, will require special design attention?
- o Describe type of exercise and time limits. Examples: Fifty-minute training sessions; Team training with ten-minute breaks between sessions; Time required to set up a problem.
- o Identify similar systems in use, where appropriate, and related experience to help substantiate utilization forecast.

D. Reliability

- o State the Reliability Mean-Time-Between-Failure (MTBF) design goals and/or requirements.

E. Maintainability

- o State goals and/or requirements for maintainability in terms of Mean-Time-To-Repair (MTTR). MTTR considerations include time trainer is down before training exercise is cancelled because of maintenance requirements alone or because of negative impact on trainee motivation.

IV. DEVICE SUPPORT

NOTE: The purpose of this section is to describe the Integrated Logistics Support (ILS) plan which will support the device at the training site and should not be addressed in terms of contract requirements.

A. Maintenance Plan

- o Describe the maintenance organization required to maintain the device.
- o State levels of maintenance such as how and by whom maintenance plan will be implemented.

B. Publications

- o Define the extent of requirements for device manuals and guides for operation, utilization and maintenance.
- o State whether material is required to supplement the device, such as graphics, aids, films, or schematics.

C. Personnel

- o Describe a personnel plan for device instructor, operator, and maintenance. State types, numbers and special talents required.

D. Training

- o Identify the need for factory or on-site training courses required to qualify personnel for operation and maintenance.
- o Specify all courses needed by title, location, length and which support personnel need courses.

E. Supply Support

- o State unusual requirements for provisioning and Provisioning Technical Documentation (PTD).

- o Identify the need for contractor interim supply support.

F. Contractor Technical Services

- o Indicate whether or not interim or continuous contractor operator/ maintenance services are required.

V. EVALUATION PLAN

- o Establish a plan for the project team to evaluate the trainer relative to the requirements of the MC. The limitations and parameters of the MC will be the guide in the evaluation. The training evaluation is intended to evaluate the effectiveness of the device in contributing to the solution of the training situation.

NOTE: A sheet in the following format will be attached to the MC for signature by the Fleet Project Team (FPT) member and to identify the points of contact at various commands.

The following personnel contributed to the development of this document and are the assigned point of contact in their specialty.

Organization	Name	Code	Phone No.

APPENDIX C

TYPICAL CONTENTS OF CONFIGURATION REPORT

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APPENDIX D

TYPICAL HUMAN FACTORS ANALYSIS

HUMAN FACTORS CONSIDERATIONS

5. HUMAN FACTORS CONSIDERATIONS

5.1 Human Engineering Criteria

5.1.1 General Arrangement - Primary human engineering criteria applied to the general arrangement are those concerned with personnel traffic flow patterns and accessibility for maintenance. Because the number of trainee and instructor personnel is small, maintaining easy ingress and egress (including emergency egress) is not a difficult problem, and hence shortness of path rather than non-interference was emphasized. Accessibility for maintenance is assured by providing appropriate spacing between units. Such spacing equals or exceeds the requirements of MIL-STD-1472.

5.1.2 Trainee Stations - Because of the nature of Device 2F112, the trainee stations are replicas of the flight and NFO compartments of the F-14A aircraft, including canopy. All items that are not functionally integrated or operative will be realistic three-dimensional replicas of the operational equipment and illuminated as in the operational equipment.

5.1.3 Instructor/Operator Station - Substantial human engineering inputs were made to the design of the IOS, described elsewhere. Criteria employed included:

(a) Design for use by instructors ranging from 5th to 95th percentile in anthropometric dimensions. Dimensions considered were those of the US Navy pilot population; male operators would have similar dimensions. Although there is a possibility that female training device operators will be in the picture during the life cycle of the 2F112, no allowance was made in console dimensioning for the smaller female, as this would severly constrain the design.

(b) Direct instructor inputs. It is not known at this time whether the two instructors will themselves assume "hands on" operation of the trainer, or whether their role will be to monitor displays and direct the operator to make needed control inputs. It was assumed, for design purposes, that the instructors would themselves undertake "hands on" operation.

(c) Ease of operation and ease of learning. Every effort was made to make IOS operation easy, and the actions needed to attain given objectives obvious and hence easy to learn. Occasionally a design situation was encountered in which there was a conflict between these two criteria. For example, in assigning a given CRT page to one of the two CRT's available

to each instructor, and, for Format A (8-inch high) pages, determining whether it would go on the upper or lower half, a "switchology" that is reasonably obvious from the switch labels would require many more key depressions than a "switchology" that was specifically designed to minimize the number of key depressions required. In this, and similar cases, emphasis was placed on efficiency of operation (e.g., minimizing the number of key depressions needed), even though this requires a modest learning effort. For most of the life cycle of the 2F112, such learning will be facilitated by the CAI system provided in the Instructor Training Mode, as described in Paragraph 5.0 of UDI-E-25517.

(d) Breadth of trainee experience. The 2F112 will make it possible for trainees to practice in a richer training environment than they will ever experience in the F-14A aircraft. The 2F112 training environment includes large numbers of targets, realistic ECM, and none of the safety, range, security, logistic, and other operational restrictions inherent in F-14A training. The IOS was designed to exploit this rich training environment, not merely to enable duplication of aircraft training missions.

5.2 Trainee and Instructor Tasks

5.2.1 Trainee Tasks - The tasks of the pilot and NFO trainees in the 2F112 are to learn, practice, and verify the skills and knowledge associated with not only operation of the front and rear cockpits of the F-14A, but crew coordination skills and knowledge as well. Learning of these skills and knowledges is facilitated by the richness of the training environment provided, as discussed in paragraph 5.1.3 (d).

5.2.2 Instructor Tasks - The two instructors, tactics and flight, perform the following functions during mission training:

(a) Selection of mission or exercise to be practiced.

(b) Preflight briefing of trainee(s).

(c) Demonstration of proper techniques and procedures.

(d) Observation and Monitoring of trainee performance.

(e) Evaluation of individual and/or crew training needs.

(f) Identification of areas that require coaching or additional practice.

(g) Coaching of trainee performance.

(h) Debriefing and critiquing of student performance.

(i) Structuring of subsequent practice.

(j) Administrative reporting of trainee progress.

In implementing this instructional loop, the instructors perform a number of operator functions, which may be delegated to the device operator:

(a) Preproblem setup, including aircraft, environment, and target parameters, and preprogrammed malfunctions.

(b) Insertion and removal of simulated malfunctions.

(c) Selecting parameters of trainee performance to be recorded.

(d) Monitoring and controlling the operational status of the trainer.

(e) Serving ATC and GCA functions.

5.2.3 Operator Tasks - The operator, under instructor direction, may perform the operator tasks listed above.

5.3 Automation of Instructional Functions

To enable the instructors to concentrate on critical, unautomatable functions, many facets of the functions enumerated in paragraph 5.2.2 have been automated, thus unburdening the instructors. An additional value of this automation is the standardization of training it provides. Among the more important functions that are automated in the 2F112 are the following:

(a) Preprogramming of targets in Formulate Mode.

(b) Storage of nine initial conditions sets.

(c) Preprogramming of Malfunctions.

(d) Display of text of GCA directions.

(e) Storage of all radio navigation facilities; no leapfrogging needed.

(f) Automatic determination of tuned/in-range criteria.

In addition, the CRT displays permit monitoring of wide aspects of trainee performance with a minimum of instructor effort.

5.4 Trainee Scoring and Evaluation Method

There are several subsystems of the trainer providing data to the instructors on trainee performance, and they are as follows:

(a) Repeater instruments. These are the traditional ways of evaluating trainee performance in a simulator.

(b) MAP and GCA pages on CRT.

(c) Recording of time history of six selected parameters.

(d) A printout of GCA performance, per Table 2 of the Specification.

Additional performance measurement will be discussed in the Trainer Configuration Report, Part II, Performance Assessment Subsystem.

5.5 Cueing and Feedback Method.

During a training exercise, the trainees will be able to evaluate their performance by interpreting cues as in the aircraft (e.g., instrument readings), and by listening to any possible instructor comments.

After the training exercise, the trainee has the following feedback:

(a) Instructor debriefing.

(b) Playback of all or part of the tactical exercise.

(c) Playback of audio.

(d) Playback (in the classroom) of two of the six cockpit displays.

(e) Printout of GCA performance.

(f) Recording six parameters (strip chart).

(g) Air-to-ground and air-to-air missile delivery scoring.

5.6 Provision for Briefing and Critique

The trainer facility will have a briefing room/classroom available for pre-exercise briefing and post-exercise critique. As noted earlier, a replay repeater will be provided in this room to playback recordings of the two cockpit displays (of the six available) selected by the instructor.

Pre-exercise briefing in the cockpit could include playback of elements of the exercise as recorded by instructors.

5.7 Abbreviations

Table 32 provides a glossary of abbreviations applicable to this report.

APPENDIX E

TYPICAL CDRL DATA FOR FPT REVIEW

TYPICAL CDRL DATA FOR FPT REVIEW

The following data items taken from NAVTRAEQUIPCEN BULLETIN 422-1B, AUTHORIZED DATA LIST dated 1 March 1983 are of direct interest to the FPT and should be reviewed by the team prior to being approved and or accepted. The column to the right lists the Data Item Discription number. The starred (*) items are of particular importance to the FPT.

1.	Planned Maintenance System Documentation	L-20304*
2.	Manual Technical, Standard	M-2044*.
3.	Computer Program Test Plan	T-2142
4.	Operator's Manual	M-2145*
5.	Software Change Proposal, Software Enhancement Proposal	E-2177*
6.	Task Analysis Report	H-5429*
7.	Design Change Notices	V-7009*
8.	Training and Training Equipment Plan	H-7066*
9.	Training Courses Proposal	H-7067*
10.	Task and Skill Analysis Report	H-7068*
11.	Training Course/Curriculum Outlines	H-7069*
12.	Instructor/Lesson Guides - Training Courses	H-7070*
13.	Student's Training Course Guide	H-7071*
14.	Audiovisual Aids, Master Reproducibles and Review Copies for Training Equipment and Courses	H-7072
15.	Audiovisual Aids Index for Training Equipment and Training Courses	H-7073
16.	Tests for Measurement of Student Achievement	H-7074
17.	Student and Training Course Evaluation Forms	H-7075
18.	Instructor's Utilization Handbook for Simulation Equipment	H-7076*
19.	On-The-Job Training Handbook	H-7077
20.	Techncial Hands-On Training System Packets	H-7078
21.	Conference Agenda	A-7088*
22.	Conference Minutes	A-7089*
23.	Maintainability Program Plan	R-7103*
24.	Training Equipment Sub-System Configuration Data List	E-25504
25.	Training Equipment Summary	E-25510*
26.	Trainer Engineering Report	E-25555*
27.	Trainer Mockup Report	E-25565*
28.	Manual, Technical, Operation and Maintenance Instrutions	M-25575
29.	Trainer Facilities Report	P-25579*
30.	Trainer Installation Requirements Report	P-25580*
31.	Trainer Reliabity and Maintainability Design Analysis Report	R-25585*
32.	Trainer Criteria Report	S-25589*
33.	Trainer Engineering Design Report	S-25591*
34.	Trainer Math Model Report	S-25592
35.	Trainer Test Procedures and Results Report	T-25594*

36. Manual, Technical, Functionally Oriented Technical Manual for Training Devices	M-25597
37. Trainer Technical Progress Report	A-25602*
38. Trainer Engineering Change Proposal Summary	E-25603
39. Trainer Specification	E-25604*
40. Maintenance Plan	L-25620*
41. Plan, Integrated Logistics Support	L-25622*
42. Training Programming Report	E-25706
43. Requirements Traceabiity Matrix	E-25841
44. Program Performance Specification	E-25843

Note: It should be noted that some items are redundant depending on the data required and procured.

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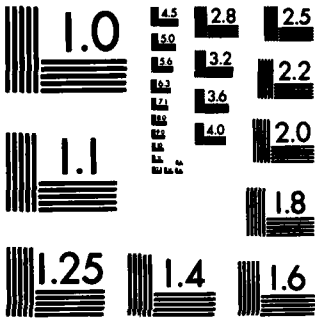

APPENDIX F

TRAINING EQUIPMENT CHANGE REQUEST FORM

TRAINING EQUIPMENT CHANGE REQUEST

6ND NTEC-4720/2 (REV. 7-76)

Ref: NAVTRAEQUIPCENINST 4720.1 (Series)

1. REQUESTING ACTIVITY (Name and address)	FOR NETSC USE ONLY
NAVTRAEQUIPCEN 82-M-1131-1	2. REQUEST NO. (TECR No.)
3. REQUESTED BY (Signature, title and code)	4. DATE / 5. AUTOVON NO.

6. TYPE CHANGE

☐ HARDWARE ONLY ☐ SOFTWARE ONLY ☐ BOTH ☐ UNKNOWN

7. TRAINING EQUIP NO.	8. TRAINING EQUIP NAME	9. SERIAL NO.

10. DOCUMENTATION AFFECTED (If computer software, program/version/release date)

11. NAME OF SYSTEM AFFECTED (Software ID No.)	12. REF. (If software, Doc No.; if hardware, DWG. No.)
13. NAME OF SUBSYSTEM AFFECTED (Module No.)	14. REF. (If software, Doc No.; if hardware, DWG. No.)

15. NEED FOR CHANGE (Describe the reason the change is needed. If the proposed change is intended to improve performance, describe the proposed improvement in quantitative terms. If safety, cost reduction, correction of deficiency, etc., describe accordingly.)

16. RECOMMENDATIONS (Provide additional information and/or data that will facilitate and expedite evaluation of the change request.)

17. IMP[illegible] OF NON-IMPLEMENTATION (Provide statement of effects on training safety, cost savings, or utilization if this change is not implemented.)

18. ☐ CHECK HERE IF MORE SPACE IS NEEDED. ATTACH ADDITIONAL IDENTIFIED SHEETS. 18a. FER consulted ____Yes or____No

19. RELATIVE PRIORITY OF CHANGE	20. REQUESTOR'S CONTROL NO.
☐ ROUTINE ☐ URGENT ☐ EMERGENCY	

APPENDIX G
TYPICAL TRAINER MESM
(From OPNAV INSTRUCTION 5442.4G)

A) 14B49 (S-3A POSITION TRAINER) MESM

EOC		Missions A B C D E F G H J K L
	Need For Mission B - Full Training Mission Capability	
C30	SONO MONITOR AND BYPASS PANEL (TACCO)	X X
C31	ATR	X X
C32	ESM	X X
C33	MAD CONTROL BOX	X X
C34	RADR SCAN CONVERTER	X X
C35	RIU	X X
	Need For Mission C - Capable of More Than 90% of Syllabus Training Missions	
D60	DATA LINK	X X X
	Need For Mission D - Capable of More than 80% of Syllabus Training Missions	
E11	MANUAL SESCOS	X X X X
E12	COPILOT INCOS	X X X X
E13	INS	X X X X
E14	COPILOT MPD	X X X X
E15	OFFLINE ACOUSTIC CAPABILITY	X X X X
E16	SLP DISPLAY	X X X X
	Need For Mission E - Capable of More than 70% of Syllabus Training Missions	
F30	ASA-65	X X X X X
F31	TACCO MPD	X X X X X
F32	TACCO INCOS	X X X X X
F33	SLU	X X X X X
	Need For Mission F - Capable of More Than 60% of Syllabus Training Missions	
G60	Time Code Generator (TCG)	X X X X X X
G61	Acoustic Signal Generator (ASG)	X X X X X X
G62	SFC-1	X X X X X X
G63	SFC-2	X X X X X X
G64	ARU	X X X X X X
G65	INSTRUCTOR ARU REPEATOR	X X X X X X
G66	IRC	X X X X X X
	Need For Mission G - Capable of More Than 50% of Syllabus Training Missions	
J30	SENSO MPD	X X X X X X X
J31	SENSO INCOS	X X X X X X X
J32	SONO MONITOR AND BYPASS PANEL (SENSO)	X X X X X X X

14B49 (S-3A POSITION TRAINER) MESM (Continued) (A

Need For Mission J - Capable of More Than 30% of Syllabus Training Missions

K60	TSD/SLP PRINTER	X	X	X	X	X	X	X	X
K61	TSD DISPLAY	X	X	X	X	X	X	X	X
K62	SRX	X	X	X	X	X	X	X	X
K63	ACOUSTIC COMPUTER	X	X	X	X	X	X	X	X
K64	ADP	X	X	X	X	X	X	X	X

Need For Mission K - Capable of More Than 20% of Syllabus Training Missions

L11	ICS	X	X	X	X	X	X	X	X	X
L12	GPDC	X	X	X	X	X	X	X	X	X
L13	TTC (PT MODE)	X	X	X	X	X	X	X	X	X
L14	PCM CONTROL	X	X	X	X	X	X	X	X	X
L15	DGU	X	X	X	X	X	X	X	X	X
L16	DMTU	X	X	X	X	X	X	X	X	X
L17	TACTICS COMPUTER	X	X	X	X	X	X	X	X	X
L18	CONTROL COMPUTER	X	X	X	X	X	X	X	X	X
L19	INSTRUCTOR MPD REPEATER	X	X	X	X	X	X	X	X	X
L20	HEADSETS	X	X	X	X	X	X	X	X	X

Need For Mission L - Capable of Less Than 20% of Syllabus Training Missions
Category Z - Not Mission Capable

Z36	FACILITY AIR CONDITIONING AND UTILITIES	X	X	X	X	X	X	X	X	X
Z89	SPECIAL INSPECTION	X	X	X	X	X	X	X	X	X
Z91	PHASE/CALENDAR INSPECTION	X	X	X	X	X	X	X	X	X
Z92	CORROSION INSPECTION	X	X	X	X	X	X	X	X	X
Z93	TECHNICAL DIRECTIVE COMPLIANCE	X	X	X	X	X	X	X	X	X

MISSION DESCRIPTION

14B49 (S-3A POSITION TRAINER) (A .

OPTIMUM PERFORMANCE CAPABILITY (OPC)

A. Maximized capability for successful completion of all CNO approved Type Commander Formal Course and/or FUNCWING Readiness Directive Syllabus Missions through the availability of all equipments.

FULL TRAINING MISSION CAPABILITY (FMC)

B. Capable of completing all CNO approved Type Commander Formal Course and/or FUNCWING Readiness Directive Syllabus Training Missions.

PARTIAL MISSION CAPABLE (PMC)

C. Capable of more than 90% of Syllabus Training Missions.

D. Capable of more than 80% of Syllabus Training Missions.

E. Capable of more than 70% of Syllabus Training Missions.

F. Capable of more than 60% of Syllabus Training Missions.

G. Capable of more than 50% of Syllabus Training Missions.

H. Capable of more than 40% of Syllabus Training Missions.

J. Capable of more than 30% of Syllabus Training Missions.

K. Capable of more than 20% of Syllabus Training Missions.

L. Capable of less than 20% of Syllabus Training Missions.

GLOSSARY

ACMS	Air Combat Maneuvering Simulator
CFA	Cognizant Field Activity
CNO	Chief of Naval Operations
COMNAVAIRLANT	Commander Naval Air Force, United States Atlantic Fleet
COMNAVAIRPAC	Commander Naval Air Force, United States Pacific Fleet
COMS	Contractor Operation/Maintenance of Simulators
COTR	Contracting Officer's Technical Representative
DCNO	Deputy Chief of Naval Operations
DMSO	Director of Major Staff Office
FASOTRAGRUPAC	Fleet Aviation Specialized Operation Training Group Pacific
FER	Field Engineering Representative
FPT	Fleet Project Team
FRS	Fleet Readiness Squadron
ILS	Integrated Logistics Support
IOS	Instructor Operator Station
MC	Military Characteristic
MESM	Minimum Essential Subsystem Matrix
MIL-SPEC	Military Specification
MIL-STD	Military Standard
NAS	Naval Air Station
NAVTRAEQUIPCEN	Naval Training Equipment Center
NPE	Navy Preliminary Evaluation
OPNAV	Office of Chief of Naval Operations
OR	Operational Requirement
RFT	Ready-For-Training
SME	Subject Matter Expert
TCTEC	Training Characteristic Training Equipment Change
TDD/AA	Training Device Development and Acquisition Activity
TECCB	Training Equipment Change Control Board
TECR	Training Equipment Change Request
TSA	Training Situation Analysis
TTPRR	Training Test Procedures and Results Report
WST	Weapons System Trainer

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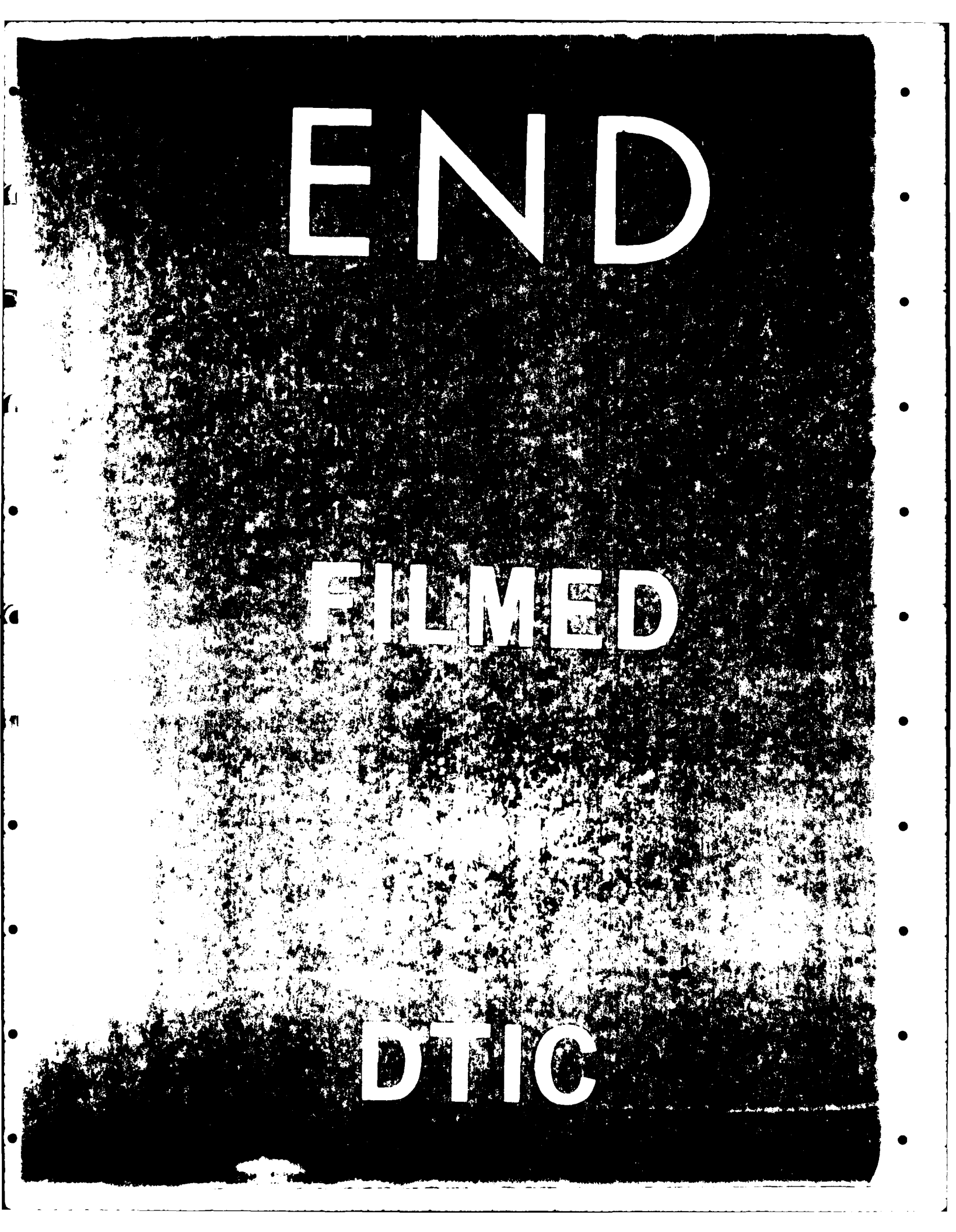
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