DEVELOPING TRAINER SPECIFICATIONS FROM TRAINEE NEEDS FOR THE CANADIAN PATROL FRIGATE COMBAT SYSTEMS

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ABSTRACT

Cost-effective military training devices are based on trainee needs not technological capabilities. This project developed specifications for training devices for Combat Systems operators, maintainers, and teams for the Canadian Patrol Frigate (CPF). An integrated training systems model included (a) determining resource requirements and (b) developing training content, methodology, and technical documentation based on task and performance data. Such models can guide the use of trainee requirements as the basis for trainer design and functionality. This paper provides an example of how to make the models work. Trainee tasks determined functional specifications for the hardware and software, in terms of (a) training media, (b) fidelity and simulation requirements, and (c) essential and desirable trainer characteristics. A resource requirements analysis indicated (a) the number of trainee positions needed in peak and steady-state conditions, and (b) the annual training input, instructor billets, and lab-loading requirements for the training devices in the Canadian Forces Fleet School setting.

INTRODUCTION

The Canadian Navy is in the process of acquiring a new class of ship, the Canadian Patrol Frigate (CPF). As a result of an increase in the program from six ships to twelve, a need was recognized for additional part-task and team training equipment for the operators and maintainers of the combat systems (CS). The present study was designed to review and quantify the training content and resource needs, develop preliminary systems designs for training devices that would meet the needs, and prepare specifications for acquisition of the recommended training systems.

The project contained a number of phased tasks which are described below. The paper also summarizes the project findings and lessons learned.

SUMMARY OF PROJECT TASKS

Task A: Understanding the Problem

Task A constituted an analysis of the CPF training problem. This was necessary to ensure that the Contractor team, the Project Management Office (PMO), and the other participants in the Project Review Matrix had a clear and common understanding of the various issues and the model to be used to address the problems.

The conceptual model for the project followed a Training Systems Integration approach presented by Bloom et. al. at the Ninth I/ITSC ([1]). The current U.S. Navy models related to Instructional Systems Development (ISD), Manpower, Personnel, Training and Safety (MPTS) and resource requirements analysis (e.g. HARDMAN) were modified in this project to incorporate, rather than generate, the required data. The modifications were appropriate because much of the training development had already been accomplished by the combat systems subcontractor for the ship supplier.

Task A recognized the existence of the contractor supplied training equipment that was already part of the CPF project. The first report documented what the PMO knew before the project began, that this equipment was insufficient to meet the peak and steady-state throughput requirements of CPF training.

The initial throughput analysis quantified the operator, maintainer, team and instructor training capacities required to fulfill the CPF training load. The throughput analysis incorporated data on the ship delivery schedule, shipboard and shore-based personnel requirements, training schedules, class sizes, and rotation/attrition factors to determine -

a. the annual training input requirements for each classification of trainee,

b. the necessary instructor complement, and

c. estimated trainer loading.

The ship delivery schedule and manning requirements are the main determinants of the annual training input requirements (ATIR). Other factors include attrition rate in training and turn-over on the job. Figure 1 shows the ATIR from the delivery of ship 1 until anticipated steady-state.

The Task A report concludes that additional trainers are required for CPF training, and that efforts towards defining and acquiring the trainers is required as soon as possible. Additional trainers are expected to be in place in early 1992. That is when the current Combat System Test and Support Facility (CSTSF) at the combat system subcontractor's plant is slated to be dismantled and moved to Halifax to become the Combat System Training Centre (CSTC).

In addressing the options for new trainers, the report argues strongly against using "MIL-SPEC" equipment as much as possible, because of its limitations in the training role. Computer-based, reconfigurable trainers offer more flexibility and may have advantages in terms of cost and maintenance. The CPF PMO concurred with the assessment, and this task became the baseline for the tasks described below.

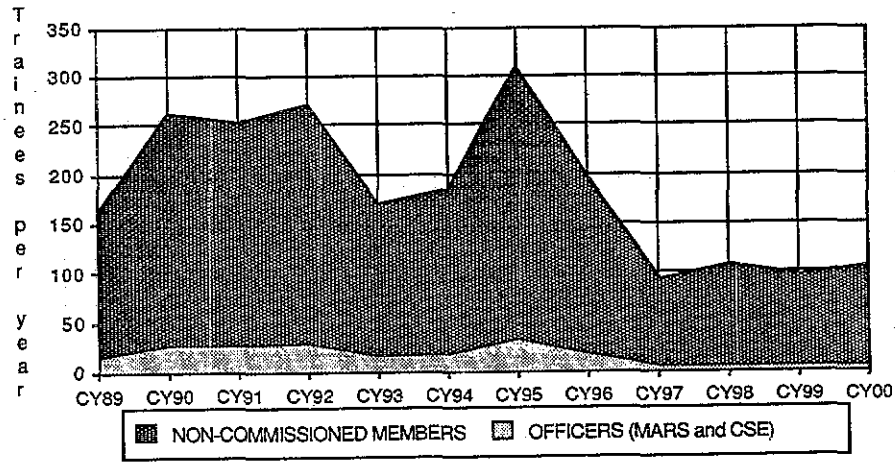

Figure 1. Annual Training Input Requirements (ATIR)

Task B: Functional Training Requirements

Task B was a comprehensive analysis of the required training strategies needed to conduct each of the training modules that have been prepared by the CS subcontractor for CPF combat system training. Each module was examined by a panel of instructional technology and naval combat systems experts to provide recommendations on:

a. training methodology;

b. instructional media; and

c. simulation requirements.

The Task B report concludes that the recommended training equipment should emphasize state-of-the-art hardware and software capable of reconfiguration to a number of training roles and incorporating advanced courseware and computer managed instruction (CMI) capabilities to enhance the training value. It was concluded that the scope of these trainers should cover:

a. advanced protocol operator team training (integrated team operations under various threat scenarios);

b. operator basic procedures training (e.g. system initialization, operational protocols, etc.); and

c. maintainer basic procedures training (e.g. initialization, running diagnostics, tracing signal flow, fault-finding, etc.).

This task provided the basis for determining the required trainer capabilities.

Task C: Essential and desirable characteristics

Task C provided recommendations on the essential and desirable characteristics of each of the types of trainers being proposed for CPF training. It identified five specific types of trainers which would be required, namely:

a. operator team trainer;

b. communications procedures trainer;

c. operator procedures trainer;

d. maintainer procedures trainer; and

e. supplementary weapons maintenance trainer.

Essential characteristics were defined as those characteristics which are required to achieve a minimally acceptable training capability. Desirable characteristics were defined as characteristics which would enhance the training or its conduct. The agreed characteristics from the Task C report form the primary functional inputs to the Task E report (described later). The Task C report provides CPF PMO with data which enhanced their understanding of the configuration capability, and functions of training devices which could fulfill operator, maintainer, and team trainer requirements.

Task D: Market Survey

Task D provided a survey of training equipment and software available or under development that could be suitable for the requirements of training systems for the CPF combat system. The database entries for hardware and software provide all available information regarding vendor, maintenance, characteristics, cost, and production status. The major categories indicated the possible application of the item to CPF training (computers, graphics software, authoring languages, etc.) The report also discusses possible industrial benefit considerations with regard to impact on the Canadian economy.

The final phase of Task D entailed a major decision meeting with the CPF Project Management Office and

the contractor team. During this meeting all parties reviewed the available information on the essential and desirable features of the required trainers (Task C) and the state-of-the-art in equipment, systems, software, and courseware (Task D). For each of the five identified trainer needs a limited number of options were selected based on this data. These options formed the basis of additional design efforts in Task E to be described below.

Task E: Trainer Concept Design

Each of the agreed upon options was subjected to detailed analysis of integration and compatability issues, engineering and systems criteria, and instructional criteria. The throughput analysis, trainer loading computations, and determination of instructor requirements were repeated using the latest available data and the five accepted trainer types to develop a preliminary, integrated, functional design document for each of the five kinds of trainers.

The Task E report also presented a discussion of other design issues such as Department of National Defence (DND) personnel requirements, cost estimates, possible implementation problems, and the trainer acquisition schedule which enabled the CPF PMO to begin the prioritization of training device acquisition.

Task F: Technical Specification

Task F provided system functional specifications for each of the required trainer types. Based on the information provided in Task E, specifications were provided for (1) a two-suite team trainer, (2) a one-suite operator procedures trainer, (3) a two-suite maintenance procedures trainer, and (4) a weapons maintenance trainer. (Training for operating the communications systems will be included with the other operator procedures training, rather than on a separate trainer.) Each specification includes -

a. a review of the scope and objectives for designing the requested training devices,

b. references to other applicable documents,

c. a description of the trainer requirements with regard to functions, features, capabilities, security, equipment, interface, documentation and physical conditions, and

d. provisions for quality assurance, packaging, delivery and set-up.

Task G: Final Report

A project final report was prepared to provide a summary of the project, additional information relevant to trainer acquisition, and a discussion of anticipated problems and recommendations. A draft Statement of Work (SOW) was included in the final report so that the CPF PMO could initiate the training device procurement process.

IMPLEMENTATION CONCERNS

Some of the concerns that evolved from the study and the lessons learned by the project staff are worth discussing to provide others with the benefit of the process which took place. The sophisticated training systems required to meet the needs of the CPF program will require careful planning to optimize their implementation and long-term success. Time is a critical factor because of the schedules of (a) ship delivery, which determines the peak trainee throughput and (b) use and availability of the contractor-supplied training and software support system. A great deal of time may be required for trainer and courseware development and for preparing suitable physical facilities.

In addition to these timing and development issues, there are several other implementation concerns. The new systems must be integrated into an existing school. This entails implementing many changes to the present facilities, procedures, and capabilities. Any organizational change of this magnitude will cause stresses which can be best handled if they are anticipated.

Several of the factors affecting implementation are outside the direct control of CPF PMO. Ongoing coordination and sharing of information between all involved parties will continue to be required. The present study has had the benefit of input from most of the relevant sources. Further efforts at maintaining communication and managing information will be required for system planning, selection, and implementation in Phase II.

LESSONS LEARNED

The observations which follow are based on lessons learned during the present study. Some relate to the specific tasks accomplished in this project. Others are based on information obtained during the project regarding other aspects of the CPF program, related naval training projects (eg. Tribal Class Update and Modernization Program - TRUMP), and other similar training systems programs.

Ensure Adequate Planning and Resources for Steady State Training

It will be a challenge to arrange for sufficient training resources to meet peak demands. Trade-offs, compromises and careful scheduling in implementing training devices will be required, along with multiple shift operation of trainers. Development of trainers during these peak demand periods will meet the identified steady state requirements.

Failure to plan adequately for all of the anticipated problems, or failure to provide sufficient training resources can lead to serious problems and inefficiencies, even to catastrophes. Adequate training is essential to operational readiness, especially in modern, sophisticated systems such as the CPF combat system.

Training has been a concern since the early stages of CPF development. The "training problem" became acute with the increase from six to twelve ships. The result has been a rush to catch up to the training requirements. The goal of future Canadian training device procurements should be to meet the steady state needs fully. This will require a significant effort at the front-end and ongoing planning and resource allocation so that training will not lag behind even minimal requirements.

New systems will provide opportunities for increased training effectiveness. But any new system, no matter how good, can fail to meet its full potential if it is not planned, managed, and implemented properly. It must be recognized that there will be many difficulties during the peak load times when the trainers are first implemented. The success of the new trainers should not be judged on these problems alone, but primarily on their ability to provide for the requirements at steady state.

There may be individuals who have reservations about new systems, especially those who believe that computer-based training should not be used as a substitute for training on real "MIL-SPEC" equipment. Any problems due to lack of planning or resources may be attributed to the training strategy. The new trainers must be ensured an adequate chance to prove their merit in a supportive environment of planned and funded implementation.

As a concrete example, sufficient instructor training in using CBT must be provided. The abilities, confidence, and attitudes of the instructors influence the attitudes and expectations of the trainees. This can play a major role in the training effectiveness of the new systems.

Imagine the difference between two training classes. The first is led by an instructor who is still uncomfortable with the new system, feels confused, and conveys to the class his fear that the training won't be as good as training on real equipment. The second instructor has received enough training, documentation, and experience to make the best use of the trainer. The second group is likely to learn more and faster because the investment in instructor training leads to more proficiency in using the teaching tools and attitudes that promote success.

The goals for steady state should be instructor training with proven effectiveness, limited rotation of instructors to maintain a high level of proficiency, and specific ways for instructors who are posted out to pass on their experience to their successors.

There are many other areas and issues where adequate planning and resources can lead to long-term success. Interminable planning without action, or grand expenditures without planning, will not solve the problems. The planning and management must be continual, with sufficient and timely resources to implement the chosen conditions, and flexibility to make changes that will achieve the steady state goals. In the end, this approach will be more economical than unplanned or ill-advised cost cutting measures.

Carefully Evaluated Trade-offs Required during Selection and Implementation

There will be many trade-offs required during the selection, implementation, and peak load periods. Part of the ongoing planning and management activities must include careful analysis of the costs and benefits of the possible courses of action, for both the short term and the long term.

During system selection, competing bidders may offer more in some areas and less in others. For example, one may offer more compatability with the PC's presently in the Fleet School while another offers a superior authoring system on a non-PC system. The short term and long term costs and benefits of each must be considered in making a decision, unless the best aspects of each proposal can be negotiated from a single bidder.

During implementation other trade-offs will be required. For example, integration of the control of several team trainers may save on initial cost and instructor manning. However, it may result in a longer implementation time and severe scheduling difficulties in the forseeable future. The pros and cons of each possible approach must be evaluated and re-evaluated as the different trainer initiatives develop.

Make Sure that the Trainers are Effective, Supportable, Flexible and Expandable.

The trainers suggested in this study represent a major investment and commitment. Training effectiveness, system supportability, and the ability to modify and expand the facilities should all receive high priority in any selection or implementation decisions. There are too many examples of training systems that fail on one or more of these criteria.

Some trainers don't train adequately because of loose specifications, contract loopholes, or inadequate acceptance testing. The contracts must specify demonstrations of training effectiveness as well as specific system functions.

Other trainers are not valuable for the planned life cycle because of loss of supportability. Using commercially available equipment and specifying requirements for long term support planning will help to avoid these problems.

There is nothing as predictable as change. Systems that cannot be modified and expanded may soon be obsolete. The capability for modification and expansion should not be restricted to the original supplier. The original contracts and the implementation management should ensure that later modifications and expansions can be performed by DND or by competitive bidding from several possible contractors.

Resolve Different Opinions on Requirements and Justify Essential Characteristics

Many parties within the Navy and the military training establishment have an input into the design, development and selection of training systems. In this project, it has been the task of the contractor team to resolve differing opinions, evaluate competing positions, and justify decisions made regarding the system design and features. In this role, it is important to focus on what are the **essential** trainer characteristics. Numerous other desirable trainer features were suggested which could enhance training, but the benefits do not always justify the costs. The client, CPF PMO, required a clearly stated rationale for decisions regarding system features and preliminary design.

SUMMARY

The paper has described a recent study of the training device needs for the combat system of the Canadian Patrol Frigate, a ship acquisition program which has a major impact on the training system of the Canadian Navy. The paper emphasized the need to base training device decisions on training skills, fidelity and simulation requirements related to teaching basic and advanced skills. Issues of the essential and desirable hardware and software training device characteristics are viewed as aspects of cost and scheduling priorities. When such a study is performed, both the military and potential training device manufacturers can have a clear understanding of what is needed, for what purpose, at what cost. They can consider the trade-offs necessary to train operators, maintainers, and combat teams as a front-end proactive issue.

REFERENCE

(1) Bloom, Robert S., Schmidt, Renata V., and Hardy, William P. "Manpower, Training and Documentation Analyses: Not Strange Bedfellows". 9th Interservice/Industry Training Systems Conference Proceedings, pp. 1-5.

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