UNDERSEA WARFARE TRAINING DEVICE REQUIREMENTS FOR THE NEXT QUARTER CENTURY

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Reasonably accurate projections of the result of any multivariate, dynamic process are generally difficult to perform and are rarely made without recourse to large remnant terms. So it is with regard to forecasting training device requirements for the next twenty-five years. What is possible, and perhaps more meaningful, is the projection of current trends in naval missions, hardware, technology, training techniques, and personnel, and relating these trends to training device requirements.

NAVAL ROLES/UNDERSEA APPLICATIONS

Currently, the Navy has four major roles, each of which is being implemented in part through undersea applications. This relationship is described in figure 1. The major trend discerned from this figure is the scope of undersea warfare and the inference of impending increases in undersea applications in the areas of covert deterrence, control, and silent presence.

Naval Roles	Undersea Applications	
	Tasks	Elements
Strategic Deterrence	Secure Patrol	SSBN
Overseas Presence	Attrition	SSN
Sea Control	Denial, Protection	SS, SSN
Projection	Demolition	Swimmers

Figure 1. Undersea Warfare

NAVAL APPLICATION TRENDS

The newer ideas for future naval undersea systems, while difficult to project, will more probably follow the form of functionally specialized units as opposed to multifunction, multilevel command type ships. The role of the submarine as an application element is currently growing and will increasingly expand. The principal application will require greater unit specialization, which in turn drives the requirement for improved fleet integration and tactically coordinated operations.

The impact of these applications is obvious: a need for additional tactical commanders, highly skilled in specific mission areas such as ASW deployment, countermeasures, and antishipping missions. These will be similar to the requirements present in the current forms of ASW aircraft such as ANEW and

the role of TACOS in those systems. Factors such as reduced manning, emphasis on the ability to select optimal hardware deployment modes in complex multivariate situations, increased individual control and responsibility, reduction in onboard maintenance through use of more modular systems, and the use of logistics managers instead of maintainers best typify these systems. The training device implications for these systems are shown in figure 2.

Future Naval Applications	Training Device Characteristics
o Larger numbers of tactical command billets.	o Increased trainee throughput
o Requirement for proficient career specialists in tactical deployment.	o In-depth, highly realistic simulations designed to develop individual skills and knowledge.
o Shift from requirements for analog maintenance to digital hardware/software maintenance skills.	o Extensive team training for many teams characterized by ease of availability, detailed performance measures, adaptive training, and secure interconnection of several remote team trainers.
o Small, close knit crews who remain a tactical team for long periods.	

Figure 2. Training Device Characteristics of Future Systems

Hardware Characteristics	Training Device Characteristics
o 1950's--Dedicated special purpose analog hardware.	o Original equipment.
o 1960's--Special purpose digital and dedicated analog.	o Original equipment. Digitally driven increase in simulation fidelity.
o 1970's--Within systems are multifunction digital processors, digital/analog displays.	o General purpose computer displays. Some built-in stimulation/training.
o 1980's--Complete general purpose digital hardware across systems. Adaptive logic, emphasis on software change.	o Major digital integration across various team, force, service trainers. Emphasis on tactical deployment, sophisticated environmental multivariate models, principal training in mental skills vs motor skills. Complete shift from hardware duplication to improving training technology.

Figure 3. Hardware and Training Trends

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A factor critical in projection of training requirements is the nature of hardware used in implementing the undersea applications listed in figure 1.

Naval hardware trends are shown in figure 3, along with their potential impact on training device characteristics. The major point is that dedicated analog equipment will be replaced by general purpose, multifunction digital processors and displays. This will, in turn, decrease the need for rote (knob and dial) skills and increase the need for in-depth, high-level mental abilities. Future operators will have to integrate the mental load of several watch stations, while rote skills will be performed automatically. In short, hardware will replace operators, per se, and the new systems will require highly knowledgeable decision makers.

Because future hardware will be general purpose, it will also be capable of self-stimulation for onboard training. Training device analysts and engineers will be increasingly required to participate in the design of the actual hardware systems because the systems themselves will be required to perform a significant portion of team and individual training at sea.

This trend also portends a requirement for a pronounced shift in emphasis from the development of training device hardware to the development of training device technology such as computer-aided instruction (CAI), computer adaptive training (CAT), and computer-managed instruction (CMI). Each involves improved measures of performance, training control, and training integration across systems, teams, task forces, and services.

TRAINING TRENDS

The trend to shift from at-sea training to shore facilities will increase in the 1970's. Principal reasons include cost of operation, reduced at-sea duty, and the reduced capability of conducting covert exercises.

This trend will require major increases in simulation fidelity with regard to models of environmental characteristics, sensors, cross-coupling, and multivarying tactical relationships. This same trend affords the opportunity for and, in fact, demands that behavioral scientists develop and apply improved training technology in such areas as CAI and CAT.

In the 1980's, some shore training will shift back to at-sea when complex team training capabilities will be resident in most digital military hardware. At that time the principal shore activity will consist of a continuing emphasis on individual training and preliminary team formulation training.

PERSONNEL TRENDS

Naval personnel will increasingly be forced to specialize in areas of expertise. General responsibilities such as management and tactical command of divisions and subdivisions will narrow down to functional areas such as ASW Tactical Command, Propulsion Systems, Strategic Systems, Sonar, etc. Training re-

quirements will shift from on-the-job training to accelerated in-depth training in subsystem specialties ashore.

Subsystem specialists may require a two- to three-fold trainee output characteristic in comparison to the typical NEC descriptor of the 1960's. Similarly, pressures for improved trainee throughput rates to offset the effects of retention problems will demand improvements in basic instructional technology. Most of these improvements will be required in the form of individualized training devices for "A" schools.

SUMMARY OF PROJECTED TRAINING DEVICE DIRECTIONS

In summary, several major shifts should occur in the direction of training device development. Perhaps the two greatest areas of impact will be the expansion of the role played by behavioral scientists in the implementation of training, and in the development of complex computer simulation models and training executive control programs.

Behavioral scientists will be tasked to precisely define the key elements of training, and then develop accurate mission and behaviorally relatable performance measures and criteria for computer automation and control of training. These efforts must be performed to define the structure of complex executive programs.

Development of simulation models will include: environmental and hardware characteristics; accurate models of other operator inputs for individual training; models of functional teams such as sonar, fire control, etc., for total ship training; and multiple ship operative knowledge for multiforce operations.

Figure 4 lists the principal directions that training device design should take. The trend can be summarized this way: The greatest emphasis must be placed on developing advanced, behaviorally derived training technology as opposed to the past twenty-five years of hardware duplication.

> o Stress training technology as opposed to
>   hardware development
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> o Behavioral scientists should guide training
>   implementation, not device design, for
>   greatest potential payoff
>
> o Improved models for simulation:
>
>   Environment
>   Integration across systems
>   Sensors
>   Operator interaction
>   Interactive evaluation
>
> o Shift from training rote skilled operators
>   to complex multifunction decision makers
>
> o General purpose hardware training devices
>
> o Built-in training devices

Figure 4. Projected Training Device Directions