"Revolution in Training"

Executive Review of Navy Training

August 8, 2001

ERNT

The current process for determining the basics of training (i.e., the who, what, where, when, and how) needs to change. Not only does the Navy lack a training strategy, there is no "Navy Training System" to allow for innovation and rapid response to new technologies, or ideas. It is clear that there should be.

If all performance deficiencies are written as training requirements, there is an inherent bias toward developing solutions that rely solely on classroom instruction. In the end, this leads to training that relies, almost exclusively, on the formal schoolhouse to develop human capabilities. We believe that a new "systems approach" to learning, one that links requirements, solution development, and feedback, is required for the Revolution in Training to achieve its objectives.

Recommendation #1: Adopt a Navy Human Performance System Model

We recommend a Human Performance System Model (HPSM) to represent a new set of fundamental, often behind-the-scenes, processes. Figure 34 shows a simplified representation of this four-quadrant process. The HPSM starts, in quadrant I, with a statement of human performance requirements (what tasks do Sailors need to able to perform?), uses the science of learning to develop optimal human performance solutions (how can we provide the required on-the-job competencies?), develops and integrates the human performance components, and then links the learning to the original requirements (did it achieve the job performance objectives?). We will proceed with a more thorough description of the model. (For the details, please see Appendix F.)

Quadrant I: Define Requirements

The first step in the process, found in quadrant I, is to define human performance requirements. We recommend that the Fleet Commanders in Chief (CINCs), the Chief of Naval Personnel, the Director of Naval Reactors, and certain other, "equivalent" decision-makers (for specialties, for example) approve all human performance requirements. Operators, Sailors, trainers, performance consultants, senior commanders, and CINCs can better understand requirements and associated measures of effectiveness and performance if requirements are defined in terms of tasks. This means breaking down jobs and job tasks into specific behaviors and competencies. Once these are defined, the CINC (or equivalent) will validate and prioritize them to determine specific job performance standards (we talk more about the role of the CINCs later in this section). In addition, job performance requirements will be defined as appropriate for different stages of Sailors' careers (apprentice, journeyman, or master) based on the level of proficiency demanded by the jobs.

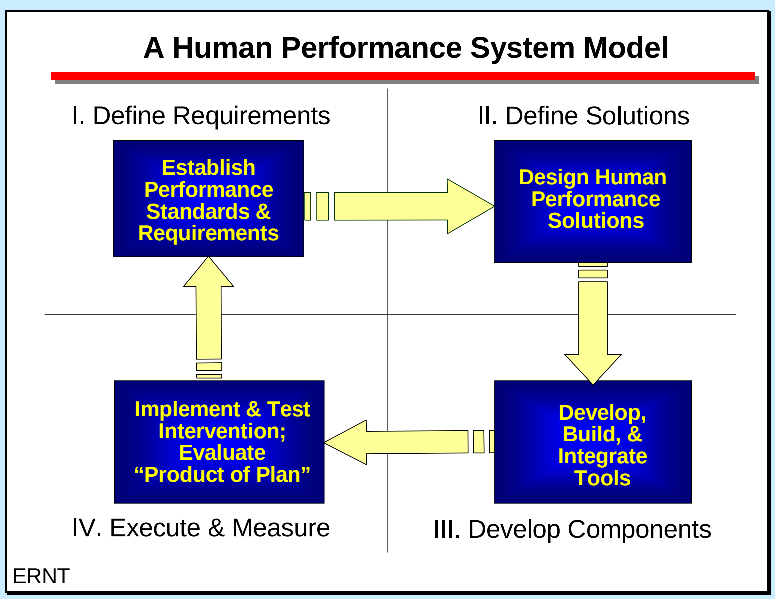

Figure 34. *A Human Performance System Model.*

Quadrant II: Design Solutions

The input to this quadrant is human performance requirements that have been defined, certified, and prioritized. In quadrant II a menu of options for performance interventions will be developed. Performance analysts and subject matter experts must evaluate the requirements and determine how best to meet them. This is the step in the process where the science of learning and human performance is applied.

Note that the requirement may not always be to achieve 100-percent warfighting capacity. In the real world of constrained resources and conflicting interests, the CINCs may establish performance criteria to achieve less than optimum performance (i.e., readiness levels C2 or C3) in certain areas in order to place more emphasis on other, higher priority areas. This trade-off is currently performed by the 11 OPNAV divisions that program and budget training resources.

Figure 35 provides some details on the process in quadrant II. This process depends on the skill, talent, and awareness of experts who can analyze human performance requirements and develop "enhancement solutions." The first step in this quadrant is to translate human performance requirements into competencies—that is, what does the learner need to have to accomplish the job or task? Competencies can be expressed in terms of knowledge, skills, and abilities (KSA). Other models factor in attitudes as well. Once competencies are established, the range of possible ways in which those competencies can be imparted must be considered. Following this "requirements first–solutions second" approach allows all of the options for improving performance to be considered, instead of limiting consideration to only schoolhouse training solutions. Decision-makers can evaluate the importance of other enhancement solution options such as:

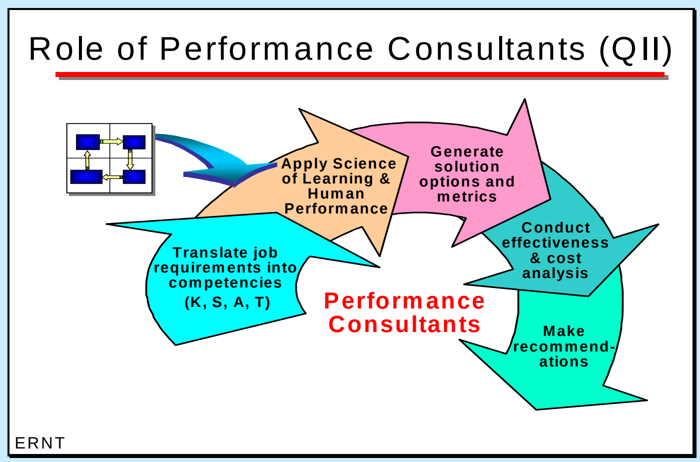

Figure 35. *Role of performance consultants, the key to quadrant II.*

- Manpower adjustments (in staff size, experience required, etc.)
- Structured on-the-job experience
- Improvements in technical support
- Job performance aids (e.g., wearable hardware)
- System redesign (changing the human task at the same time)
- Changes in operating or maintenance procedures.

An essential part of the HPSM is the contribution of the performance consultants. Industry is increasingly using performance consultants to assess and help solve human performance problems. Performance consulting is a disciplined approach to diagnosing individual and organizational performance issues and developing the entire range of possible solutions.

Part of this recommendation is also to create enough performance consultants (in government or contracted) to determine the right set of performance-enhancing tools for each of the Navy's human performance requirements. For the long term, we believe that many of the Navy's civilian education specialists will need additional training and education, but will be able to become qualified performance consultants.

Performance consultants are trained in and experienced at understanding human performance and competencies. They appreciate the range of potential solutions for imparting those competencies. Ideally, they have an educational background and experience in an applied human performance/behavioral science field. They require all the competencies of education specialists, plus an understanding of the job context and the contributions of structured experience, wearable hardware, and other performance enhancement options. Fundamentally, they act as system engineers for the human part of people and machines working together.

In addition, when performance consultants are most effective, they work closely with subject matter experts and end users. In fact, it is almost always the case in industry that a team of performance consultants with a variety of complementary expertise will be deployed to analyze a performance situation. It is also important to note that many companies have recently employed performance consultants to deal with urgent issues. This is a definite departure from the traditional, and more limited use of education specialists only as long-term curriculum design experts.

The final step in quadrant II is passing the "menu" of interventions to the CINC, or other equivalent decision-maker in quadrant I, for selection of the human performance solution to be developed and deployed.

Quadrant III: Develop, Build, and Integrate Tools

As noted above, the solution options generated in quadrant II are passed to the decision-maker in quadrant I. The CINC, or equivalent, will select the appropriate intervention(s) based on effectiveness, cost, and so on. The choice(s), then, are passed to quadrant III for coordinated development. A number of processes and organizations may contribute to the building of the integrated components of the solutions. Solution options can include traditional classroom instruction; eLearning; job performance aids; electronic performance support systems; manpower adjustments; on-the-job-training; integrated electronic technical manuals (IETMs); simulations, models, or games; experience; job redesign/automation; and so forth. Performance consultants stay engaged to conduct initial assessments and provide important feedback to developers as the intervention is being designed. Development of the specific training tools in quadrant III should take place in the competitive marketplace (see sidebar). Then the tools, the training solutions, are passed to quadrant IV.

The Marketplace: Quadrant III

The intent here is to exploit the best technology, tactics, and techniques available anywhere in putting these training solutions together. Navy training activities, warfare centers, SYSCOMs would compete for this business with the best of industry and academia.

Quadrant IV: Execute and Measure Effectiveness

Quadrant IV is where both the execution and the evaluation of the intervention occur. It is where the product of the plan is measured to determine whether expectations for improvements in human performance have been met. The evaluation function of quadrant IV begins with the training experience. The evaluation provides for immediate level 1 and 2 feedback at this point:

- Is the student enjoying the experience?
- Is the student learning facts?

In addition, CINCs carry out level 3 and 4 measurement and use the data for evaluating the effectiveness of the intervention on the level of performance that is important to them. In other words, the organization that sets the requirement evaluates the product of the plan. This feedback includes answering these questions:

- Is the Sailor more productive in prescribed tasks?
- Is the team/command more proficient because of the performance enhancement solution?

At the conclusion of the quadrant IV evaluation phase, the CINCs (or CINC-equivalents), as well as performance consultants and executors, will receive information on whether the original objectives were met. This information will then be used in quadrant I for refining performance requirements and in quadrant II for evaluating the intervention strategies. The end users determine human performance requirements and are involved in both the first and last steps of the process. They are key to the operation of this model for continuous improvement based on direct feedback, changing operational needs, and advances in technology.

Conclusions About the HPSM

There are compelling reasons to make this change. In the HPSM, job requirements initiate the process, which has several advantages. First, operators know what tasks are required to form high performance teams. Second, performance consultants can translate required tasks into human performance interventions that are most likely to achieve the competencies required to successfully complete the tasks. Third, instructors and others who are powering the training system modify on the fly because they can easily see which changes will be helpful to students. Fourth, because the requirements are defined as tasks, they are easier to understand, test, and modify. Lastly, the sponsors of the requirements can more easily measure whether “graduates” have successfully completed their studies. If graduates can perform the defined tasks, the system has worked. In essence, by defining the requirements in terms of tasks, the requirement sponsors, the performance consultants, the instructors, and the Sailors can communicate in the “language of work.”

Requirements are also placed within the purview of operational commanders (the Fleet CINCs), the Director of Naval Reactors, and the Chief of Naval Personnel. Job performance requirements can be validated so that redundant and outdated requirements can be deleted. Requirements can also be prioritized by those closest to the operations.

In addition, the science of learning has matured to the point where some general “rules” have been developed and tested by performance consultants. Applying these rules, and eventually contributing to the rule set, will allow Navy performance consultants to offer the best menu of blended learning solutions by determining explicitly what is necessary to meet job performance requirements.

This model suggests that Navy's use of "training requirements" has led to traditional and (sometimes) unimaginative solutions. We worked through 10 job performance "use cases" using the HPSM and found that adopting the HPSM leads directly to retiring the term "training requirement." (We present these "use cases" in appendix F). Training, as one of many performance-enhancing tools, is merely a method of meeting a job performance requirement, not a requirement itself. As part of this Revolution, we recognize that there are only "job performance requirements" and that by stating them in terms of the tasks required to do a job, we open the door to new learning technologies, new learning continuums, and a more responsive human performance development system.

The Navy Learning Model

One way to fully integrate training technology, human performance requirements, and the science of learning into the Human Performance Systems Model is to coalesce these three elements into a framework. This framework will guide the formation of solution options for performance issues. In an earlier section of this report, we said that the science of learning revealed the following:

- Individuals respond differently to various learning techniques.
- Learning can be improved when the instruction can be tailored to the individual's unique needs.
- Individuals acquire knowledge more thoroughly when more than one training delivery method is used.
- The transfer of learning is more comprehensive when practice, support, and feedback reinforce newly learned skills.

Because people learn in a variety of ways, and also differ in how they retain knowledge, we need to apply the science of learning in developing a framework for an effective and efficient learning system. The Navy Learning Model we are proposing links theoretical learning concepts to the practical applications of Navy training. The Navy Learning Model comes into play in the four-quadrant model (in quadrants II and III) in the design and development of interventions for improving human performance.

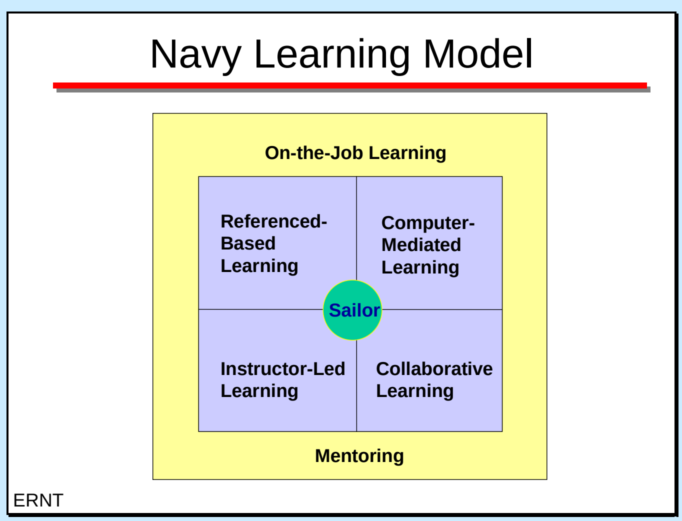

Figure 36. *Navy Learning Model*.

The Navy Learning Model (figure 36) describes several ways in which people learn, arranged into a framework that can be used to design training delivery methods. We began by adopting the learning model used by the IBM Corporation. Using one version or another of such a model, corporate leaders and learners alike can appreciate the opportunities for teaching and learning afforded by melding the best of traditional approaches with the newest technologies. We can also incorporate these approaches into our special training environment by using this model when designing training solutions at the unit or group level.

The four blocks in the center of this Navy Learning Model represent four major methods of learning. The surrounding learning level, *On-the-Job Learning* and *Mentoring*, reflects the enormous importance to the Navy (especially) of hands-on, trial-and-error, mentor-guided learning in the performance of complex tasks by Sailors. Understanding this model of learning helps us explain how training solutions should be developed and built to integrate the science of learning and the concepts of human performance. Here is more detail on the five components of our Navy learning model:

Reference-Based Learning. This component describes situations where the learner gains access to information and knowledge as needed. It is characterized by a one-way interaction between the learner and the knowledge. It is often just reading, and may or may not be mediated by technology. Understanding knowledge management (i.e., when and where knowledge is required) and database design are central issues in realizing the potential of reference-based learning. Developing the appropriate human-computer interface is essential when technology is involved. Examples include equipment/design manuals, CD-ROMs, tactical publications, Internet databases, reference matter, videos, and books.

Computer-Mediated Learning. In this category, the learner *interacts* with a computer, system, or other technology in order to learn. The system reacts to the learner by providing hints or cues, branching to new material, tailoring instruction, and/or providing feedback. Intelligent training technologies (e.g., automated performance assessment, diagnosis, and feedback) are crucial to this type of training and will eventually, as technology develops, allow for individual intelligent tutoring. Examples of computer-mediated learning include: computer-based training, intelligent tutoring, simulations, games, scenario-based training (one learner), training devices/simulators/stimulators, and interactive electronic technical manuals (IETMs).

Collaborative Learning. Learning in this category occurs when learners teach and guide one another. Often, but not always, learners' interactions are computer-mediated because learners are physically dispersed. This type of training may or may not include a formal instructor or expert and often involves a scenario or exercise. Technologies necessary to provide and enable collaborative learning environments include those that allow distributed users to be networked together. Communication bandwidth is an important ingredient. Examples of this type of training include: chat rooms, multi-player games/simulations, peer-to-peer mentoring, computer-mediated mentoring, distributed team training, scenario-based training (multiple players), multi-platform exercises/team training, and web-based study groups.

Instructor-Led Learning. In this category, the learner interacts face-to-face with an instructor and other learners. This type of learning describes traditional, classroom-based learning, as well as other techniques such as laboratories and role-playing. Electronic classroom technologies can improve this type of instruction, and/or instructors can lead dispersed students in "netted" classrooms. Other examples include traditional classrooms, laboratories, role-playing, and study groups.

On-the-Job Learning and Mentoring. Learners in this category interact with their own equipment, workmates, and/or situation as a mechanism for learning. This is the category into which continuous learning environments fit. OJT and mentoring require an appropriate climate for learning. OJT can be individual or group-based. This category also includes specific mentoring by leaders on the job. Learning in this category benefits greatly from embedded training technologies, including automated instructor aids and automated assessment and feedback. It is also dependent on the skills and abilities of leaders to mentor their subordinates and of peers to mentor one another. (These are things that leaders and peers can be taught.) Examples of this category include: embedded simulations/stimulations, mentoring and coaching, continuous learning, guided team self-correction, learning through electronic performance support systems, and decision support systems. In interviews, Sailors told us that OJT was among the most valuable, relevant, and effective training from which they benefit.

In terms of developing training solutions to human performance requirements, the Navy Learning Model provides a framework for integrating learning concepts, appropriate methods of delivery, and achieving desired training goals. Understanding this model of learning will help us explain how the set of human performance improvement solutions developed in quadrant II, and approved in quadrant I, should be built in quadrant III and delivered and assessed in quadrant IV. This further enables today's training organizations to build on past training successes and develop a more robust repertoire of training options.

CINC Roles and Responsibilities

Among the most significant implications of the four-quadrant Human Performance System Model is the increased role and responsibilities of the Fleet CINC(s), OPNAV (on behalf of the Chief of Naval Operations), the Director, Naval Reactors, and certain other officials. We look first at the expanded role of the Fleet CINC(s), then address the possible changes in duties for others. The four-quadrant process, with its specific job/task requirements and objective measures of effectiveness and performance, allows the decision-makers to make choices with a much greater understanding of the consequences.

In quadrant I, the CINC must validate all individual, unit, and group job/task requirements (figure 37). This requires a direct job-task-skill competency linkage. Today, the Navy has broad Battle-Group-level tasks that are generally linked to Joint Mission-Essential Task Lists (JMETLs). The Navy is gradually developing the associated Navy Mission-Essential Task Lists (NMETLs). This linkage is essentially severed before reaching the individual Sailor level, where rating requirements generally are based on knowledge-based occupational standards (OCCSTANDARDS) rather than task-based job performance needs.

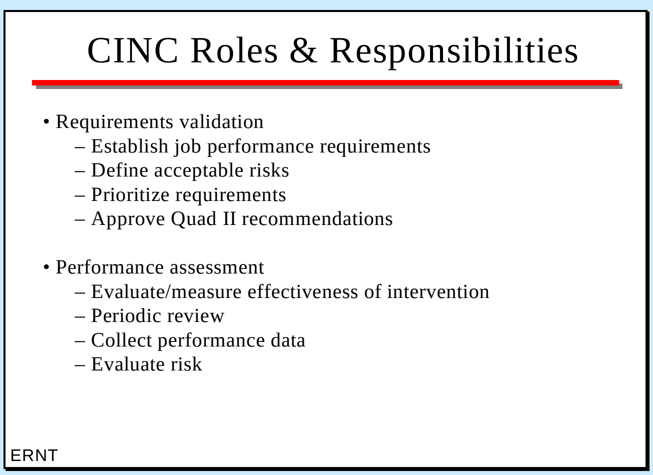

Figure 37. *CINC roles and responsibilities in defining performance requirements and evaluating the product of the plan.*

To assist in this process, we assume that the CINC will delegate many of these job task analysis and measurement responsibilities as follows:

- Manpower: Navy Manpower Analysis Center (NAVMAC)
- Battle Group: C2F and C3F, or CCG 1 and CCG 4
- Unit: Type Commanders (TYCOMs).

The CINC must also select from among the options presented by a Human Performance Systems Organization (HPSO) for improving human performance those that are most suitable for meeting learning requirements and other criteria (e.g., cost, timeliness). We discuss a Human Performance Systems Organization in the next section. The CINC may choose something less than the optimum solution. The CINC's choice will in any case then become the target objective for Fleet performance measurement.

This particular function requires that the CINC be cognizant of all aspects of human performance development and management. It is envisioned that HPSO representatives would be assigned to the CINC staffs to assist in this endeavor. This may well demand additional people, skills, and other resources for the Fleet CINC staffs, and the staffs of other decision-makers.

The CINC must determine the minimum acceptable readiness, at the individual unit and mission level, given available resources. The CINC then evaluates the "product of the plan" (in quadrant IV) to ensure that the organizations responsible for delivering the product have been effective and efficient. From the organizational alignment perspective, this provides the opportunity for direct feedback to the original solution provider.

A few other Navy officials should have (as we have said) similar responsibilities. For general skills in the development of both Enlisted and Officer Sailors, DCNO (N1), on behalf of the CNO, should develop and approve requirements for training. N1 should relate to the HPSO, in this case, in the same way as do the Fleet CINC(s). Certain other community sponsors, as well as the Director of Naval Reactors (for nuclear power training) should function in the same way.

A Human Performance System Organization (HPSO)

Explicitly managing human performance is not a function the Navy performs today. Significant change and growth will be required to implement this concept, which is one of the fundamental tenets of the proposed Human Performance System Model. Position descriptions for Navy performance consultants, the single most important ingredient in the HPSO concept, must be developed, and the competency grown from the Navy's inventory of Educational Specialists, and from the best sources elsewhere. In the short term especially, experts from the private sector may be needed.

A HPSO would design both near- and long-term human performance solutions. These solutions would consider hardware, personnel, training, and operational factors. The HPSO's optimum solution for any particular requirement would be developed without resource or time constraints, but palatable alternatives would also be developed and prioritized against available resources, time constraints, and relative contribution to warfighting mission value.

A HPSO would perform most of the functions in quadrant II and coordinate the activities of quadrant III. These include:

- Applying science of learning and human performance considerations to Navy job requirements
- Analyzing and diagnosing performance problems
- Developing performance measures
- Providing learning objectives

- Generating knowledge, skill, abilities, (KSAs) and providing tools
- Developing and recommending blended human performance solutions based on the Navy Learning Model
- Transitioning research and development innovations
- Maintaining a 24/7 help desk for human performance problems
- Maintaining internal workforce Navy currency in science of learning
- Assessing the cost effectiveness (e.g., return on investment) of performance and learning solutions
- Developing and maintaining Navy-wide strategic learning plans (simulators, eLearning, virtual reality, etc.).

Several different organizational constructs, ranging from fully centralized to fully decentralized, are feasible in implementing a HPSO solution. Regardless of the structure, the organization should represent the equities of all warfare and support communities in the Navy, as skill-based intervention solutions are rarely platform-specific. The ERNT felt that the ideal structure would be a “hub and spoke” organization, with about a third of its members at the hub and the remainder in the field (see figure 38).

The hub (or core component) would provide the centralized control and continuity, maintain connectivity with industry and academia, and develop and manage “master plans.” It would identify common human