REPORT OF THE DEFENSE SCIENCE BOARD 1982 SUMMER STUDY PANEL ON TRAINING AND TRAINING TECHNOLOGY

NOVEMBER 1982

OFFICE OF THE UNDER SECRETARY OF DEFENSE
FOR RESEARCH AND ENGINEERING

WASHINGTON, D.C. 20301

Report

of the

DEFENSE SCIENCE BOARD

1982 Summer Study Panel

on

TRAINING AND TRAINING TECHNOLOGY

November 1982

Office of the Under Secretary of Defense for Research & Engineering

Washington, D.C. 20301

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DEFENSE SCIENCE BOARD

OFFICE OF THE SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301

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MEMORANDUM FOR THE SECRETARY OF DEFENSE

THROUGH: UNDER SECRETARY OF DEFENSE FOR RESEARCH AND ENGINEERING

23 FEB 1983

SUBJECT: Defense Science Board Study on Training and Training Technology - ACTION MEMORANDUM

The Defense Science Board Summer Study on Training and Training Technology, co-chaired by Admiral Isaac C. Kidd, Jr., USN (Ret), and Dr. Walter B. LaBerge, has completed its work and submitted its report. This memorandum provides that report, highlights the recommendations, and proposes a set of actions to implement them (Attachment 1).

The study panel concluded that major improvements in training are necessary and that technology will contribute significantly toward effecting these improvements, thereby enhancing force readiness and productivity. Because of the need for a commitment to invest now in research, development, and application of technology for training, several of the recommended actions deserve your specific guidance to the staff and the Military Departments. Those recommended actions are identified on the plan by an asterisk and are contained in a memorandum for your signature (Attachment 2).

General Vessey has already offered the service of his office to put in motion a working group to establish the steering committee on training and training technology. These and the remaining recommended actions will be initiated by Dr. DeLauer's office after you approve the plan.

Recommend that you approve the report, the implementing plan, and sign the attached memorandum.

Norman R. Augustine
Chairman
Defense Science Board

Attachments 2

COORDINATION:

ASD(MRA&L) _____ Approve _____

15 FEB 1983 Disapprove _____

Copy to:
Chairman, JCS

29908

OFFICE OF THE UNDER SECRETARY OF DEFENSE

WASHINGTON, D C 20301

RESEARCH AND
ENGINEERING

20 December 1982

MEMORANDUM FOR CHAIRMAN, DEFENSE SCIENCE BOARD

SUBJECT: Defense Science Board 1982 Summer Study on Training and Training Technology.

Herewith is the final report of the Defense Science Board Summer Study on Training and Training Technology (attached).

The study undertook a re-examination of training capabilities both at the training institutions and in the field. The Military Services provided documentation and candid information that left the panel comfortable with the effort.

The primary conclusions of the study are:

o Training, at present, is not yet of a quality or character sufficient to fully realize designed capabilities of new and existing weapons sytems. Much more emphasis must be placed on training before IOC if future systems are to perform as designed. Currently, training aspects of systems development are too often sacrificed first when funds run short. Thus, gaps in readiness grow larger.

o Much improvement in readiness is available through improved training. High technology can help. Rapid progress is possible with promise of high payoff by funding known successful applications such as computer-aided instruction.

o Easily identifiable proponency is missing in OSD and the Military Departments to direct R&D related to training, to review technology for training applications and to influence training initiatives.

o Information to support management decisions on training is sparse--because training is intangible and hard to measure, researchers and managers alike tend to avoid hard analysis and contribute to less-than-wise decisions on training.

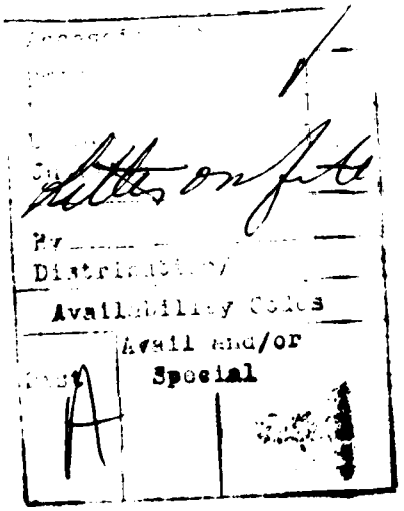
The panel made 56 statements of recommendation. Following Dr. DeLauer's guidance, these have been consolidated to 17 implementable recommendations that, if acted upon, will begin to

make large differences quickly in the combat capability of our nation. There is a requirement for new money. We cannot afford to procrastinate further. I urge the rapid implementation of these recommendations--if necessary, at the expense of hardware of force structure. Training is the force multiplier most critical to our combat capabilities that can now give us a very large return in relatively shorter times than it takes to introduce new systems. It is, in fact, one of the soundest ways to get fastest positive returns from so many of the weapons systems and manpower investments we have already made.

Isaac C. Kidd, Jr., Admiral, USN (Ret)
Chairman,
Defense Science Board 1982 Summer Study
on Training and Training Technology

Walter B. LaBerge
Co-Chairman,
Defense Science Board 1982 Summer Study
on Training and Training Technology

Attachment



TRAINING AND TRAINING TECHNOLOGY

Actions Required to Implement Defense Science Board Recommendations

A. ORGANIZATION AND MANAGEMENT

*1. Recommendation: Establish an OSD Steering Committee for Training and Training Technology. Focus is to be on policy review and coordination of initiatives to produce more effective training through use of existing and new technology.

Action: Chairman JCS provide the initial Steering Committee Chairman. Steering Committee Chairman convene a working group from USDRE, MRA&L, PA&E and Comptroller to plan establishment of the Steering Committee and adopt charter.

2. Recommendation: Establish a Defense Training Data and Analysis Center for all training related data.

Action: USDRE, in coordination with ASD(MRA&L), prepare a proposed charter and initiate the establishment of the Center.

3. Recommendation: Revise acquisition process to (a) ease procurement specifications and standards commensurate with training device use and (b) acquire training requirements data earlier in weapons system development cycle.

Action: USDRE and ASD(MRA&L) review acquisition and procurement procedures and request the Military Department Acquisition Executives to report within 120 days if changes are necessary to modify the requirements and process.

4. Recommendation: Increase use of analytical methods to (a) assess/project impact of manpower pool on new weapons systems and (b) identify where training may increase skills/performance of recruits to meet system needs, do not wait for more analysis/assessment. There are enough data to proceed now.

Action: ASD(MRA&L) establish policy that will require design trade offs and contractor assessments early in the weapons systems development phases to identify their impact on weapon system design and skill performance requirements. Manpower and training projections be used to identify impact on weapon system design and skill performance requirements.

5. Recommendation: Direct the Military Departments to increase funding and management emphasis on research and development of training technology, its application and its payoff.

   Action: USDRE provide guidance to the Military Departments to increase training R&D funds by 15%. Funds to come from other than Personnel and Training R&D programs.

*6. Recommendation: Direct the Military Departments to provide a single point of contact for proponency and coordination of training and training technology.

   Action: Secretary of Defense ask the secretaries of the Military Departments to designate a proponent and review authority for training matters within their Secretariate.

B. PLANNING AND APPLICATION

*1. Recommendation: Provide the Reserve Components with up-to-date training technology and equipment. Support training to meet the unique needs of the Reserve Component training objectives, schedules, and environment.

   Action: Secretary of Defense provide guidance to Military Departments with ASD(MRA&L) to follow up.

2. Recommendation: Support the funding of research, development and applications of technologies for unit training.

   Action: (a) ASD(MRA&L) increase transfer of successful training procedures to unit training and establish a technology watch to accelerate future technology transfer and, (b) USDRE provide guidance to Military Departments on research and development to exploit new technologies for unit training.

3. Recommendation: Support research, development and use of war games that provide intelligent adversaries and realistic conditions to promote effective combat leadership training.

   Action: USDRE provide guidance to Military Departments to increase emphasis for research, development and implementation of campaign battle and engagement simulation for purposes of leadership training.

*4. Recommendation: Upgrade ranges; increase number/size of ranges based on requirements for operational training and testing of current/programmed weapons.

   Action: Secretary of Defense provide guidance to Military Departments to maximize capability and effectiveness of existing ranges and to seek those additional ranges needed to accommodate newer long-range weapons. ASD(MRA&L) to follow up.

5. Recommendation: Accelerate use of computer-based instructional methods (includes CAI and CMI) in the schoolhouse and on the job via portable aids and/or embedded training systems.

   Action: ASD(MRA&L) provide guidance to Military Departments.

6. Recommendation: Use transportable devices in the field to broaden understanding and general skill knowledge for career growth and leadership.

   Action: MRA&L assess the potential applications and payoffs of existing technology to enhance career development.

C. TECHNOLOGY

1. Recommendation: Establish (a) a research and development program on performance measures to develop criteria, methodology and equipment for use at all levels of training and (b) demonstration projects for new training technology to collect data on performance and cost effectiveness.

   Action: USDRE to support Tri-Service program element 64722A. Military Departments to program early demonstration projects for Advance Technology Development program elements.

2. Recommendation: Increase exploration and use of current/advanced technology devices (e.g., arcade-like games) to motivate and teach functional skills.

   Action: USDRE provide guidance to Military Departments to increase funds to explore use of such devices. Funds to come from other than Personnel and Training R&D programs.

3. Recommendation: Increase support/funding for research, development and use of the following technologies; voice recognition, interactive display, personal aids and VHSIC.

   Action: USDRE (a) request DARPA to increase research of these technologies for training application and(b) request Military Departments to emphasize application of these technologies for training.

4. Recommendation: Develop and incorporate embedded training and performance measurement/recording capabilities for for new weapon and support systems.

   Action: MRA&L determine the potential and real value of embedded training and performance measurement and to provide direction with trade-off criteria for their use.

TABLE OF CONTENTS

I. INTRODUCTION

This report summarizes the subject, approach, findings and recommended actions of the Defense Science Board (DSB) 1982 Summer Study on Training and Training Technology. The study was in response to a request by the Under Secretary of Defense for Research and Engineering (USDRE), Dr. Richard Delauer. The study panel consisted of experienced military commanders, industrialists and educators. Briefings were presented to the panel by the Office of the Secretary of Defense (OSD), each of the Services, and selected relevant Government laboratories and industry. The panel arrived at 17 actions to improve the acquisition, management, development, and conduct of training.

A. Background

Reports from Previous DSB Studies on Training Technology (1976), and Operational Readiness with High Performance Systems (1982), have underscored both the need to improve training for achieving operational readiness and to elevate the priority and support of training accordingly. The more recent report, for example, stressed that training is perhaps the single most important element in the operation and maintenance of weapon systems.

Although it was agreed that training is important, efforts to improve training effectiveness have been uninspiring since completion of the 1976 report. Thus, the present study was initiated to assess further the magnitude and importance of the training challenge and to provide specific, up-to-date recommendations for enhancing training through effective use of modern training technology.

B. Purpose

The purpose of this study was to recommend actions for improving military training effectiveness. To be implementable, the recommendations needed to reflect the organizational and financial capabilities of

the involved agencies. This required an interdisciplinary perspective on the problem, backed by military operational experience, in-depth knowledge of training systems development and management, and awareness of the capabilities (and limitations) of advanced instructional technology. The main focus and direction of the analysis was given by the study Terms of Reference (see Appendix A) as summarized below.

C. Study Terms of Reference

The panel was asked to consider how well we are training, how effectively we evaluate that training, whether we are making adequate use of manpower availability projections in establishing and fulfilling our training requirements, and whether there are technologies that should be emphasized or introduced to enhance military training. With each of these questions was the requirement to recommend specific actions, identify the responsible (action) agency, and estimate the cost.

Dr. DeLauer directed the panel to be selective in its recommendations, and that it set priorities for the actions recommended. Items were selected and ranked according to their criticality, implementability, and visibility. Criticality was viewed in relation to operational readiness; implementability considered the variables of organization, management, schedule, and budget; visibility referred to observable results that would relate training investment to improved operational capability.

II. APPROACH

The panel was composed of an interdisciplinary group with outstanding credentials in military operations and training and the training technology industry. The main panel was divided into four subpanels, to address the areas of (1) operational training, (2) manpower requirements and skill training, (3) training technology, and (4) organiztion and acquisition of training.

A. Panel Structure

The panel was co-chaired by Admiral Isaac C. Kidd, Jr., USN (Ret), former Chief of Naval Materiel, and former Commander-in-Chief, Atlantic Fleet. Dr. Walter B. LaBerge, former Principal Deputy Under Secretary of Defense for Research and Engineering, co-chaired the panel. The subpanel chairmen and membership were as follows:

Subpanel I - Operational Training

Co-Chairmen: General Robert M. Shoemaker, USA (Ret)
Mr. Morris S. Macovsky

Members: Dr. Frank A. Andrews
General Robert J. Dixon, USAF (Ret)
Mr. Ervin Kapos
General Bryce Poe II, USAF (Ret)
Mr. Ralph H. Shapiro
Lt. General Philip D. Shutler, USMC (Ret)
Rear Admiral John M. Thomas, USN (Ret)

Subpanel II - Manpower Requirements and Skill Training

Co-Chairmen: Dr. James W. Singleton
Mr. Peter D. Weddle

Members: Dr. Dexter Fletcher
Dr. Susan R. Nevas
Dr. Gerald F. Tape

B. Briefings and Analysis

The work of the panel was done in two phases. The first phase was a series of pre-briefings in Washington, D.C. over a period of six weeks. The second phase was a two-week working session in Colorado Springs, Colorado. The briefings in Washington were presented to the panel by OSD, the Services, Government/Service laboratories, and representatives of private industry. Preliminary findings and recommendations were formulated in Washington and taken to Colorado for review and revision.

Further briefings and deliberations were conducted at Colorado Springs from 26 July through 6 August 1982, with the Services represented throughout. The findings and recommendations of the panel were presented to senior government and military officials at a formal outbriefing on 6 August. The presentation was repeated at the Pentagon on 7 September 1982, for those officials who were unable to attend the Colorado Springs outbriefing.

The recommendations presented at the outbriefing were subsequently consolidated and set in order of priority, as discussed below.

III. FINDINGS AND RECOMMENDATIONS

Appendix B presents the panel's findings and recommendations as given at the formal outbriefing.[1] Table 1 consists of the highest priority recommendations, after review and consolidation of the outbriefing items shown in Appendix B.

Overall, training was found to be good, but not good enough. An estimated $2.6B is needed to upgrade and balance training in relation to hardware acquisition expenditures. The $2.6B would consist both of one-time and recurring cost elements.

There is a major disconnect between the activities of the "hardware people" and the "people people." Redress of this issue is of the utmost importance. DoD should assign authority and responsibility to the people

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[1]The working notes and developmental writings of the panel are presented as a supplement to the present report.

people so that the human factor moves forward in conjunction with hardware development.

Table 1 shows the consolidated, specific recommendations according to three categories -- organization and management, planning and application, and technology. These three categories correspond generally to the three main action agency categories -- OSD, Services headquarters, and laboratories. Each of the recommendations is stated below, with a brief explanatory comment.

A. Organization and Management

Recommendations in this category are intended to enhance coordination and focus of training advocacy and oversight, and to acquire the data needed for cost-effectiveness tradeoff analyses and decisions.

1. **Establish an OSD Steering Committee for Training matters.**

   A weakness of the overall training system has been an absence of high level perspective and proponency. The recommended committee will strengthen the position of training at the budget table, and help to prevent administrative and technical duplication of effort.

2. **Establish a Defense Training Data Center for all training-related data (cost-effectiveness, student flow, training effectiveness, funding, RDT&E acquisition and support).**

   A data base from which to develop and evaluate training programs and technology is severely lacking. This perpetuates the weak position of training in competing for funds, and in demonstrating its value. Without a centralized and properly designated repository of training information/data, this problem cannot be alleviated. The Data Center will be a prime source of management and technology information for the OSD steering committee, for the Service training points of contact, and for the entire training community.

TABLE 1

RECOMMENDATIONS ON TRAINING AND TRAINING TECHNOLOGY

Category:	Organization and Management	Planning and Application	Technology
Major Responsibility:	**OSD**	**Services HQ**	**Laboratories**
	1. Establish an OSD Steering Committee for Training matters.	1. Provide the Reserve Components with up-to-date training technology/equipment; support training to meet the unique needs of Reserve Component training objectives, schedules and environments.	1. Establish (a) a performance measurement R&D program to develop criteria, methodology, and equipment for use at all levels of training; (b) demonstration projects for new training technology, to collect data on performance and cost-effectiveness.
	2. Establish a Defense Training Data Center for all training-related data (cost-effectiveness, student flow, training effectiveness, funding RDT&E, acquisition and support)	2. Support the funding of R&D and applications of technologies for unit training.	2. Increase exploration and use of current/advanced technology devices (e.g., arcade-like games) to motivate and to teach recruits functional skills.
	3. Revise acquisition process to (a) ease procurement specifications and standards, commensurate with training device use; (b) acquire training requirements data earlier in weapon system development cycle, for use by training community.	3. Support R&D and use of war games employing intelligent adversaries and realistic conditions (as found, for example, in engagement simulation).	3. Increase support/funding for R&D and use of: • voice recognition and synthesis (including speech storage) • interactive display technology • personal microprocessor training aids • application value of MISIC to training
	4. Increase use of analytical methods (e.g., Navy HARTMAN, Army MIST) to assess/project impact of manpower pool on new weapon systems, and to identify where training may increase skills/performance of recruits to meet system needs.	4. Upgrade ranges; increase number/size of ranges -- based on requirements for operational training, and testing of current and programmed weapons.	4. For new weapon and support systems, develop and incorporate embedded training and performance measurement/recording capabilities.
	5. Direct the Service laboratory to increase funding and management emphasis on training technology, its applications, and its payoff.	5. Accelerate use of computer-based instructional methods (includes CAI and CMI) in the schoolhouse and on-the-job, via portable aids and/or embedded training systems.	5. Direct future acquisitions of training equipment to use transportable software and to be "user-friendly" in meeting instructional needs.
	6. Direct the Services to provide a single point of contact for proponency and coordination of training and training technology.	6. Use advanced video and microprocessors to increase recruit awareness of job characteristics/benefits.	

3. **Revise acquisition process to (a) ease procurement specifications and standards, commensurate with training/device use; (b) acquire training requirements data earlier in weapon system development cycle, for use by training community.**

   a. Many training devices and simulators are over designed and over engineered. They are required to meet standards and specifications intended more for field and combat conditions than for the instructional environment in which they will be used. Substantial time and money can be saved by eliminating excessive design/manufacturing requirements.

   b. A chronic complaint from the training and user community alike is that training packages/devices arrive too late for effective use, often months or even years after the weapon system has been fielded. The intent of the present recommendation is to have the training devices in place by the time they are needed. Earlier acquisition of training requirements data is one way to help achieve that goal, but other alternatives should be pursued as well.

4. **Increase use of analytical methods (e.g., Navy HARDMAN, Army MIST) to assess/project impact of manpower pool, and to identify where training may increase performance of recruits to meet system needs.**

   There is a disconnect between the skill performance requirements for operation and maintenance of new weapons systems and the aptitude of the available or projected manpower to meet those requirements. Training provides whatever link there is, but that link is approaching its limit. Although progress in science and technology cannot be constrained by manpower capabilities, these fields cannot continue to forge ahead unmindful of those who will be the operators and maintainers of their innovations. A data and analysis system is needed that will detect and measure present and impending gaps between system

operator/maintainer performance requirements, and the capacity to access and train personnel to meet those requirements.

5. **Direct the Service laboratories to increase funding and management emphasis on training technology, its applications, and its payoff.**

   With a few notable exceptions, the laboratories' R&D priorities are not driven by operational requirements or problems. Moreover, operational people, when faced with immediate applied questions, rarely look to the laboratories for answers. Training suffers the most from this situation, because it is intangible and unexciting compared to working on exotic technology. Training is unlikely to be given the attention it needs by the laboratories unless it receives the recommended administrative direction.

6. **Direct the Services to provide a single point of contact for proponency and coordination of training and training technology.**

   This recommendation is a tenet of sound management. A single point of contact in each service will facilitate communication and will help to optimize use of training and training development resources.

B. Planning and Application

This general category of recommendations is intended to enhance the integration of training management and training technology.

1. **Provide the Reserve Components with up-to-date training technology/equipment; support training to meet unique needs of Reserve Component training objectives, schedules, and environments.**

Advanced training technology (e.g., microprocessors, interactive video, arcade-like games) is well suited for Reserve Component training, where training time and space are limited and actual equipment for training is either in short supply or outmoded.

2. **Support the funding of R&D and applications of technologies for unit training.**

   Classroom and laboratory methods and training aids are often unsuitable for use in unit/operational training, especially in the field environment on an "opportunity for training" basis. Unit training, in particular, needs more emphasis and support; better techniques and training aids need to be developed. The state of the art here is inadequate and outmoded.

3. **Support R&D and use of war games employing intelligent adversaries and realistic conditions (as found, for example, in engagement simulation).**

   War gaming is important to leader training. Leader development is inadequate at all levels due to limited resources and opportunities for real world exercises. Technology must be exploited to help provide the needed training.

4. **Upgrade ranges; increase number/size of ranges -- based on requirements for operational training, and testing of current and programmed weapons.**

   Our sea, air, and land ranges are being reduced through encroachment and other non-military restrictions. At the same time, the range and speed of our weapons systems is increasing. Training ranges must be protected and expanded where necessary, to be consistent with weapon system and training objectives.

5. **Accelerate use of computer-based instructional methods (including computer assisted instruction (CAI) and computer managed instruction (CMI)), in the schoolhouse and on-the-job, via portable aids and/or embedded training systems.**

   It is time to move forward with the use of computers in instruction and instructional management. The way needs to be paved for greater use and acceptance of computer-based instructional technology in all phases of DoD training.

6. **Use advanced video and microprocessor technology to increase recruit awareness of job characteristics/benefits.**

   Today's recruits are of the television generation. Video and microprocessor media can be one of the most effective tools for career counseling of that population. Enhanced selection and placement will help improve the needed match between people and technology/systems. It will also increase job satisfaction and retention.

C. Technology

The following recommendations are intended to increase the ability to evaluate and capitalize on new training technology.

1. **Establish (a) a performance measurement R&D program to develop criteria, methodology, and equipment for use at all levels of training; (b) demonstration projects for new training technology, to collect data on performance and cost-effectiveness.**

   Training requirements continue to increase in scope and complexity. The traditional approach to training performance measurement is inadequate and fragmented. A systematic program is needed to obtain performance data for the proposed Data Center, to evaluate and support training acquisition and management, and to appraise the potential of new training technology.

2. **Increase exploration and use of current and advanced technology devices (e.g., arcade-like games) to motivate and to teach recruits functional skills, including English language and reading skills.**

   There are new training technologies that may be applied to teaching basic (language, computation) skills and job performance (functional) skills, while reducing reliance on bulky and ineffective printed matter.

3. **Increase support/funding for R&D and use of:**

   - **voice recognition and synthesis (including speech storage)**
   - **interactive display technology**
   - **personal microprocessor training aids**
   - **application value of VHSIC to training**

   These technologies are necessary for a dramatic improvement in the state of the art of military training. Work must be accelerated in these areas to facilitate progress in schoolhouse and unit/operational training.

4. **For new weapon and support systems, develop and incorporate embedded training and performance measurement/recording capabilities.**

   Emerging weapon systems with internal microprocessors and computers afford the opportunity for incorporation of embedded training and performance measurement. This capability should be considered early in system development, and coordinated with the overall training program for the weapon system.

5. **Direct future acquisitions of training equipment to use transportable software and to be "user-friendly" in meeting instructional needs.**

System or computer-specific software complicates operations and training, and increases costs. More generalized software designed for the non-technical (i.e., non-computer trained) operator and maintainer will increase operational capability, reduce training scope and complexity, and reduce training costs.

The panel considered the foregoing recommendations to be the most critical and implementable subset of the many steps that might be taken to improve training, and to ensure that our weapon systems are operated and maintained to their full design potential. Previous DSB studies have asserted the importance of training. The present study urges decisive and immediate action. Our operational readiness demands nothing less than the best training possible.

REFERENCES

1. Office of the Director of Defense Research and Engineering. Report of the Task Force on Training Technology, 15 March 1976. Defense Technical Information Center Technical Report AD A0 69852.

2. Office of the Under Secretary of Defense for Research and Engineering. Report of the Defense Science Board, 1981 Summer Study Panel on Operational Readiness with High Performance Systems, April 1982.

3. Office of the Under Secretary of Defense for Research and Engineering. 1982 Defense Science Board Summer Study Briefing Report for Training and Training Technology, 26 July - 6 August 1982. United States Air Force Academy, Colorado Springs, Colorado.

APPENDIX A

TERMS OF REFERENCE

THE UNDER SECRETARY OF DEFENSE

WASHINGTON D C 20301

RESEARCH AND
ENGINEERING

18 JUN 1982

MEMORANDUM FOR THE CHAIRMAN, DEFENSE SCIENCE BOARD

SUBJECT: Defense Science Board Summer Study: Training and Training Technology

You are requested to undertake a Summer Study on Training and Training Technology to enhance the ability of our military forces to achieve and sustain optimum weapon system performance. Margins of superiority can be lost if our personnel are not able to operate and maintain their weapons close to the designed performance levels. This is an important issue, not only because of the sophistication of much of the new equipment, but also because of limits on the supply and quality of personnel available to maintain and operate our weapon systems. Relevant questions to be considered include but are not limited to:

1. How effective is current training? How do we measure training effectiveness? What data do we have and what are the cost-benefit trade-offs for using simulators and other training aids versus actual equipment for training?

2. What technologies exist that would improve the training of operator and maintenance personnel? How much improvement is projected and what areas or types of training could benefit most by adopting new approaches?

3. Are manpower data (actual and projected) on the supply and skill requirements needed from that manpower used to determine what training and/or new developments are needed to meet current and future manpower capabilities?

4. What actions are recommended to improve the implementation and utilization of advances in training technologies?

This Summer Study topic is sponsored by The Chairman Joint Chiefs of Staff. Admiral Isaac Kidd, Jr., has agreed to serve as Chairman. Captain Paul Chatelier (OUSDRE) will serve as Executive Secretary. Lieutenant Colonel Jerome Atkins will be the DSB Secretariat representative.

APPENDIX B

FINDINGS AND RECOMMENDATIONS

TABLE B-1 - OPERATIONAL TRAINING

STATUS:

- Current training effectiveness is good, but not good enough
- Basis of training assessment
  - studies
  - audits
  - joint exercise reports
  - service evaluations
- Proficiency gap

FINDINGS	RECOMMENDATIONS
LEADER DEVELOPMENT Leader training at all levels is inadequate. Senior operational commanders need greater opportunity to participate in commander/staff exercises.	• Develop campaign, battle, engagement simulations and operationally realistic war games. • Formulate vigorous training programs in all field units.
COMMAND TRAINING • Insufficient training in tactics for commanders	ASW Commander's Tactical Action Game • Micro computer-based game for individuals and teams • Machine provides environment, opposition, execution of orders • For use by fleet ASW training centers, type/fleet commanders, tactical group commanders
• Low cost media needed	Tactical Action Situation Games • Paper medium, produced in quantity • Self-paced programmed instruction • For use by NCOs to senior officers
UNIT TRAINING Successful training methods exist, but funding is inadequate.	• Increase funding of known successful methods.
Improved methods and devices (technology) needed, with funding	• Develop concentrated thrust in R&D to exploit new technology

TABLE B-1 (cont'd)

FINDINGS	RECOMMENDATIONS
NATIONAL GUARD AND RESERVE TRAINING	
Unique needs -- not well met • Limited training time • Dispersed location • Equipment deficiencies	• Tailor and deliver training support material to Reserve Components.
JOINT/COMBINED TRAINING	
Not enough practice in multi-service operations	• JCS, each CINC, develop realistic exercises, simulations and war games
Lessons learned are being forgotten	• Extract problems, prioritize, and fix them
RANGES (AIR, LAND, SEA)	
Encroachment, restriction on expansion, priority conflicts, equipment limitations	• JCS provide position to OSD to get/keep ranges • Provide/augment range equipment, threat simulation (physical and electronic) • Develop concentrated thrust in R&D to exploit new technology

TABLE B-2 - MANPOWER REQUIREMENTS AND SKILL TRAINING

STATUS:

- Recruit quality and quantity goals met in FY 1981; FY 1982 will be even better, but...
- Future shortages may be anticipated
  - declining manpower pool, changing demographic mix, expanding economy
  - increasing skill requirements
- Training technology offers significant and exciting solutions to some of the challenges.
- More and better data are needed to guide future applications.

FINDINGS	RECOMMENDATIONS
Demographic projections and "technology creep" indicate manpower problems of numbers and richness of mix.	• Use technology to simplify operator/maintainer tasks. • Explore self-motivating arcade-like devices to increase performance level of recruits. • Require use of contemporary analytic methodology such as Navy HARDMAN to match hardware to people.

TABLE B-2 (cont'd)

FINDINGS	RECOMMENDATIONS
Educational deficits can result in serious under-utilization of recruits' talent.	• Develop technology to match instruction to ways recruits learn best. • Use innovative ways to provide necessary English language skills. • Use technology such as video disk trainers in school and field to teach students about equipment. • Use transportable devices in the field to broaden knowledge and skills for career growth and leadership.
Benefits of computer assisted instruction (CAI) and new technology for field refresher and other training are limited by slow introduction into the training base.	• Develop innovative ways to make trainers accept technology changes such as CAI, and learn to use them. • Accelerate introduction of CAI into the schoolhouse to allow transportability of this training to the field. • Build CAI into training packages of all new operational systems.
Adequate data not yet assembled to determine cost-effectiveness of training methods and devices.	• Undertake demonstration projects and provide high technology testbeds for training and performance measurement. • Direct, where possible, embedded training and performance measurement be built into new systems. • Develop and adopt quantitative performance measures. • Establish a repository for all training data.

TABLE B-3 - TRAINING TECHNOLOGY

STATUS:

- Microprocessor based, interactive video disk systems have revolutionized the instructional industry.
- DoD need not fund the entire technology, but only its special needs.
- Software, including courseware development, is the dominant cost factor for computer-based instructional systems.
- Potential exists for improved training and performance measurement using embedded simulation and stimulation.
- New technologies, such as VHSIC, advanced storage techniques, voice synthesis and recognition will produce improvements useful in training.

FINDINGS	RECOMMENDATIONS
Advanced software techniques exist which promise gains in software/ courseware production efficiency, but they are not yet applied.	SHORT TERM: • Encourage use of common courseware modules and "user friendly" interfaces (artificial intelligence-based). • Direct future CAI acquisitions to specify transportable software, including operating systems. LONG TERM: • Direct machine intelligence R&D efforts in automatic programming, information extraction, expert systems, and "good teacher" models to reduce courseware production costs.

TABLE B-3 (cont'd)

FINDINGS	RECOMMENDATIONS
Weapon systems based on digital technology can be used to provide more effective training and performance measurement with little additional cost.	• Embedded training: new weapon systems should include means of providing simulated targets and environmental conditions. • Develop and incorporate performance measurement capabilities in new weapons systems.
Satellite communications capacity exists that may be used for remote training, maintenance, technical manual updating, and maintenance teleconferencing.	• Develop cost-effective ground stations with hardcopy and video recording capability. • Pursue technologies related to data compression. • Establish a group from the training commands to explore satellite capability.
Injection of war-time realism into engagement simulation and stimulation.	• Increase research to determine amount of fidelity required for individual and unit simulations. • Introduce into training as soon as feasible.
Critical training technologies need additional emphasis and focus by USDRE.	• USDRE assign responsibilities within DARPA and Services for emphasis on key technologies -- such as: - voice recognition and synthesis - voice forwarding and speech storage - interactive display technology (soft and hard) - personal microprocessor training aids • Use advanced training devices as testbeds for application of VHSIC (very high speed integrated circuits). • Establish "brainstorming" sessions with industry to devel-develop new ideas.

TABLE B-4 - ORGANIZATION AND ACQUISITION

STATUS:

1. OSD and Joint Chiefs not tuned to Services' training management and training technology needs.
2. Control and management of 6.1-6.4 training technology funds are fragmented within most of the Services. This fragmentation causes inadequate emphasis and/or acceptance of new training technologies.
3. Currently available data on individual/collective performance is not sufficient to support effective management of training resources (system and non-system).
4. Training devices often seriously lag the introduction of new weapon systems.
5. Service laboratories direct very little effort to the potential improvements in training through the application of contemporary technologies.

FINDINGS	RECOMMENDATIONS
The need for proper training management and training technology mandates that OSD establish the proper environment to support the training initiatives of the Services and JCS.	• Establish an OSD Steering Committee for Training matters.
A single proponent within each Service for consideration of new training technologies and devices is needed.	• SECDEF direct the Services to provide a single proponent within each Service for consideration of new training technologies and devices.