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AIR CUSHION VEHICLE OPERATOR TRAINING SYSTEM (ACVOTS) PROBLEM ANALYSIS (PROGRAM ELEMENT 64703N)

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This report presents the results of an Air Cushion Vehicle Operator Training System (ACVOTS) Problem Analysis. Data were collected from training site visits. The focus of the analysis was on the JEFF B air cushion vehicle.

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Significant recommendations for development of a Landing Craft, Air Cushion (LCAC) training system that will result in a training and cost effective operator training system are as follows:

- Conduct an ISD program per MIL-T-29053B(TD), MIL-STD-1379B, or similar specifications,
- Incorporate "lessons learned" and training concepts and strategies from both the surface and aviation communities, as well as the existing AALC and Voyageur ACV programs,
- Assign an education specialist (1710) to the LCAC program,
- Develop an LCAC operator manuals system,
- Develop an LCAC operator instructor training program, and
- Expand the ISD training development to other LCAC areas to include remaining onboard crew members and all areas of LCAC maintenance.

EXECUTIVE SUMMARY

This Air Cushion Vehicle Operator Training System (ACVOTS) Problem Analysis (PA) was conducted at the direction of the David Taylor Naval Ship Research and Development Center to assess the Air Cushion Vehicle (ACV) operator training problem. Data collected during the analysis are to be used for establishing boundaries in the development of future ACVOTS. Two advanced development air cushion vehicles (ACVs), designated JEFF A and JEFF B, are currently being tested under the Navy's Amphibious Assault Landing Craft (AALC) Program. Focus was on the JEFF B at the AALC Experimental Trials Unit (ETU) due to its projected similarities with the Landing Craft, Air Cushion (LCAC). Recommendations contained in this report are of three categories based upon their area of most significant impact. Recommendations affect:

- current AALC ETU training,
- LCAC, and generic ACV training, and,
- Instructional Systems Development (ISD) analyses which support both of the above.

The current JEFF craft training system at the ETU is adequate and is responsive to Navy ACV R&D needs. Potential areas for improvements, however, were identified which, if implemented, will enable proper AALC - LCAC interface. Recommendations for revisions or new approaches were formulated within the basic scope of the existing system and do not require major system overhaul or hardware procurements. Recommended improvements to JEFF craft training conducted at AALC ETU include and are prioritized as follows:

- Future AALC manning requirements be scoped for the entire duration of the program prior to existing personnel being reassigned.

- Addition of an educational specialist (1710) to the AALC program to assist in improving the current AALC operator curriculum and provide continuity of Navy ACV training into the LCAC program.

- Specific training goals/objectives be developed for all areas of AALC training and be included in the unit operations manual.

- Internal and external program constraints be reviewed and reduced where possible.

- A unit training plan and operator syllabus be developed.

- Conduct thorough underway mission briefings and debriefings.
- Consideration be given to conducting more training-only missions and conducting engine-running crew changes.
- A detailed student training folder be developed for each AALC student operator and qualified operator and be kept in the AALC facility.
- Lessons reviewed to improve objectives and ensure that academic information includes the latest changes to the craft. Responsibility be assumed by either AALC or contractor personnel to ensure future craft operation and system changes are incorporated in the academic curriculum.
- Careful consideration be given to tailoring AALC operator academics towards teaching systems by how they are operated by the operator while underway with the amount of system maintenance and design knowledge that enhances the operators' performance.
- Consideration be given to improving the visual quality of academic transparencies.
- Tests be reviewed and changed to make them more operator relevant.
- Document system check-off criteria and make it available to the students.
- Coordinate student handout narration with included graphics.

Given implementation of the above recommendations, the JEFF B training system provides an excellent foundation for the development of the LCAC operator training system. Much of the information and procedures for JEFF B operations and systems performance is relevant to the LCAC. There will be, however, significant differences between the two craft which will affect training program development.

In order to increase the validity of the LCAC training program and reduce overall developmental resource requirements, several recommendations for applying ISD methodologies early in the program were developed. They include:

- Define student entry level requirements.
- Determine hands-on and academic media requirements.
- Determine training basing and facilities.

Recommendations for development of the LCAC training system that will provide the training inputs for the areas discussed above and result in a training and cost effective LCAC Operator Training System are as follows:

- Conduct an ISD program per MIL-T-29053B(TD), MIL-STD-1379B, or similar specifications.
- Incorporate "lessons learned" and training concepts and strategies from both the surface and aviation communities, as well as the existing AALC and Voyageur ACV programs.
- Assign an education specialist (1710) to the LCAC program.
- Develop an LCAC operator manuals system.
- Develop an LCAC operator instructor training program.
- Expand the ISD training development to other LCAC areas to include remaining onboard crew members and all areas of LCAC maintenance.

Detailed explanations for each of these recommendations are included in Section II of this report.

The above recommendations should be implemented at the earliest possible time. Many of the ISD process steps recommended impact on LCAC decisions that are currently being made or will be made in the near future. As an example, the three areas (Student Entry Level Requirements, Training Media Requirements, and Basing and Facilities Requirements) are representative of the decisions which require immediate training inputs.

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SECTION I
INTRODUCTION

OVERVIEW

The Air Cushion Vehicle Operator Training System (ACVOTS) program is planned to identify and fully define, test, evaluate and document devices for Air Cushion Vehicle (ACV) operator training. Other craft in the Amphibious Assault Landing Craft (AALC) family of advanced landing craft have been projected. The Landing Craft, Air Cushion (LCAC) was the first design chosen for development. Other advanced craft with different payload and performance characteristics are now under consideration, and limited model tests and design studies have been undertaken. Thus, in the far term, other advanced craft, possibly ACVs, may also reach acquistion and fleet introduction in addition to LCACs. These craft are referred to as Landing Craft Experimentals (LCXs). This ACVOTS Problem Analysis (PA) was sponsored under the direction of the David Taylor Naval Ship Research and Development Center (DTNSRDC), Carderock, Maryland.

Two advanced development ACVs, designated JEFF A and JEFF B, are currently being tested under the Navy's AALC program. These craft are intended to develop the technology and assess the feasibility and military utility of employing ACVs in amphibious assault. The follow-on design and procurement of the production craft are being accomplished under the LCAC acquisition program. These craft are intended to be operated by an all enlisted man crew. Projected initial operational capability (IOC) for the LCAC is 1986. Overall LCAC Integrated Logistics Support (ILS) is under NAVSEA PMS-377.

The objective of this analysis was to provide recommendations for LCAC training system development which will serve as a baseline from which future ACVOTS programs can be developed. These recommendations are supported by an analysis of current ACV operator training in which "lessons learned" are documented. A secondary objective of the program was to provide recommendations to upgrade current AALC training.

Data used in this analysis was acquired from a variety of sources including technical reports, training materials and training site visits. A complete listing of data sources appears in Appendix B.

BACKGROUND

The Navy has recently awarded a contract for limited production of six (6) LCAC craft to be followed after Operational Evaluation (OpEval) and Technical Evaluation (TechEval) by full production. These craft will be capable of carrying a 60-ton payload in an amphibious assault. While the production LCAC will embody many useful features identified during tests and trials of the JEFF A and JEFF B in the AALC program, it will present unique training challenges.

ACVs are unique vehicles. They are amphibious. They behave differently from land wheeled or tracked vehicles, and are different from boats and other water craft. Preliminary indications are that operators of ACVs such as the LCAC will be confronted with a complex mix of tasks requiring skill in control coordination and navigation not presently required of operators of conventional landing craft.

While the ACV grants an enormous increase in capability as a landing craft, the ACV operator trainee is presented with complex handling characteristics. Initial perception problems include:

- extensive instrumentation,
- many possible control combinations,
- increased speeds of operation,
- anticipation of control effects,
- environmental interactions,
- ship interfaces, and
- casualty modes of operation.

The following brief descriptions of these problem areas and handling characteristics are intended to grant some understanding of the objectives of ACV operator training.

EXTENSIVE INSTRUMENTATION. Operators of conventional craft are not accustomed to the aircraft-type instrumentation to be found in many ACVs. There are a multitude of controls and gages in the control stations of the prototype JEFF A and JEFF B not found in current landing craft.

MANY POSSIBLE CONTROL COMBINATIONS. In order to maneuver an ACV, many different techniques can be used for control. For example, control mechanisms in the JEFF B include:

- propeller differential pitch,
- rudders,
- bow thrusters (rotatable), and,
- lift fans (vane settings).

Turns can be executed using various combinations of rudder, bow thrusters and propeller differential pitch. The number of possible permutations of these factors is large, and proper coordination of controls to produce a given maneuver requires extensive training.

INCREASED SPEEDS OF OPERATIONS. For the new ACV operator, the speed of operation attainable is much higher than that for conventional craft. Events occur faster, and the trainee will be unaccustomed to the relative motion problems at higher speeds.

ANTICIPATION OF CONTROL EFFECTS. The ACV operator must think "ahead of the craft" and acknowledge the time delay of a control input. Experience with JEFF craft operator training has shown that familiarity with and confidence in reacting to this effect take time to acquire.

ENVIRONMENTAL INTERACTIONS. An ACV is sensitive to its environment. Although uncoupled from a flat surface while on cushion, the craft is affected by wave speed, wave direction and winds. Water depth will change craft drag dramatically. Also, craft weight and center of gravity position affect craft performance in a seaway. Experience with these factors is important since wind and sea conditions are essentially different from day to day.

ACVs can be expected to behave differently overland as compared to overwater due to essentially different drag characteristics. The magnitudes of responses of the craft are also different. With a varying terrain, the operator must guide the ACV toward his objective, keeping in mind that the craft is a low-potential seeking vehicle; it will slide off dunes and down graded banks unless under positive control. In addition, obstacle clearance must continually be a part of the operator's thinking.

Transit through surf in an ACV is an entirely new experience to an operator accustomed to conventional craft. Some factors which affect ACV behavior through surf are the surf height, angle of craft approach to the beach, wave period, and craft attitude. These factors must be integrated in order to form a judgment of how best to transit the surf zone.

When the ACV operator fully understands how his craft behaves, occasionally he can even use the environment to an operational advantage. For example, with the craft in an overload condition in shallow water it may not be capable of operating over "hump" speed (about 20 knots). However, if there is adequate wind and the craft is piloted downwind, above-hump speed is attainable. Once above-hump speed is achieved, the ACV operator can resume his course and has power available to maintain speed to his objective.

SHIP INTERFACE. Entering the well deck of an amphibious ship at anchor has been characterized by JEFF craft operators as an easy task for a trainee who can accomplish low speed maneuvering. However, entering a ship underway is much more difficult. As the ACV approaches the well deck entrance, subtle changes in the environment (seaway, crosswinds, etc.) complicate the problem of maintaining proper alignment between the ACV and the ship.

CASUALTY MODES OF OPERATION. An ACV operator must gain an appreciation for the capabilities of his craft with various systems/subsystems degraded or inoperable. He must be familiar with the control techniques required to pilot the craft during casualty modes of operation.

STATEMENT OF THE PROBLEM

LCAC training system development will require a complete understanding of these and other potential operational problem areas and the application of instructional technology and methods in order to maximize the utility of the LCAC and ensure its full integration into the amphibious assault fleet. The challenge is to develop operator training systems which are:

- cost effective,
- training effective,

- safe,
- time responsive, and,
- within program constraints.

A brief discussion follows for each of the above requirements as they apply to the LCAC program.

COST EFFECTIVE. The Technical Letter Requirement (TLR) specifies mission requirements to be fulfilled by the LCAC. Unclassified requirements currently include:

- Operate from, and be capable of being loaded and unloaded from, all existing and projected US Navy amphibious ship wells.
- Carry all items of Marine Corps tactical equipment normally included in the assault echelon of the Marine Air/Ground Task Force.
- Accomodate personnel (combat ready troops) normally associated with embarked equipment and vehicles.
- Accomodate drive-through loading/unloading of Marine Corps equipment, including prime movers with towed loads.
- Transit at high speeds from amphibious shipping to designated shore areas.
- Transit through the surf, onto shore, across the beach, and traverse inland to a suitable discharge site for loading/unloading.
- Operate during periods of darkness or reduced visibility.
- Land personnel of assault waves not delivered by the other assault amphibious vehicles or helicopters.

The TLR drives the operational concept and design of the LCAC which, taken with craft performance data gathered during craft trials, sheds light on operator proficiency requirements. The current full proficiency definition may be subject to change as alternative missions are defined during the remainder of the AALC program.

While on the one hand, proficiency requirements define the level and depth of operator training, there are cost factors to be considered in arriving at the desired level of proficiency in training. Decisions must be reached concerning the most cost effective hardware support of training. The major considerations in those hardware choices are escalating fuel costs and required maintenance support. Consideration of these factors impacts decisions relating to:

- use of production LCAC craft for training,
- use of alternative or "training" craft, and,
- use of stationary training devices, both those currently available and those that could be developed.

The basic trade-off is the cost to develop a training system less reliant on utilization of actual craft vs. operational costs associated with a system which depends heavily on use of actual craft.

TRAINING EFFECTIVE. A program is considered training effective if the students graduate possessing the skills and knowledge which satisfy the operational command's requirements. Students can achieve proficiency in a multitude of ways depending on the media available for the instruction.

The balance between training effectiveness and cost effectiveness must be achieved through full definition of what is to be trained, to what proficiency levels, the conditions under which the training must take place, and how it is to be trained. The ideal training program is one where maximum training effectiveness is achieved for the minimum amount of cost.

SAFE. The complexity of operator tasks in ACVs relative to other craft should be apparent. The major training considerations include speed of response and execution, and ability to locate proper controls and make correct interpretations from complex presentations and potential seaway hazards. There must also be a fine balance between developing operator confidence and preventing overconfidence.

TIME RESPONSIVE. The current acquisition strategy calls for more than 100 craft following initial OpEval and TechEval of the production LCACs currently under contract. Initial craft deliveries through 1986 will occur as follows:

LCAC #1: May, 1984
LCAC #2: December, 1984
LCAC #3: April, 1985
LCAC #4: July, 1985
LCAC #5: November, 1985
LCAC #6: January, 1986

OpEval will commence on or about March, 1985. This requires that initial factory training be completed by May, 1984. The Navy is currently anticipating a requirement for an in-place operator training system in FY 1986.

Due to the fact that other ACV configurations may emerge from LCAC experience, three terms of training modes may be defined:

- short term: LCAC 1 & 2
- mid-term: LCAC 3 - 6
- long term: LCAC 7 - 108, LCX

During the short term, prime contractor factory training and AALC experience will be the major operator training system contributors. In the mid-term, a well-defined, well-managed LCAC operator instructional system must be developed. For the long term, generic ACV instructional strategies must be organized based on LCAC and AALC experience to cost effectively train ACV operators. The long term requirement, while undefined at present, does nonetheless support the development of a well documented LCAC ACV operator training system for the mid-term.

PROGRAM CONSTRAINTS. During development of the LCAC training system, certain constraints will be encountered similar to those in most emerging training system development efforts. These constraints are availability of adequate:

- time,
- manpower,

- funding,
- LCAC Subject Matter Experts (SMEs), and
- LCAC engineering and operations data.

These constraints can be easily minimized through proper integration of training development milestones with the total system planning. Thus, each of the constraints can be addressed as to their impact during each phase of the training development process.

SCOPE

Preparation of this report included the collection and analysis of ACV training characteristics and resources data, and collection of as much production LCAC craft data as was currently available. Analysis results provide the data necessary to select an approach for development of an LCAC operator training system.

This PA addresses current Navy replacement training of AALC operators to include JEFF A, JEFF B and Bell Voyageur. Also included is discussion of Assault Craft Unit (ACU) training, U.S. Army LACV-30 operator training, Royal Navy Hovercraft Training and new training approaches. Training specifically addressed is:

- current ACU training at the Naval Amphibious Group, Coronado, California,
- JEFF A, JEFF B and Voyageur training at the AALC Experimental Trials Unit (ETU), Naval Coastal Systems Center, Panama City, Florida,
- U.S. Army LACV-30 training at the U.S. Army Transportation School (USATSCH), Ft. Eustis, Virginia, and,
- British Royal Navy Hovercraft Trials Unit training.

Specific emphasis was placed on the JEFF B curriculum due to that craft's anticipated similarities to production LCAC craft.

The rationale behind the application of analysis of current ACV training programs to the development of LCAC training recommendations is twofold:

- lessons learned from other ACV programs are applicable to the LCAC program; and,
- operational requirements and in some cases logistical requirements, possess similarities to the LCAC program.

REPORT ORGANIZATION.

This remainder of this report is organized and sequenced as follows:

Section II - Description of Approaches to ACV Training, both current and potential.

Section III - Conclusions and Recommendations to enhance procurement and development of an LCAC training system.

Appendix A - Discussion of Fundemental Training Analysis Requirements.

Appendix B - Data Sources.

SECTION II
APPROACHES TO TRAINING

PRESENT ASSAULT CRAFT UNIT (ACU) TRAINING PROGRAM DESCRIPTION

OVERVIEW. Present ACU operator training consists of qualifying operators on the Landing Craft Utility (LCU) type craft. A representative ACU training program was reviewed during development of this PA at ACU-1 located at the Naval Amphibious Group, Coronado, California. There is a second ACU training program located at the Naval Amphibious Group, Norfolk, Virginia (ACU-2). The ACU operator training description contained in this PAR is based on the training being conducted at ACU-1.

TRAINING PROGRAM GOALS. The overall goal of the ACU operator training program is to provide the Navy with qualified LCU craft masters.

STUDENT POPULATION. The current ACU-1 training program trains four to five new students per year. Student ACU operators enter the course as unqualified craftmasters in the grades of E-6 and E-7. A few E-5s are also selected, but only as exceptions. Selectees are required to have three years service retainability as the current LCU tour of duty is three years.

CURRICULUM. Current ACU-1 training uses an apprenticeship-tutorial approach. At the completion of the training program (approximately six months), students receive an oral competency board. Students who successfully complete the oral board are certified as qualified craftmasters.

ACU students begin their training with a one week rules-of-the-road course. After completion of this course they receive a copy of the unit standard operating procedures (SOPs) and a Personnel Qualification Statement (PQS) manual. The students study the SOPs to familiarize themselves with ACU operations. The PQS manual contains the training tasks that must be accomplished prior to certification.

After the students are knowledgeable in the SOPs they complete their underway training. Underway training is conducted by qualified craft masters. Students do not necessarily train with the same crew each mission. Training tasks completed during each mission are documented in the PQS manual by a qualified crew member. After all the items in the PQS manual are signed off, the students are ready for their oral certification board.

ACU-1 Command personnel interviewed during gathering of PA data estimate the LCAC will be at least four times more difficult to operate than present ACU craft. On a difficulty scale of one to ten, the ACU craft operating difficulty was rated a two, and the LCAC craft was rated an eight to nine.

TRAINING EQUIPMENT, OPERATIONAL EQUIPMENT, AND FACILITIES.

Training Devices. No training devices are used in the ACU-1 training program.

Training Aids. No training aids are used in the ACU-1 training program.

Training Ranges. ACU-1 underway training is accomplished in Coronado Bay, and in the Pacific Ocean near Coronado, San Clemente Island and Camp Pendelton, California.

Audiovisual Equipment. No audiovisual equipment is used in the ACU-1 training program.

Facilities. ACU-1 training takes place in operational facilities.

AALC TRAINING PROGRAM DESCRIPTION

OVERVIEW. ACV technology has rapidly developed viable operating platforms with a variety of applications. The Navy has been investigating applications of this technology to the amphibious assault mission under the AALC program. Current test craft represent a radical departure from previously available control and maneuverability.

Two advanced development craft, JEFF A and JEFF B, have undergone testing during Navy Trials. Numerous aspects of craft operability, reliability and maintainability were established. While several minor problems involving traffic interface and noise were uncovered, their solution was accomplished with little impact on the ETU mission.

Navy replacement crews were also trained as operators (helmsmen) and assistant operators (relief helmsmen) on both craft. Time lags in controls and the newness of the "fly-by-wire" control regime coupled with the primary mission of prototype testing presented a challenge to training execution. These types of challenges frequently occur in such R & D environments.

Despite these challenges and minor problems, there now exists a small cadre of experienced Navy operators who have been trained in a moderately organized, non-standardized program of classroom instruction and operating practice on the JEFF A and JEFF B. Recently, a Bell-Textron Voyageur hovercraft has been leased by the Navy to investigate possible reduction in underway JEFF craft time.

TRAINING PROGRAM GOALS. The overall goal of the AALC training program is to provide the Navy with a core of qualified ACV operators and assistant operators for the ETU mission. It is hoped that many individuals within this group will form the initial cadre of Navy instructors upon delivery of the first six LCAC and subsequent production craft. Depth of training should be, as a result, appropriate to most required instructor/operator qualifications.

It should be emphasized that the primary mission of the ETU is conduct of full-scale craft trials. AALC operator replacement training has to date taken place under the constraint of reaching this primary goal during craft trials.

Orientation of the AALC JEFF craft training program is towards full systems knowledge. This is in keeping with the R&D nature of the ETU mission and the pursuit of the goal of a training-ready group of fully qualified instructors/operators once production craft are placed in the fleet. The Voyaguer training program is more operations oriented.

Operator trainees have thus far been brought on board with a variety of backgrounds from several sources including small surface craft and aviation communities. A search for an optimum qualifying rating or background for operators was the driving force here. Most students were assigned to the ETU as a shore tour based on the individual's request. Most were location volunteers in that the location of the AALC program was a determining factor in acceptance of the assignment rather than the uniqueness of and interest in ACVs.

The overall goal of the Bell-Textron Voyageur training program being conducted at the ETU is a reduction in underway JEFF craft training time.

The Voyageur is less costly to operate yet provides ACV operator/assistant operator trainees with the opportunity for early hands-on learning. This may or may not significantly enhance skill level, confidence and motivation prior to entry into the JEFF craft.

At present, the impact of Voyageur training on AALC/LCAC training has not been established. However, studies are currently underway which, if fully implemented, will allow complete specification of the training craft role in ACV training. Factors to be identified include:

- tasks to be trained on operational craft only,
- optimum depth of task training on Voyageur, and,
- tasks which could be trained on Voyageur, given certain modifications to the Voyageur.

Orientation of the Voyageur training program is towards required operator skills and knowledge. The course is taught by contractor personnel on a one-to-one or one-to-two basis due to small program inputs and the variability in student backgrounds.

TRAINING PROGRAM ORGANIZATION. The AALC and subsequent production LCAC programs involve an emerging system and thus, organization of commands involved in or supporting Naval ACV training is not established. Structure of the training aspect of the AALC program is attached to the R&D management structure as shown in Figure 1. The roles of each are as follows:

OPNAV: Responsible for overall program effort.

NAVSEA: Administer overall RDT&E of ACV craft.

DTNSRDC: Provide technical direction to RDT&E activities.

NAVTRAEQUIPCEN: Assist in training program definition and support requirements.

AALC ETU: Conduct craft trials and support replacement crew training.

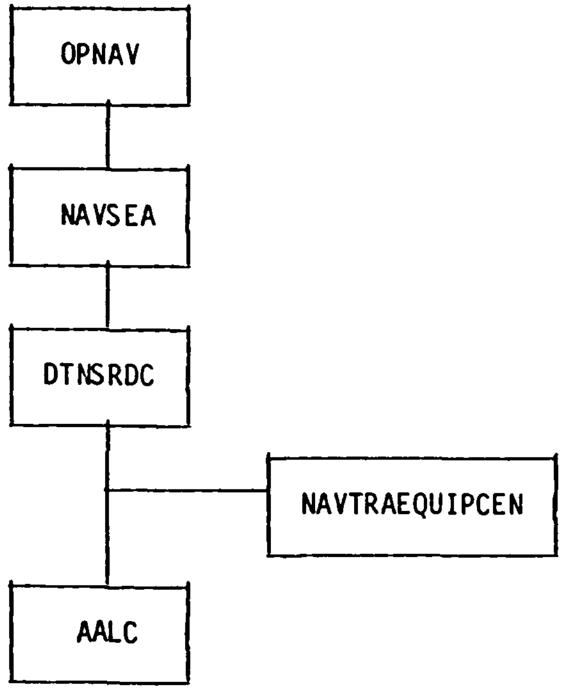

Figure 1. AALC R&D Management Structure

INSTRUCTIONAL STAFF. The instructional staff at the ETU consists of a training director and four (4) contractor personnel: two Voyageur instructors (1 academic and 1 underway) and one instructor each for the JEFF A and JEFF B (both conduct academic and underway training). These instructors are highly qualified ACV operators with at least four years of JEFF craft or Voyageur experience. Recently, qualified Navy operators have begun to serve as underway instructors in the JEFF B.

STUDENT POPULATION. Students presently in ACV training at the ETU and their sources are as follows:

NEC	PREVIOUS JOB TITLE	NUMBER ASSIGNED
0161	Tug Craftmaster	1
0162	YF Craftmaster	1
0165	ACU Craftmaster	1
8319	Test Operations Aviation Maintenance	2
1110	Damage Control	1
4362	Main Propulsion Technician	1
1110	Propulsion Ass't. Destroyer	1
1110	Fire Control	1

Forty-four percent (44%) of the students had no actual surface ship operating experience prior to AALC assignment. ACV operator and assistant operator trainee source selections have been themselves in an experimental mode throughout the AALC program. The following factors were unknown at program initialization:

- availability of surface ship ratings for future program input,
- whether or not ability to synthesize complex system information and performance would override large craft handling experience and knowledge of "rules of the road," and,
- at what point in a student's lack of progress a "wash-out" might be determined.

Due to the small number of trainees, instruction was tailored to individual student requirements in pursuit of full proficiency training.

Records of student performance are being constructed to be evaluated in light of original and future pipeline sources.

Additionally, with zero hours of actual underway ACV operating time initially for most students, evaluation of "time to proficiency" was conducted during replacement crew training. It is anticipated these estimates will be further revised with the addition of the Bell Voyageur training craft into the curriculum. Because Voyageu training is a recent addition to the AALC program, there have been a limited number of students. Two Chief Petty Officers with surface craftmaster ratings and one Lieutenant with ASW destroyer missile/fire control experience (who will become a JEFF B OIC) were recently trained on the Voyageur. Number of underway hours in the Voyageur were roughly comparable for the two CPO's at 60-70 hrs. The Lieutenant has recently completed his underway portion with 50 hours of time logged. They are scheduled to begin JEFF B training in the immediate future. It should again be noted that scheduling of JEFF craft training is on an as-available basis as the craft are primarily dedicated to the RDT&E mission.

Attrition at ETU over the past two years has been 2 student operators. Motivational problems were cited in both cases. Remediation classroom instruction is always available. Instructors noted that student motivation was the most important factor in a student's progress and was heavily related to determination of a "wash-out" point or screening variables which, at present, are still to be determined.

CURRICULUM. The JEFF Craft operator academic course is a systems-based course taught in a traditional classroom setting with lectures supported by overhead transparancies and student handouts as the primary media. Contractor personnel, who were the original Navy operators, conduct the course from prepared outlines which are similar in design to the student handouts. Tests are given periodically during this phase and an end-of-course (final) is given. Tests are primarily multiple choice. Student system check-outs and check-offs are accomplished during this phase of training.

Syllabi are prescribed for proficiency training of operators and assistant operators on both the JEFF A and JEFF B. In addition, a familiarization course for Officer-in-Charge (OIC) training for each course is also provided (OIC's will not be assigned to the LCAC). Since a production contract for the LCAC has been awarded to the manufacturer of the JEFF B, emphasis will be on that craft. The syllabi are defined as follows:

- Basic Syllabus - full classroom and hands-on instruction on all craft systems.
- Assistant Operator Syllabus - basic syllabus plus fulfillment of prescribed proficiency requirements underway.
- Operator Syllabus - basic syllabus plus fulfillment of prescribed proficiency requirements underway.

The number of hours required for individual position certification have varied considerably. This was most likely due to the variation in student backgrounds and program constraints. The basic syllabus employs academic classroom instruction supported by viewgraphs and a series of check-outs (student inspects system on craft and clears any difficulties with instructor) and check-offs (student describes system in detail to instructor's satisfaction) to prepare the student for underway training. At no time were the craft operated by the student before full completion of the basic syllabus. Length and general content of the three syllabi are summarized in Figure 2.

Weeks	Basic Academic Syllabus Training
1-4	Systems classroom instruction and check-out/check-off.

Weeks	Operator Underway Syllabus Training
5-	25 hours in Ass't. Operator's seat 50 hours in Operator's seat

Weeks	Assistant Operator Underway Syllabus Training
5-	25 hours in Ass't. Operator's Seat 25 hours in Operator's seat

Figure 2. General Outline of AALC/ETU JEFF Craft Syllabi

Measures of student performance in the classroom consist of lesson quizzes with immediate review. Each student corrects another's quiz during quiz review. Completion of systems instruction requires a system walk-through on board the craft (check-out) and an oral briefing given by the student to the instructor (check-off) in which the student's mastery of the subject matter is verified.

During the underway syllabus, instructors evaluate student performance via subjective evaluation of the task performance. Feedback is most often given during the R&D mission debrief and occasionally immediately following task performance.

An oral board is conducted for each student operator at the completion of underway training to assess his qualifications and performance. This board consists of the unit OIC, craft OIC, instructors, the test director and craft engineers.

The Voyageur syllabus is based around a study guide developed from the operating manual and other contractor resources. It is utilized in a series of 12 academic lessons (approximately 30 classroom hours) covering ACV operation and Voyageur-specific systems during underway training. Academic lessons are supported by extensive use of viewgraphs illustrating system characteristics and flows. During the underway training which follows, the student is exposed to increasingly difficult exercises until he has reached proficiency in basic maneuvers. Check rides are scheduled at 15, 25, and 40 hours and the last mission of underway training.

TRAINING EQUIPMENT, OPERATIONAL EQUIPMENT AND FACILITIES. Specific areas of ETU training equipment and facilities are discussed below.

Training Devices. There are currently no training devices in use in the AALC program.

Training Aids. A cut-away scale model of the AVCO-Lycoming TF-40 gas turbine engine is available for use in academic lessons covering JEFF B engine system functions.

Training Ranges. Training ranges available for all craft training operations are as follows:

- Ramp Approach and Departure (ETU)
- Pier Approach and Departure (West of Bear Point)
- (2) Intracoastal Navigation (East and West Bays)
- Close-in maneuvering (Long Point)
- Overland operations (Crooked Island)
- Open water operations (Gulf of Mexico)

Audio Visual Equipment. Overhead projectors are used in every academic lesson to project viewgraphs of system flow diagrams, key instructional points, etc. Videotapes of JEFF craft ramp approaches and departures are frequently recorded and reviewed during the mission debriefs.

Facilities. One academic classroom used to teach JEFF craft academic lessons is located on the second deck of the ETU main building. There is one academic classroom for Voyageur academic lessons located within the contractor's on-site facilities.

AALC TRAINING PROGRAM EVALUATION

OVERVIEW. Results of interviews conducted at ETU and collection of training information, indicate that AALC training is adequate within given constraints. Aspects of the JEFF craft operator training program which could be improved, however, were identified and will be presented in this section. In addition, training improvement recommendations will be included for each improvement area.

Due to the infancy of the Voyageur program, an objective assessment of its benefits and value to the AALC program and, more importantly, the LCAC program were not attainable. Assessment of this program was limited by only three students having been trained to date. Since none of these students had begun JEFF Craft training, this prevented a complete evaluation of Voyageur training transfer. A much more comprehensive assessment can be made with additional experience. However, certain aspects of the program were assessed and their results and recommended improvement areas will be presented in the following paragraphs.

The number of recommendations accepted and implemented must be measured against the number of students that will be trained prior to the end of the AALC program. Most of the changes can be implemented with minimum expenditure of funds or time and will contribute to Navy achievement of proficient AALC operator personnel for a lower end cost.

The training improvement areas listed below should not overshadow the dedication, concern, and professionalism observed in all assigned AALC personnel during the one week on-site visit at the ETU in Panama City, Florida. It was only through their cooperation and concern for unit improvement, and more specifically concern for achieving an optimum LCAC training program that training improvement areas were identified.

GENERAL PROGRAM ASSESSMENT. The ETU has a primary mission of conducting full-scale trials, therefore, training has been a secondary goal. As such, specific unit training goals/objectives were not evident in the unit operations manual current at the time of data collection. The absence of these goals/objectives appears to reduce the importance of unit training. As an example, JEFF craft mission briefings for underway activities are very detailed for the experiments portion of the mission but little, if any, briefing time is devoted to the training activities to be conducted. Recommend specific training goals/objectives be developed for all areas of AALC training and be included in the unit operations manual.

The JEFF craft operator training curriculum is structured in the academic area, but underway tasks to be accomplished, number of repetitions for each task, and in what sequence they are to be performed are not fully documented. This area could be strengthened through the development of an AALC unit training plan and a syllabus for each training area (i.e. academic and underway). Specific recommendations for academics and underway training will be included in their respective sections of this assessment.

The instruction for each JEFF class follows the same sequential flow of academics followed by underway training. However, deviations occur during operator training. These deviations are caused by both internal and external program constraints. Internal constraints included:

- students being taken out of class to perform other primary duties,
- extended periods occurring between completion of academic training, and the beginning of underway training, and;

- completing academics in one type of craft and beginning academic and underway training in another craft and then completing underway training in the original craft.

These internal constraints provide learning barriers. External constraints such as craft down time due to maintenance failure, completion of primary underway craft tests, and weather/sea-states also contribute to sequence deviations. It is recommended these constraints be reviewed and reduced where possible.

Two specific JEFF craft training program weaknesses were identified which limit optimum training impact assessment being made in relation to the above internal and external program constraints. These weaknesses are: absence of a unit training plan and underway operator syllabus, and insufficient student training documentation. These areas are discussed in the following paragraphs.

Unit Training Plan and Operator Syllabus. The absence of and need for an AALC unit training plan and operator syllabus were evident during on-site interviews. A unit training plan and operator syllabus would provide command personnel with the required training event sequence, prerequisite relationships, repetition and frequency information to more objectively assess training impact imposed by internal/external program constraints. It cannot be overemphasized as to the need for these documents.

Student Training Documentation. Student training documentation is not readily available to the AALC Commander. Documentation that is available is not documented sufficiently to aid the commander in his training decisions. Underway documentation is maintained by the contractor and is located at his facility. It is recommended that a detailed student training folder be developed for each AALC operator student and qualified operator and be kept in the AALC facility. Contents of the folder should include the following:

- Academic performance by each system and phase of operation knowledge on all required normal and casualty procedures.
- Underway performance for each mission to include date of mission, events scheduled, events completed, events where proficiency displayed, events where additional training above syllabus

requirements is required, and a written narrative for each event where less than perfect performance was displayed.

The latter recommendation requires further explanation. Detailed written narration of student less-than-perfect performance allows early identification and correction of trend deficiencies that would not otherwise be evident until they become a problem in later phases of training.

AALC manning has created past and current training problems. As an example, the two original JEFF craft operators retired from the Navy at a point which left the AALC unit without any qualified operators. In addition, personnel were assigned to the AALC operator program who did not have adequate retainability and/or who had other problems which forced their removal from the program. The non-existance of a formal AALC operator pipeline source has created a situation where maintenance technician personnel, who do not possess any craft operator experience, have been entered into operator training in order to maintain an adequate number of qualified operator personnel for both JEFF Craft. The impact of these manning problems seriously affects the amount of increased training requirements that has had to be assumed by AALC. In light of these manning problems and high priority experimental test requirements, the can-do attitude of the AALC personnel has reduced the significance of these increased training requirements. AALC's experience in dealing with these manning problems makes their input into future LCAC student entry level decisions of utmost importance. Recommend future AALC operator manning requirements be scoped for the entire duration of the program so adequate replacements can be input into the program prior to existing personnel being reassigned. This would ensure that Navy program knowledge and "lessons learned" are passed from the outgoing person to the incoming person. It would also eliminate qualified operator availability problems.

The addition of an educational specialist (1710) to the AALC program could assist in improving the current AALC operator curriculum. In addition, it could provide the foundation from which this person could be assigned to the LCAC program. This would maintain Navy ACV training experience and "lessons learned" continuity from the R&D program into the operational program. This person could also provide guidance on development of all LCAC training to include crew, maintenance, and support requirements.

The primary mission of the Voyageur is training, therefore the training constraints evident in the JEFF craft programs are non-existent in the Voyageur program. This makes the training problem much less complex.

Specific overall training goals/objectives seem to be evident, but not formally documented. The main goal/objective is to provide the JEFF operator students with some basic ACV skills. A training syllabus was available which outlined underway lessons with objectives. An academic syllabus was also evident. The levels of detail in these syllabi was representative of what is found in most traditional training programs. However, it is not anywhere as detailed as what would be found in an ISD constructed program. A training plan was not evident and consideration should be given to developing one.

The sequential flow of instruction is an academic phase followed by an underway phase. There were no evident training constraints that caused deviations from the planned sequence of instruction.

ACADEMICS. Primary academic emphasis was placed on the JEFF B program even though both JEFF craft and Voyageur curricula were reviewed. As previously mentioned, the JEFF craft academic courses are systems-based and concentrate on how systems are designed and operate rather than how the operator interacts with the system. A breakdown of the JEFF B curriculum which illustrates the heavy maintenance emphasis versus operation emphasis is shown in Figure 3.

	Total	Operator Oriented	Maintenance Oriented
JEFF B ACADEMIC HOURS	55	15	40
JEFF B CHECKOUT HOURS	33.5	5	28.5
JEFF B CHECKOFF HOURS	15	1.5	13.5

Figure 3. JEFF B Academic Summary

Figure 4 contains a detailed JEFF B academic curriculum summary which shows classroom, checkout and checkoff hours by subject. These figures and subject listing were obtained from the curriculum that was current as of July 1981.

LESSON TITLE	PHASE I CLASS	PHASE II CHECKOUT	PHASE II CHECKOFF
General Description	2 hrs.	2 hrs.	.5 hrs.
Propulsion System - Engines	5 hrs.		
Propulsion System - Transmission	2 hrs.		
Propulsion System - Propellers	1 hr.	4 hrs.	1.5 hrs.
Propulsion System - Bow Thrusters	1 hr.		
Lift Systems - Lift Fans	1 hr.		
Lift Systems - Plenum	.5 hr.	3 hrs.	1.5 hrs.
Lift Systems - Skirts	1.5 hrs.		
Fuel Systems - Tanks	.5 hrs.		
Fuel Systems - Piping Layout	2 hrs.		
Fuel Systems - Valving/Pumps	2 hrs.	5 hrs.	2.5 hrs.
Fuel Systems - Refueling*	.5 hrs.		
Fuel Systems - Defueling*	.5 hrs.		
Lubrication System- Oil/Pumps/Coolers	2 hrs.		
Lubrication System- Piping Layout	1 hr.	6 hrs.	2.5 hrs.
APU	2.5 hrs.	1 hr.	1 hr.
Electrical Systems	2.0 hrs.	2 hrs.	1 hr.
Hydraulic System	5.5 hrs.	4 hrs.	1.5 hrs.
Communications Systems	3.5 hrs.	1 hr.	.5 hrs.
Navigation Systems	5 hrs.	.5 hrs.	.5 hrs.
Cabin Layout*	8 hrs.	1 hr.	.5 hrs.
Pre-operational & Operational Checks*	6 hrs.	4 hrs.	1 hr.

Figure 4. Most Recent JEFF B Curriculum

*Operations oriented.

During the interviews with AALC student and qualified operator personnel, 44% found the academic instruction to be too detailed and not really relevant to the operator needs. It is recommended that careful consideration be given to tailoring AALC operator academics towards teaching systems by how they are operated by the operator while underway with the amount of system maintenance and design knowledge that enhances the operators' performance requirements. Figure 5 illustrates the emphasis placed on design knowledge in the present training approach versus the recommended emphasis in the approach discussed above.

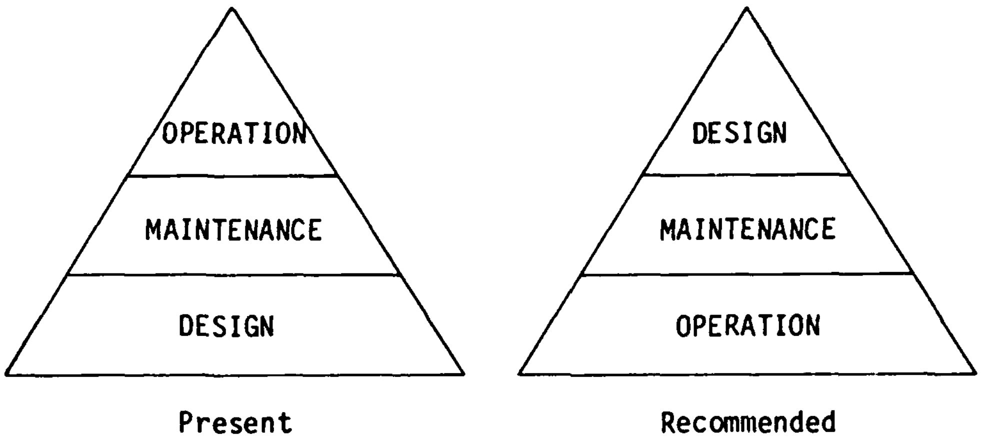

Figure 5. Present - Recommended Academic Training Approach

Visual transparancies presently used are primarily reproductions from maintenance technical orders. Their quality and clarity are degraded enough to impair instructional effectiveness. Recommend consideration be given to improving the visual quality of these transparancies.

Instruction irregularities were noted during review of instructional materials and from interviews with AALC personnel who recently completed the academic training phase. Examples of these irregularities are as follows:

- academic objectives do not match lesson content or learning, and,
- students are presented systems information in class which is proven inaccurate when the students are completing system checkouts due to recent system changes.

Recommend lessons be reviewed to improve objectives and ensure that academic information includes the latest changes to the craft. In addition, recommend responsibility be assumed by either AALC or contractor personnel and a system designed to incorporate future craft operation and systems changes.

Student handouts for each lesson include detailed narration and graphic reproductions which support classroom lectures. However, information is not available to the students as to which graphic(s) support which part of the narrative. This could easily be accomplished by numbering the graphics and providing number cues on the left side of the narrative indicating to the student the graphic to be referenced.

Academic tests appear not to be developed to course objectives. They are also very heavily maintenance oriented. Recommend tests be reviewed and changed to make them more operator relevant. Also, system check-off criteria should be documented and available to the students. Student check-off pass/fail currently rests entirely on instructor subjective judgement.

The Voyageur operator academic course is a systems-based course taught in a traditional classroom setting with lectures supported by visual transparencies and a study guide as the primary media. Academics are taught by one contractor instructor who instructs from a lesson outline.

A review of the academic course resulted in the observation that the approach used in the Voyageur program, although systems-based, was much more operator oriented than the AALC program. Motivational and ACV theory as it relates to an operator were provided in the beginning lesson. Systems presentations were more at an operator level than a maintenance technician level. The study guide used by the students was broken down into two parts (Part I - Systems, Part II - Operations). Part I appeared to contain too much system detail for the operators, much more than what was being presented in class. Part II was more operator oriented.

Visual transparencies were reviewed and, as in the AALC program, many were reproductions from technical manuals. Their clarity and quality was adequate, but it did not appear that they would sufficiently enhance the instruction. According to the contractor instructor, they were being considered for upgrade.

Academic objectives were not developed to the standards expected in a criterion-referenced objective; however, they appeared to be adequate. In most cases, they matched lesson instructional content.

Academic tests were multiple choice and appeared to be operator oriented, but not necessarily developed to test the lesson objectives.

UNDERWAY TRAINING. Due to a lack of qualified Naval personnel, AALC underway training was conducted by contractor instructor personnel. These instructors not only conducted the underway training, but were also responsible for evaluation and recommendations for certification. The OIC of the ETU has changed his concept in order to provide Navy operator personnel with more operator time and become less reliant on contractor personnel. JEFF Craft OICs are now responsible for conduct of underway training while their craft operators provide the actual instruction. This appears to have had a positive morale effect on both qualified and student personnel. The ETU OIC's support of his people is noteworthy. Contractor instructor personnel still provide recommendation inputs for certification.

As previously mentioned, training is not a primary ETU mission objective. This philosophy has had its greatest detrimental effect in the underway phase of training. As previously recommended, the addition of a unit training plan and training syllabus would enhance the overall training effectiveness of the ETU. These additions would be most beneficial to the underway phase. Presently, it is conceivable for operator personnel to become certified without having demonstrated full proficiency and/or even been exposed to certain training events, both normal and/or casualty tasks. This situation could exist for two reasons. First, the absence of a documented training events list to include:

- Sequence of events. Scenarios which begin with simple tasks building on their proficiency while proceeding with more complex tasks until the student demonstrates proficiency in all normal and casualty tasks.

- Number of repetitions. Although AALC training exercises a train-to-proficiency philosophy, number of repetitions for each training event should still be documented. This documentation assists command personnel in budget proposal preparation, mission scheduling, etc.

- Frequency. Providing specific frequency guidelines for each training event would help ensure that student training continues to increase/maintain proficiency. Long time intervals between repetitions of certain training events can foster loss of retention.

Secondly, the absence of complete student folder documentation, as previously discussed in this section, allows certification to occur based on instructor/evaluator subjective recommendations without objective written supporting documentation being available for review. It is strongly recommended these areas be improved in the near future due to their potential negative effect on underway safety.

Underway mission training briefings should be conducted for each mission to include detailed preparation and review. This will ensure that students are properly prepared to perform scheduled underway training events. This is currently not being accomplished, but could be easily implemented. Contents of briefings should be standardized through development of instructor and student briefing guides which would include specific areas to be covered.

Mission training debriefings should be conducted for each mission. Specific areas should be identified and included in the debriefing which ensure the student fully understands the areas he is satisfactorily progressing and the areas where improvement is required. Prescriptions for improving weak areas should be included in the debriefing. Following each debriefing, instructors should prepare a training accomplishment/evaluation sheet on each student.

All underway missions presently being conducted by AALC are test missions. It is highly recommended that consideration be given to conducting more training-only missions. In addition, consideration should be given to conducting engine-running crew changes where the craft comes to the approach ramp and a new crew or specific crew members go aboard and relieve the onboard crew or certain crew members. A second mission could thus be accomplished without shutting the craft down. Procedures for this type of activity could be easily developed. The end result would be increased underway activities without increased maintenance costs.

Concepts for increased underway training activities such as these would contribute to elimination of some proficiency problems noted during on-site interviews. For example, one operator trainee indicated he had undergone numerous, short (10-20 minutes) underway experiences, totalling theoretically beyond the required number of hours for certification, yet he cannot be certified.

Voyageur underway training consists of 31 missions with 50 hours of underway time. As in the AALC program, training is to proficiency, not hours. Mission objectives are evident for each mission. Training events are taught beginning with the simple and proceeding through the most complex.

A mission briefing is conducted for each mission. It consists of a briefing of mission objectives to ensure that the student is properly prepared to accomplish scheduled training events. A debriefing is held for each mission. Contents include review of mission training events, reinforcement of satisfactory performance and prescriptions for less than satisfactory performance.

Evaluations are provided by the instructor who has provided the instruction. They are based on the instructor's subjective evaluation as documented criteria do not exist.

INSTRUCTORS. As mentioned above, most JEFF craft instruction is presently being administered by AALC personnel under the supervision of the craft OICs. However, there are no instructors formally identified and placed on instructor orders. It is recommended that JEFF Craft instructors be formally identified by name and documented on a locally prepared instructor order. In addition, criteria have not been established for instructor qualification. Conducting training without certified instructors leaves the Navy open to severe criticism in the event of an underway incident or accident. This area should receive immediate attention.

Two contractor instructors provide the total instruction for the Voyageur program. One teaches academics and the other underway training. This breakout of responsibilities contributes to increased program standardization in both phases.

OTHER ACV TRAINING

LACV-30 TRAINING PROGRAM DESCRIPTION

OVERVIEW. The Lighter, Air Cushion Vehicle, 30 Ton (LACV-30) will provide the US Army Logistics System with a rapid lift capability to move cargo and equipment over water, marginal areas, beaches, ice, snow and inland. The LACV-30 is capable of carrying military cargo consisting of cargo containers, wheeled and tracked vehicles, engineer equipment, pallets, nets, barrels, and general cargo. It can be used in LOTS missions, coastal, harbor and inland waterway roles; search and rescue; medical evacuation and icebreaking. Other missions such as support of forces conducting amphibious operations and shore-to-shore operations and other water operations can be provided as required. The vehicle is especially valuable in marine, delta, and cold region environments, crossing barrier reefs and underwater obstruction; transiting rivers and river beds; moving across sand pits and beaches; crossing snow, ice, tundra, and other marginal terrain which requires a highly mobile vehicle.

The Army will soon have an ongoing training program for LACV-30 operators and navigators once initial production craft are delivered. The first class to receive operator training for production craft began in April 1981. A second class was begun in August 1981. Operators in these classes are being trained by Army operator instructor personnel who formed the original LACV-30 initial operator cadre. Future training will be conducted at Fort Eustis, Virginia by Army instructor operators.

The similarities between the LACV-30 and the Voyageur prompted investigation of current and proposed LACV-30 training for inclusion in this report.

TRAINING PROGRAM GOALS. The overall goal of the LACV-30 operator training program is to provide the Army with qualified operators and navigators for the 12 production craft to be delivered between October 1981 and May 1983.

Students trained in the first two classes will become the instructors in the operational unit. Remaining students will be taught in the training unit at Fort Eustis with a curriculum developed by the U.S. Army Transportation School (USATSCH). This training was scheduled to begin in October 1981.

STUDENT POPULATION. Students are assigned by the Department of the Army or Post Headquarters. They are selected from the Army marine community. There are no changes expected to this pipeline source.

Original candidates were E-7s and E-8s, but difficulty was encountered in acquiring these levels of personnel. This was primarily due to the lack of enthusiasm which centered on career progression concerns. They viewed this duty as a career "dead-end." Selectees are presently E-5s with a typical age of 24-25.

Career progression problems may affect morale of the navigator personnel. This may be caused by the operator program strategies. All personnel enter the program as operators, however, some of the personnel end up as navigators due to a mandatory attrition system built into the program at the 40 hour point.

Selectees are required to have three years retainability. However, several students have been selected with only 18 months retainability.

CURRICULUM. Operator and navigator students receive approximately 2 weeks classroom training on craft terms, procedures, and systems followed by 40 hours of craft underway training per student. Underway training is under the instruction of a certified instructor operator. At the completion of the 40 hours a selection is made (regardless of rank) from the 8 operator/navigator students as to which students will continue on to receive the additional 60 hours stick time required to achieve operator status.

Those students not selected as operators continue training to acquire 40 hours underway as navigators and work as crew members training in cargo loading and discharging, deck maintenance and support operator training to its completion. It is noted that the purpose of the 40 hours underway time for the navigator is to provide a "bring home" capability should the operator become incapacitated. This 40 hours also provides a solid training base in the TOE unit for new operators.

Once the prospective operator is selected, it will not be a requirement for him to improve his proficiency with an instructor operator as he accumulates the remaining 60 hours of underway time. A certified operator can fulfill this need. Upon completion of the total 100 hours the student operator will be given a "check ride" by an instructor operator to assure complete qualification as a LACV-30 operator.

A general academic course consisting of 26 hours is given to all LACV-30 students. The objective of this course is one of LACV-30 familiarization. The student outcomes include identifying LACV-30 terms and nomenclature, plan for its transportability, mission capability, and safe utilization. A two hour multiple choice test is administered to evaluate students' progress and course effectiveness. Upon completion of this course, specific courses of instruction are provided for crew and maintenance personnel.

Operator/navigator academic instruction consists of 110 hours. The academic approach is operator oriented versus maintenance oriented. Of the 110 hours of instruction, two (2) are related to vessel systems, 102 to craft operation, and six (6) to logistics procedures. Interviews with instructor personnel confirm their acceptance and endorsement of this concept. Instruction is delivered by the instructor from a prepared outline and supported visually with overhead transparancies. The quality of the transparencies was very good and their support of the lecture was outstanding. Especially noteworthy was the instructional strategy employed to teach students cockpit system location with overhead transparencies showing total cockpit layout with highlight of the specific instructional control, display, or panel. Four hours of testing are administered during the instruction to measure students' progress and course effectiveness.

Underway training concentrates on teaching simple tasks and proceeding through the most complex tasks. Underway training is divided into two phases. Phase one terminates at the 40 hour point where the students are selected for further operator training or transferred into the navigator training track. Continuing operator students receive 60 hours in the second phase. Two underway tests are administered, each of eight hours duration. The first is administered at the end of Phase I and the second at the end of Phase II.

Detailed mission briefs and debriefs are conducted prior to and following each mission. The unit training NCO maintains individual student progress records and an overall training status board. This assists in properly scheduling students for the correct training events and ensures that the frequency between missions is not overextended.

TRAINING EQUIPMENT, OPERATIONAL EQUIPMENT AND FACILITIES. Specific LACV-30 training equipment and facilities are described below.

Training Devices. There are currently no training devices in use in the LACV-30 training program. However, a training device letter requirement (TDLR) is being developed. A draft was reviewed during this analysis. The Army is definitely interested in supporting the LACV-30 training program with an operator training device.

Training Aids. There are no operator or navigator training aids available. However, nonserviceable items of equipment have been turned into maintenance training aids.

Training Ranges. All underway training is accomplished on a designated beach at Fort Story and adjacent off-shore waters from both Fort Eustis and Fort Story.

Audiovisual Equipment. Overhead projectors are currently the only media equipment used in the LACV-30 training program.

Facilities. Academic training is conducted in the U.S. Army Transportation School classrooms.

ROYAL NAVY HOVERCRAFT TRIALS UNIT TRAINING PROGRAM DESCRIPTION

OVERVIEW. The Interservice Hovercraft Trials Unit (IHTU) was established by the U.K. in 1961 to evaluate the military potential of hovercraft. Initially, commerical craft were leased from their manufacturers, but later some craft were purchased for the unit. Evaluations served the double purpose of enabling military personnel to gain experience in hovercraft operations and were superseded by the NHTU. The NHTU was formed for the purpose of carrying out trials and associated training in support of development of hovercraft for naval missions, especially mine countermeasures.

The SRN5, SRN6, BH-7 and VT-2 have different sizes and momentum characteristics, and provide different operator motion cues. Control systems differ between the craft. Also, each craft requires certain unique procedures for optional operation. Thus, there is not a direct training transfer between the craft, and hence the need exists for a carefully supervised conversion course for the larger craft.

British hovercraft are less complex in terms of control machinery and instrumentation than the JEFF craft. However, British craft do require more control skill in some conditions and in general may be considered more complex in handling.

Each member of NHTU staff, besides administrative and military functions, is also an instructor on one of the unit's hovercraft. The unit has several different craft, with a variety of control system features and craft sizes represented. Each craft has at least one associated instructor.

STUDENT POPULATION. All trainees are officers and have volunteered for service with the unit. Initially the unit was composed predominately of aviators, both fixed and rotary wing, but currently a mixture of aviation and surface officers exists, with the trend toward surface officers increasing.

CURRICULUM. Operator training is divided into basic and advanced stages. Training begins on a dual control SRN5, the smallest and least complex of the unit's craft. Only a brief course outline exists. During the basic stage the trainee is familiarized with the effects of all controls and gentle maneuvers by lectures, demonstrations, hands-on experience, and where appropriate, emergency drills. The trainee then progresses to more rigorous maneuvers, emergency stops and ramp approaches and eventually to low- speed, close-in maneuvering on the hardstand.

All these closely supervised exercises are completed in favorable weather conditions and take about ten operating hours. Considerable flexibility is used in catering to individual trainee aptitude or previous experience. The trainee then executes a five-hour solo flight with a qualified navigator and proceeds to the advanced stage. (The navigator is usually a 1st Class or Chief Petty Officer who "directs" the trainee in an advisory sense regarding craft course and heading).

The advanced stage occupies a further thirty-five hours and includes operation in strong winds and high seas, navigation under radar control, operation in poor visibility and extended navigation exercises away from home. The trainee is then acquainted with the techniques of approaching buoys, coming alongside vessels and operating over various terrains. The trainee accomplishes these tasks as lesson assignments. Towards the end of this period night operations are executed and a "Rules of the Road" examination taken; the successful operator is given a Hovercraft Type Certification of Qualification. Having completed the training course on the SRN5, the operator will then usually progress to the larger SRN6, and complete a ten to twelve hour conversion course. Depending on the position held within the unit, the operator will then act as an SRN6 pilot throughout his tour, or be trained to drive the BH7. The procedure for this conversion is similar.

TRAINING EQUIPMENT, OPERATIONAL EQUIPMENT AND FACILITIES.

Training Devices. There are no training devices used in RNHTU training.

Training Aids. There are no training aids used on-site in the RNHTU training program. Vendor support is available on an opportunity basis.

Training Ranges. RNHTU underway training is accomplished in the adjacent waters of Solent Channel through Southampton water and Portsmouth harbor and the waters surrounding the Isle of Wight. A gravelly beach is available near the Browndown Army base for water/land transit training.

Audiovisual Eqiupment. Motion pictures and viewgraphs are used to support academic training at RNHTU.

Facilities. RNHTU academic training takes place in recently overhauled operational facilities which have improved audiovisual and conference facilities.

NEW TRAINING APPROACHES

OVERVIEW. Although ACV training is currently being conducted in the Navy, Army, British Royal Navy, and various other military and civilian operations, training approaches have remained traditional (a traditional approach is defined as an academic phase followed by a hands-on phase). The high cost of traditional training has led to exploration and implementation of new approaches by both the military and civilian communities. New educational approaches provide multiple training alternatives to traditional approaches for emerging systems such as ACVs.

New education approaches are selected based on objective data rather than "how we have done it in the past" philosophies. The end result is a developed training program that is the most training effective for the least amount of cost.

NEW APPROACHES. Some of the new approaches which should be considered for future ACV operator training programs are:

- Place as many ACV training requirements as possible into academics.
- Place as many remaining ACV training requirements as possible into training devices.
- Place only those training requirements that cannot be trained to partial or full proficiency in either of the above categories into the operational ACV and/or a trainer ACV.
- Totally integrate academic, training device, and craft training.

Each of these approaches will be discussed in detail in the following paragraphs.

Academic. The primary form of academic media used in a traditional approach is a classroom situation in which an instructor lectures to the students. This may be supported by one or a combination of the following media: overhead viewgraphs, 35mm slides, 16mm films, videotape, or student handouts. Instructors are also supported by either a brief outline, detailed script, or some combination of those previously listed. These media are limited in the scope of their effectiveness.

Providing cost effective instruction requires consideration of adding other forms of media to support expanded instructional strategies. The primary goal of providing cost effective and training effective instruction requires transfer of as many training requirements as possible from the actual craft/training craft and training devices into the academic environment. Transfer of these training requirements is facilitated through ISD process procedures. A detailed discussion of the fundamental training analysis requirements for ISD-based training systems development is contained in Appendix A.

Academic expansion and flexibility can be achieved through the addition of newer instructional strategies such as tracked instruction, individualized instruction, and self-paced instruction. These strategies differ significantly from the locked-step traditional classroom approach, and new types of media are used to support their implementation.

- programmed text/storyboard text,
- sound slide,
- videotape,
- computer based instruction (CBI), and;
- video disc.

These media not only provide greater academic flexibility, but significantly enhance higher learning levels and increased knowledge retention through student interaction with the instruction and the increased emphasis on visual acuity as a learning cue. The higher costs associated with the media is easily offset by the reduction in training device/training craft/operational craft utilization.

Training Devices. The second area where maximum training effectiveness can be achieved is in training devices. Achieving optimum benefits from training devices centers on two conditions. First, the right suite of devices must be available to support the training requirements and second, they must be properly utilized.

Defining the right suite of training devices is very critical to the efficiency of any training system. In the past the user detects he has a need for some type of training device(s). Based on this subjective need, millions of dollars have been expended to design and procure these devices. Unfortunately, in many cases these devices, even though designed to specifications, fall short of providing desired training. These situations can be prevented by designing training devices to specific identified training requirements rather than the subjective whims and desires of the user. The specific training requirements are identified through the ISD process.

Ensuring the training devices are properly utilized can also be derived through the ISD process. After the training requirements have been identified, instructional strategies need to be defined as to how to best ensure the students achieve desired proficiency levels. Instructional strategies are selected for each training requirement as the conditions and standards are being developed for them. Considerations such as the difficulty level of the objectives, and exactly how they will be taught are also assessed for their impact on students achieving desired proficiency levels. These instructional strategies also impact the training device design especially in the areas of instructor operating stations, performance measurement requirements, and other instructional features.

Instructional strategies which require playback, problem freeze, and performance measurement are reviewed for specific requirements (i.e., maximum time of playback, amount of demonstration capability and definition of exact performance measurement parameters). The end result is the design and use of training devices which provide the maximum training for the least amount of cost.

Training device state-of-the-art capabilities are changing almost on a daily basis. It is recommended that training devices be fully explored for ACV operator training beginning with the LCAC program. Not only is it anticipated that high proficiency levels could be achieved for minimum costs, but additional benefits in reducing noise abatement, traffic congestion, and fuel and operating costs could result from reduction in training/operational craft underway training requirements and associated craft operating time and training missions. Retention of qualified operators' skills could also be enhanced through availability of training devices.

Training/Operational Craft. The remaining training requirements which cannot be taught to partial/full proficiency in academics or training devices are required to be taught in either a training craft, operational craft, or combination of the two. Although actual craft provide the most realistic training, they are not the most cost-effective. This is primarily due to the high costs associated with fuel, maintenance, and initial craft acquisition.

The decision as to whether a training craft is required is based primarily on two considerations. First, the number of training requirements which cannot be taught to partial/full proficiency in either academics or training devices must be significant to warrant procurement of a trainer craft. Second, the costs of a training craft must more than offset the cost savings derived from reducing the amount of underway training hours required in the operational craft. The training requirements placed in a training craft must also be measured for their training transfer (positive/zero/negative) into the operational craft.

Operational craft should be used only after other available forms of cost effective and training effective media have been fully utilized. Operational craft required for training burden the number of craft available for operational commitments and proficiency missions for qualified operators.

To ensure maximum training effectiveness is achieved when using training/operational craft for training, it is important to ensure the areas listed below are adhered to during development of the underway syllabus. These areas are:

- training requirements are sequenced from simple to complex,
- the correct number of repetitions for each training requirement is determined, and
- the frequency in which each training requirement should be completed is identified.

In the past, these areas may or may not have been considered. However, until the ISD process was accepted, the consideration of these areas was, at best, minimal. These areas must be fully defined and documented and included in the underway syllabus. From the syllabus, appropriate lesson materials and briefing guides can and should be developed for both instructors and students which communicate respective responsibilities and expectations.

The final requirement in developing training effective and cost effective underway instruction is proper and complete recording of student progress. This area was previously discussed earlier in this section as a deficiency in the current AALC training program evaluation. Further discussion is not required in that it would duplicate the AALC training documentation discussion.

Development of operational/training craft operator instruction which incorporates the new approaches described above will result in the most training effective and cost effective ACV operator underway training.

Total Integrated Training. The previous academic, training devices, and operational/training craft new approach discussions centered specifically on each respective area. However, the key to achieving optimum instruction within any training program is total integration of all the elements. ACV elements are academics, training devices, and operational/training craft. The traditional training programs of the past and present are usually presented in a compartmentalized format. This format is where each training element is taught separately. Using the ACV elements, an example of this format would be where academics are taught, followed by training devices, and concluding with operational/training craft training. This compartmentalized approach creates learning barriers which reduce the training effectiveness of the systems which consequently increases training costs. An example is shown in Figure 6.

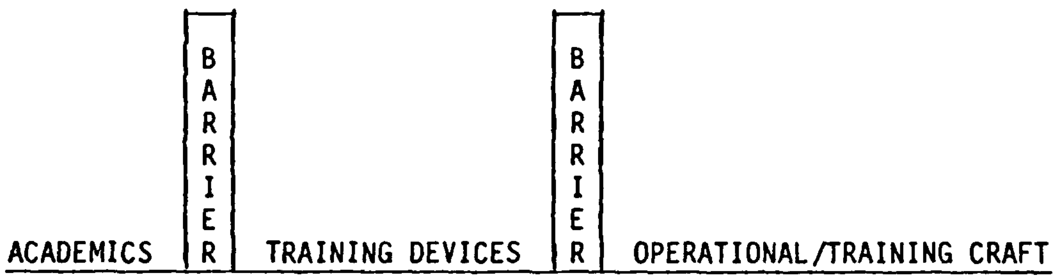

Figure 6. Learning Barriers Caused by Compartmentalized Instruction.

Removing these barriers is a new approach which results in increasing students proficiency through faster learning and increased retention. An example of removing these barriers using ACV elements is shown in Figure 7.

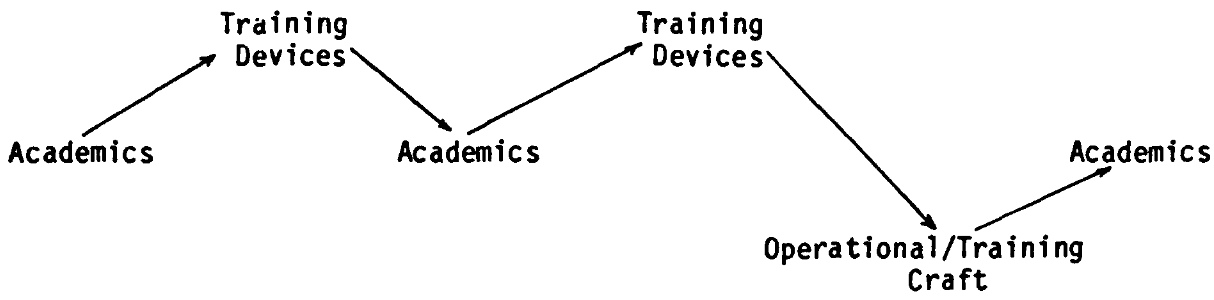

FIGURE 7. Totally Integrated Instruction.

This approach centers on teaching prerequisite task/subtask knowledge in academics and immediately providing application of the knowledge in the applicable hands-on media (training devices, operational/training craft). A key element in this approach is the identification of tasks/subtasks prerequisites, both academic and hands-on.

NEW APPROACH EXAMPLES. These new approaches have been or are in the process of being implemented and prevalent in both military and civilian training programs. The following new military training programs are examples where several or all of these approaches are being considered for implementation.

- The Navy AN/SQQ89 training program. This training program provides training for the following component sonar systems:

    * AN/SQR-19 Tactical Towed Array.

    * AN/SQQ-28 Lamps Mark III Shipboard Electronics.

    * AN/SQS-53B Hull Mounted Sonar.

  This system includes development of eleven different curricula and incorporates eighteen different trainers for operator, maintenance, and team training.

- The Navy VTX Training System (VTXTS). The VTXTS, a multi-faceted training system, will replace the present intermediate and advanced phases of the Naval Flight Training Program which trains pilots in the operation of jet aircraft. It contains four key elements which are academics, training devices, aircraft, and a training management system (TMS).

- The Marine AV-8B Harrier Pilot Training Program. The AV-8B training program is an emerging system which will provide initial training and maintenance proficiency for AV-8B pilots. The curriculum will cover both Fleet Readiness Squadron (FRS) and Fleet training requirements, thus 100% of the AV-8B training syllabus.

These systems are all being developed using the ISD process. It is only through application of the ISD process that these approaches can be properly developed to ensure the most training effective and cost effective training systems are attained. In order to ensure these approaches are incorporated into future ACV programs with minimum problems, it is imperative that the "lessons learned" from programs such as the above be incorporated into future ACV training systems development.

SECTION III

RECOMMENDATIONS

OVERVIEW

The LCAC is an emerging system. As such, it requires detailed integrated planning for many areas. One of these areas is operator training. Although this area may seem insignificant to consider this early in the development of the LCAC system, it generates many requirements and demands on the high cost drivers of the total system. Therefore, training development must begin early in the system development in order to have required objective data available for input into the overall system planning and development. Specific areas where training inputs are required early in the total system planning and development include:

- Student entry level requirements.
- Training media requirements.
- Basing and facilities requirements.

Each of these areas and their required training inputs will be discussed in the following paragraphs.

STUDENT ENTRY LEVEL REQUIREMENTS

In order for the student entry levels to be defined and the number of required students determined for training, it is important to know what has to be trained. Definition of training requirements has to be completed in order to make the required student entry level decisions objectively. Training requirements are defined through development of a task listing. This task listing would include all tasks and subtasks which are accomplished by operator personnel in an LCAC operational environment. From this task listing, selected tasks are identified for training. They are referred to as training requirements.

Based on identified LCAC training requirements and inputs from experienced ACV personnel, objective decisions can be reached as to the type and number of LCAC student personnel to be trained. The results of these decisions impact future training decisions as to the amount and depth of training to be conducted in the LCAC training system.

TRAINING MEDIA REQUIREMENTS

Training media requirements can be classified into two categories. They are hands-on and academic media. Hands-on media are those where the students actually perform partial or complete tasks. In the LCAC program, they would include the LCAC craft and training devices such as simulators and/or partial task trainers. Academic media include many different types which facilitate student knowledge learning. Examples of academic media include: instructor lecture, mediated lecture, storyboard text, program text, sound-slide, videotape, video disc, computer assisted instruction (CAI), computer managed instruction (CMI), etc. It is anticipated that multiple forms of academic media will be selected for the LCAC program.

Hands-on media requirements have to be identified early in the system development for four reasons. First, additional acquisition of operational hardware such as the LCAC craft and training devices require long lead times for funding, purchase, and development. Second, training device design is dependent on tasks that are to be trained and the instructional strategies that will be used in the device(s). The third reason is the time required to conduct cost-benefit analyses as to determine the best mix of hands-on media (LCAC craft - training device[s]). The base facilities impact caused by both LCAC craft and training devices is the fourth reason these decisions should occur early in the program development. Additional training craft/training devices require storage, maintenance, and support facilities which may be above those considered for operational purposes.

Academic media selection is less important due to its less significant impact on cost and facilities. However, it still can be completed early in the development of the program. It is recommended that it be completed as early as possible in the LCAC program development.

Both hands-on and academic media selection are influenced by the student entry level results. As an example, if highly qualified ACV operators were assigned to the LCAC program, the requirements for both academic and underway training would be significantly reduced from a program in which personnel were assigned without any ACV experience. Therefore, student entry level influences media selection which in turn impacts basing and facilities requirements.

BASING AND FACILITIES REQUIREMENTS

The level of impact of the system training requirements influence the decisions as to where the training should take place. In the case of the LCAC program, three alternatives should be considered. They are as follows:

- Initial training conducted in a central training unit followed by special training conducted in the operational units.
- All training conducted in the operational units.
- All training conducted in a central training unit.

The most objective decisions concerning training location(s) can best be made after initial decisions have been made as to:

- Identification of LCAC training requirements,
- Identification of type and number of personnel to be trained, and
- Selection of hands-on and academic media.

RECOMMENDATIONS

Recommendations for development of the LCAC training system that will provide the training inputs for the areas discussed above and result in a training and cost effective LCAC Operator Training System are as follows:

- Conduct an Instructional System Development (ISD) program as per MIL-T-29053B(TD), MIL-STD-1379B, or similar specification.
- Incorporate "lessons learned" and training concepts and strategies from both the surface and aviation communities, as well as the existing AALC and Voyageur ACV programs.
- Assign an education specialist to the LCAC program.
- Develop an LCAC operator manuals system.
- Develop an LCAC operator instructor training program.
- Expand ISD training development to other LCAC areas.

These recommendations are discussed in detail in the following paragraphs.

LCAC ISD PROGRAM. ISD can be conducted for both existing and emerging systems. The LCAC is an emerging system which will incorporate data from existing systems, as well as other data sources.

The AALC training system will provide the primary inputs into the LCAC ISD process. Additional inputs will be collected from the Voyageur and LACV-30 programs, where applicable. Although these inputs will be of value to the LCAC training program development, they are not seen as significantly reducing training development time or costs.

In discussing the inputs from AALC and the other ACV programs, it should not be inferred that analysis activities will involve only taking these inputs and updating it with LCAC requirements. On the contrary, it is recommended these inputs be used to validate LCAC ISD results and ensure "lessons learned" are incorporated.

The recommended ISD program should be a full scope effort consisting of the ISD steps accomplished in five phases. These phases and their respective ISD steps and resulting end-products are shown in Figure 8.

PHASE	ISD PROCESS STEPS	END PRODUCTS
I	- Develop a Training Development Support Plan (TDSP)	- A TDSP Report which defines the approach, procedures, and management design to be employed in conducting a LCAC training development program.
	- Develop a LCAC Task Listing	- A validated LCAC listing of the major job tasks required of the LCAC operator.
	- Develop a LCAC Student Entry Level Analysis	- A report which provides data concerning the entry level skills of students expected to be trained in the LCAC operator training program.
	- Develop a LCAC Training Device Requirements Analysis	- A report which provides LCAC training device alternative mixes.
	- Develop LCAC Objectives Hierarchies	- A compilation of all LCAC behavioral objectives required for training operator personnel.
	- Develop a LCAC Media Selection Model	- A media model to support final hands-on and academic media selection.
	- Conduct LCAC Media Selection and Develop a LCAC Operator Syllabus	- A report which identifies what is to be taught at each step in the LCAC training program and specifies the primary and alternate media for each training event.

Figure 8. ISD Program Phases, Steps, and End Products

PHASE	ISD PROCESS STEPS (Cont.)	END PRODUCTS (Cont.)
	- Develop a LCAC Training Support Requirements Analysis (TSRA).	- A report which presents a detailed analysis of all the LCAC resource requirements necessary to design, develop, implement, evaluate, and maintain the LCAC operator training system.
II	- Develop LCAC Lesson Specifications.	- A report which contains the LCAC operator subject matter content, instructional strategies, and other support information for each lesson of instruction in the LCAC operator training program.
	- Develop LCAC Operator Training Materials and Associated Tests.	- LCAC Operator academic, training device, and under-way training materials and associated tests.
	- Develop LCAC Quality Control and Implementation Plans.	- A LCAC Quality Control Plan which specifies the personnel, organization, functions, and procedures for evaluating and revising the course materials, syllabus, and instructional management system. A LCAC Implementation Plan which defines the instructional management system for the LCAC training program.
III	- Implement LCAC Instruction.	- Instruct students to be fully qualified LCAC operators.
IV	- Conduct Internal and External Evaluation.	- Ensure instruction is meeting the needs of the students and the LCAC operational units.
V	- Maintain LCAC instructional materials.	- Ensure LCAC instructional materials are updated/changed based on internal and external evaluation feedback, student entry level changes, and student entry level changes, and LCAC craft system/ operating procedure changes.

Figure 8. ISD Program Phases, Steps, and End Products (Continued)

Completion of the above phases and respective steps will result in a LCAC Operator Training Program which will serve the needs of the LCAC total system throughout its life cycle.

INCORPORATE "LESSONS LEARNED" FROM THE SURFACE AND AVIATION COMMUNITIES. As previously mentioned in this report, ACVs are a unique vehicle type. They incorporate skills and knowledges found in both the surface and aviation communities. It is therefore recommended that a continuous observation plan be implemented to obtain the best features, both operational and training, from both of these communities, especially in new systems acquisition, and incorporate them into the LCAC program. Examples of new surface and aviation programs were previously discussed in Section II.

ASSIGN AN EDUCATION SPECIALIST. As previously discussed in Section II, an education specialist (1710) should be assigned to the AALC program in order to document "lessons learned" and gain as much ACV training knowledge as possible that will transfer into the LCAC program. This person should then be assigned to the LCAC training program to ensure Navy ACV training experience is available during future LCAC training development efforts.

DEVELOP AN LCAC OPERATOR MANUALS SYSTEM. The development of a LCAC operator manuals system would enhance operator performance both in normal and casualty environments. This recommendation was enthusiastically received and endorsed by AALC, Voyageur, and LACV-30 students, operators, and instructor personnel who were interviewed during this analysis. A system similar to that used in the Navy aviation community (i.e. Naval Air Training and Operating Procedures Standardization [NATOPS] Flight Manual and Pocket Checklist) is recommended for the LCAC program.

DEVELOP AN LCAC INSTRUCTOR PROGRAM. The development of an LCAC operator instructor training program should receive equal priority with that of the operator training program. The development of this program should be accomplished using an ISD process similar to the one recommended earlier in this section. It is recommended that consideration be given to developing and implementing this program prior to conduct of training on the initial six LCAC craft. This would allow the instructor program to be implemented in the AALC JEFF B program to qualify an initial cadre of Navy LCAC instructors. These LCAC instructors could then be the first Navy crews trained on the initial six LCAC craft. Future Navy LCAC operators could then be trained by these instructors. This would provide the Navy with two benefits. First, future LCAC training would not have to be totally reliant on contractor support, and second, the Navy could continue expansion of this instructor cadre to support instructor requirements at sea and other types of operational mission deployments.

OTHER TRAINING DEVELOPMENT AREAS. Although not within the scope of this PA, the need for training in other areas was readily apparent. It is recommended that the Navy consider placing emphasis on training development in other areas such as the LCAC Navigator and other crew positions and all the LCAC maintenance areas.

The above recommendations should be implemented at the earliest possible time. Many of the ISD process steps discussed in this section impact on LCAC decisions that are currently being made or will be made in the near future. As an example, the three areas (Student Entry Level Requirements, Training Media Requirements, and Basing and Facilities Requirements) discussed in the Overview of this section are representative of the decisions which require immediate training inputs.

APPENDIX A

FUNDAMENTAL TRAINING ANALYSIS REQUIREMENTS

INSTRUCTIONAL SYSTEMS DEVELOPMENT (ISD) OVERVIEW

The term ISD has been referred to earlier in Section II of this report. It was deemed appropriate to include a discussion of what ISD is, what it includes, and what the results of an ISD effort should be. ISD is an emerging technology with roots in the behavorial sciences and systems engineering. The goal of ISD application is to maximize both training and cost effectiveness through rigorous and well-documented front-end analysis, application of sound learning principles, and systematic effectiveness validation. ISD is the deliberate and orderly process for planning and developing instructional programs which ensure that students are taught the knowledge, skills, and attitudes essential for job performance. The key word in this definition is "essential." By teaching only the essential skills and knowledge, the most training and cost effective training systems can be developed.

ISD RATIONALE

One of the best explanations for how ISD differs from existing practices, the basis for ISD, and its potential benefits is contained in the Interservice Procedures for Instructional Systems Development,[1] NAVEDTRA 106A, Executive Summary and Model Volume, dated 1 August 1975 and is contained in the following paragraphs.

HOW ISD DIFFERS FROM EXISTING PRACTICES. One way to indicate the differences between ISD and existing practices is to point out that there are currently a number of existing practices, some of which represent excellent applications of ISD. There are outstanding examples of well-conceived and delivered instruction available within the interservice training community. However, these efforts do not represent a very large fraction of the total interservice training establishment.

[1] Interservices Procedures for Instructional Systems Development, NAVEDTRA 106A, Executive Summary and Model Volume, 1 August 1975.

An important difference between ISD and more traditional forms of instruction is that the ISD process, through occupational surveys and job analysis requires the thoughtful selection of what is to be trained based upon solid job data from the field. This practice tends to ensure that training will be provided for those tasks most critical to adequate job performance, and that training will not be wasted on tasks which have a low probability of meeting immediate needs or critical long-term needs.

A second important difference between traditional practice and ISD procedures is the consideration of how training is to be conducted. The recent past has seen a number of innovations in approaches to training all of which are either as good or better than traditional methodology. The generation and application of alternative training methodology is required in the ISD process; it is not assumed that all training will be platform instruction.

A third critical difference between traditional practice and ISD is the use of test data based on absolute standards of performance and the use of that data to grade students and to judge the quality of instruction. There are specific objectives that courses are planned to meet, and ISD requires that courses be evaluated on their ability to meet those stated objectives, and be revised if they fail to do so.

Finally, the ISD process requires the application of modern technology to the fullest degree possible in order to optimize training effectiveness, efficiency and cost. Consideration is given to the relative value of training compared to its cost, and whether the output of the training system is worth the investment of time and resources required to produce that output. A unique feature which distinguishes ISD from more traditional approaches is that course time and cost reductions are brought about not by the elimination of content or the reduction of service but through the application of a technology to achieve expected performance with fewer resources. The application of unit cost and unit time reduction techniques often have produced dramatic results.

BASIS FOR ISD. ISD has grown out of basic research in three separate areas: management sciences, communications sciences, and behavioral sciences. Examples of basic research areas in the management sciences include: job analysis, occupational survey techniques, decision theory, cost effectiveness models, and computer technology.

From the communications sciences, research in communications, electronics, and media utilization have produced a wide variety of alternative techniques and procedures for accomplishing instructional objectives.

There are three important areas of research in the behavioral sciences which have yielded results that are useful in ISD. Learning research has provided a solid foundation for the design of alternative approaches to instruction. Measurement and evaluation of behavior have matured to the point that it is possible to have great confidence in the measurement and evaluation procedures. And, the recent past has seen a large variety of instructional design and management approaches which have yielded impressive results.

These contributions from the management, communications, and behavior sciences allow for the development of ISD technology. The ISD process includes the capability for specific research and development to resolve existing problems. In addition, because it provides for so many alternatives to traditional forms of instruction, the ISD process allows for the analysis and use of existing research bases.

POTENTIAL ISD BENEFITS. Based on a large number of successful demonstrations, there is now empirical evidence that competent use of the ISD approach can greatly improve training in at least three distinct ways:

- Effectiveness. Through the design and development procedures, a careful selection of what is to be trained, the measurement and evaluation of training, and the revision of the training program until it meets its objectives should greatly increase training effectiveness.

- Efficiency. Several military applications of ISD have indicated that effective instruction can be offered in a much more time-efficient way than has been true in the past. The application of ISD procedures to instruction in order to make it more time-efficient has paid off handsomely.

- Costs. It is not reasonable to believe that the use of ISD procedures will always result in lower costs. It is unrealistic to expect lower costs per student on all existing completely effective courses. However, the ISD procedure does provide a systematic way of viewing costs of training and considering whether additional resources are justified in view of the output.

There have been many demonstrations that combinations of effectiveness, time-efficiency, and cost considerations have yielded impressive results, particularly when they have been considered in the context of making alternative investment decisions. Investments in technology for certain long high-flow courses have demonstrated improvements in cost per student, time required to complete, and increased effectiveness. These results have been obtained on large systems which use advanced training devices and also in areas of training which use no hardware at all. The common element is the procedure and approach, not the hardware or equipment.

A vitally important management function is the accurate collection and use of cost data. Such data permit cost comparisons as soon as they are available, and, more importantly, make the conduct of cost-effectiveness studies more likely and their conclusions more accurate.

ISD MODELS

There are many ISD models available for use in the Navy that would be appropriate for ACV training program development. Figure 9 presents a list of ISD documents and a comparison of their respective strengths and weaknesses. It is recommended that a combination of the best of these ISD models process procedures from these documents be used for future ACV operator training programs, beginning with the LCAC training program.

Most ISD models have five distinct phases. These phases are:

- Analyze.
- Design.
- Development.
- Implementation.
- Evaluation.

Common Name	Full Title	Source	CONTENT		Comments
			ISD Procedures	Mgt. Direction	
106A	Interservices Procedures for Instructional Systems Development (5 Volumes)	NAVEDTRA	Extensive	None	
110	Procedures for Instructional Systems Development	NAVEDTRA	Limited	None	Summary of 106A
29053	MIL-T-29053A (TD) Training Requirements for Aviation Weapons Systems	NTEC	Moderate	Extensive	
1379B	MIL-STD-1379B Contact Training Programs	DOD	Limited	Moderate	First 3 Phases of 106A
OD45260	Training System Development (3 Volumes)	NAVSEA	Limited	Extensive	Design for New Systems

Figure 9. ISD Model Document Comparision.

Most ISD models are developed and based on the following assumptions:

- The mission of a military instructional system is to determine instructional needs and priorities, to develop effective and efficient solutions to achieving these needs, to implement these solutions in a competent manner, and to assess the degrees to which the output of the system meets the specified needs.
- There are alternative approaches to the solution of instructional problems which are differentially responsive to specific environmental constraints found in the Armed Forces.
- The existing large body of research and development in learning, instruction, and management techniques may provide the basis for significantly improved instruction.
- A systems approach to the process and procedures of instruction is the most effective current means of evaluating, developing, and implementing these alternatives.
- Regardless of the complexity of the job tasks to be performed, the instructional system should optimize the proportion of entering students who meet acceptable job task performance standards by the end of instruction.
- Individuals differ in their abilities, achievement, motivation, and rate of learning and an instructional system must accomodate these differences to capitalize on the opportunity for increasing the effectiveness and efficiency of instruction.
- Two or more equally successful alternative solutions can be found for any instructional problem, and these solutions will differ in cost.
- Intensive and recurring training of managers and instructional developers represent a direct first step toward achievement of this mission.

Based on the above assumptions, the functions are described below that are necessary to analyze instructional needs; design, develop, and implement instruction; and maintain quality control of instruction.

- Phase I, ANALYZE, presents procedures for defining what jobs are, breaking these down into statements of tasks, and using numerical techniques to combine the best judgment of experienced professionals to select tasks for training. Phase I also presents processes for construction of job performance measures and the sharing of occupational and training information within and among the services.

It provides a rationale for deciding whether tasks should be trained in schools, on the job, or elsewhere, and also requires consideration of the interaction between training and career progression.

- Phase II, DESIGN, deals specifically with the design aspects of the training program within selected settings. Design here is considered in the architectural sense in which the form and specifications for training are laid down in careful detail. Phase II reviews the considerations relating to entry behavior of two separate kinds: general ability and prior experience. A rationale is presented for establishing requirements based on the realistic evaluation of both of these factors.

- Phase III, DEVELOPMENT, refers to the actual preparation of instruction. Determinations are made about how the students shall be managed, the kinds of learning experiences they will have, the activities in which they will engage, and the form and content of the instructional delivery system. Techniques are presented for the careful review and adaptation of existing materials. Procedures for the systematic design of instruction which can be delivered in a variety of media are also included. Phase III terminates with a carefully developed procedure for testing and evaluating the instruction to ensure that its performance meets expectations.

- Phase IV, IMPLEMENTATION, specifically treats the necessary steps to implement the instruction according to the plan developed in Phase III. Two important steps highlight Phase IV, that of training the staff in the procedures and problems unique to the specific instruction and actually bringing the instruction on-line and operating it. The Phase IV effort continues as long as there is a need for the instruction.

- Phase V, EVALUATION, deals with the procedures and techniques for maintaining instructional quality control standards and for providing data from internal and external sources upon which revision decisions can be based. Emphasis is placed on the importance of determining whether the trainees are learning what was intended, and upon determining whether what they have learned is of the expected benefit to the receiving command. A negative answer to either of these would suggest revisions in the content or procedures in order to make the instruction meet the need it is intended to serve.

CONCLUSION. The ISD process has applied a systematic approach to instruction which results in planning, development, implementation decisions being made with much more objectivity than in the past. ISD is not a panacea or an exact science, but a tool which assists in providing higher levels of training and cost effective instruction than have been achieved in the past.

APPENDIX B

DATA SOURCES

Data on current ACV training systems and characteristics of the LCAC were collected through on-site visits and document review. Sources of data were as follows:

- JEFF B Operators Manual, Bell-Textron Report #7385-927036
- Voyageur Study Guide, Bell-Textron Report #7385-924001
- AALC/ETU Operations Manual
- Personnel Subsystem Criteria and Standards for the Amphibious Assault Landing Craft (AALC) Navy Trials, NPRDC, TR74-30, April 1974
- Service Suitability and Flying Qualites Evaluation of Amphibious Assault Landing Craft Prototypes JEFF A and JEFF B, Final Report, NAVSEA, RW-20R-79, November 1979
- Assessment of the Bell Voyageur 004 ACV as a preliminary ACV Operator Trainer, Technical Report, NAVTRAEQUIPCEN, N61339-80-D-0011
- Jane's Book of Surface Skimmers and Hydrofoils, 1978
- The Interservice Hovercraft Trials Unit, Russell, Brian J.: Hover Publications, Gospart Hants, U.K., April, 1979.
- JEFF A training materials
- JEFF B training materials
- Voyageur training materials
- LACV-30 training materials
- On-site interviews and surveys at DTNSRDC AALC ETU, Panama City, Florida. Data was collected from representatives of the following groups:
  - Command Navy AALC personnel
  - Officers and Enlisted Navy AALC personnel
  - Civilian AALC personnel
  - Mantech, Inc.
  - Bell-Textron, Inc.
- On-site interviews at DTNSRDC, Carderock, Maryland

- On-site interview at Naval Facilities Command (NAVFAC), Washington, D.C.

- On-site interviews at U.S. Army Transportation School (USATSCH), Ft. Eustis, Virginia

- On-site interviews at Assault Craft Unit 1, Naval Amphibious Group, Coronado, California