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AIR FORCE HUMAN RESOURCES LABORATORY

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ADVANCED ON-THE-JOB TRAINING SYSTEM: SYSTEM SPECIFICATION

Douglas Aircraft Company
A Division of McDonnell Douglas Corporation
2450 South Peoria
Aurora, Colorado 80014

TRAINING SYSTEMS DIVISION
Brooks Air Force Base, Texas 78235-5601

May 1990

Interim Technical Paper for Period August 1985 - December 1989

Approved for public release; distribution is unlimited.

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BROOKS AIR FORCE BASE, TEXAS 78235-5601

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This paper has been reviewed and is approved for publication.

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The System Specification for the Advanced On-the-job Training System (AOTS) establishes the performance, design, development and test requirements for the prototype AOTS. The purpose of the AOTS was to test a design concept for improving current practice in the Air Force On-the-Job Training (OJT) program. The AOTS is a computer-based, training management, training development and delivery, and training evaluation system especially designed to enhance OJT activities in the field.

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TRAINING SYSTEMS DIVISION
Brooks Air Force Base, Texas 78235-5601

Reviewed and submitted for publication by

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Chief, Advanced On-the-job Training System Program

This publication is primarily a working paper. It is published solely to document work performed.

SUMMARY

The Advanced On-the-job Training System (AOTS) was an Air Staff directed, AFHRL developed, prototype system which designed, developed, and tested a proof-of-concept prototype AOTS within the operational environment of selected work centers at Bergstrom AFB, Texas, and Ellington ANGB, Texas, from August 1985 through 31 July 1989. This System Specification establishes the performance design, development and test requirements for the prototype AOTS. The purpose of the AOTS was to test a design concept for improving current practices in the Air Force On-the-Job Training (OJT) program. The AOTS is a computer-based, training management, training development and delivery, and training evaluation system especially designed to enhance OJT activities in the field.

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PREFACE

This paper was prepared by Douglas Aircraft Company, the AOTS development contractor, under Government Contract Number F33615-84-C-0059. The AFHRL Work Unit number for the project is 2557-00-02. The primary office of responsibility for management of the work unit is the Air Force Human Resources Laboratory, Training Systems Division, and the Air Force AOTS manager is Major Jack Blackhurst.

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1 SCOPE

This specification establishes the performance design, development and test requirements for the prototype Advanced On-the-job Training System (AOTS). The purpose of the AOTS is to test a design concept for improving current practice in the Air Force On-the-Job Training (OJT) program. The AOTS is a computer-based, training management, training development and delivery, and training evaluation system especially designed to enhance OJT activities in the field. The prototype will be installed and tested at Bergstrom AFB, Texas and Ellington ANGB, Texas.

The AOTS program shall consist of three phases. They are referred to as follows:

Phase I	Preliminary Design Phase
Phase II	Detail Design and Development Phase
Phase III	System Level Test and Evaluation (SLT&E)

Each of these three phases also correspond to calendar time. Phase I before Phase II and Phase III after Phase II. A Phase IV designation was applied to the Training Development and Delivery Subsystem (TDDS) as it was not part of the initial contractor effort. When this element was added to the contractor's effort, it was incorporated into Phase II and III calendar time too. After its incorporation, the designation Phase IV no longer was applicable.

2 APPLICABLE DOCUMENTS

The following documents, of the exact issue shown, form a part of this specification to the extent specified herein. In the event of conflict between the documents referenced herein and the detailed contents of this specification, the contents of this specification shall be considered as the superseding requirement.

2.1 Government Documents.

The following Government documents are applicable to this specification.

2.1.1 *Specifications.*

70S647100 31 Oct 1989	Prime Item Development Specification for the Management Subsystem
70S647200 1 Apr 1986	Prime Item Development Specification for the Training Development and Delivery Subsystem
70S647201 1 Apr 1986	The Training Development Component Critical Item Specification
70S647202 1 Apr 1986	The Training Delivery Component Critical Item Specification
70S647300 31 Oct 1989	Prime Item Development Specification for the Evaluation Subsystem
70S647400 17 Apr 1986	Prime Item Development Specification for the Computer Support Subsystem

70S647401 1 Jun 1988	Critical Item Development Specification for the Hardware Component of the Computer Support Subsystem
70S647411 Part 1 17 Apr 1986	The Management Subsystem Computer Program Configuration Item Development Specification
70S467411 Part 2 23 Jun 1989	The Management Subsystem Computer Program Configuration Item Product Specification
70S647412 Part 1 17 Apr 1986	The Training Development Delivery Subsystem Computer Program Configuration Item Development Specification
70S647413 Part 1 17 Apr 1986	The Evaluation Subsystem Computer Program Configuration Item Development Specification
70S647413 Part 2 23 Jun 1989	The Evaluation Subsystem Computer Program Configuration Item Product Specification
70S647414 Part 1 17 Apr 1986	The System Support Computer Program Configuration Item Development Specification
70S647414 Part 2 23 Jun 1989	The System Support Computer Program Configuration Item Product Specification
70S647500 28 Mar 1986	Prime Item Development Specification for the Personnel and Support Subsystem

2.1.2 *Standards.*

MIL-STD-421C 12 Jun 1981	Definitions of Effectiveness Terms for Reliability, Maintainability, Human Factors and Safety
MIL-STD-470A 3 Jan 1983	Maintainability Program Requirements for Systems and Equipment
MIL-STD-471A 8 Dec 1978	Maintainability Verification/Demonstration /Evaluation
MIL-STD-483 Notice 2 21 Mar 1979	Configuration Management for Systems, Equipment, Munitions, and Computer Programs
MIL-STD-785B 15 Sept. 1980	Reliability Program for Systems and Equipment Development Production

MIL-STD-1472C 1 Sept. 1983	Human Engineering Design Criteria for Military Systems, Equipment and Facilities
MIL-STD-1815A 22 Jan 1983	Ada Programming Language

2.1.3 *Other Publications.*

MIL-H-46855A 2 May 1972	Human Engineering Requirements for Military Systems, Equipment, and Facilities
AOTS Software Development Plan 7 Apr 1986	Prepared by Douglas Aircraft Company, a division of McDonnell Douglas Corporation, under contract F33615-84-C-0059
Computer Program Test Report 19 Dec 1988	Prepared by Douglas Aircraft Company, a division of McDonnell Douglas Corporation, under contract F33615-84-C-0059
Computer Programming Standards Manual 15 Sep 1986	Prepared by Douglas Aircraft Company, a division of McDonnell Douglas Corporation, under contract F33615-84-C-0059
Configuration Management Plan 18 Jul 1988	Prepared by Douglas Aircraft Company, a division of McDonnell Douglas Corporation, under contract F33615-84-C-0059
Final Technical Report 31 Oct 1989	Prepared by Douglas Aircraft Company, a division of McDonnell Douglas Corporation, under contract F33615-84-C-0059
Human Engineering Plan 27 Jan 1987	Prepared by Douglas Aircraft Company, a division of McDonnell Douglas Corporation, under contract F33615-84-C-0059
Interim Technical Report 6 Jan 1987	Prepared by Douglas Aircraft Company, a division of McDonnell Douglas Corporation, under contract F33615-84-C-0059
Maintainability Program Plan 1 Oct 1986	Prepared by Douglas Aircraft Company, a division of McDonnell Douglas Corporation, under contract F33615-84-C-0059
Master Test Plan 31 Aug 1987	Prepared by Douglas Aircraft Company, a division of McDonnell Douglas Corporation, under contract F33615-84-C-0059
Reliability Program Plan 1 Oct 1986	Prepared by Douglas Aircraft Company, a division of McDonnell Douglas Corporation, under contract F33615-84-C-0059
Site Preparation and Installation Plan 25 Aug 1986	Prepared by Douglas Aircraft Company, a division of McDonnell Douglas Corporation, under contract F33615-84-C-0059
System/Design Trade Study Report(s) 14 Apr 1986	Prepared by Douglas Aircraft Company, a division of McDonnell Douglas Corporation, under contract F33615-84-C-0059
System Engineering Management Plan 30 Sep 1986	Prepared by Douglas Aircraft Company, a division of McDonnell Douglas Corporation, under contract F33615-84-C-0059

AFR 12-35 June 1985	Air Force Privacy Act Program
AFR 30-17 15 Jun 1977	Safeguarding Controlled Item (Test Materials) Information
AFR 50-1 Aug 1987	Ancillary Training Program
AFR 50-8 Aug 1984	Policy and Guidance for Instructional System Development (ISD)
AFM 30-3 Vol 4. Mar 1986	Personnel Accounting Symbol System
AFM 30-130 Vol. 1 Oct 1986	Base Level Military Personnel System
AFM 50-2 Jul 1986	Instructional System Development
AFM 66-279 Vol. 17 Jan. 1987	Core Automated Maintenance System (CAMS ISD: G054/FS(PA) Training Management
AFR 205-1 7 Dec 1982	Information Security Program

2.2 Non-Government Documents.

None are required for this specification.

3 REQUIREMENTS

3.1 System definition.

The Advanced On-the-job Training System (AOTS) is a prototype, proof-of-concept, computer-based training system that shall, when developed, apply automated support to increase the efficiency and effectiveness of the current Air Force On-The-Job Training (OJT) system. The AOTS shall provide improved capabilities to:

a. Define the performance and training requirements for entire Air Force Specialties (AFSs), groups of members within AFSs, groups of members across AFSs, and individual trainees;

b. Manage training progress through the attainment of task and duty position qualification for individuals throughout the entire periods of their Air Force careers;

c. Provide list(s) of resources required to develop and deliver training, and to evaluate trainee knowledge and performance skills;

d. Develop instructional materials and evaluation instrumentation;

e. Deliver instruction and trainee evaluation; and

f. Evaluate the effectiveness of the training system.

The AOTS shall rely on interfaces with existing and future Air Force personnel, training, and resource management systems to further facilitate efficient and effective operation. Existing Air Force Systems with which the AOTS shall interface include:

a. The Personnel Data System (PDS);
b. The Core Automated Maintenance System (CAMS);

This specification applies to a prototype proof-of-concept AOTS to be developed and tested at Bergstrom AFB, and Ellington ANGB, both located in Texas. The AOTS prototype shall be developed and tested within Air Force active duty, reserve, and Air National Guard forces. The participating Air Force Specialties for the prototype AOTS are Security Police, Aircraft Maintenance, Aircraft Jet Engine Maintenance and Personnel. Workcenter supervisors, trainers, trainees, training managers and commanders shall have access to the prototype AOTS through terminals located within their respective work areas.

The AOTS shall include five subsystems. These subsystems are:

a. The Management Subsystem (Specification 70S647100);
b. The Training Development and Delivery Subsystem (Specification 70S647200);
c. The Evaluation Subsystem (Specification 70S647300);
d. The Computer Support Subsystem (Specification 70S647400); and
e. The Personnel and Logistics Support Subsystem (Specification 70S647500).

The Computer Program Configuration Items (CPCIs) to support the AOTS subsystems are:

a. The Management CPCI (Specification 70S647411);
b. The Training Development and Delivery CPCI (Specification 70S647412);
c. The Evaluation CPCI (Specification 70S647413); and
d. The System Support CPCI (Specification 70S647414).

3.1.1 *General information.*

AOTS shall prototype functional requirements to manage and administer OJT for an entire major Air Force installation (the prototype test is constrained to a sampling of AFSs and two bases - Bergstrom AFB and Ellington ANGB). It shall have the capacity to accommodate training loads of up to eight hundred trainees. The AFSs and workcenters that have been selected to participate in the development and test of the prototype AOTS are representative of those found at any major Air Force installation.

a. The prototype system shall consist of a central computer with dedicated lines extending to the participating workcenters to facilitate system access via terminals. Terminals shall also be provided for members of an Air Force instructional systems team and contractor personnel to facilitate development and system test efforts.

b. The prototype system shall be capable of performing the same types of training development, delivery, management and evaluation functions required of a larger operational system, except that electronic interfaces with external computer systems shall be simulated. The general capabilities that shall be provided by the prototype system are listed below, beneath the applicable functional area categories.

1. Training Management
   (a) Automated identification of tasks required for each AFS and duty position, and for specified groups of individuals
   (b) Automated identification of training needed by each individual to qualify in his/her position

(c) Automated records of training status and completions spanning individuals' entire Air Force careers

(d) Automated prioritizing of development, training and evaluation requirements

(e) Automated identification of resources required for development of training and evaluation materials, and for delivery of training and evaluations

(f) Automated assignment of training requirements, and scheduling training and evaluation events

(g) Automated generation of reports relevant to trainee progress status

2. Training Development

(a) Automated task analysis

(b) Automated behavioral objective authoring

(c) Automated test item authoring

(d) Automated Computer Assisted Instruction (CAI) lesson authoring

3. Training Delivery

(a) On-line delivery of lessons

(b) On-line delivery of graphics and simulations and Interactive Video Disk (IVD)

(c) On-line and off-line delivery of trainee evaluations

(d) Interface with training delivery agencies external to the AOTS for scheduling of events and collecting trainee progress data

4. Training System Evaluation

(a) Automated selection of personnel and tasks for Quality Control evaluations to determine the effectiveness of training received and to determine individual retention of proficiency

(b) Automated generation of reports relevant to AOTS efficiency and effectiveness, and the effectiveness of individual OJT programs

(c) Automated analysis of knowledge test items and performance evaluation instruments to determine their validity and the validity of behavioral objectives and training materials.

3.1.2 *Mission.*

The prototype AOTS shall prove the feasibility of enhancing OJT with computer support by:

a. Focusing attention on job task proficiency through promoting complete specification of the tasks required to be performed in a given duty position, and by promoting adequate definition of the training required to become fully position qualified;

b. Providing workable and cost-effective methods for evaluating task performance in an operational setting;

c. Easing the inherent difficulties of using operational equipment for OJT by more efficient scheduling of training and evaluation;

d. Addressing the problem of limited availability of technically qualified personnel to act as trainers, and the limited training skills of such personnel when they are available by providing automated support for training activities;

e. Easing the paperwork burden associated with scheduling OJT opportunity, tracking training progress, evaluating task and associated test performance, and managing the flow of training data;

f. Addressing the difficulty of adapting modern curriculum development and delivery procedures to the job site environment (via a through e above).

3.1.3 *Threat.*

This paragraph is not applicable to this specification.

3.1.4 *System diagrams.*

This paragraph incorporates the system-level diagrams. Figures 1 and 2 provide a system level view of the AOTS as a training system and as a computer system. Figures 3 thru 9 comprise a visual table of contents for AOTS as well as a functional hierarchy description. Figure 10 is the specification tree for AOTS, depicting all the specifications that shall be generated during the development and implementation of the system.

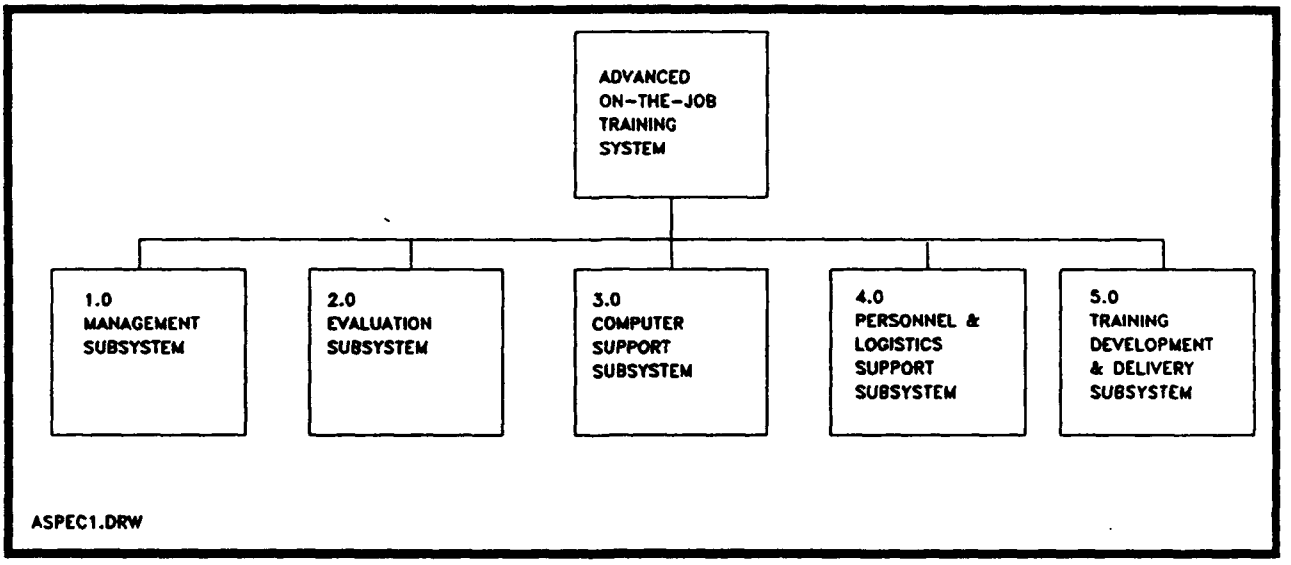

Figure 1. AOTS Training System Diagram

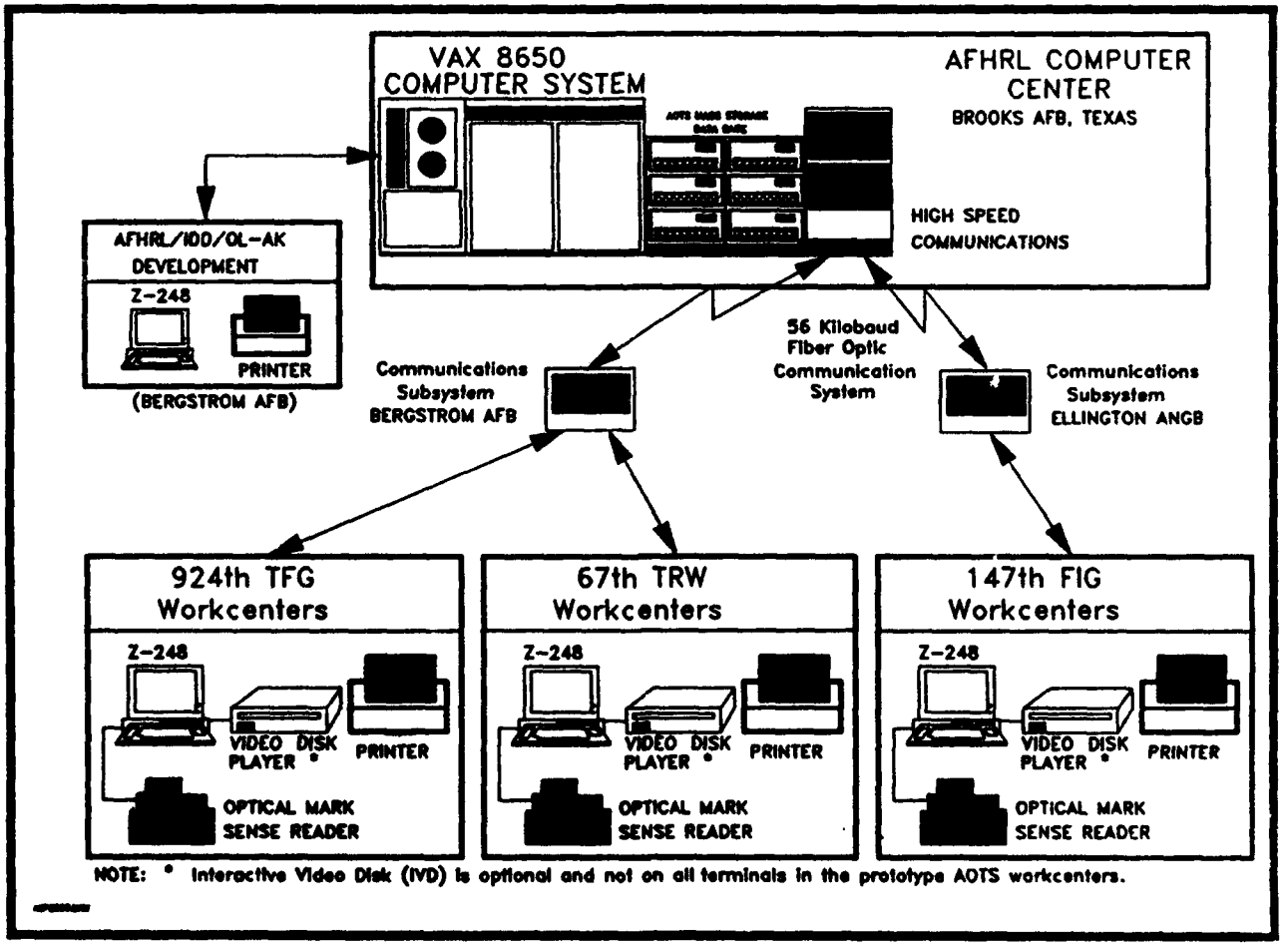

Figure 2. AOTS Computer System Diagram

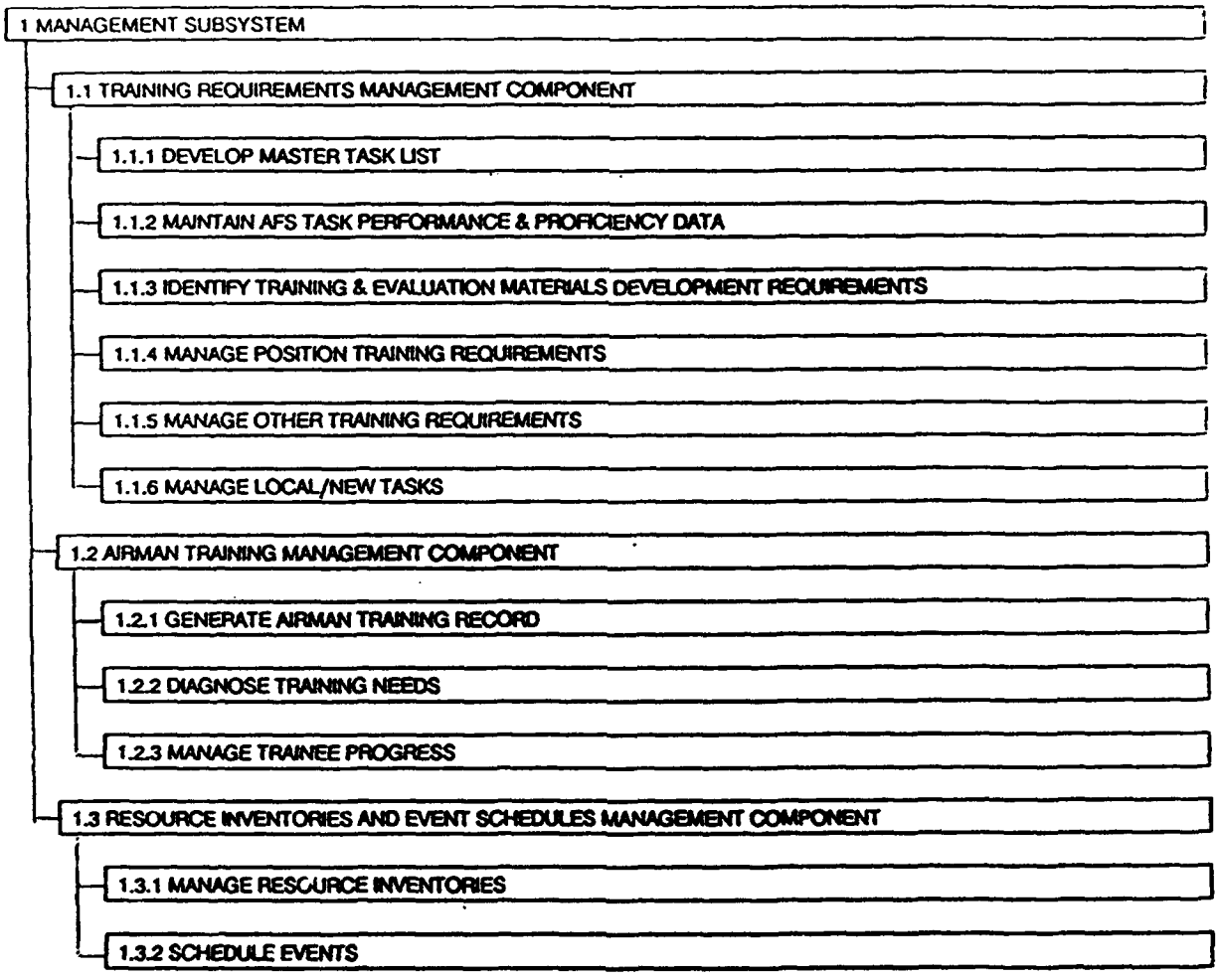

Figure 3. Management Subsystem

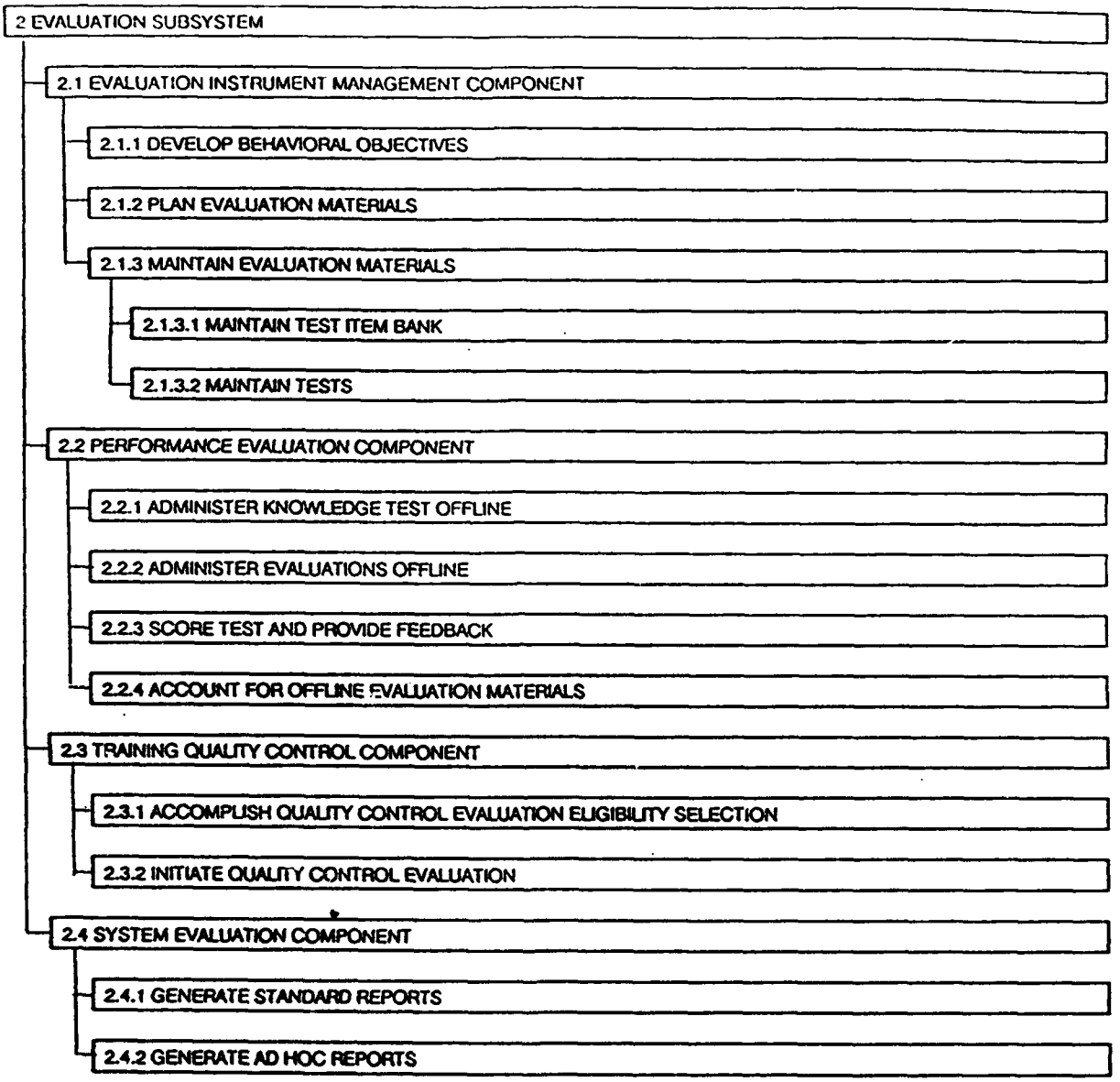

Figure 4. Evaluation Subsystem

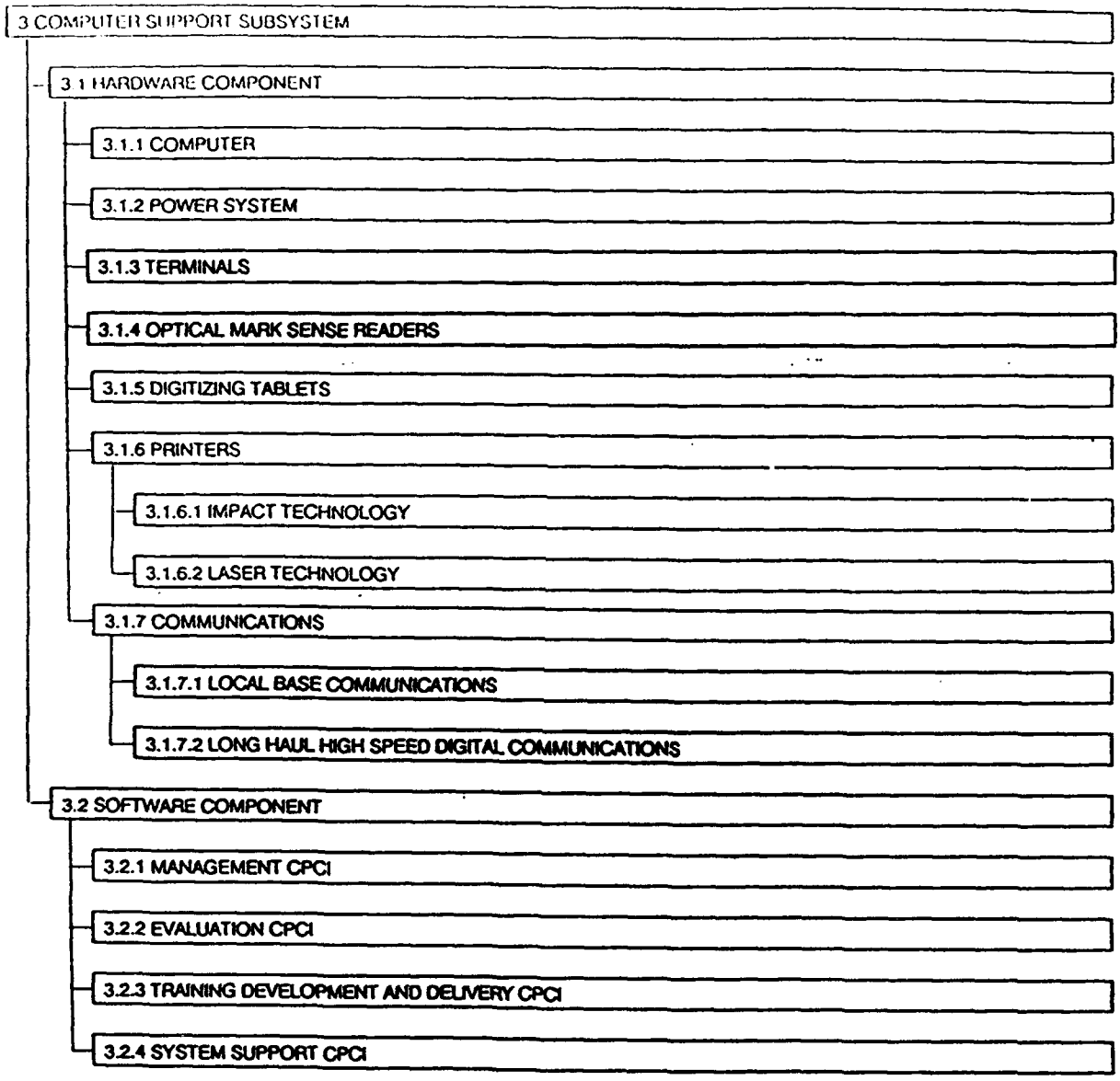

Figure 5. Computer Support Subsystem

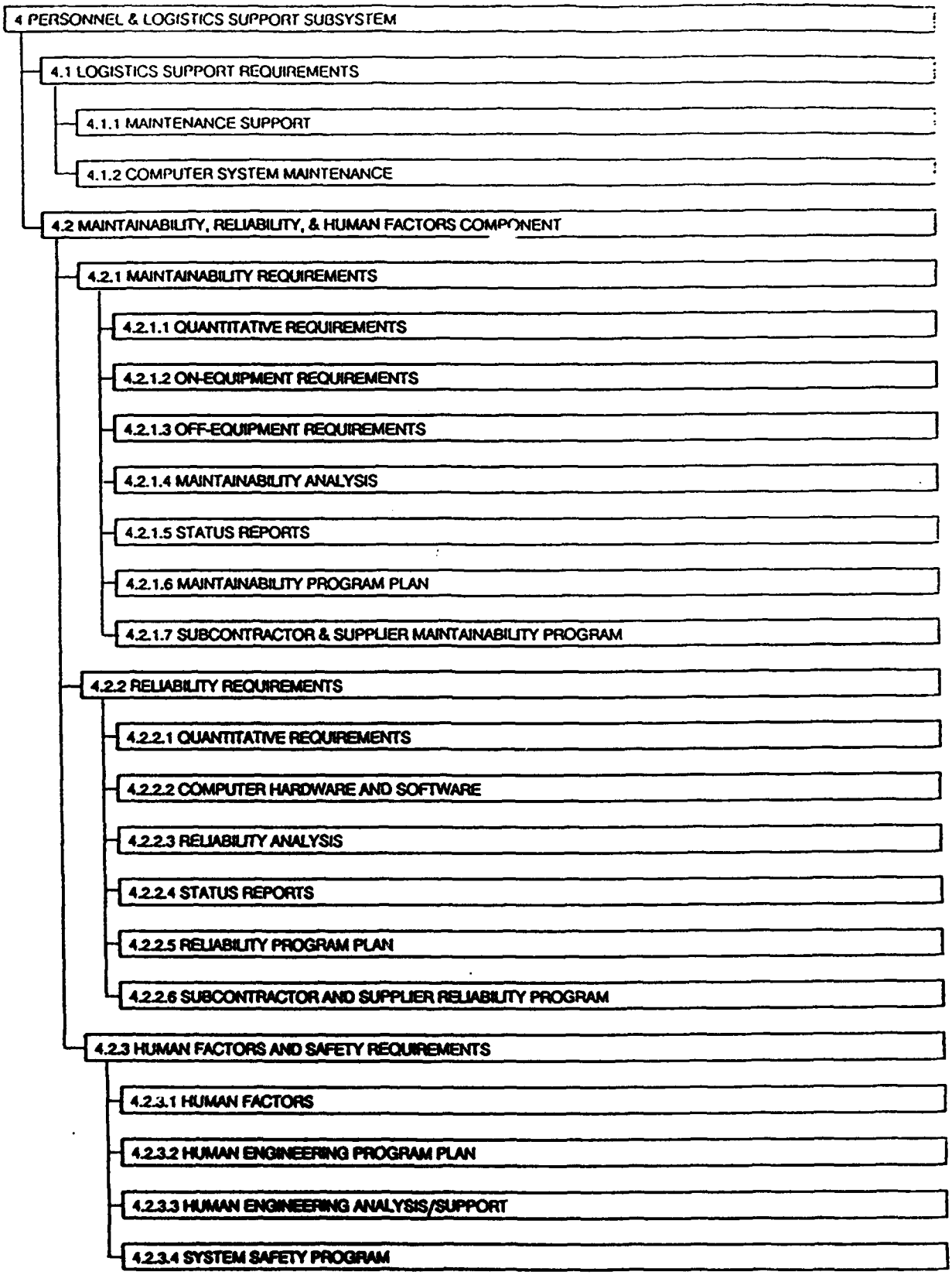

Figure 6. Personnel and Logistics Support Subsystem

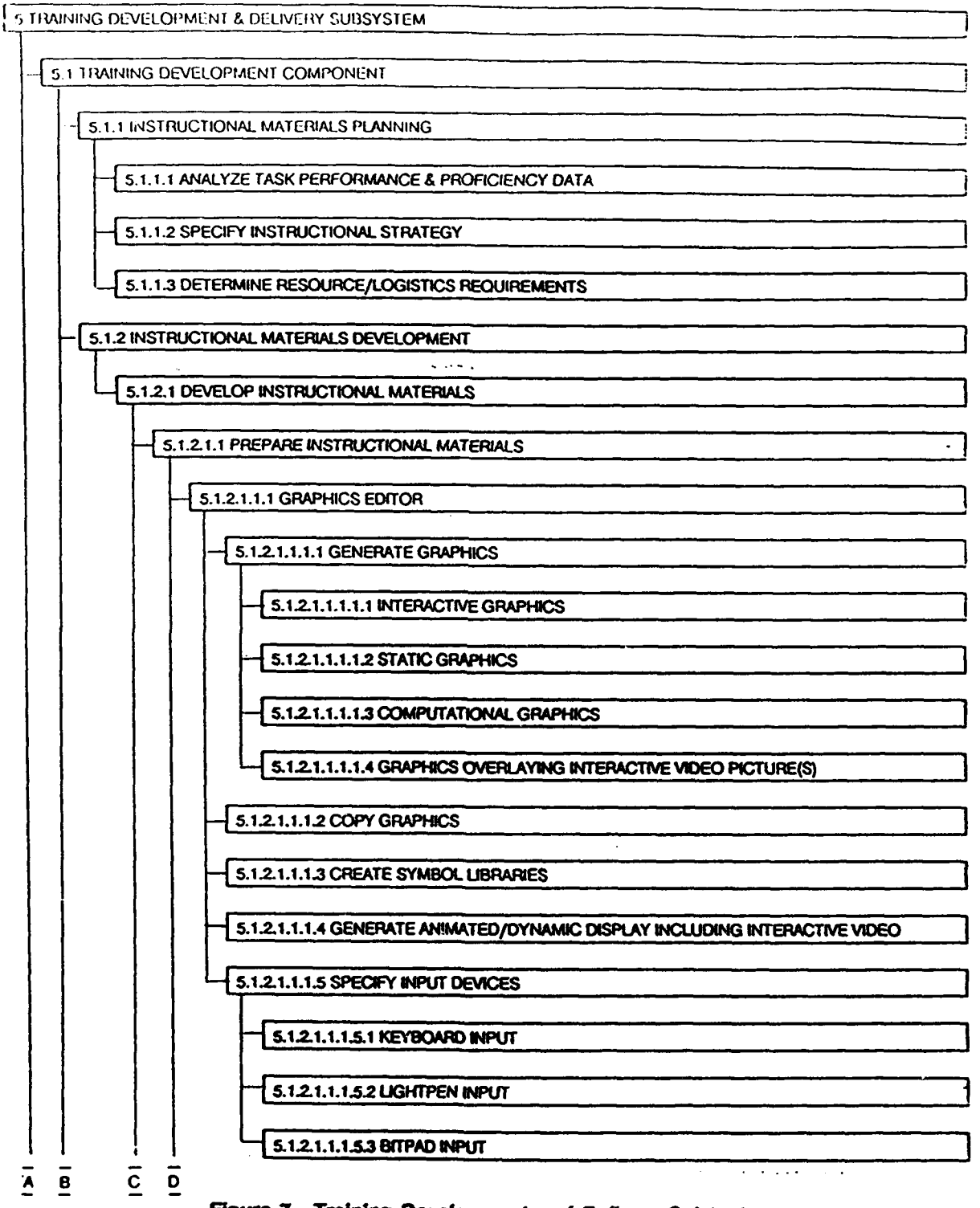

Figure 7. Training Development and Delivery Subsystem

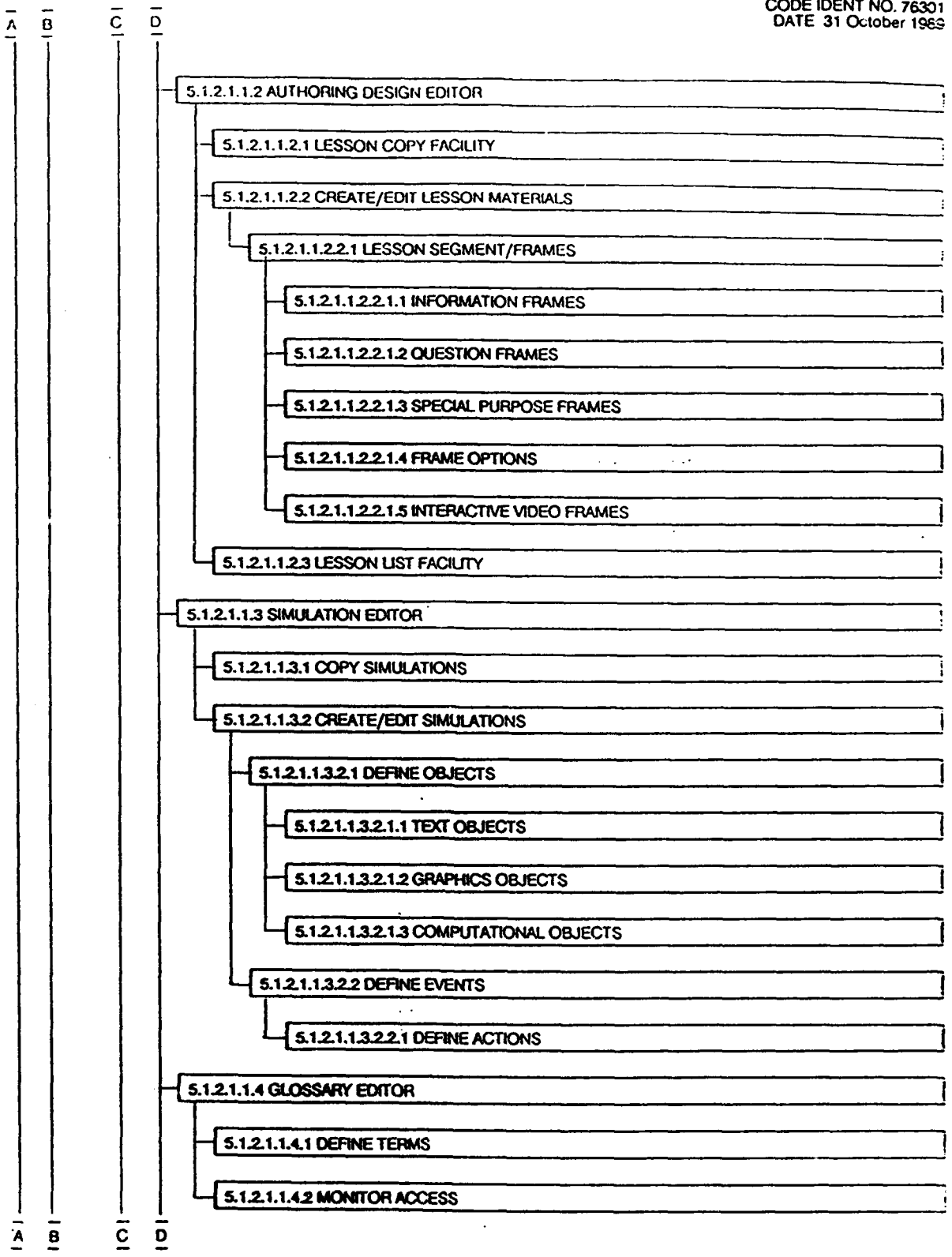

Figure 8. Training Development and Delivery Subsystem - continued

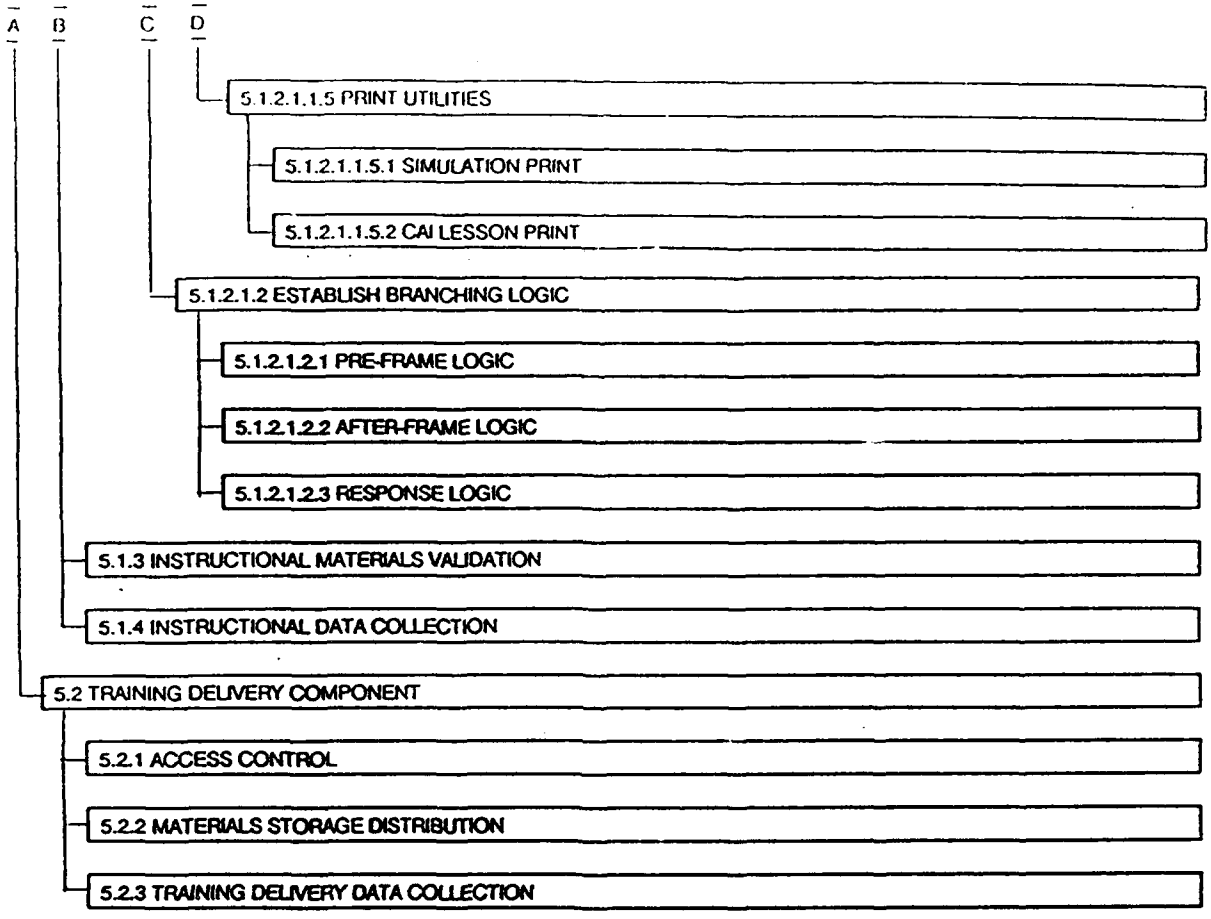

Figure 9. Training Development and Delivery Subsystem - continued

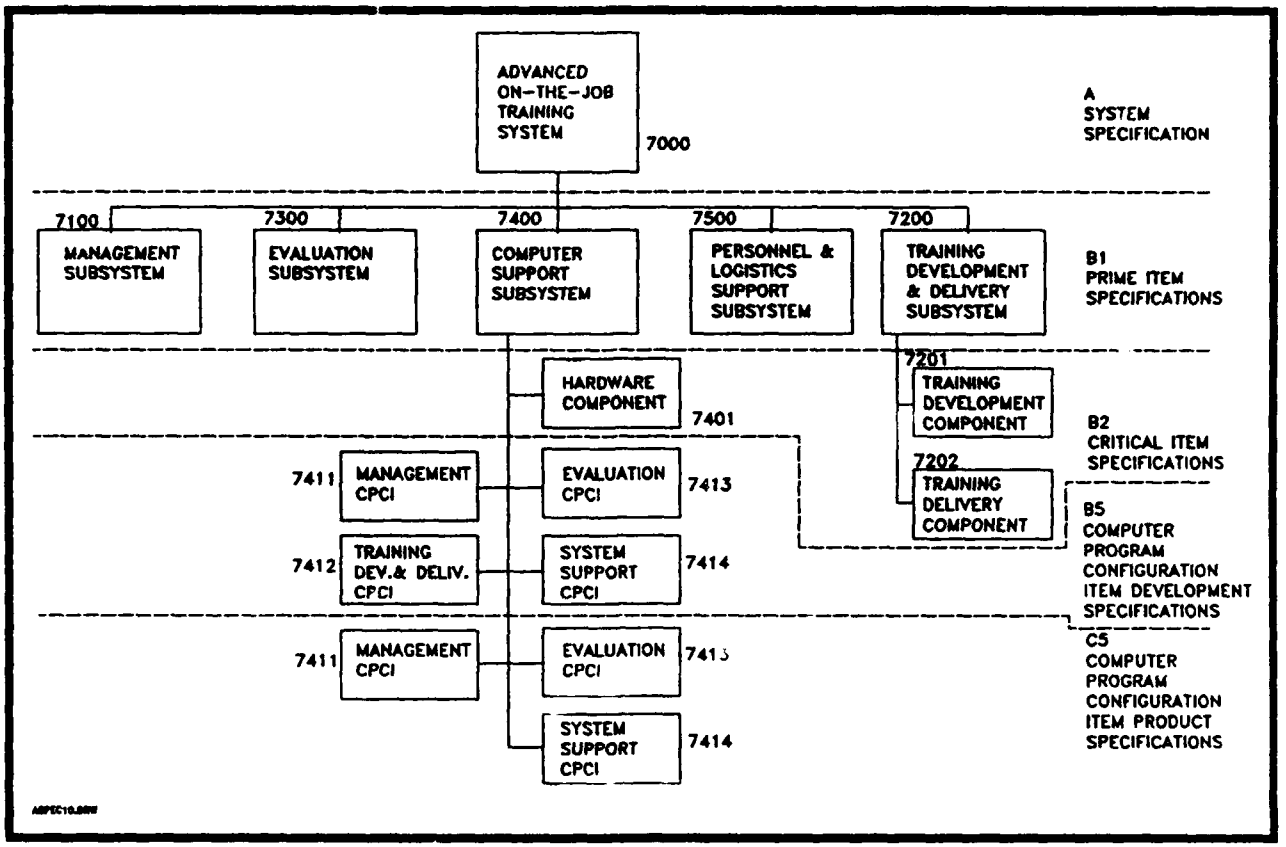

Figure 10. AOTS Specification Tree

3.1.5 *Interface definitions.*

This section defines the interfaces that shall be required for the AOTS to function as a computer-based training system within the Air Force operational environment. Definitions are included for both the interfaces that shall occur between the AOTS and Air Force systems and organizations external to the AOTS, and the interface between the AOTS subsystems.

3.1.5.1 *Interfaces between the AOTS and external entities.*

The external entities with which the AOTS shall interface are depicted in Figure 11. Interfaces that shall be established between the AOTS and other Air Force computer-based systems and organizations are described in the subsequent paragraphs. Included as external entities are Air Force systems that currently exist plus those that are known to be under study and/or development. Air Force systems that emerge during the development of the prototype AOTS shall be reviewed to determine if further interfaces are required. As stated in Section 3.1.1, no electronic interfaces between the prototype AOTS and other computer-based systems are anticipated. The methods for exchanging data between the AOTS and external computer-based systems, e.g., magnetic tapes or manual transfer, will be used.

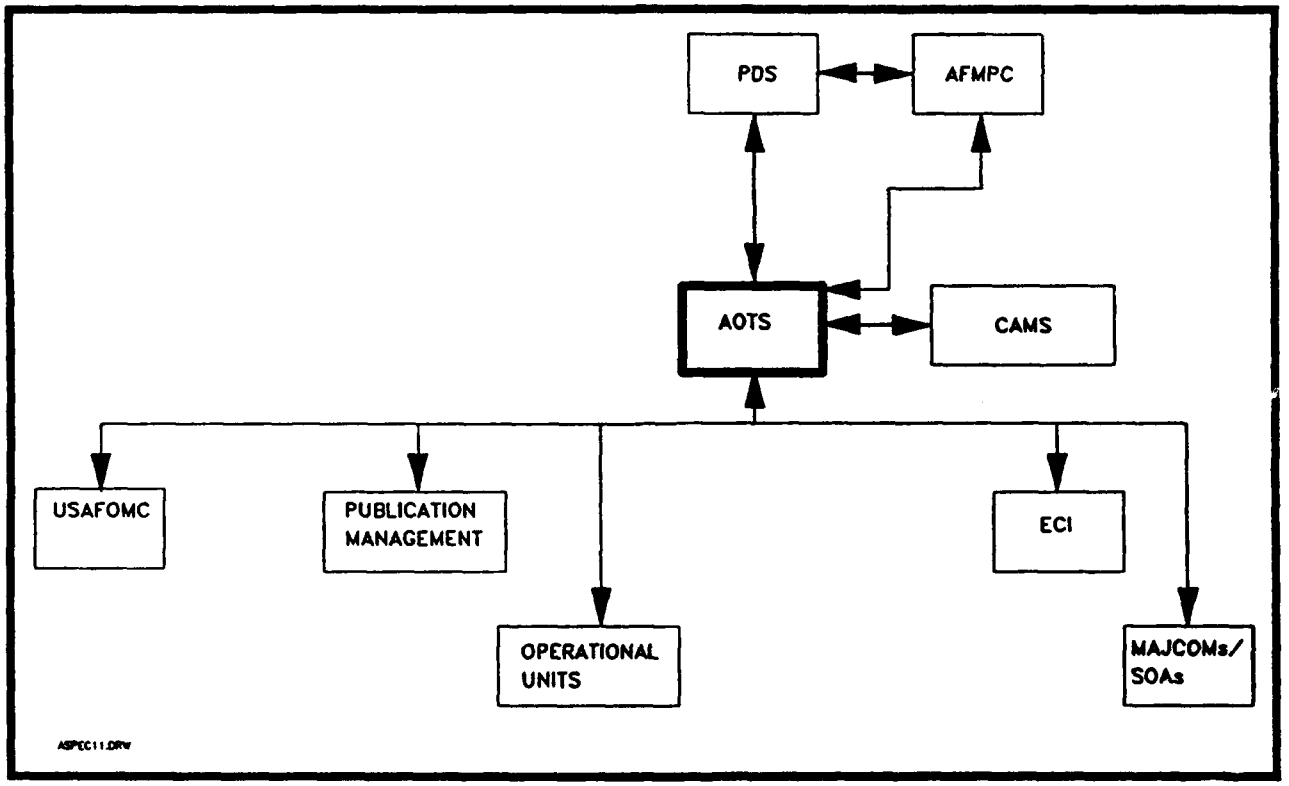

Figure 11. External Interfaces with AOTS

3.1.5.1.1 *United States Air Force Operational Measurement Center (USAFOMC) Interface.*

An interface between the AOTS and the USAFOMC shall be established during the prototype AOTS development phase (Phase II) to pass occupational survey data and analysis results to the AOTS Management Subsystem for use in defining Air Force Specialty (AFS) tasks, and associated task data. The data received from the USAFOMC shall include task identification numbers, task statements, task factor analysis results and the identification of support equipment, where

applicable, for all tasks reported during occupational surveys as performed in the specified AFSs. Further, this interface shall facilitate the AOTS Management Subsystem identifying to the USAFOMC Survey Branch those tasks that are found to be performed by personnel assigned within specific AFSs that have not been included in the applicable occupational survey instruments.

3.1.5.1.2 *Publications Management Systems Interface.*

Interfaces shall be established during Phase II between the AOTS and Air Force publications management agencies and systems to acquire those regulations, manuals, technical orders, and other documents that prescribe training requirements or contain task performance and proficiency data. The publications and documents shall be used by AOTS developers when defining performance and training requirements within the AOTS Management Subsystem, and for developing behavioral objectives and test instruments within the AOTS Evaluation Subsystem. An Air Force Customer Account Representative (CAR) will interface with the Publications Distribution Office (PDO) at Bergstrom AFB for ordering and receiving Air Force and Major Command publications. A representative will also interface with the Technical Order Distribution Office (TODO) at Bergstrom.

3.1.5.1.3 *Extension Course Institute (ECI).*

An interface with the ECI shall be established during Phase II to provide the AOTS Management Subsystem with the data required to maintain the current availability status of correspondence courses. This interface shall also facilitate the Management Subsystem processing of correspondence course enrollments for members in upgrade training during the prototype AOTS demonstration and test phase (Phase III). To facilitate the matching of appropriate correspondence courses to upgrade training requirements, procedures shall be instituted whereby projected changes to correspondence course availability and effective dates of changes are provided by ECI.

3.1.5.1.4 *Air Force Military Personnel Center (AFMPC) Interface.*

Interfaces shall be established during Phase II between the AOTS and the offices located at the AFMPC having primary and/or collateral responsibilities for training and AFS classification policies. The current office symbol is AFMPC/DPMRTC3. Interfaces with the training policy makers are required for AOTS managers to receive, in sufficient time for planning and making adjustments, any forthcoming changes to policies that could affect AOTS management and software programs. As a minimum, the AOTS Management Subsystem will require information policy changes relevant to on-the-job training, ancillary training, additional duty training and contingency task training.

3.1.5.1.5 *Operational unit interfaces to include interfaces with computer-based systems that support unit training programs.*

Interfaces with operational units, to include interfaces with computer-based systems such as the Core Automated Maintenance System (CAMS) and the Personnel Data System, shall be established during Phase II. These interfaces are required to collect information relevant to individual qualifications and training course completions; to identify resources required for training and evaluation; to schedule training and evaluation events; and to provide reports relevant to training progress, and AOTS effectiveness. During the initial loading of data into the prototype AOTS, the AOTS Management Subsystem shall collect from applicable operational units the training data currently maintained on training forms and within computer data bases for those personnel whose training shall be managed within the AOTS. Also to be collected are the nomenclatures and quantities of those training and evaluation resources which shall be identified by the AOTS, and the identification of contingency tasks that are controlled by these units. The methods for collecting these data and loading them to the prototype AOTS shall be either by manual entry

or by using an electronic media (e.g. magnetic tape). During the operational test phase for the AOTS, the identity of training and evaluation events that are not controlled by the AOTS shall be sent to the AOTS Management Subsystem, which shall, in turn, identify those personnel requiring the specified event and record event data. Schedules for training and evaluation events that are controlled by the Management Subsystem shall be provided to the applicable units. Formats for data exchange between the AOTS and other systems shall be established to facilitate exact interpretation. During Phase III, training progress status reports for individual trainees or groups of trainees shall be provided by the AOTS Management Subsystem. Reports on training progress analyses, training quality control, and training system effectiveness shall be provided by the AOTS Evaluation Subsystem. The frequency and formats of these reports shall be specified by the Air Force. The Management Subsystem shall receive training data on selected individuals by interfacing with the CAMS. These data shall be used in scheduling training and evaluation events. The frequencies for providing these data, the formats in which they shall be provided, and field sizes are specified in the Management and Evaluation Subsystem Prime Item Specifications (see applicable documents).

3.1.5.1.6 *Personnel Data System (PDS) interface.*

To facilitate operation of the AOTS Management Subsystem, an interface shall be established during Phase II between the AOTS and the PDS. The AOTS Management Subsystem shall require access to personnel data maintained within the PDS in order to create Airman Training Records (ATRs). The types of data required to create an ATR include trainee names, social security account numbers, grades, Air Force Specialty Codes (AFSCs), Training Status Codes (TSCs), Personnel Accounting System (PAS) codes, training course completions, education levels, Air Force Reading Abilities Test (AFRAT) scores, personnel record status codes, duty status codes, duty position numbers, office symbol codes, and Armed Service Vocational Aptitude Battery (ASVAB) scores. Changes to these data shall be provided to the AOTS Management Subsystem as they occur so that impacts on training requirements can be determined. Products reflecting the unit manpower personnel requirements shall be provided from the PDS for use in the development of Position Task Requirement (PTR) listings. Training status data used within the overall personnel system that shall reside within the PDS, shall be provided upon request. The types of data provided from the AOTS to the PDS are training progress status, such as time in training versus the estimated training completion times, training course failures, qualifications, etc., that may influence promotion, demotion, separation, classification, retraining, or assignment actions. The specific data to be exchanged between these systems and the data field sizes are specified by the Management Subsystem Prime Item Specification (see applicable documents). The data from PDS shall be supplied to AOTS on magnetic tape. A unique DESIRE will be required from the Active, Reserves, and Air National Guard PDS for each magnetic tape.

3.1.5.1.7 *Off-line training activities interface.*

Procedures shall be established during Phase II to obtain from applicable non-AOTS training agencies; i.e., the Field Training Detachment (FTD), the CBPO-OJT Unit, the Combat Arms Range, the Safety Office, the Judge Advocate Office, the Disaster Preparedness Office, the Drivers School, the Supply Custodian School, the Director of Administration, etc., that information required to identify personnel for training and evaluation events, and to record progress and completion status. Information relevant to event cancellation shall likewise be provided. Training and evaluation events scheduled by non-AOTS agencies shall be entered into the AOTS Management Subsystem, (via magnetic tape media), and the personnel requiring the training shall be identified through an automated training diagnosis process. In some instances the non-AOTS agencies will have standard methods for identifying the information that differs from those methods used in AOTS, e.g., course codes identify the same event. Therefore, a method shall be devised to cross-reference this information. Interfaces shall be established that enable the AOTS Management Subsystem to receive trainee progress and event completion data from non-AOTS sources. Training specific data to be processed, data formats, and field sizes are specified in the Prime Item Specifications (see applicable documents).

3.1.5.1.8 *Core Automated Maintenance System (CAMS) Interface.*

The interface between the AOTS and the CAMS is limited to extracting training data effecting the selected AFSs that are part of the prototype AOTS. This interface shall be accomplished by taking output from CAMS and manually entering this information into AOTS.

3.1.5.2 *Internal interfaces.*

Interfaces that shall be established between AOTS subsystems are functionally described in the following paragraphs.

3.1.5.2.1 *Management Subsystem support for the Evaluation Subsystem.*

Functions to be performed by the Management Subsystem in support of the Evaluation Subsystem shall include the following:

a. Task identification and performance assessment requirements specified by the Training Requirements Management Component
b. Airmen training management program (e.g., progress, ATR/ITR composition, data needed to evaluate system effectiveness)
c. Training scheduling program
d. Trainer qualifications and certified tasks for Training Quality Control evaluation/resource allocations and schedules

3.1.5.2.2 *Evaluation Subsystem support for the Management Subsystem.*

Evaluation Subsystem tasks shall include the following:

a. Identify evaluation resources required for evaluation of job-site task performance
b. Develop behavioral objectives, knowledge test items, performance evaluation checklists, and oral test guides
c. Maintain the Test Item Bank
d. Identify objectives, items, and materials by task/subtask identification
e. Randomly select appropriate tasks, certified airmen, and evaluators for Training Quality Control evaluation events
f. Provide Training Quality Control evaluation results
g. Deliver evaluation materials

3.1.5.2.3 *Management Subsystem support for the Computer Support Subsystem.*

The Management Subsystem shall provide functional requirements to the Computer Support Subsystem.

3.1.5.2.4 *Computer Support Subsystem support for the Management Subsystem.*

The Computer Support Subsystem will provide the following in support of the Management Subsystem:

3.1.5.2.4 *Computer Support Subsystem support for the Management Subsystem.*

The Computer Support Subsystem will provide the following in support of the Management Subsystem:

a. Commercially available language compilers
b. Debugging and authoring aids
c. Ada Joint Program Office-approved Ada programming compiler
d. Hardware support
e. Software programs and editors to accomplish specified objectives

3.1.5.2.5 *Management Subsystem support for the Personnel and Support Subsystem.*

The Management Subsystem tasks shall include the following:

a. Assistance in design of training courses for AOTS personnel
b. Specify personnel skills and training required

3.1.5.2.6 *Personnel and Support Subsystem support for the Management Subsystem.*

The Personnel and Support Subsystem will provide the following in support of the Management Subsystem:

a. Trained personnel necessary to perform required skills
b. AOTS Human Engineering
c. AOTS Reliability

3.1.5.2.7 *Management Subsystem support for the Training Development and Delivery Subsystem.*

The Management Subsystem shall provide the following capabilities in support of the Training Development and Delivery Subsystem:

a. Training materials development requirements
b. Individual trainee training requirements
c. Resource requirements and schedules
d. Task Training Requirements

3.1.5.2.8 *Training Development and Delivery Subsystem support for the Management Subsystem.*

The tasks to be performed by the Training Development and Delivery Subsystem shall include the following:

a. Design and develop training hierarchies
b. Present embedded test items materials on-line
c. Develop instructional strategies
d. Collect trainee performance data

3.1.5.2.9 *Training Development and Delivery Subsystem support for the Evaluation Subsystem.*

The tasks to be performed by the Training Development and Delivery Subsystem in support of the Evaluation Subsystem shall include, but will not be limited to, the following:

a. Assist in collection of data to evaluate system effectiveness
b. Operationalize instructional strategies

3.1.5.2.10 *Evaluation Subsystem support for the Training Development and Delivery Subsystem.*

The Evaluation Subsystem shall provide the following capabilities in support of the Training Development and Delivery Subsystem:

a. Effectiveness data on strategy(s) used in evaluation instruments
b. Assist in collecting trainee task performance and requisite knowledge test data
c. Assist in ranking and selection of evaluation strategies
d. Assist in data collection to validate instructional instruments
e. Provide system reports as required

3.1.5.2.11 *Training Development and Delivery Subsystem support for the Computer Support Subsystem.*

The tasks to be performed by the Training Development and Delivery Subsystem shall include, but will not necessarily be limited to, the following:

a. Functional requirements to support the accomplishment of Training Development objectives
b. Functional requirements to support the accomplishment of Training Delivery objectives

For purposes of the prototype AOTS, the CAI capability from the existing Government owned Instructional Support System (ISS) shall be used to the maximum extent possible.

3.1.5.2.12 *Computer Support Subsystem support for the Training Development and Delivery Subsystem.*

The Computer Support Subsystem shall provide the following in support of the Training Development and Delivery Subsystem:

a. Commercially available language compilers
b. Debugging and authoring aids
c. Ada
d. Terminal and printer support
e. Software programs and editors required to accomplish specified objectives

3.1.5.2.13 *Training Development and Delivery Subsystem support for the Personnel and Support Subsystem.*

The tasks to be performed by the Training Development and Delivery Subsystem shall include, but will not be limited to, the following:

a. Assist in the design and development of necessary training courses
b. Specify personnel skills required

3.1.5.2.14 *Personnel and Support Subsystem support for the Training Development and Delivery Subsystem.*

The Personnel and Support Subsystem shall provide the following in support of the Training Development and Delivery Subsystem:

a. Trained personnel necessary to perform required skills
b. AOTS Human Engineering

3.1.5.2.15 *Evaluation Subsystem support for the Computer Support Subsystem.*

Evaluation Subsystem capabilities shall include, but not be limited to, functional requirements to support completion of Evaluation Subsystem objectives. These objectives are:

a. To plan, develop, validate, and maintain evaluation instruments
b. To administer evaluation instruments and collect performance evaluation results
c. To provide quality control evaluations for assessment of training effectiveness
d. To provide unit training and system effectiveness reports

3.1.5.2.16 *Computer Support Subsystem support for the Evaluation Subsystem.*

The Computer Support Subsystem shall provide the following in support of the Evaluation Subsystem:

a. Commercially available language compilers
b. Debugging and authoring aids
c. Ada
d. Hardware support
e. Software programs and editors to accomplish specified objectives.

3.1.5.2.17 *Evaluation Subsystem support for the Personnel and Support Subsystem.*

Evaluation Subsystem tasks shall include, but not be limited to, the following:

a. Specify personnel skills required for performance of Evaluation Subsystem objectives

3.1.5.2.18 *Personnel and Support Subsystem support for the Evaluation Subsystem.*

The Personnel and Support Subsystem will provide the following in support of the Evaluation Subsystem:

a. Train personnel necessary to perform tasks required by Evaluation Subsystem
b. AOTS Human Engineering

3.1.5.2.19 *Personnel and Support Subsystem support for the Computer Support Subsystem.*

The tasks to be performed by the Personnel and Support Subsystem in support of the Computer Support Subsystem shall include, but will not be limited to, the following:

a. Train personnel to perform required AOTS tasks
b. Hardware and Software Reliability reports
e. Maintenance logistics support
f. Monitor Human Engineering requirements in the design of AOTS.

3.1.5.2.20 *Computer Support Subsystem support for the Personnel and Support Subsystem.*

The Computer Support Subsystem shall provide the following in support of the Personnel and Support Subsystem:

a. Hardware logistics/maintenance requirements
b. Specific personnel skills needed to perform necessary jobs.

3.1.6 *Government-furnished property list.*

3.1.6.1 *Government-furnished computer programs.*

Government-furnished computer programs which AOTS may utilize as is or which may be modified to meet the requirements of this specification will include Instructional Support System (ISS), General Imagery Intelligence Training System (GIITS), or any others that may be deemed applicable. Various elements of the ISS software, (e.g. system support, virtual machine, CAI, test analysis, etc., software packages), and the GIITS, (e.g. the file management interface with the computer), are available for use in AOTS.

3.1.6.2 *Other government-furnished property.*

The Government will furnish power, some of the communication cabling and connections, and facilities as specified. The Government shall also provide Zenith Z-248 personal computers, associated printers, digitizer tablets (small) and software, and use of a Digital Equipment Corporation VAX 8650 computer system. The Government shall also provide Digital Equipment Corporation VT100 computer terminals and Tektronix 4105 color computer terminals.

3.1.6.2.1 *Power.*

The government will furnish adequate electrical power. The government will interface with the electrical power provider to resolve any power problems. The electrical power will meet normal standards, including voltages within the tolerance of +15% or -10% of nominal levels, frequency variations less than +/- 1 hertz, and no surges or brown-outs.

3.1.6.2.1.1 *Connecting devices power requirements.*

The government will provide 120 volt, 60 hertz, single-phase power to each connecting device by way of a wall-mount receptacle. The power will be protected from electrical surges or brown-outs. Each connecting device, except the terminals and mark readers, will require one wall outlet with a 20-amp receptacle supplying a maximum of 3 amps. The terminal controller and monitor will each require one receptacle with a total load of less than 3 amps each. All power provided to connecting devices should be on independent circuits. If that is not possible, circuits will be provided which do not have large electrical noise-inducing components such as calculators, typewriters, or copiers.

3.1.6.2.2 *Communication cabling and connections.*

The government will provide building-to-building communications lines. The lines will run from government-provided terminal blocks in the building that contains the computer component to government-provided terminal blocks in the buildings that contain the connecting devices. Each connecting device or group of connecting devices, where multiplexed, will require a four-wire circuit. Adequate backup four-wire circuits should be provided in the event of communication-line failure. Full requirements shall be a part of the Site Preparation and Installation Plan(s).

3.1.6.2.3 *Facilities.*

The government will provide facilities to meet the following requirements.

3.1.6.2.3.1 *Computer component failures.*

Should a dedicated computer system be required (lack of availability or capacity of the Government furnished DEC VAX 8650 computer system that is located at AFHRL/SC on Brooks AFB, TX.), then the computer component will operate under the following environmental constraints. The government will provide facilities that meet and maintain the following conditions.

3.1.6.2.3.1.1 *Computer component environment.*

The following limits indicate the range of environmental factors for the computer room environment. Out-of-range conditions beyond the maximum limits may cause the system to be shut down, or may damage the equipment. The air-conditioning system should provide the range of temperature and humidity indicated under the recommended limits.

Maximum limits

a. 65-85 degrees Fahrenheit
b. Maximum rate of change of temperature 5.5 degrees Fahrenheit per hour
c. 20-80 percent relative humidity, noncondensing
d. Maximum rate of change of relative humidity 6 percent per hour

e. Low dust, filtered air

f. Clean environment

Recommended Limits

a. 65-75 degrees Fahrenheit

b. 45-55 percent relative humidity, noncondensing

c. Nearly dust free

3.1.6.2.3.1.2 *Computer facility floor.*

A raised computer facility floor will be provided to make room for power, control, and communication cables. The floor should be raised at least 9 inches above the building floor level. A ramp at least 4 feet long will lead from the building floor to the raised floor. Both the ramp and the computer facility floor will be capable of supporting an average load of 200 lb./sq.ft. and will be capable of supporting a concentrated load of 1000 lb./sq.in. Floor vibrations of any magnitude will not be acceptable while the computer is operational.

3.1.6.2.3.1.3 *Computer facility doorways.*

To provide entry and removal of computer hardware at the computer facility, doorways along the path of entrance will provide at least a 36-inch opening. A 6-foot deep area will be provided on each side of doorways where hardware will be turned.

3.1.6.2.3.1.4 *Fire protection.*

The government will provide a method of detecting and extinguishing any fire in the computer component facility. The extinguishing method will not cause further damage to the computer component. A Halon system is recommended. The system will be automatically initiated and will provide ample warning to personnel. The fire-detection scheme will also shut down the air conditioning system. The power system component will have an interconnect available for use by the government in shutting off the air-conditioning system in the event that fire is detected. If the government does not choose to use the interconnect, the government will provide a method for shutting down the air-conditioning system.

3.1.6.2.3.1.5 *Water protection.*

The government will provide an alarm system capable of detecting the presence of water or other liquids seeping into the computer component facility. That alarm system also will provide a normally closed or normally open breaker for sensing by the power system component to provide shutdown of the computer system.

3.1.6.2.3.2 *Connecting devices.*

The government will provide an office-quality environment for the connecting devices that will meet the following constraints:

a. 65-90 degrees Fahrenheit

b. 20-80 percent relative humidity, noncondensing.

In addition, the connecting devices will not be exposed to excessive dirt or dust nor will they be exposed to spilled substances or to grease. The connecting devices will not be placed in an area where eating and drinking are permitted.

3.1.7 *Operational and organizational concepts.*

3.1.7.1 *Basic performance parameters.*

a. Operational factors

1. OJT program structure/policy considerations

(a) The AOTS shall comply with Air Force training policies unless deviations from governing directives have been approved. It shall be supportive of current classification structures and be capable of adapting to AFSC conversions.

(b) To the greatest extent possible, the AOTS shall provide automated means of identifying duty position performance requirements, identifying individual and group training requirements, scheduling training events, developing evaluation instruments, evaluating training and system performance, and developing and delivering training. Major goals shall be (1) where possible, to reduce the workload experienced by employing the current OJT system; (2) where feasible, to streamline methods of producing, delivering, recording, and evaluating training; and, (3) where appropriate, to introduce new technologies into the workcenter OJT arena that have not heretofore been available.

(c) From the results of the operation, test, and evaluation of AOTS, suggestions shall be provided on configuration(s) and concepts for managing the system when it is turned over to the Air Force or for Full Scale Engineering Development for future Air Force wide deployment.

2. Environmental considerations

(a) The AOTS peripherals shall be capable of operating within areas having high concentrations of dust, grease, etc., particularly in workcenters supporting aircraft maintenance. Peripherals that have alternative models that can operate within these types of environments shall be given preference.

(b) The AOTS shall be user-friendly. It shall allow airmen with differing levels of experience to operate the system with a minimum of training. Menus and prompts shall be used to promote easy understanding of what is required from the user as input and the output or results being displayed. Experienced users shall have options to abbreviate the prompts and menus if desired.

b. Organizational factors. In that each organization may be structured differently and that shift work may be an integral element, the AOTS shall be capable of operating 24 hours per day.

3.1.7.2 *AOTS relationships with other Systems.*

Interfaces and relationships with systems already operational in the Air Force are defined in 3.1.5. As existing systems are modified or changed, the Air Force PM will ensure that the contractor is aware of these changes and is furnished sufficient documentation to effect any modifications to the AOTS that may be necessary. These changes shall be incorporated as necessary. The mission of the AOTS in relationship to other AF systems shall be unique in its purpose and supportive of other training systems in the Air Force. Currently, there is no Air Force-standardized mechanized support for OJT except for the Personnel Data System which records only a few "bits" of data pertaining to OJT such as Primary, Secondary, Duty and Control AFSCs, dates entered training or retraining, date upgraded, and Training Status Code. No system manages the determination of task performance requirements, the selection and prioritization of training requirements, and the systematic scheduling of personnel to training or evaluation events.

3.1.7.3 *Anticipated deployment.*

a. Prototype Application

(1) The prototype AOTS shall be designed to accommodate an annual training load of approximately 800 airmen and direct users of the system (including supervisors, trainers, trainees, and the IST). It shall provide the mechanisms by which all aspects of job-site training shall be managed in each of the designated workcenters from the 67th Tactical Reconnaissance Wing (67th TRW), the 924th Tactical Fighter Group (924 TFG-AFRES) at Bergstrom AFB, Texas and the 147th Fighter Interceptor Group of the Air National Guard located at Ellington ANGB, Texas. Test Air Force Specialties designated by the AF are:

(a) 454X0A Aerospace Propulsion
(b) 452X4D/M Tactical Aircraft Maintenance
(c) 732X0 Personnel
(d) 811X0 Security
(e) 811X2 Law Enforcement

(2) Following completion of the system test and evaluation of the prototype, the contractor shall deliver the prototype AOTS to AFHRL at the development site.

3.2 Characteristics.

3.2.1 *Performance characteristics.*

The system performance shall be determined during each phase of the program.

3.2.1.1 *Response performance goals.*

Response performance goals for the AOTS development system for each phase, operating under normal load, shall be (average):

a. Phase II - 2 seconds (worst case)
b. Phase III - 2.5 seconds (worst case)
c. Master Task List Search - Phase III - 1 minute maximum
d. Compile rate during software development - 600 LPM compile

3.2.1.2 *Computer components.*

The AOTS Computer Component Subsystem specification 70S647400 consists of the following components:

a. Computer System Component
b. Terminal Component
c. Optical Mark Reader Component
d. Printer Component
e. Digitizer Tablet Component
f. Terminal Component with Interactive Video Disk (IVD) capability

3.2.1.2.1 *Computer component goal specification.*

The specific characteristics that will be used as goal specifications for the Computer System Component are:

a. Computational Capacity - 6 MIPS PHASE II
b. Computational Capacity - 8 MIPS PHASE III
c. Computational Capacity - 8.5 MIPS PHASE IV
d. Disk Storage subsystem
    1. 1.3 GigaBytes (GB) Disk Storage - PHASE II & III
    2. 1.7 GB Disk Storage - PHASE IV
e. Computer Memory subsystem
    1. Minimum of 32 MB main memory Phase II
    2. Minimum of 64 MB main memory Phase IV
f. Magnetic Tape Subsystem
    1. Magnetic Tape Backup Subsystem
g. Line Printer - 445 LPM 96 Character Set
h. Communications subsystem
    1. RS232C Communications capability (serial)
        (a) 64 Ports - Phase II
        (b) 124 Ports - Phase III & IV
i. Virtual Memory Capability
j. Floating Point Accelerator
k. Cache Memory - Minimum 8 KiloBytes (KB)
l. Vector Priority Interrupt Structure
m. Real Time Clock and Interval Timer
    (a) Real Time clock minimum resolution of .001 second
    (b) Interval Timer minimum resolution of 1 millisecond
n. I/O Bandwidth of 20 MB/seconds Minimum
o. Virtual Memory Disk Based Operating System
p. Validated Ada Compiler

q. Support System Software (e.g., editors, debuggers, Source Code Control System)
r. MTBF 600 hours minimum (goal)
s. MTTR 1.5 hours Maximum (goal)
t. Offer Full Service Maintenance Contracts
    1. Hardware
    2. Software

3.2.1.2.2 *Terminals.*

The terminals of the AOTS system shall use Personal Computers only for ease of expandability. The terminal specification to be used as goals for the AOTS development program are:

a. 80286 Microprocessor at 6 MHz (minimum) or equal
b. MS-DOS 3.1 or higher operating system or equal
c. IBM AT compatible or equal
d. 512 KB minimum main memory expandable to 6 MB minimum
e. Serial interface
f. Parallel printer port
g. QWERTY Keyboard, AT Compatible or equal
    (1). Detached
    (2). 10 function switches, numeric keypad and cursor control
h. 360KB floppy disk (minimum)
i. 20.0 MB hard disk
j. MTBF 2000 hours
k. MTTR 0.5 hour
l. Graphics/Text controller
m. Interactive video (optional)
    (1). Support genlock
    (2). Graphics/Text overlay capable
    (3). Standard 525 commercial color TV compatible
    (4). Acceptable video sources:
        (a). Video Disk
        (b). Video Tape
n. Monitor (Graphics/Text color)
    (1). Medium resolution (640 X 480)
    (2). 12 to 14 Inch (diagonal)
    (3). Color
    (4). Minimal flicker (medium to long persistence phosphor)
    (5). 9300 degree Kelvin color temperature
    (6). Interlaced and non-interlaced switchable (interlaced at minimum)
    (7). Tilt/Swivel (or equivalent means of achieving this)

(8). Low glare screen (preferred)
(9). MTBF of 15,000 hours minimum
(10). MTTR of 0.5 hour
(11). Analog or TTL RGB input

p. Monitor (video/graphics/text color) - additional characteristics
(1). 6500 Degree Kelvin Color Temperature

3.2.1.2.3 *Optical mark sense reader.*

The optical mark sense reader shall have the following general characteristics:

a. Optical technology used.
b. 12 inches per second scanning rate minimum
c. 8.5 X 11 inch paper size minimum
d. Bubble matrix 80 X 25 X 2 minimum
e. Optional printer/terminal interface

3.2.1.2.4 *Printers.*

The characteristics of the printers are for both color and monochrome. The specifications are:

a. Printer - Color
(1). Minimum of 4 colors (preferred is 8 colors)
(2). Support graphics (for screen dumps and general graphics/plotting capability)
(3). Bi-Directional printing (optional)
(4). Multi-Densities printing (draft, intermediate, high quality)
(5). Printing Speeds:
(a). High - 100 character per second (CPS)
(b). Low - 35 CPS
(6). Dot matrix, 100 dots per inch minimum
(7). MTBF 2000 hours minimum
(8). MTTR 0.5 hour
(9). Regular bond paper capability preferred (e.g. 20lb standard 8.5 x 11 inch bond paper)

b. Printer - Monochrome
(1). Dot matrix
(2). Impact or laser technology
(3). Minimum of 300 CPS printing speed (draft quality)
(4). Support graphics
(5). Variable pitches 6 - 16.6
(6). Resolution of 240 dots per inch minimum
(7). Draft resolution of 60 dots per inch is acceptable

(8). Bond paper single sheet feed capable
(9). Fanfold paper capable with tractors (for impact printer type)
(10). Alternate fonts (Minimum of 4)
(11). Bi-Directional printing (optional)
(12). MTBF of 5000 hours minimum
(13). MTTR of 0.5 hour
(14). Noise level not to exceed 55 db for sensitive areas

3.2.1.2.5 *Digitizer tablet.*

The digitizer tablet (or pad) characteristics are:

a. 11 X 11 inch minimum digitizing area
b. 20 X 20 inch digitizing area required for large drawing digitizing
c. Resolution of .005"
d. Accuracy of .005"
e. Cursor puck with minimum of 3 control buttons

3.2.1.2.6 *Specifications for all items.*

The following characteristics act as specifications for all items covered in this section:

a. All items must be safe to operate and handle
b. Easy to transport
c. Meet office environment (unless otherwise stated)
d. Operating temperature range:
   (1). Computer system: 65 to 75 degrees Fahrenheit
   (2). All other components: 55 to 90 degrees Fahrenheit
e. 20 to 80 percent relative humidity (non condensing)

3.2.2 *Physical characteristics.*

No special constraints exist for the prototype AOTS.

3.2.3 *Reliability.*

3.2.3.1 *Hardware and software reliability.*

A tailored reliability program shall be developed and maintained in accordance with MIL-STD-785. It shall identify and include all program management tasks in a manner that permits the economical achievement of overall program objectives. Reliability tasks shall be used to evaluate system reliability, identify problems, and recommend solutions. Quantitative reliability requirements shall be incorporated into the Reliability Plan. Specific reliability data shown in Table I shall be used as a goal for Phase II and Phase III of the AOTS program. (Since Phase IV uses the same system, the data will also apply to this phase.) Continually gathered data will be used to update this specification. With deployment of AOTS Air Force wide, the reliability data will be mandatory. The following techniques shall be used to achieve required levels of reliability.

a. Use various diagnostic routines
b. Use of automatic error checking (built into hardware)
c. Modular design (board level repair/replace)
d. Component failure messages to operators (via reports, logs, direct displayed messages, etc.)
e. Identification of impending failures (i.e., graceful degradation)

Mission reliability prediction will be performed in accordance with MIL-STD-785B, paragraph 50.2.2.3. Table 1 contains the reliability goals requirements.

Table 1. Reliability Goal Requirements for Phase II and Phase III of the AOTS Program

Parameter	Threshold	Estimate
MTBF MTBDE	250 Hours 400 Hours	400 Hours TBD
Mission Reliability	96.5%	97.5%

Table 2 provides reliability and maintainability quantitative definitions.

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Table 2. Definitions of Reliability and Maintainability Parameters

Parameter	Definition
Mean Time Between Downing Events (MTBDE)	Based on no greater than five terminals being down at one time.
Mean Time Between Failure (MTBF)	The mean time between relevant failures excluding preventive maintenance.
Mission Reliability	The ability of an item to perform its required functions for the duration of a specified mission profile. (Includes equipment and functional redundancies, BITE, and support equipment.)
Mean Preventive Time (Mpt)	The mean time to perform preventive maintenance on the system.
Mean Time To Repair (MTTR)	The mean time to perform corrective maintenance on the system.
Mean Time Between Maintenance (MTBM)	The mean time between maintenance actions-either corrective or preventive.
Administrative Delays (Adt)	The mean time involved in supporting the maintenance activity (e.g., Paperwork, etc.).
Logistics Delay Time (Ldt)	The mean time involved in providing items to the maintenance activity (e.g., the time to deliver parts, etc.).
Mean Maintenance Time (M)	Mpt + MTTR
Mean Maintenance Down Time (MDT)	(MTTR + Mpt) + (Adt + Ldt)
Mean Time to Restore (MTR)	MTTR + mean time to restart program
Operational Availability (Ao)	$A_o = \frac{MTBM}{MTBM + MDT}$ (Adt = 4 Ldt = 0)

Software standards, testing, and quality assurance are pertinent to software reliability. An AOTS Software Development Plan shall be maintained to describe these methodologies. Accepted computer programming standards, in accordance with the AOTS Software Development Plan and Computer Programming Standards Manual, shall be strictly adhered to in software development. Software testing shall be performed on the unit, program, and system level. This testing shall be in accordance with the AOTS Software Development Plan and Computer Software Test Plan. A software quality assurance plan shall ensure that reliable software, which fulfills AOTS requirements, is maintained throughout the software life cycle. In addition to these methodologies, the following techniques shall be used to achieve required levels of reliability for software:

a. Data validity checking
b. Hardware and software error recognition (exception handling)
c. Program failure messages to operators
d. Avoidance of failed hardware (degraded mode of operation).

3.2.3.2 *System reliability.*

AOTS shall be designed to ensure system reliability. System reliability, aside from hardware and software concerns, shall be tested at the user interface level during the development and implementation of AOTS. System reliability issues center around the concern users have for the consistency and accuracy of output after input has been processed. The users will also be concerned about how easily system corrections can be made if processing problems are discovered. Users of AOTS will review trainee and system status data to determine if the system, as designed, is working consistently and accurately (i.e., reliably). For example, if trainees are failing Quality Control evaluations at unacceptable rates, then it is apparent that AOTS is not functioning properly (i.e., it is not consistent: trainees are being certified but cannot perform their tasks). This information triggers the problem-solving process. Maintainability allows the user to trace effects to causes for this phenomenon (see 3.2.4 below).

3.2.4 *Maintainability.*

The following factors are an AOTS requirement in the design evolution of the AOTS maintenance concept with MIL-STD-470, MIL-STD-421, and MIL-STD-1472 used as guides:

a. Use of built-in tests for both rapid detection, isolation and correction of failures.
b. Use of functional reverification to ensure proper operation.
c. Use of standard tools and equipment to maximize interchangeability; or
d. Exchange of failed items.
e. Use of modular design to enhance diagnostic capabilities.

Also see Table 2 for some of the information on maintainability that is normally associated or works in conjunction with reliability.

3.2.4.1 *Hardware malfunctions.*

Hardware system malfunctions shall be repaired on-line by the removal and replacement of modules, assemblies, or complete terminals as appropriate. BIT and computer diagnostics shall be employed to the maximum possible extent to facilitate identification and replacement of failed modules or assemblies. The first-line maintenance shall also include all scheduled preventive maintenance tasks. Second-line maintenance, which includes repair by replacement of faulty cards or circuit boards, shall be accomplished on-site for the host computer system. Second-line maintenance on terminals may be effected off-site by the designated repair authority. All third-line maintenance, which includes component removal and replacement, shall be effected off-site by the designated repair authority.

3.2.4.2 *Maintainability requirements.*

Maintainability requirements shall not be construed so as to impose design constraints on off-the-shelf hardware. Records shall be maintained on/for:

a. A tracking system
b. Location of equipment
c. Quantity of equipment at a location

The specifications in Table 3 for the maintainability of the system, its components, and subsystems shall apply.

Table 3. Maintainability Specifications

Parameter	Threshold
MTTR on the System 90% upper limit to repair	1.5 Manhours 2.5 Manhours
Mean-Time-To-Restore the system 90% upper limit to restore	0.5 Manhours 1.0 Manhours
Mean-Time-To-Remove and Replace 90% upper limit to remove and replace	0.4 Manhours 1.25 Manhours
Direct maintenance manhours per equipment operating hour	0.05 Hours
Response time to site of failure	4.0 Hours
Principal Period of Maintenance	16 hours / day 7 days per week
Off line maintenance average MTTR 90% upper limit to repair	1.5 Manhours 6.0 Manhours
Mean preventive maintenance time	3 Hours
Mean Maintenance Time	3.4 Hours
Logistic delay time	4 Hours (90%tile)
Maximum corrective maintenance time	8 hours
Administrative delay time	2 hours
Maintenance downtime	7.4 hours
Maintenance manhours/month	6 hr/mo.
Frequency of Preventive Maintenance	1 time per month per workcenter

3.2.4.3 *Maintenance techniques.*

Maintenance on the system can be accomplished using the following techniques:

a. Maintenance contracts with vendors
b. Time and material billing for repair of equipment
c. Prime contractor's maintenance personnel
d. Other (must be identified in the maintance plan)

3.2.4.4 *Software maintainability.*

The computer system component of the AOTS system must have periodic software backup performed. The following specification applies:

a. Weekly complete backups of all data stored on disk drives
b. Daily backup on changed files only

The previous weekly backups must be kept in a separate location from the computer location. All software master copies of vendor supplied software must be backed up and kept at a different location. Software maintenance shall also include the following functions:

a. Installation of new software or updates

b. Restoration of all data should a failure in the disk subsystem occur or a system "crash" occur resulting in loss of all data on a disk subsystem

3.2.4.5 *System maintainability.*

AOTS shall be designed to ensure system maintainability. System maintainability, with the exception of software and hardware, shall be tested at the user interface level during the development and implementation of the prototype AOTS. A key aspect of maintainability is traceability. For hardware and software, documentation allows one to trace from effects back to causes. Similarly, AOTS products shall be associated with one another by referential, or linking, identifiers. For example, task information shall be linked to behavioral objectives, behavioral objectives to test items, test items to evaluation instruments, etc. These connections provide a context for any one element and can help those responsible for system maintainability to adapt the system to changing conditions or to isolate deficiencies that result in unreliable outputs. As system deficiencies are detected through the use of system reports, problem areas can be identified and solutions recommended. These solutions shall be tested, new data collected, and system reports generated. This cycle of monitoring for reliable outputs (i.e., reviewing reports), documenting changes, and monitoring again is the application of maintainability, or maintenance. Following the installation of the prototype AOTS, systems reports shall serve as the primary mechanism for maintainability.

3.2.5 *Availability.*

The availability specification in Table 4 applies to the AOTS system.

Table 4. Availability Specification

Parameter	Threshold
System wide availability	95%
Computer System Component availability	96.5%
Terminal Component Availability	98%
Printer Components Availability	98%
Digitizer Pad Component Availability	99%

Availability status reports shall be made periodically by the Prime contractor.

3.2.6 *System effectiveness model.*

The report generation capabilities of the Evaluation Subsystem shall be designed to ensure system effectiveness. Data resulting from system functions at all levels of the AOTS shall be collected and used in the generation of status reports. Computer-supported functions within the Evaluation Subsystem shall collect, maintain, and report status data to system managers, allowing an assessment of the effectiveness of AOTS. Data summaries and reports shall provide an analysis of both trainee and system status data compared to AOTS performance standards established by the

contractor in conjunction with the Air Force. These reports can be used to identify what is working well and where deficiencies or problem areas exist. System reports generated by the Evaluate System Component shall include standard reports generated at periodic intervals for prespecified recipients to address specific AOTS performance aspects or concerns. Specific data types contained in these reports shall include: task training and performance evaluation data; ancillary and additional duty training and performance data; and career development course training and performance data. The report generation capabilities of the Evaluation Subsystem and system testing during development and implementation shall provide the basis for the program evaluation of AOTS.

Formative and summative testing shall be based on the Criteria Acquisition Model (CAM), a classic, widely used model from program evaluation literature. However, due to the limited number of the prototype AOTS participants a real classical scientific research program can not be achieved. As such, a semi-scientific approach with the CAM shall be designed to provide systematic, comprehensive evaluation of a large scale system as it progresses through its development and test stages. The CAM model shall be used in developing the Master Test Plan.

The central notion of the model is that there are distinct evaluation stages in the life of a development product and that it is possible to specify criteria that must be met before the product can be advanced to the next stage of development. There are three facets of the CAM as adapted to AOTS:

a. The formal stages of the program (Phase II and Phase III)

b. The criteria domains that will be used as the basis for the evaluation (Compliance, Performance, Acceptability, and Suitability)

c. The various audiences for the evaluation, i.e., the people who must be satisfied by the system (AOTS developers and operators, AOTS end product users, and Air Force Management)

These three facets continually intersect to provide testing points. This model will ensure relevant testing for system effectiveness during detailed development and System Level Test and Evaluation (SLT&E or Phase III). The information resulting from system reports can be used to support future AOTS requirements (i.e. for Full Scale Engineering Development - FSED).

3.2.7 *Environmental conditions.*

The environmental conditions for the AOTS system shall be:

a. Phase II Office environment

b. Phase III Office environment

Office environment specifications shall be within standard limits of commercially available off-the-shelf equipment. The limits in Table 5 shall apply as acquisition goals for the system.

Table 5. System Component Environment Limits

Component	Op. Temp. Range (Degrees)	Non-Op. Temp. Range (Degrees)	Rel. Hum. %
Computer System	65 - 75 F	50 - 100 F	20 - 80
Terminal	55 - 90 F	45 - 100 F	20 - 80
Printer	55 - 90 F	45 - 100 F	20 - 80
Digitizer Pad	60 - 85 F	45 - 100 F	20 - 80
Optical Mark Reader	60 - 85 F	45 - 100 F	20 - 80

The overall approach for the Phase II and Phase III will be to use off-the-shelf equipment designed for an office environment.

3.2.8 *Nuclear control requirements.*

This paragraph is not applicable to this specification.

3.2.9 *Transportability.*

The AOTS equipment shall be transportable within the limits of commercial off-the-shelf equipment. The following specifics shall be applied to each component:

a. The computer system shall be able to be transported using air ride vans. All major components of the computer system that are floor standing units shall have casters with the exception of the line printer.

b. The AOTS Terminal shall be capable of being moved, in component pieces, by a single person. No single component shall exceed 50 pounds in weight.

c. The printers used shall all be capable of being moved and not exceed 50 pounds in weight.

d. All optical mark readers shall be capable of being moved and not exceed 50 pounds in weight.

e. All digitizer pads shall be capable of being moved and not exceed 50 pounds in weight.

f. All other items used on AOTS shall be capable of being moved and any single item shall not exceed 50 pounds in weight.

g. All items shall be capable of being moved using a dolly type device. All protruding items shall be capable of being removed for ease of moving and safety during moving.

h. Only standard type power plugs shall be used for ease of power relocation. No hard wiring of power shall be permitted (must have connector/plug arrangement for power).

3.3 Design and construction.

3.3.1 *Materials, processes, and parts.*

This paragraph is not applicable to this specification.

3.3.2 *Electromagnetic radiation.*

The AOTS system off-the-shelf components shall comply with the FCC regulations Part 15, subpart J, class A through C (as applicable to each component). There are no TEMPEST requirements for AOTS.

3.3.3 *Nameplates and product marking.*

Nameplates and product markings of off-the-shelf items shall conform to standard commercial practice.

3.3.4 *Workmanship.*

The workmanship used on off-the-shelf items shall conform to standard commercial practice.

3.3.5 *Interchangeability.*

In order to enhance interchangeability of all items in the AOTS system, component standardization is a requirement. In particular, the standardization of the AOTS terminal, (including the basic unit component, electronic support cards, monitors, etc.), is a requirement. Use of equipment that is currently in the United States Air Force's Integrated Logistics System (ILS) is strongly encouraged where applicable. Particular emphasis is placed on the AOTS terminal(s) and support equipment. The use of a validated Ada compiler is necessary to ensure highly transportable software and interchangeability of software modules with existing AOTS specific software and future AOTS software. All AOTS specifically developed software shall use modular construction techniques. Stand alone software modules shall be used wherever possible. Reuse of software, where applicable, is required.

3.3.6 *Safety.*

All equipment shall be safe to use and transport. The system with its equipment shall be designed or chosen to preclude injury of personnel during installation, operation, and maintenance. System safety considerations and design features shall be incorporated where appropriate. Any system component cannot exceed 70 db noise level without use of:

a. A special room to house the system or:
b. Sound absorbing cabinet.

Any system component that will be used in a sensitive office environment cannot exceed 55 db noise level.

3.3.7 *Human performance/human engineering.*

The provisions of MIL-STD-1472 and MIL-H-46855 shall be used to establish an effective Human Engineering Program. The Human Engineering Program established shall be planned, integrated,

and developed in conjunction with other design, development, and operational functions in a manner that permits the economical achievement of overall AOTS program objectives. Equipment design shall be evaluated to ensure that optimal man-machine interfaces are accomplished, as well as to ensure the other program objectives are accomplished for providing:

a. User Friendliness
b. Supportability

3.3.7.1 *Human Engineering Program.*

An effective Human Engineering (HE) Program shall be established and maintained throughout the period of the contract. The HE Program shall be developed in conjunction with the Maintainability Program and Reliability Program. The HE Program Plan shall provide for a documented human engineering analysis of any equipment specifically designed for the AOTS. The human engineering design factors of all existing equipment used within the AOTS shall also be reported.

3.3.7.2 *Human Engineering analysis/support.*

Human engineering analysis and support shall be maintained throughout the period of the AOTS contract. Human engineering analysis support shall be provided to designers of equipment specifically designed for the AOTS. The contractor analysis shall be conducted to aid in the selection of commercially available equipment that meets AOTS human engineering criteria. Special emphasis shall be placed on factors such as supervisor, trainer, and trainee interface with computer and peripheral devices.

3.3.7.3 *Equipment, environment, and facilities design.*

It shall be the intent to design the equipment, the work environment and the facilities to accommodate all personnel between, and including, the fifth percentile female and the ninety-fifth percentile male as anthropometrically defined in MIL-STD-1472. Optimal man-machine interfaces shall be accomplished by gathering data from such sources as: expert opinion; questionnaires detailing intended use of work space and equipment therein; industry and military human factors studies and assessments; and interviews with supervisors, trainers and trainees concerning level of understanding of computer and peripheral device usage. These data shall be analyzed, and results shall be used to meet the unique constraints imposed by job-site operation. Some of the specifics to be addressed, and accommodated in accordance with MIL-STD-1472, are lighting, noise levels, temperature and other known relevant environmental factors, distracting conditions, work space requirements, normal viewing distances, equipment placement, use of equipment, etc.

3.3.8 *Computer programming.*

Computer programs and computer data bases shall be considered as software. Software shall be categorized as support or applications software.

3.3.8.1 *General requirements.*

Software shall meet the following design, language, and coding requirements:

3.3.8.1.1 *Design requirements.*

3.3.8.1.1.1 *Computer program structure.*

The computer program structure shall consist of Computer Program Configuration Item(s), Component and Module.

a. Computer Program Configuration Item (CPCI). A CPCI is the actual computer program end item in the form of computer instructions stored on machine-readable media. A CPCI shall consist of one or more computer program components.

b. Computer Program Component (CPC). A CPC is a functionally, logically distinct part of a CPCI. A CPC is identified for purposes of convenience in specifying and developing a CPCI as an assembly of subordinate elements. A CPC consists of a logical composition of one or more subordinate or interfacing modules.

3.3.8.1.1.2 *Top Down Design (TDD).*

Software shall be designed in a top down manner. The processing activities of the system shall be identified and organized beginning with higher levels of organization, i.e., top levels. These higher levels shall then be expanded and broken out to include a more detailed definition of the processing activities by identification of subordinate levels. The lowest level of processing shall correspond to the module.

3.3.8.1.1.3 *Top Down Implementation (TDI).*

The project software shall be implemented in a top down manner as defined herein. Conceptually, top down implementation proceeds from a single starting point while conventional implementation proceeds from as many starting points as programs in the design. The single starting point does not imply that the implementation must proceed down the hierarchy in parallel. For example, user or other external interfaces might be implemented before some of the other partitions to permit early demonstration of software subsystem capabilities, partial software system evaluation, training, or even incremental software system acceptance. The project software shall be implemented in a series of RELEASES which shall provide for successive system capabilities.

3.3.8.1.2 *Programming language.*

Newly developed software for this system shall be restricted to the high order language Ada, per MIL-STD-1815A.

3.3.8.2 *Operating System (OS) requirements.*

The OS shall conform to the following requirements:

a. The OS shall be vendor-supplied, off-the-shelf package.

b. OS augmentations shall be allowed, but shall be limited to new software. No augmentations shall be permitted to be embedded within the vendor supplied OS software; a separate interface shall be provided.

c. No OS interface or augmentation software shall compromise the capability of the OS vendor to provide maintenance over the life cycle of the systems.

d. No instructions shall be executed that will cause the computer to halt processing pending an external event, except by the OS. An exception to this restriction shall be permitted for augmentations to the OS where the augmentation is designed as an extension of the processing control of the OS. The exception is subject to review and approval by the Government.

3.3.8.3 *Firmware requirements.*

Computer programs and data loaded in a class of memory that cannot be dynamically modified by the computer during processing shall be considered firmware. Data requirements on firmware shall be the same as those on software. Use of firmware shall be subject to approval by the Government.

3.3.8.4 *Software utility services.*

This support software shall provide the following minimum capabilities:

a. Compilation
b. Assembly which produces relocatable object code
c. Linking type loader
d. Generation, maintenance, and initialization of storage media for programs and data
e. Diagnostics to support fault isolation
f. Editing and debugging tools

All support software shall be executable on the AOTS.

3.3.8.5 *Message generation.*

The generation of error/diagnostic messages shall make a distinction between (1) the requirements for on-line messages to facilitate real-time fault isolation required to maintain the system in operational status and (2) the logging of fault messages onto system files for the category of faults which require isolation and correction, but which can be addressed off-line and do not degrade the system performance. The required processing time to identify and generate an error/diagnostic message either for on-line or off-line and correction shall not degrade the operational requirements of the system.

a. Processor message and advisory formats shall not require additional interpretation by the operator, such as table lookups and references to documentation, with the exception of lengthy diagnostic procedures to be followed by the operator following an abnormal condition.
b. No computer program shall generate a message or advisory identical to one generated by the OS or by another program.
c. Off-line error messages shall contain as a minimum the following information:

(1) Time error was detected.
(2) Textual description of error condition.
(3) Required operator action where applicable.
(4) Identification of triggering module.
(5) Computer program or system execution status following the error.

On-line error messages shall contain as a minimum the information in Items (1), (2), and (3) above.

3.3.8.6 *Program coding conventions.*

Software shall conform to required coding conventions stated below.

a. Each line of source code shall contain no more than one statement.
b. Source code shall be clearly and conspicuously annotated to explain all inputs, outputs, branches, and other items not implicit in the code itself.
c. Names of operator commands, data entries, program components, variables, procedures, and other software components shall be consistent with those used in system design.
d. Code shall be written such that no code is modified during execution.

3.4 Documentation.

3.4.1 *Development documentation.*

The Quality Assurance Program shall monitor the AOTS design drawings and specification releases in accordance with MIL-STD-490 and MIL-STD-483. The Quality Assurance Program shall ensure that configuration records reflect the outstanding and incorporated changes. Engineering changes shall be proposed and submitted as required. Submittals shall be subject to prior coordination with and surveillance by the Quality Assurance Program.

3.4.1.1 *Specifications.*

The specifications for AOTS are shown in Figure 10.

3.4.1.2 *Reports.*

The following reports shall be prepared for AOTS.

System/Design Trade Study Reports
Interim Technical Report
Final Technical Report
Computer Program Test Report(s)

3.4.1.3 *Plans.*

The Following plans shall be prepared for AOTS.

Computer Software Test Plan
Configuration Management Plan
Software Development Plan
Systems Engineering Management Plan
Master Test Plan
Site Preparation Requirements Equipment Installation Plan

Human Engineering Plan
Maintainability Program Plan
Reliability Program Plan

3.4.1.4 *Other.*

The following other documents shall be prepared for AOTS.

Computer Programming Standards

3.4.2 *Hardware and software product documentation.*

The following documentation is required for all commercially procured off-the-shelf components (hardware and software) from manufacturers. All documentation shall conform to best commercial practice. Where appropriate, the manufacturer's documentation shall be supplemented by commercially available documentation selected on the basis of clarity, style, presentation and completeness. For hardware components, the following documentation is required (as appropriate):

a. Reference manual(s) for all hardware items procurred unique to AOTS
b. User Manual(s) for all hardware items procurred unique to AOTS
c. Maintenance manual(s) for all hardware items procurred unique to AOTS
d. Diagnostic reference manual(s) for all hardware items procurred unique to AOTS
e. Operator manual(s) for all hardware items procurred unique to AOTS

For software components, the following documentation is required (as appropriate).

a. VAX/VMS operating system
b. VAX/VMS Ada compiler
c. VAX/VMS Fortran compiler
d. SAS reference manual(s)
e. Alsys Ada compiler
f. Ethernet Local Area Network reference manual(s)
g. Infotron 992 network reference manual(s)
h. Computer Program Source Software Listing (as required by specific AOTS specifically developed software and to be included in C5 specifications).

All documentation required to support the operation and maintenance of the AOTS program shall be maintained during the life of the program.

3.5 Logistics.

3.5.1 *Maintenance.*

The specific responsibilities of personnel and a detailed description of maintenance support shall be defined in the Maintenance Plan. AOTS Maintenance shall address requirements to achieve the following hardware maintenance goals:

a. Daily check of mainframe components, including all elements critical to support the terminal network.

b. Restoration of mainframe equipment availability with spares, whenever feasible. Repair or restoration of mainframe equipment shall be effected within established reliability standards.

c. Maintenance of peripheral equipment as recommended by the hardware vendor.

d. Repair of terminals by spare interchange until repairs can be effected. Spares shall be maintained at levels sufficient to achieve a 90% immediate replacement rate.

e. Restoration of AOTS communication line continuity shall be by exchange of circuit when feasible. Repair or restoration of communications equipment shall be effected within established reliability standards.

3.5.1.1 *Measuring and testing equipment.*

Measuring and testing equipment, used to ensure that components conform to requirements that are specified in the vendors maintenance documents and shall be calibrated against certified measurement standards which have valid relationships to standards maintained by the National Bureau of Standards (NBS). A calibrated equipment index shall be maintained for the equipment utilized. Additionally, equipment users are responsible for ensuring that necessary calibrations are in effect. The status of equipment calibration shall be indicated on the equipment and included in the Quality Assurance audit of acceptance tests. Equipment which is intended for use in developmental, repair, and maintenance activities where strict calibration is not required shall be identified as non-calibrated. The Quality Assurance Representative shall determine that the necessary certifications exist prior to returning equipment to an in-calibration status.

3.5.2 *Supply.*

During design of the prototype AOTS, maximum use of standard off-the-shelf items shall be made. In addition, the AOTS shall be designed to be maintained and repaired using standard support equipment to the maximum extent possible.

3.5.3 *Facilities and facility equipment.*

Design and construction of real property facilities will be accomplished by the government.

3.6 Personnel and training.

3.6.1 *Personnel.*

The personnel required to operate, update, and maintain the prototype AOTS shall consist of Air Force personnel, Air Force civilians, and contractor personnel. The number and functions shall be determined by the Air Force and the contractor for each phase of the AOTS program.

3.6.2 *Training.*

Training shall be conducted at Bergstrom AFB, in Building 1808 or in other suitable GFE space. The contractor shall provide training on the AOTS software and system procedures developed

to meet the requirements as specified in this and lower level specifications. Training shall occur during Phase II and possibly into Phase III. The Air Force, assisted by the contractor, shall provide training to the workcenter personnel prior to and during Phase III.

3.7 Functional area characteristics.

The functional areas within AOTS, represented by the five subsystems, were derived from the requirements that AOTS must meet to improve AF OJT. The links between these requirements and the functional areas are depicted in Figure 12 and explained in paragraphs 3.7.1 through 3.7.8. The vertical headers down the left side of Figure 12 show AF OJT requirements, and the horizontal headers across the top of the page show AOTS functions (subsystems). Descriptions of the five subsystems are given in paragraphs 3.7.9 through 3.7.13.

REQUIREMENTS	PRINCIPAL FUNCTIONS PERFORMED BY THE AOTS					BENEFITS
	MANAGEMENT SUBSYSTEM	EVALUATION SUBSYSTEM	COMPUTER SUPPORT SUBSYSTEM	COMPUTER ASSISTED TRAINING SUBSYSTEM	PERSONNEL AND SUPPORT SUBSYSTEM	
OJT Administration	Accurately identifies training for full position qualification		Provides automated training identified support, keeps training records		Identifies training requirements for system managers and users	Redirects OJT from general career development to specific position qualification. Relieves supervisor of administrative documentation burden.
OJT Management	Manages learning activities and controls progress, and schedules training.		Provides automated support for prioritizing training requirements.			Efficiently employs "big picture" training program management. More accurate capacity estimates.
Training Evaluation/ Assessment		Identifies, selects, and delivers evaluation instruments.	Provides on-line delivery, support off-line delivery, keeps evaluation and assessment records.			Enables more frequent task proficiency evaluations and unit training effectiveness assessments to ensure quality training.
System Evaluation		Performs QA and System evaluation.	Collects, stores, calculates, and delivers reports.			Enables system quality assurance and reliability checks.
Data Automation Support			Provides integrated data processing support for subsystems			Provides user-friendly single-source support.
Specification of AOTS Operational Requirements					Identifies personnel and organizational requirements for AOTS.	Provides a traceable hierarchy of the system.
Development of Evaluation and Training Materials		Identifies and develops task-specific evaluation instruments.	Supports development. Stores materials.	Develops task-specific evaluation and training materials.		Provides needed training materials/devices with efficient balance between centralization and decentralization.
Delivery of Evaluation and Training Materials		Delivers on and off line evaluation instruments.	Delivers materials and tests. Records response/progress.	Provides training on-line or prints for off-line use.		Employs new technology and efficiencies in training techniques.

Figure 12. Functional Allocation of the Advanced On-the-job Training System (AOTS)

3.7.1 *OJT administration requirement.*

The AOTS is designed to solve problems in OJT administration (planning training requirements). It changes the emphasis in OJT from general career preparation to position qualification. AOTS helps the workcenter supervisor plan training that qualifies trainees for specific positions while relieving the supervisor of much administrative paperwork.

3.7.1.1 *Management Subsystem function.*

The function of the Management Subsystem is to assist the workcenter supervisor in making accurate selections of duty position tasks and in determining current training requirements. These training requirements include:

a. Day-to-day production requirements

b. Wartime/contingency task requirements (e.g., operating field radio gear, converting a bus to an emergency medical facility in the event of natural disaster).

c. Career Development Course requirements

d. Additional duty training requirements (e.g., supply custodian, building custodian, security monitor, etc.)

e. Ancillary training requirements (e.g., Protection of the President, Standards of Conduct, etc.)

3.7.1.2 *Computer Support Subsystem function.*

The functions of the Computer Support Subsystem are to:

a. Simplify the supervisor's job of determining specific training requirements for full position qualification by providing automated support;

b. Identify and manage training requirements for full position qualification, and hold constant the quality of training across positions;

c. Reduce administrative paperwork involved in recording training progress.

3.7.1.3 *Personnel and Support Subsystem function.*

The function of the Personnel and Support Subsystem is to identify task and training requirements for the management and operation of AOTS.

3.7.2 *OJT management requirement.*

The AOTS is designed to solve problems in OJT management. The supervisor is helped to maintain a global perspective on the status of training, trainers, evaluators, and trainees.

3.7.2.1 *Management Subsystem function.*

The functions of the Management Subsystem are to:

a. Assist with planning individual and group OJT programs to achieve mission objectives and field requirements without duplication of effort (i.e. knowledge of available training more widely dispersed);

b. Assist with determining OJT capability and capacity by identifying training resources (people, places, materials); qualified trainers are identified and training events are scheduled;

c. Promote mission capability and state of readiness as a result of single-point management.

3.7.2.2 *Computer Support Subsystem function.*

The function of the Computer Support Subsystem is to provide automated and automatic support for the Management Subsystem functions. For OJT management, it automatically prioritizes the training plan based on the training capability and capacity of AOTS at a given point in time. Schedules are automatically generated.

3.7.3 *Training evaluation/assessment requirement.*

Good quality training must be encouraged. With AOTS, this is promoted because there are frequent task proficiency evaluations and because unit training effectiveness is assessed.

3.7.3.1 *Evaluation Subsystem function.*

The functions of the Evaluation Subsystem in support of this requirement are to identify, select, and deliver evaluation instruments. Proficiency evaluations are sampled from all available tasks rather than from a small group of the most commonly performed ones. Evaluations can be administered on- or off-line.

3.7.3.2 *Computer Support Subsystem function.*

The functions of the Computer Support Subsystem are to:

a. Provide support for on-line evaluation or printing tests for off-line use; and
b. Store test results and keep records for tracking individual as well as unit progress and efficiency.

3.7.4 *System evaluation requirements.*

There is a need for quality control over OJT. AOTS enables system quality assurance and provides *reliability checks.*

3.7.4.1 *Evaluation Subsystem function.*

The functions of the Evaluation Subsystem are to:

a. Provide performance analyses to managers which show system effectiveness; and
b. Randomly select individuals for testing to provide quality control over the training process.

3.7.4.2 *Computer Support Subsystem function.*

The function of the Computer Support Subsystem is to assist the Evaluation Subsystem with the collection, storage, calculation, and delivery of reports.

3.7.5 *Data automation support requirement.*

There is a need in AF training to maintain a single point of control over resource scheduling and training requirements.

3.7.5.1 *Computer Support Subsystem function.*

The Computer Support Subsystem promotes the linkage of the subsystems to one another. This encourages data integrity and the avoidance of data duplication. It also maintains a central point for reporting of extraction of OJT information.

3.7.6 *Specification of AOTS operational requirements.*

The AOTS development effort shall provide for the transition of the prototype to the AF and its expansion to other AF bases.

3.7.6.1 *Personnel and Support Subsystem function.*

The Personnel and Support Subsystem shall support four main functions to fulfill AOTS operational requirements.

3.7.6.1.1 *Personnel requirements function.*

The Personnel and Support Subsystem shall be used to determine personnel requirements for designing, developing, maintaining, and operating the prototype AOTS.

3.7.6.1.2 *Logistics support requirements function.*

The Personnel and Support Subsystem shall be used to determine logistics requirements in maintenance support (part-task trainers, study carrels, etc.) and computer support maintenance (computer equipment).

3.7.6.1.3 *Maintainability, reliability, and human factors requirements function.*

The Personnel and Support Subsystem shall be used to determine maintainability, reliability, and human factors requirements for the AOTS.

3.7.7 *Development of evaluation and training materials requirement.*

There needs to be a method for developing evaluation and training materials which are homogeneous across AFSs, but which can also reflect local requirements.

3.7.7.1 *Evaluation Subsystem function.*

The function of the Evaluation Subsystem is to support the development of behavioral objectives, test items, and tests in accordance with the ISD approach. These can be constructed to reflect global needs as well as the peculiarities of certain locations/conditions.

3.7.7.2 *Computer Support Subsystem function.*

The function of the Computer Support Subsystem is to support the preparation/selection of objectives, test items, and tests in a user-friendly manner.

3.7.7.3 *Training Development and Delivery Subsystem function.*

The function of this subsystem is, in addition to supporting test development, to support the development of on-line instructional materials and their delivery. These materials can be constructed to reflect global needs as well as the peculiarities of certain locations/conditions.

3.7.8 *Delivery of evaluation and training materials requirement.*

OJT must be more efficient in the delivery of training materials.

3.7.8.1 *Evaluation Subsystem function.*

The function of the Evaluation Subsystem is to evaluate personnel on-line and off-line for task requisite knowledge (i.e., knowledge that an individual must have in order to perform the task) and performance skills (i.e., the requirements for performing the task).

3.7.8.2 *Computer Support Subsystem function.*

The functions of the Computer Support Subsystem are to deliver training materials and tests, and to record trainee responses and progress, in order to improve the efficiency of OJT.

3.7.8.3 *Training Development and Delivery Subsystem function.*

The function of this subsystem is to train personnel on-line for task requisite knowledge.

3.7.9 *The Management Subsystem.*

The knowledge and performance requirements necessary to support accomplishment of Air Force mission responsibilities assigned to the enlisted force shall be implemented within this subsystem. It is within this subsystem that training requirements needed to qualify enlisted members in their assigned jobs shall be defined and managed. The Management subsystem shall be comprised of three major components: 1) the Training Requirements Management Component, 2) the Airman Training Management Component, and 3) Maintain Resource Inventories and Schedule Events Component. These components shall comprise three computer-based management methodologies: 1) a methodology for identifying Air Force Speciality (AFS) and other training required to achieve position qualification within an assigned operation duty position; 2) a methodology for managing and recording airman training progress toward task proficiency and position qualification within an operation duty position, and 3) a methodology for identifying performance, training, and evaluation resources and scheduling training. A detailed description of this subsystem is found in Specification 70S647100.

3.7.10 *The Evaluation Subsystem.*

The Evaluation Subsystem shall provide a computer-based development and implementation process, within which evaluation materials and procedures shall be developed. The Evaluation Subsystem shall assess both task proficiency and trainee knowledge. It shall also collect and analyze data that is related to the efficiency and cost-effectiveness of job-site training. This subsystem shall present, store, distribute, and limit access to computer-based evaluation data and generate all system evaluation reports. The subsystem shall be composed of four components: 1): the Manage Evaluation Instrumentation Component; 2) the Evaluate Performance Component; 3) the Apply Training Quality Control Component and 4) the Evaluate System Component. A detailed description of this subsystem is found in Specification 70S647300.

3.7.11 *The Computer Support Subsystem.*

This subsystem shall be the computer hardware and software required to support the management, development, delivery, and evaluation of job-site training and performance evaluation within Air Force OJT. The other four subsystems within AOTS shall provide requirements/needs for

hardware, software, and database needs. The Computer Support Subsystem, in turn, shall provide the computer hardware equipment, automated software services, and the repository space for data necessary to satisfy the AOTS requirements of the other subsystems. This subsystem shall be composed of two components: 1) the Hardware Component, and 2) the Software Component. A detailed description of this subsystem is found in Specification 70S647400.

3.7.12 *The Personnel and Support Subsystem.*

This subsystem shall identify and designate the personnel required to perform the jobs created or changed by the other AOTS subsystems. It shall identify maintenance support requirements for training devices and associated computer hardware. The subsystem shall be composed for two components: 1) the Logistic Support Requirements Component; and 2) the Maintainability, Reliability, and Human Factors Requirements Component. A detailed description of this subsystem is found in Specification 70S647500.

3.7.13 *The Training Development and Delivery Subsystem.*

This subsystem shall provide a computer-based, interactive, instructional materials development process for writing, evaluating, and revising appropriate training materials. It shall also provide for computer presentation, storage, distribution, and access control of training materials. The training materials development environment shall be supportive of requirements imposed by AFM 50-2 and AFR 30-17, unless deviations from such regulations and manuals have been approved by the AF. Training materials developed shall be stored and delivered in support of trainee position qualification. Access control of training materials shall comply with requirements set forth in AFR 205-1. Individual trainee assignments shall be generated which are predicated on current trainee position qualification status. Data reflecting individual training status shall be generated as training and evaluation events occur. The subsystem shall be composed of two components: 1) the Training Development Component, and 2) the Training Delivery Component. A detailed description of this subsystem is found in Specifications 70S647200, 70S647201, and 70S647202. This subsystem will make maximum use of the ISS software that will be provided by the Government.

3.8 Precedence.

This specification shall take precedence over any document referenced herein. The contracting activity shall be notified immediately of each instance of conflicting, or apparently conflicting, requirements.

4 QUALITY ASSURANCE PROVISIONS

4.1 General.

The quality assurance provisions of this section shall be directed towards verifying compliance with the system requirements stated in this specification. All verifications/acceptance activities shall be accomplished as prescribed in this section, unless expressly waived by the government. There will be two types of testing of AOTS. The first type ensures that the system hardware and software perform as specified in Section 3 of the specification. That is, the system should operate as specified and should meet all performance requirements. The second type of testing is the proof-of-concept for the system. The concept must be tested that AOTS meets the OJT requirements for the AF. This is done by continual monitoring of the prototype AOTS as it is incrementally developed and activated at the test sites (Bergstrom AFB and Ellington ANGB). By administering questionnaires and interviews to workcenter managers, instructional design personnel, and other relevant subjects, as well as through other testing methods, the detailed design of AOTS can be modified to more closely fit AF needs and enhance the ability of AOTS to meet OJT needs AF wide. Tests shall be conducted at Bergstrom AFB and at Ellington ANGB, both in Texas. There are four critical issues in regard to testing AOTS. These issues rise [illegible]

the proper functioning of system hardware and software and are exclusive of hardware and software testing alone. They relate to a system's overall capability and must be addressed in an evaluation of the system, as a whole. Furthermore, they are of primary importance to the decision authority for AOTS.

a. Critical Issue No. 1: Compliance - whether the prototype AOTS meets the system specification requirements.

Supporting Rationale - The critical question associated with compliance is:

(1). Does the prototype AOTS meet the requirements of the system specification, while operating in an operational environment? This is followed by the following subquestions:

(a). Does AOTS provide the required interfaces with external entities (system specification sections 3.1.5.1.1-2, 3.1.5.1.4-6, and 3.1.5.1.8-10)?

(b). Does AOTS meet the response performance goals (system specification section 3.2.1.1)?

(c). Does AOTS meet the hardware reliability goals (system specification section 3.2.3.1)?

(d). Does AOTS meet the hardware maintainability goals (system specification section 3.2.4.2)?

(e). Does AOTS provide required system availability (system specification section 3.2.5)?

b. Critical Issue No. 2: Performance - whether the prototype AOTS is more effective and efficient than conventional OJT.

Supporting Rationale - The critical questions associated with performance are:

(1). Do trainees achieve position qualification at a faster rate under the prototype AOTS? This is followed by the following subquestions:

(a). Do trainees become position qualified sooner under AOTS than under conventional OJT?

(b). Does the AOTS improve the rate at which airmen progress toward position qualification?

(2). Do those trainees who are trained under the prototype AOTS perform better in duty position tasks? This is followed by the following subquestion:

(a). Does the AOTS improve the performance of airmen on quality control and other standard evaluations?

(3). Do the workcenters using the prototype AOTS contribute more to mission readiness? This is followed by the following subquestion:

(a). Do the repeat maintenance actions within the aircraft maintenance workcenters decrease after the AOTS is implemented?

(4). Do the workcenters using the prototype AOTS contribute more to mission readiness? This is followed by the following subquestions:

(a). Do base crime statistics attributed to the applicable security police workcenters improve after the AOTS is implemented?

(b). Do supervisors feel that they contribute more to mission readiness, as a result of AOTS implementation?

(5). Does the prototype AOTS require less time for management of AFS related training? This is followed by the following subquestion:

(a). How much time is spent managing AFS related training under the AOTS vs. conventional OJT?

(6). Do users feel that training under the prototype AOTS is more effective? This is followed by the following subquestion:

(a). Do users feel that trainees who have been trained under the AOTS are more capable of performing AFS task requirements than trainees trained under conventional OJT?

c. Critical Issue No. 3: Suitability - whether the prototype AOTS solves the problems experienced with conventional OJT and is suited for deployment throughout the Air Force.

Supporting Rationale - The critical questions associated with suitability are:

(1). Does the prototype AOTS result in more time spent on AFS task training, for those airmen who are not yet fully position qualified? This is followed by the following subquestion:

(a). Does the time spent on task training increase under AOTS?

(2). Are supervisors better able to determine training and evaluation requirements under the prototype AOTS than under conventional OJT? This is followed by the following subquestions:

(a). Do supervisors feel they are better able to determine training and evaluation requirements under AOTS than under conventional OJT?

(b). Do the AOTS documents enable supervisors to do a better job of determining training and evaluation requirements?

(3). Are supervisors better able to determine trainee qualifications under the prototype AOTS than under conventional OJT? This is followed by the following subquestions:

(a). Do supervisors feel the prototype AOTS helps them to determine trainee qualifications?

(b). Do supervisors use the AOTS products in determining trainee qualifications?

(4). Does the prototype AOTS provide standardized methods for evaluating task performance in an operational setting? This is followed by the following subquestions:

(a). Do the AOTS evaluation methods meet the needs of the workcenters?

(b). Does the AOTS provide standardized evaluation products and processes for the operational setting of OJT?

(5). Does the prototype AOTS compensate for the limited availability of operational equipment for training? This is followed by the following subquestions:

(a). Is the availability of operational equipment a problem for training?

(b). Does the prototype AOTS provide effective methods to compensate for the limited availability of operational equipment for training?

(5). Does the prototype AOTS provide improved capabilities for managing the availability of qualified trainers? This is followed by the following subquestion:

(a). Do users feel that the prototype AOTS provides improved capabilities for managing the availability of qualified trainers, as compared with conventional OJT?

(6). Does the prototype AOTS enhance trainer effectiveness? This is followed by the following subquestions:

(a). Do users feel that the prototype AOTS enhances trainer effectiveness?

(b). Do the AOTS products and processes make trainers more effective?

(7). Does the prototype AOTS reduce the administrative burden associated with the management of training? This is followed by the following subquestions:

(a). Do users feel that the prototype AOTS reduces the administrative burden associated with the management of training?

(b). Do users spend less time on administrative jobs related to management of training under AOTS than under conventional OJT?

(8). Does the prototype AOTS provide improved capabilities for implementing state-of-the-art instructional technology into the operational environment? This is followed by the following subquestions:

(a). Do users feel that the prototype AOTS provides improved capabilities for implementing instructional technology into the operational environment?

(b). Does AOTS provide state-of-the-art instructional technology for OJT?

(9). Can the prototype AOTS be deployed to the operational workcenters? This is followed by the following subquestion:

(a). Do users of the prototype AOTS feel the prototype AOTS can be deployed to the operational workcenters?

d. Critical Issue No. 4: Acceptance - whether the prototype AOTS is user friendly and liked by the users.

Supporting Rationale - The critical questions associated with acceptance is:

(1). Do users of the prototype AOTS like the capabilities that are provided for managing training? This is followed by the following subquestions:

(a). Are the capabilities provided adequate for managing training within the AOTS workcenters?

(b). Do the users like the management products generated by the AOTS?

(c). How satisfied are users with the training they received on operating the AOTS management programs and maintaining management data?

(2). Do users of the prototype AOTS like the capabilities that are provided for delivering training? This is followed by the following subquestions:

(a). How satisfied are users with the capabilities provided for authoring training materials?

(b). How satisfied are users with the functions of the training delivery programs?

(c). How satisfied are users with the training they received on operating the training delivery programs?

(3). Do users of the prototype AOTS like the capabilities that are provided for evaluating training? This is followed by the following subquestions:

(a). How satisfied are users with the capabilities provided for evaluating training?

(b). How satisfied are users with the functions of the evaluation programs?

(c). How satisfied are users with the training they received on operating the AOTS evaluation programs?

4.1.1 *Responsibility for tests.*

The contractor shall be responsible for conducting all tests. Both contractor and AF personnel shall conduct and participate in tests. A determination shall be made, through negotiations between the AF and the contractor, which tests will require AF participation and the level of participation required.

4.1.2 *Special tests and examinations.*

This section is not applicable to this specification.

4.2 Quality conformance inspections.

Verification of the requirements of section 3 of this specification shall include the use of inspection, analysis, test, and demonstration (or evaluation). Verification shall be accomplished in accordance with the Software Test Plan and the Master Test Plan.

4.2.1 *Test matrix.*

The test matrix, Table 6, establishes the inspection, analysis, test, and demonstration (evaluation) requirements for each of the requirements specified in section 3. All verifications shall be conducted to satisfy as many matrix entries as possible.

Table 6. Quality Conformance Methods

Section	N/A	Inspection	Analysis	Test	Demonstration
3	X				
3.1		X			
3.1.1		X			
3.1.2		X			
3.1.3	X				
3.1.4		X			
3.1.5		X			
3.1.5.1		X			
3.1.5.1.1		X			
3.1.5.1.2		X			
3.1.5.1.3		X			
3.1.5.1.4		X			
3.1.5.1.5		X			
3.1.5.1.6		X			
3.1.5.1.7		X			
3.1.5.1.8		X			
3.1.5.1.9		X			
3.1.5.1.10		X			
3.1.5.1.11		X			
3.1.5.1.12		X			
3.1.5.1.13		X			
3.1.5.1.14		X			
3.1.5.1.15		X			
3.1.5.1.16		X			
3.1.5.1.17		X			
3.1.5.2		X			
3.1.5.2.1		X			
3.1.5.2.2		X			
3.1.5.2.3		X			
3.1.5.2.4		X			
3.1.5.2.5		X			
3.1.5.2.6		X			
3.1.5.2.7		X			
3.1.5.2.8		X			
3.1.5.2.9		X			
3.1.5.2.10		X			
3.1.5.2.11		X			
3.1.5.2.12		X			
3.1.5.2.13		X			
3.1.5.2.14		X			
3.1.5.2.15		X			
3.1.5.2.16		X			

Table 6. Quality Conformance Methods, cont.

Section	N/A	Inspection	Analysis	Test	Demonstration
3.1.5.2.17		X			
3.1.5.2.18		X			
3.1.5.2.19		X			
3.1.5.2.20		X			
3.1.6	X				
3.1.6.1		X			
3.1 6.2		X			
3.1.6.2.1		X			
3.1.6.2.1.1		X			
3.1.6.2.1.2		X			
3.1.6.2.2		X			
3.1.6.2.3		X			
3.1.6.? 3.1		X			
3.1.6.2.3.1.1		X			
3.1.6.2.3.1.2		X			
3.1.6.2.3.1.3		X			
3.1.6.2.3.1.4		X			
3.1.6.2.3.1.5		X			
3.1.6.2.3.2		X			
3.1.7	X				
3.1.7.1	X				
3.1.7.2	X				
3.1.7.3	X				
3.2	X				
3.2.1	X				
3.2.1.1				X	
3.2.1.2		X			
3.2.1.2.1		X			
3.2.1.2.2		X			
3.2.1.2.3		X			
3.2.1.2.4		X			
3.2.1.2.5		X			
3.2.1.2.6		X			
3.2.2	X				
3.2.3	X				
3.2.3.1			X		
3.2.3.2		X			
3.2.4	X				
3.2.4.1	X				
3.2.4.2			X		
3.2.4.3		X			

Table 6. Quality Conformance Methods, cont.

Section	N/A	Inspection	Analysis	Test	Demonstration
3.2.4.4		X			
3.2.4.5		X			
3.2.4.6	X				
3.2.5			X		
3.2.6		X			
3.2.7		X			
3.2.8	X				
3.2.9		X			
3.3	X				
3.3.1	X				
3.3.2	X				
3.3.3		X			
3.3.4		X			
3.3.5		X			
3.3.6		X			
3.3.7					X
3.3.7.1		X			
3.3.7.2		X			
3.3.7.3		X			
3.3.8		X			
3.3.8.1	X				
3.3.8.1.1	X				
3.3.8.1.1.1		X			
3.3.8.1.1.2		X			
3.3.8.1.1.3		X			
3.3.8.1.2		X			
3.3.8.1.3		X			
3.3.8.2		X			
3.3.8.3		X			
3.3.8.4		X			
3.3.8.5		X			
3.3.8.6		X			
3.4	X				
3.4.1	X				
3.4.1.1		X			
3.4.1.2		X			
3.4.1.3		X			
3.4.1.4		X			
3.4.2		X			
3.5	X				
3.5.1		X			
3.5.1.1		X			
3.5.2		X			

Table 6. Quality Conformance Methods, cont.

Section	N/A	Inspection	Analysis	Test	Demonstration
3.5.3		X			
3.6	X				
3.6.1	X				
3.6.1.1		X			
3.6.1.2		X			
3.6.1.3		X			
3.6.2		X			
3.7	X				
3.7.1		X			
3.7.1.1		X			
3.7.1.2		X			
3.7.1.3		X			
3.7.2		X			
3.7.2.1		X			
3.7.2.2		X			
3.7.2		X			
3.7.2.1		X			
3.7.2.2		X			
3.7.4		X			
3.7.4.1		X			
3.7.4.2		X			
3.7.5	X				
3.7.5.1		X			
3.7.6		X			
3.7.6.1		X			
3.7.6.1.1		X			
3.7.6.1.2		X			
3.7.6.1.3		X			
3.7.6.1.4		X			
3.7.7		X			
3.7.7.1		X			
3.7.7.2		X			
3.7.7.3		X			
3.7.8		X			
3.7.8.1		X			
3.7.8.2		X			
3.7.8.3		X			
3.7.9		X			X
3.7.10		X			X
3.7.11		X			X
3.7.12		X			X
3.7.13		X			X
3.8	X				

4.2.2 *Verification definitions.*

a. Inspection is defined as the examination by visual or other equivalent means to determine conformity to specified requirements or performance characteristics. The criterion of acceptance for each inspection item will be expert consensus or equivalent, as agreed upon by the contractor and Air Force PM.

b. Analysis is defined as the determination of conformity to specified requirements or performance characteristics by use of descriptive data gathering, analysis, and interpretation techniques. The criterion of acceptance for each analysis item will be a quantifiable measure or composite measure as agreed upon by the contractor and Air Force PM.

c. Test is defined as the determination of conformity to specified requirements or performance characteristics under controlled conditions with specified inputs, outputs, and data analysis methods or procedures. The criterion of acceptance for each test item will be a quantifiable measure or composite measure, to a specified statistical probability level, as agreed upon by the contractor and the Air Force PM.

d. Demonstration is defined as determination of conformity to specified requirements or performance characteristics under controlled or uncontrolled conditions, with specified inputs, outputs, and data analysis methods or procedures. Additionally, demonstration may include the variation of inputs and the determination of resultant differential outputs and consequences, and may include either descriptive or statistical treatments of individual or composite data measures. The criterion for acceptance of each evaluation item will be a quantifiable measure, composite measure, index, or profile configuration as agreed upon by the contractor and Air Force PM.

5 PREPARATION FOR DELIVERY

5.1 General requirements.

The equipment shall be packaged for protection against corrosion, other forms of deterioration, and physical damage during shipment from the manufacturer's plant to the point of destination. The protection processes to be used shall be the minimum required for adequate protection under the conditions of normal handling, shipment by common carrier and anticipated storage. Best commercial standards shall apply. All equipment/materials susceptible to damage from EMR, temperature variations, humidity extremes, static discharge and shock shall be appropriately shielded and documented prior to packaging and shipment. Magnetic media such as floppy disks, magnetic tapes or disk packs shall be isolated and shielded as far as practical from those factors which may damage or alter the integrity of the data.

5.2 Detailed preparation.

5.2.1 *Preservation and packaging.*

Measuring and testing equipment, used to ensure that components conform to requirements th are specified in the vendors maintenance documents and shall be calibrated against certifi measurement standards which have valid relationships to standards maintained by the Nationa Bureau of Standards (NBS). A calibrated equipment index shall be maintained for the equipmer utilized. Additionally, equipment users are responsible for ensuring that necessary a are in effect. The status of equipment calibration shall be indicated on the eq included in the Quality Assurance audit of acceptance tests. Equipment whi

use in developmental, repair, and maintenance activities where strict calibration is not required shall be identified as non-calibrated. The Quality Assurance Representative shall determine that the necessary certifications exist prior to returning equipment to an in-calibration status.

All materials shall be packaged in containers constructed to provide a compact and non-shifting load. Such containers may be of subcontractor's supply or manufacturer's crates/cartons. Adequate cushioning, blocking, bracing, or strapping shall be provided so as to prevent damage due to shock, vibration, or impact during shipment, handling, and storage.

5.2.2 *Packing.*

Units packaged in accordance with 5.2.1 shall be packed in containers which will ensure acceptance by common carrier and safe delivery at destination. Shipping containers shall comply with common carrier rules and regulations as applicable to the mode of transportation, and may be the supplier's commercial practice when such meets these requirements. Packing shall be in accordance with best commercial practices or special instructions based on unique requirements for an item.

5.2.3 *Marking for shipment.*

Interior packages and exterior shipping containers shall be marked in accordance with the best commercial practices or special instructions.

6 NOTES

This section is not applicable to this specification.

7 N/A

8 N/A

9 N/A

10 N/A

11 N/A

12 N/A

13 N/A

14 N/A

15 N/A

16 N/A

17 N/A

18 N/A

19 **DATA FLOW DIAGRAM**

Data Flow Diagram Symbols: Description of the symbols appearing in the following data flow diagram:

a. Square: an external entity symbol. A source and/or destination of data outside the system, subsystem, component, or process being described. Numbered references of the external entity are contained in the top left corner of the square.

b. Arrow: data flow symbol. A pathway along which data moves into, around, and out of the system or component. Each data flow is labeled. Definitions of data flows are organized alphabetically in Section 20.

c. Rounded rectangle: a process symbol. A function of the system or component which logically "transforms" data. The processes are numbered numerically, beginning with "1", on each data flow diagram. The numbering system follows a logical decimal scheme to trace from one process to another.

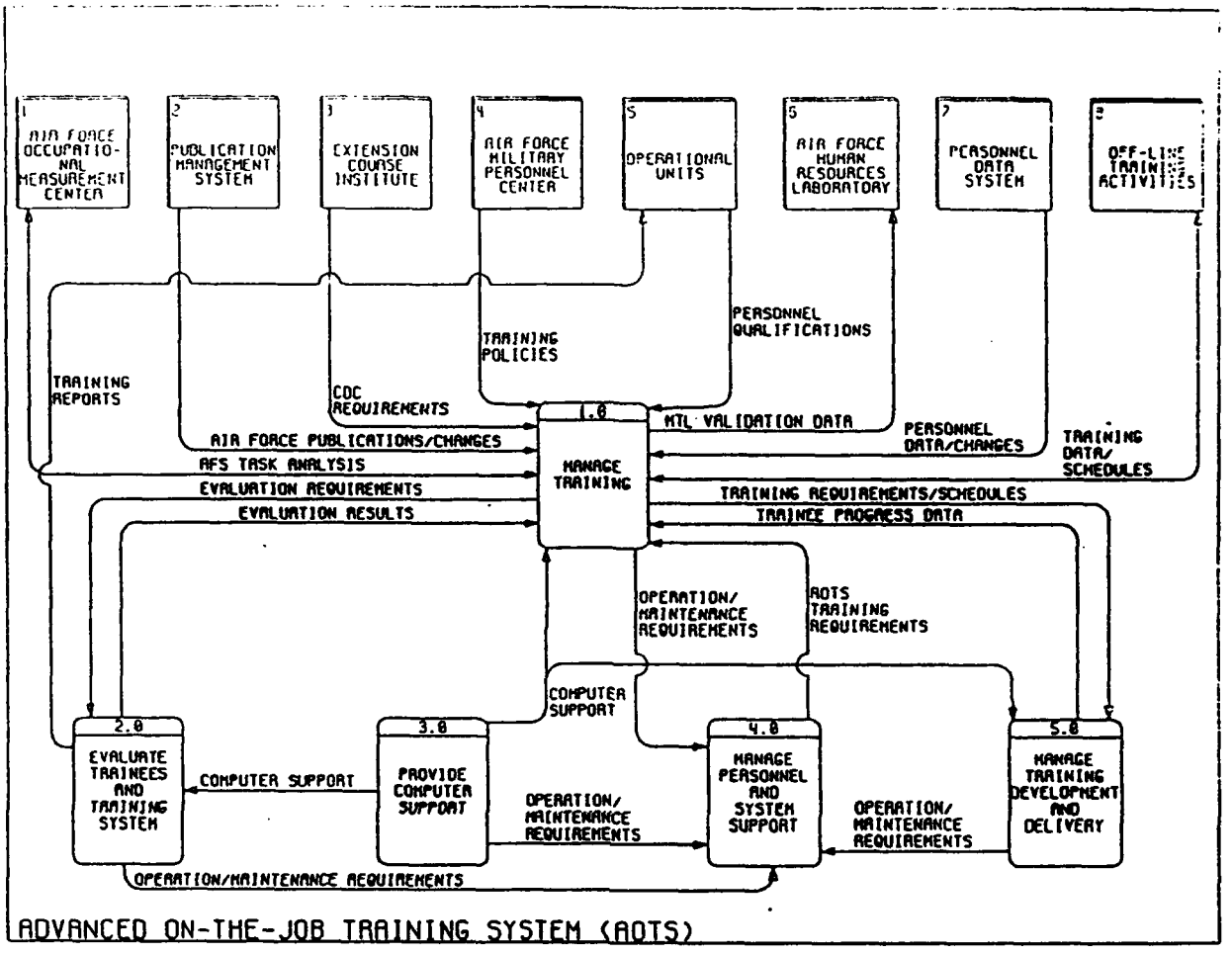

Figure 14. System Data Flow Diagram

20 DATA DICTIONARIES

20.1 Scope.

This appendix contains data defining the processes, data flows, and external entities pertinent to the AOTS, as follows:

a. External entities: The external entities are identified. External entities are organized numerically.

b. Data processes: The highest level processes were described in the text of Section 3.7. Those descriptions are repeated here. They are organized numerically.

c. Data flows: Defines the content of the data flows depicted on each DFD. They are organized alphabetically. Each data flow entry explains the data source, data destination, and structure (when known).

External	Entities
1	Air Force Occupational Measurement Center (AFOMC)
2	Publication Management System
3	Extension Course Institute (ECI)
4	Air Force Military Personnel Center (AFMPC)
5	Operational Units
6	Air Force Human Resources Laboratory (AFHRL)
7	Personnel Data System (PDS)
8	Off-Line Training Activities

PROCESS: 1.0, Manage Training

LEVEL OF AUTOMATION: N/A

DESCRIPTION: The knowledge and performance requirements to support accomplishment of Air Force mission responsibilities assigned to the enlisted force shall be identified within this subsystem. Training requirements for qualifying enlisted members in their assigned jobs shall be defined and managed in this subsystem.

DATA SOURCE: N/A

DATA DESTINATION: N/A

STRUCTURE: This subsystem includes processes:

- Process 1.1, Manage Training Requirements
- Process 1.2, Manage Airman Training
- Process 1.3, Manage Resources and Training Schedules

PROCESS: 2.0, Evaluate Trainees and Training System

LEVEL OF AUTOMATION: N/A

DESCRIPTION: The Evaluation Subsystem shall provide computer-based development and delivery processes, within which evaluation materials and procedures shall be developed. The Evaluation Subsystem shall assess both the task proficiency and the task requisite knowledge of the trainee. This subsystem shall present, store, distribute, and limit access to computer-based evaluation instruments and items. It shall collect task performance evaluation data and generate all system evaluation reports.

DATA SOURCE: N/A

DATA DESTINATION: N/A

STRUCTURE: This subsystem includes processes:

- Process 2.1, Manage Evaluation Instrumentation
- Process 2.2, Evaluate Performance
- Process 2.3, Apply Training Quality Control
- Process 2.4, Evaluate System

PROCESS: 3.0, Provide Computer Support

LEVEL OF AUTOMATION: N/A

DESCRIPTION: This subsystem shall be the computer hardware and software required to support the management, development, delivery, and evaluation of job-site training and performance evaluation within Air Force OJT. The other four subsystems within AOTS shall provide functional hardware, software, and database requirements to the Computer Support Subsystem. The Computer Support Subsystem, in turn, shall provide the computer hardware equipment, automated software services, and the repository space for data necessary to satisfy the AOTS requirements of the other subsystems.

DATA SOURCE: N/A

DATA DESTINATION: N/A

STRUCTURE: This subsystem includes processes:

- Process 3.1, Manage Hardware
- Process 3.2, Manage Software

PROCESS: 4.0, Manage Personnel and System Support

LEVEL OF AUTOMATION: N/A

DESCRIPTION: This subsystem shall consist of the processes and procedures required for providing the personnel, maintenance, and logistic support required for the operation of the prototype AOTS.

DATA SOURCE: N/A

DATA DESTINATION: N/A

STRUCTURE: This subsystem includes processes:

- Process 4.1, Identify Logistics Support Requirements
- Process 4.2, Identify Maintainability, Reliability, and Human Factors Requirements

PROCESS: 5.0, Manage Training Development and Delivery

LEVEL OF AUTOMATION: N/A

DESCRIPTION: This subsystem shall provide a computer-based, interactive *instructional materials development process* within which appropriate training materials can be written, evaluated, and revised. It shall also provide for computer presentation, storage, distribution, and access control of training materials and trainee data. The training materials development environment shall be supportive of requirements imposed by AFM 50-2 and AFP 50-58, unless deviations from such regulations and manuals have been approved by the AF. Training materials developed shall be stored and delivered in support of trainee position qualification. Access control of training shall comply with requirements set forth in AFR 205-1.

DATA SOURCE: N/A

DATA DESTINATION: N/A

STRUCTURE: This subsystem includes processes:

- Process 5.1, Manage Training Development
- Process 5.2, Manage Training Delivery

DATA FLOW: AFS Task Analysis

DESCRIPTION: Occupational Survey (OS) data and Comprehensive Occupational Data Analysis Program (CODAP) task data are passed from USAFOMC to Process 1.0, Manage Training, and analyzed. Tasks required to be performed in a duty position, but which are not found on the OS or CODAP data, are analyzed, added to the Master Task List (MTL) of the AOTS, and passed back to USAFOMC.

DATA SOURCE: External Entity 1, USAFOMC; Process 1.0, Manage Training

DATA DESTINATION: Process 1.0, Manage Training; External Entity 1, USAFOMC

STRUCTURE: Structure will be determined in the B-1, B-5, and C-5 specifications.

DATA FLOW: Air Force Publications/Changes

DESCRIPTION: Data identifying Air Force Publications, such as regulations, technical orders, manuals, and other documents, that provide performance and proficiency requirements for task performance. Also included are notices of publication changes that may affect performance and proficiency requirements. Publications are identified by identification code, title, volume number (if applicable), and breakdowns in subunits of the publication (as appropriate to the particular task).

DATA SOURCE: External Entity 2, Publication Management System

DATA DESTINATION: Process 1.0, Manage Training

STRUCTURE: Structure will be determined in the B-1, B-5, and C-5 specifications.

DATA FLOW: AOTS Training Requirements

DESCRIPTION: Training identified within the Personnel and Support Subsystem processes as being required for the functioning of the AOTS are passed on to the Training Management Subsystem for implementation.

DATA SOURCE: Process 4.0, Manage Personnel and System Support

DATA DESTINATION: Process 1.0, Manage Training

STRUCTURE: Structure will be determined in the B-1, B-5, and C-5 specifications.

DATA FLOW: CDC Requirements

DESCRIPTION: Requirements for airmen to enroll in Career Development Courses (CDC) are passed from the external entity, Extension Course Institute (ECI), to the Training Management Component. The courses provide general knowledge for particular Air Force Specialties (AFSs). Requirements by AFS skill level are listed in the ECI catalog.

DATA SOURCE: External Entity 3, Extension Course Institute

DATA DESTINATION: Process 1.0, Manage Training

STRUCTURE: Structure will be determined in the B-1, B-5, and C-5 specifications.

DATA FLOW: Computer Support

DESCRIPTION: This data flow consists of the software components and data required for the functioning of the other AOTS subsystems.

DATA SOURCE: Process 3.0, Provide Computer Support

DATA DESTINATION: Process 1.0, Manage Training; Process 2.0, Evaluate Trainees and Training System; Process 5.0, Manage Training Development and Delivery

STRUCTURE: Structure will be determined in the B-1, B-5, and C-5 specifications.

DATA FLOW: Evaluation Requirements

DESCRIPTION: Data identifying tasks and/or subtasks on which specified airmen are scheduled to be evaluated for task-requisite knowledge and/or task performance. These requirements may pertain to position qualification or quality control evaluation events.

DATA SOURCE: Process 1.0, Manage Training

DATA DESTINATION: Process 2.0, Evaluate Trainees and Training System

STRUCTURE: Structure will be determined in the B-1, B-5, and C-5 specifications.

DATA FLOW: Evaluation Results

DESCRIPTION: Data detailing the outcomes of completed evaluation events. The data will include pass/fail information. It may also include trainee performance on specific questions or performance steps.

DATA SOURCE: Process 2.0, Evaluate Trainees and Training System

DATA DESTINATION: Process 1.0, Manage Training

STRUCTURE: Structure will be determined in the B-1, B-5, and C-5 specifications.

DATA FLOW: MTL Validation Data

DESCRIPTION: This data flow consists of Tentative Master Task List (TMTL) data that is passed from Process 1.0, Manage Training, to the Air Force Human Resources Laboratory (AFHRL) for validation and the response of AFHRL concerning the validity of the TMTL. Upon being validated by AFHRL, Process 1.0 will incorporate the TMTL data into the Master Task List (MTL).

DATA SOURCE: Process 1.0, Manage Training; External Entity 6, Air Force Human Resources Laboratory

DATA DESTINATION: External Entity 6, Air Force Human Resources Laboratory; Process 1.0, Manage Training

STRUCTURE: Structure will be determined in the B-1, B-5, and C-5 specifications.

DATA FLOW: Operation/Maintenance Requirements

DESCRIPTION: Data identifying the personnel, maintenance, and system support resources required by the subsystem for adequate functioning within the AOTS system.

DATA SOURCE: Process 1.0, Manage Training; Process 2.0, Evaluate Trainees and Training System; Process 3.0, Provide Computer Support; Process 5.0, Manage Training Development and Delivery

DATA DESTINATION: Process 4.0, Manage Personnel and System Support

STRUCTURE: Structure will be determined in the B-1, B-5, and C-5 specifications.

DATA FLOW: Personnel Data/Changes

DESCRIPTION: Elements extracted from the Personnel Data System (PDS) that are required to establish Airman Training Records (ATRs), to manage training, and to report training status either by individual or group. Also included are Unit Manager Personnel Requirements (UMPR), a listing that shows manpower authorizations for organizations by workcenter and includes AFSCs authorized, authorized ranks, and position identification numbers.

DATA SOURCE: External Entity 7, Personnel Data System

DATA DESTINATION: Process 1.0, Manage Training

STRUCTURE: Structure will be determined in the B-1, B-5, and C-5 specifications.

DATA FLOW:	Personnel Qualifications
DESCRIPTION:	Data provided to the Training Management Subsystem by the Operational Units concerning airman training needs, airman progress toward position qualification, airman individual training requirements, and other personnel data required to support airman training and airman training records.
DATA SOURCE:	External Entity 5, Operational Units
DATA DESTINATION:	Process 1.0, Manage Training
STRUCTURE:	Structure will be determined in the B-1, B-5, and C-5 specifications.

DATA FLOW:	Trainee Progress Data
DESCRIPTION:	Data concerning individual trainee progress through training materials contained within the Training Development and Delivery Subsystem.
DATA SOURCE:	Process 5.0, Manage Training Development and Delivery
DATA DESTINATION:	Process 1.0, Manage Training
STRUCTURE:	Structure will be determined in the B-1, B-5, and C-5 specifications.

DATA FLOW:	Training Data/Schedules
DESCRIPTION:	Contains off-line training requirements, schedules, completions, and progress reports for individual airmen.
DATA SOURCE:	External Entity 8, Off-Line Training Activities; Process 1.0, Manage Training
DATA DESTINATION:	Process 1.0, Manage Training; External Entity 8, Off-Line Training Activities
STRUCTURE:	Structure will be determined in the B-1, B-5, and C-5 specifications.

DATA FLOW:	Training Policies
DESCRIPTION:	Contains Ancillary and Additional Duty training requirements.
DATA SOURCE:	External Entity 4, Air Force Military Personnel Center (AFMPC)
DATA DESTINATION:	Process 1.0, Manage Training
STRUCTURE:	Structure will be determined in the B-1, B-5, and C-5 specifications.

DATA FLOW: Training Reports

DESCRIPTION: Contains Standard or Ad Hoc reports. Standard reports are generated automatically by the system on a periodic basis. Authorized personnel may also obtain the current standard reports upon demand at any time. Standard reports are available at four organizational levels--individual, workcenter, unit, and base. Ad hoc reports are generated upon demand to provide information for authorized personnel that is not available in the standard reports. The content and structure of an ad hoc report is defined by the system administrator and the requester at the time that it is requested.

DATA SOURCE: Process 2.0, Evaluate Trainees and Training System

DATA DESTINATION: External Entity 5, Operational Units

STRUCTURE: Structure will be determined in the B-1, B-5, and C-5 specifications.

DATA FLOW: Training Requirements/Schedules

DESCRIPTION: Training requirements and schedules for individual airmen that is passed from the Training Management Subsystem to the Training Development and Delivery Subsystem in order to enable the airman to proceed with training.

DATA SOURCE: Process 1.0, Manage Training

DATA DESTINATION: Process 5.0, Manage Training Development and Delivery

STRUCTURE: Structure will be determined in the B-1, B-5, and C-5 specifications.