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MIL-HDBK-29612-5
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DEPARTMENT OF DEFENSE
HANDBOOK

ADVANCED DISTRIBUTED LEARNING (ADL)
PRODUCTS AND SYSTEMS
(PART 5 OF 5 PARTS)

This Handbook is for guidance only. Do not cite this document as a requirement.

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FOREWORD

1. This handbook is approved for use by all Departments and Agencies of the Department of Defense (DoD).

2. This handbook is intended for guidance only. This handbook cannot be cited as a requirement. If it is, the contractor does not have to comply.

3. MIL-HDBK-29612-5 is Part 5 of 5 Parts. Part 5 provides background information that may be used by DoD (all Services) and Industry for the acquisition and development of Advanced Distributed Learning (ADL) products and systems. These products support the ADL Initiative. Use of this guidance is not mandatory.

4. Considerations/issues regarding ADL have been threaded throughout the MIL-HDBK-29612-1, -2, and-3. Part 1, MIL-HDBK-29612-1, DoD Handbook, Guidance for Acquisition of Training Data Products and Services, contains guidance to be used by all Services for the preparation of solicitations and evaluation of solicitation responses for training. Part 2, MIL-HDBK-29612-2, DoD Handbook, Instructional Systems Development/Systems Approach to Training and Education, provides guidance that may be used by all Services for the analysis, design, development, implementation, and evaluation of instruction and instructional materials. Part 3, MIL-HDBK-29612-3, DoD Handbook, Development of Interactive Multimedia Instruction (IMI), contains guidance on the application of multimedia instructional courseware development process. Part 4, MIL-HDBK-29612-4, DoD Handbook, Glossary for Training, contains a listing of commonly used training terms, acronyms, and definitions.

5. This handbook was developed within the DoD with the assistance of all Services as represented by the Defense Training Standards Working Group (DTSWG) and the Joint Services Advisory Group - Interactive Multimedia Instruction (JSAG-IMI).

6. Guidance provided in this handbook is not intended to supplement or duplicate policies and procedures in existing Federal, DoD, and Military Service regulations. Should a conflict arise between this handbook and any of the previously mentioned regulations, the regulations take precedence.

7. Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Air Warfare Center Aircraft Division, Code 414100B120-3, Highway 547, Lakehurst, NJ 08733-5100, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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1. SCOPE.

1.1 Scope. The Advanced Distributed Learning (ADL) Initiative is a structured, adaptive, collaborative effort between the public and private sectors to develop the standards, tools, learning objects, and delivery mechanisms for the future-learning environment. The ADL Initiative supports the development of a system capable of delivering instruction to users anytime, anywhere. The Department of Defense (DoD) has outlined a strategy for implementing a DoD-wide Distributed Learning (DL) system. Its goal is to transition from the current "in-residence" focused education and training environment to a global DL system designed to deliver training, education, and information "on-demand" as a continuum to support DoD operational readiness. This handbook provides information for the acquisition and development of DL products that operate within an environment that satisfies the standards and goals of the ADL Initiative. Electronic communication products that support the ADL Initiative include Interactive Multimedia Instruction (IMI) and products developed to use and deliver instructional content, having the characteristics of being accessible from any location, remote or local, utilizing a DL environment. The selection and acquisition of products for use in a DL environment merge well within the Instructional Systems Development/Systems Approach to Training (ISD/SAT) model, see MIL-HDBK-29612-2. The ISD/SAT process phases include: analysis, design, development, implementation, and evaluation. DL products are now another training media consideration for the acquisition manager of instructional systems. This handbook supplements general acquisition guidance provided in MIL-HDBK-29612-1 and interfaces with MIL-HDBK-29612-2, -3 and -4.

1.2 Application guidance. This handbook is intended for guidance only. This handbook cannot be cited as a requirement. If it is, the contractor does not have to comply.

1.2.1 How to use this handbook. The guidance provided in this handbook applies to the acquisition of training products for the delivery of instruction using advanced communications technologies (e.g., software, computers, simulations, networks, etc.). This handbook is to be used in conjunction with MIL-PRF-29612, MIL-HDBK-29612-1, -2, -3, and -4 to aid in the acquisition of ADL products. MIL-PRF-29612 provides verification criteria for products to be used in an ADL environment. MIL-HDBK-29612-1 contains guidance for the preparation of solicitations and evaluation of solicitation responses for training. MIL-HDBK-29612-2 provides guidance for the selection of instructional media. MIL-HDBK-29612-3 provides background information for the planning, design, development, implementation, evaluation, and management of IMI products. MIL-HDBK-29612-4 contains a listing of commonly used training terms, acronyms, and definitions.

1.2.2 Topics addressed in this handbook. This handbook is organized in a manner that provides the reader with an overview of the products to be acquired to support an ADL system from the broadest scope of a training portal to the smallest product (i.e., existing courseware) and everything in between (e.g., Learning Management Systems (LMS), Course Management Systems (CMS), courseware development/authoring tools, infrastructure requirements,

audio/video streaming capability, etc.). After an overview of the products to be acquired is a section that provides the roles and responsibilities of the various ADL team members.

2. APPLICABLE DOCUMENTS.

2.1 General. The documents listed below are not necessarily all of the documents referenced herein, but are the ones that are needed in order to fully understand the information provided by this handbook.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the latest issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto.

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-PRF-29612	Performance Specification, Training Data Products

DEPARTMENT OF DEFENSE HANDBOOKS

MIL-HDBK-9660	Department of Defense Handbook, DoD-Produced CD-ROM Products
MIL-HDBK-29612-1	Department of Defense Handbook, Guidance for Acquisition of Training Data Products and Services
MIL-HDBK-29612-2	Department of Defense Handbook, Instructional Systems Development/Systems Approach to Training and Education
MIL-HDBK-29612-3	Department of Defense Handbook, Development of Interactive Multimedia Instruction (IMI)
MIL-HDBK-29612-4	Department of Defense Handbook, Glossary for Training

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.2.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein.

DoD HLA	High Level Architecture (HLA)
OUSD Memo	DoD Joint Technical Architecture (JTA)

SCORM Sharable Content Object Reference Model (SCORM)

(The HLA can be downloaded from http://www.ntsc.navy.mil.)

(The JTA can be downloaded from http://www-jta.itsi.disa.mil.)

(Copies of the SCORM may be downloaded from the ADL Web site at Uniform Resource Locator (URL) http://www.adlnet.org.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. DEFINITIONS.

3.1 General. Training definitions and acronyms are provided in MIL-HDBK-29612-4. As MIL-HDBK-29612-5 contains many computer technology related acronyms, those acronyms unique to MIL-HDBK-29612-5 are provided as follows:

ACRONYM	LONG TITLE
ADL	Advanced Distributed Learning
ADSL	Asymmetric Digital Signal Loop
AGR	AICC Guidelines and Recommendations
AICC	Aviation Industry Computer Based Training (CBT) Committee
AIS	Alarm Indication Signal
API	Application Program Interface
ATM	Asynchronous Transfer Mode
ATSC	Advanced Television Systems Committee
AU	Assignable Unit
bps	Bits per second
CBT	Computer Based Training
CCITT	Comité Consultatif International Téléphonique et Télégraphique
CD	Compact Disc
CD-I	Compact Disc Interactive
CD-R	CD-Recordable
CD-ROM	Compact Disk-Read Only Memory
CD-RW	CD-Rewriteable
CMI	Computer Managed Instruction
CMS	Courseware Management System
COTS	Commercial Off-the-Shelf

ACRONYM	LONG TITLE
CPU	Central Processing Unit
CSF	Course Structure Format
CSS	Cascading Style Sheet
DBS	Direct Broadcast Satellite
DDA	DoD Data Architecture
DDDS	Defense Data Dictionary System
DITIS	Defense Instructional Technology Information System
DL	Distributed Learning
DMSO	Defense Modeling and Simulation Office
DNS	Domain Name System
DOCSIS	Data Over Cable Service Interface Specification
DoD	Department of Defense
DoDISS	Defense Index of Specifications and Standards
DTSWG	Defense Training Standards Working Group
DTV	Digital Television
DVD	Digital Versatile Disk
DVD-RW	Rewriteable DVD
EIA	Electronic Industries Association
EPSS	Electronic Performance Support System
FAQ	Frequently Asked Questions
FDDI	Fiber Distributed Data Interface
fps	frames per second
FTP	File Transfer Protocol
GB	Gigabyte
GOTS	Government Owned Training System
GUI	Graphical User Interface
HDD	Hard Disk Drive
HDTV	High Definition Television
HLA	High Level Architecture
HTML	Hypertext Markup Language
HTTP	Hypertext Transfer Protocol
I/O	input/output
ICW	Interactive Courseware
IEC	International Engineering Consortium
IEEE	Institute of Electrical and Electronic Engineers
IETF	Internet Engineering Task Force
IETM	Interactive Electronic Technical Manual
IM	Immediate Messaging
IMI	Interactive Multimedia Instruction
IMS	Information Management System

ACRONYM	LONG TITLE
IP	Internet Protocol
ISD/SAT	Instructional Systems Development/Systems Approach to Training
ISDN	Integrated Services Digital Network
ISO	International Standards Organization
ISP	Internet Service Provider
IT	Information Technology
ITU	International Telecommunication Union
JIEO	Joint Interoperability and Engineering Organization
JPEG	Joint Photographic Experts Group
JSAG-IMI	Joint Services Advisory Group-Interactive Multimedia Instruction
JTA	Joint Technical Architecture
KB	Kilobyte
Kbps	Kilobits per second
LAN	Local Area Network
LMS	Learning Management System
LO	Learning Objective
LOS	Loss Of Signal
LTSC	Learning Technology Standards Committee
MB	Megabyte
Mbp	Megabits per
Mbps	Megabits per second
MHz	Megahertz
MILCON	Military Construction
MP3	MPEG audio layer 3
MPEG	Moving Picture Experts Group
NIPRnet	Unclassified but Sensitive Internet Protocol Router Network
NT	New Technology
NTSC	National Television Standards Committee
ODBC	Open Database Compliancy
OJT	On the Job Training
PAL	Phase Alternation by Line
PC	Personal Computer
PCI/AGP	Peripheral Component Interconnect/Accelerated Graphics Port
PCM	Pulse Code Modulation
PCMCIA	Personal Computer Memory Card International Association
PDF	Portable Document Format
PG	Program Guide
PKI	Public Key Infrastructure
PNO	Public Network Operators
PnP	Plug and Play

ACRONYM	LONG TITLE
POTS	Plain Old Telephone System
PSIP	Program and System Information Protocol
PTO	Public Telephone Operator
R/RW	Read/Rewriteable
RAM	Random Access Memory
RDI	Remote Defect Indication
RFP	Request For Proposal
ROI	Return On Investment
RS	Recommended Standard
SCO	Sharable Content Object
SCORM	Sharable Content Object Reference Model
SDE	Standard Data Element
SDTV	Standard Definition Television
SG	Study Group
SGML	Standard Generalized Markup Language
S-HTTP	Secure Hypertext Transfer Protocol
SI	System Information
SIPRNet	Secret Internet Protocol Router Network
SME	Subject Matter Expert
SMIL	Synchronized Multimedia Integration Language
SONET	Synchronous Optical Network
SSL	Secure Sockets Layer
TCP	Transmission Control Protocol
TCP/IP	Transmission Control Protocol/Internet Protocol
TEDED	Training and Education Data Element Dictionary
TEE	Training Effectiveness Evaluation
TEMPEST	Transient Electromagnetic Pulse Standard
TIA	Telecommunications Industry Association
TLO	Terminal Learning Objective
TOC	Table Of Contents
TWG	Technical Working Group
UDP	User Datagram Protocol
UHF	Ultra High Frequency
URL	Uniform Resource Locator
VBA	Visual Basic for Applications
VCR	Video Cassette Recorder
VHF	Very High Frequency
VRML	Virtual Reality Modeling Language
VTC	Video Teleconferencing Centers
VTT	Video Teletraining

ACRONYM	LONG TITLE
W3C	World Wide Web Consortium
WAN	Wide Area Network
WBT	Web Based Training
WG	Working Group
XGA-TFT	Extended Graphics Array-Thin Film Transistor
XHTML	eXtended HyperText Markup Language
XML	Extensible Markup Language
XSL	Extensible Style Sheets Language

4. ADL OVERVIEW.

4.1 Introduction. The ADL Initiative is a strategy developed to harness the power of learning, information, and communication technologies to modernize education and training. The ADL Initiative is intended to implement the "anytime-anywhere" learning concept to provide access to the highest quality education and training materials that can be tailored to individual needs and delivered cost-effectively, whenever and wherever it is required.

4.1.1 A cultural change. Joint Vision 2020 and the individual Service Vision statements mandate a change in the way we fight war and in the way we train to fight war. Each of the Services is driven to revolutionize war materiel, strategies, tactics, and the deployment of personnel. The requirement to operate joint missions, for example, has major impact. This revolution represents a significant cultural change in the way we do business. ADL is a major element of the training establishment's response to that cultural change. ADL supports Joint training with transportable and interoperable training materials. It supports forward deployment with accessibility and adaptability of training materials. It supports reduced manning with the efforts to provide training where and when it is needed. Finally, ADL supports reduced resources by providing reusability and affordability. ADL also supports quality of life issues with personal education and training opportunities. Joint Vision 2020 is available at Defense Technical Information Center's Web site at URL http://dtic.mil/doctrine/.

4.1.2 Realizing the ADL Initiative. To fully realize the intent of the ADL Initiative it will be necessary to institute a cultural change within the Services and their activities. ADL will affect each individual differently as the decisions on how to implement ADL will be made by each Service. Within each Service, the activities will have to decide how to fit ADL into their training structure, and policies will need to be developed to institute these changes. The availability of advanced and professional military education through a combination of flexible delivery methods accessible 24 hours a day from stateside activities, deployed, and home with minimal resident time will make education and professional development a career reality. Within the context of a virtual university, individual Service members will be able to evaluate and access the educational offerings available. Service members who are part-time students,

isolated from a traditional campus, frequently move, or are deployed will be able to accumulate credits earned from different colleges, individual Service training sites, or commercial sources (i.e., residential, non-traditional, or ADL) and apply those credits toward completion of a degree or certification. This handbook provides information that supports the achievement of the cultural change.

4.1.3 What is ADL? ADL is an evolution of DL that is advanced through the use of state-of-the-art technologies. ADL, has at its core, instructional content that has the following characteristics:

a. Accessibility. The ability to access instructional components from one remote location and deliver them to many other locations.
b. Interoperability. The ability to use instructional components developed in one location with one set of tools or platform in another location with a different set of tools or platform. (Note: there are multiple levels of interoperability).
c. Durability. The design of instructional components is such that it does not require redesign or re-coding to operate when base technology changes.
d. Reusability. The design of instructional components is such that it can be incorporated into multiple applications.
e. Adaptability. Instruction is tailorable to individual and situational needs.
f. Affordability. Increase learning effectiveness significantly while reducing time and costs.

4.1.4 The DL and ADL relationship. Within a DL environment, learning usually takes place at locations remote from or in the absence of an instructor and utilizes technology-based devices to achieve a specific learning goal. An ADL program satisfies all the DL functions and promotes delivering instruction using a variety of flexible delivery methods that are accessible 24 hours a day.

4.2 Overlying architectures and standards. The architectural framework includes all information technology services supporting training and various training enabling strategies and the applicable technology standards. Specific architectures and standards are described below.

4.2.1 DoD Joint Technical Architecture (JTA). The DoD JTA is a document that mandates the minimum set of standards and guidelines for the acquisition of all DoD systems that produce, use, or exchange information. A fully operational ADL program will require a robust data and video network infrastructure between the decentralized databases and repositories for digital courseware and geographically dispersed or mobile students. That network infrastructure must be interoperable among force components, echelons, delivery platforms, and user terminals. The network infrastructure must be compliant with the DoD's JTA, and should be transparent to managers, Instructional Developers, administrators, and users and should build on the existing infrastructure. The JTA is to be used by anyone involved in the management, development, or acquisition of new or improved information systems within DoD. Services may supplement the

DoD JTA with Service specific requirements. For specific information regarding the JTA, refer to their Web site at URL http://www-jta.itsi.disa.mil. Standards will only be mandated if they meet all of the following criteria:

a. Interoperability. They enhance joint and potentially combined Service/Agency information exchange and support joint activities.
b. Maturity. They are technically mature (strong support in the commercial marketplace) and stable.
c. Implementability. They are technically implementable.
d. Public. They are publicly available.
e. Consistent with Authoritative Source. They are consistent with law, regulation, policy, and guidance documents.

4.2.2 High Level Architecture (HLA). The HLA was developed by the DoD under the leadership of the Defense Modeling and Simulation Office (DMSO) to support reuse and interoperability (i.e., JTA) across the large number of different types of simulations developed and maintained by the DoD. An individual simulation or set of simulations developed for one purpose can be applied to another application under HLA concepts. The intent of the HLA is to provide a structure that will support reuse of capabilities available in different simulations, ultimately reducing the cost and time required to create a synthetic environment for a new purpose and fostering the possibility of distributed collaborative development of complex applications. For specific information regarding HLA, refer to their Web site at URL http://www.dmso.mil/.

4.2.3 Standards that support the ADL Initiative and overlying architecture. To meet DoD-wide needs, there must be standards for courseware interoperability that are compatible among vendors and that do not sacrifice quality, transparency of operations, or efficiency of storage, manipulation, and management. As potentially one of the largest users of courseware-development, delivery, storage, and management systems, the DoD can and does influence Industry trends. The primary agent in addressing the critical area of standards generation to meet the goals of the ADL Initiative has been the ADL Technical Working Group (TWG). This collaborative group is comprised of representatives from DoD, Industry, Academia, other Federal agencies, and all the major standards-granting organizations. To fulfill the objectives of the ADL Initiative it was necessary for the TWG to develop a unique new standard for sharable courseware. Through their collaborative efforts the SCORM was developed. SCORM is a standard that includes the capability of tagging course structures and instructional elements so that any SCORM conformant courseware is transportable to any SCORM conformant training system. The SCORM is a suite of specifications that leverage the work of the international standards granting bodies. While the SCORM defines a very specific "content model," work from the groups can be integrated into this model and adapted or extended to meet the requirements of the ADL Initiative. Important parts of the SCORM can now be harmonized and synchronized with

developing Industry practices. For more information about the SCORM and other Industry standards that relate to ADL see Appendix A.

4.2.3.1 Internet-based standards. The ADL Initiative espouses the use of the Internet and Web-based technologies. The Internet is a worldwide system of computer networks in which a user at one computer can obtain information from another computer. Technically, what distinguishes the Internet is its use of a set of protocols (i.e., rules) called Transmission Control Protocol/Internet Protocol (TCP/IP) that govern the electronic transmission and receipt of data. Two adaptations of Internet technology, the intranet and the extranet, also make use of the TCP/IP. See Appendix A for Internet and Web-based standards including Internet Engineering Task Force (IETF) Recommendations.

4.2.3.2 Standards approved by standards granting bodies. When acquiring products for use in an ADL environment it is essential that the products and delivery methods incorporate non-proprietary standards. There are numerous standards granting bodies and working groups that develop and promote the use of standards for technologies (e.g., audio/video streaming technology, desktop conferencing, data sharing, mobile codes, etc.) that are used for the delivery of instruction in an ADL environment. For a description of these standards granting bodies and working groups (e.g., Institute of Electrical and Electronic Engineers (IEEE), Aviation Industry Computer Based Training (CBT) Committee (AICC), Instructional Management System (IMS), etc.), and their respective standards that relate to ADL see Appendix A.

4.2.3.3 Audio/video standards and protocols. The majority of communications between devices require that the devices agree on the format of the data. The set of rules defining a format is called a protocol. At the very least, a communications protocol must define the rate of transmission (in baud or bits per second (bps)), whether transmission is to be synchronous or asynchronous, whether data is to be transmitted in half-duplex or full-duplex mode. In addition, protocols can include sophisticated techniques for detecting and recovering from transmission errors and for encoding and decoding data. See Appendix A for protocols for audio and video.

4.3 Transitioning from traditional learning to an ADL environment. Many existing DoD courses are still best presented in an instructor-led or collaborative environment. Currently, there are Web-based training courses that can be downloaded and completed in a self-study environment, however training portals need to be expanded to fully support other learning modes in an ADL environment. Some education and training objectives do not lend themselves to the mode of learner-centric courses presented in an ADL environment. A robust training portal must have specific features and functions to accommodate this type of learning environment. Necessary features and functions of a training portal are described below.

4.3.1 Training portals. Training portals are locations on the Web or network that serve as a gateway or entry point to central sources for education and training information and instructional content. A training portal can be thought of as a single entry point on the Web or network to

specific training and education needs, whether the user is a manager, Instructional Developer, Information Technology (IT) Specialist, instructor, or student. Training portals serve as a guide to find information for instructional development or specific training and education needs. A robust training portal may be comprised of an LMS; a CMS; asynchronous and synchronous communications modules; a course development, conversion, and maintenance module (i.e., courseware development/authoring tool), and reference resources. It should be noted that not all of the features and functions listed for each category are deployed by training portal developers in that specific category. The most important objective is that a training portal contains the desired features and functions to support the instructional need. Existing training portals should be evaluated by the Instructional Developer to determine if they are sufficient to support the instructional need. Courseware development should proceed with the knowledge of the training portal's capabilities and limitations. The major components of a training portal are illustrated in Figure 1 and are described below.

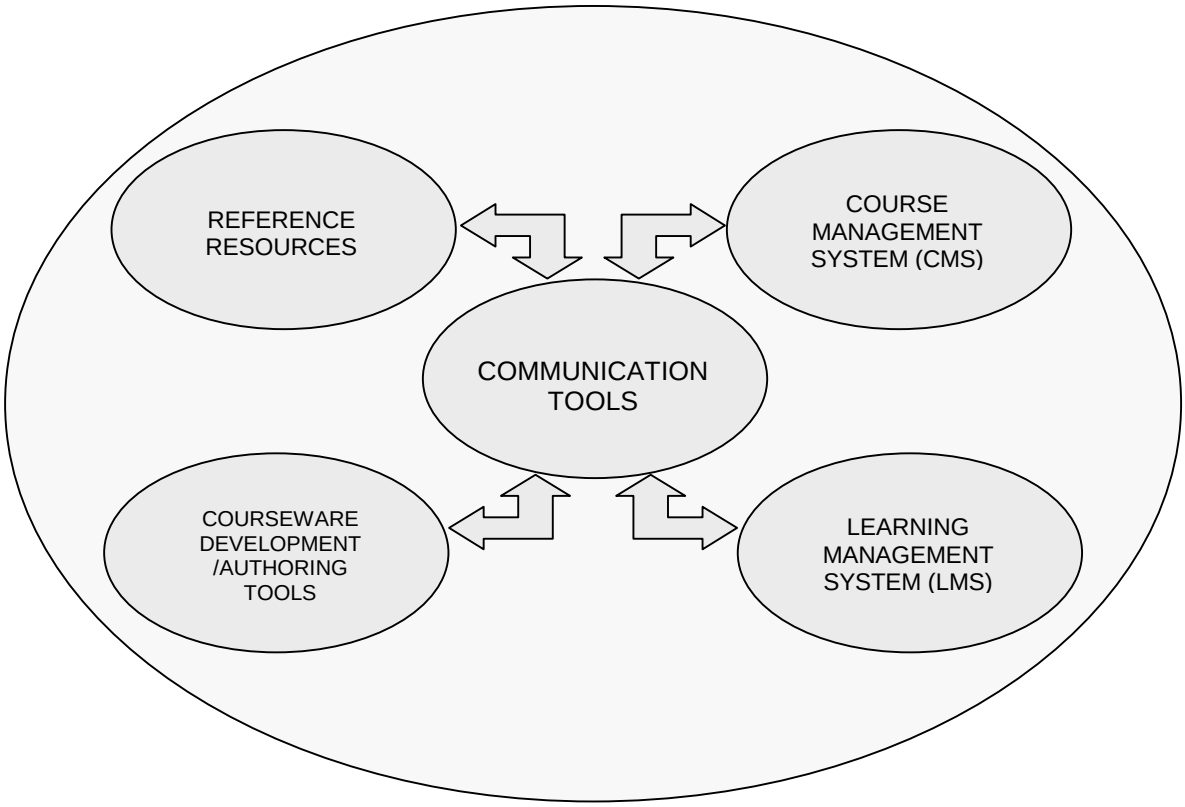

FIGURE 1. **Training portal.**

NOTE: Many participants in the development of learning technology standards now use the term LMS instead of CMI so as to include new functionalities and capabilities that have not historically been associated with CMI systems such as back-end connections to other information systems, complex tracking and reporting, centralized registration, on-line collaboration and adaptive content delivery. For the purpose of this document the term LMS will be used from this point on and is intended to be inclusive of CMI.

Features of evolving LMS and CMS products often overlap. The overall desired features of the training portal become the criteria for selection, not the position of the features within the training portal subcomponents. A robust LMS will include features of both CMS and Computer Managed Instruction (CMI).

4.3.1.1 Learning Management System. An LMS should serve as a primary interface for administrative functions of the training site. The LMS provides management of curriculum, course(s), and student data of an organization. The LMS also provides student and instructor interaction with all instructional elements of a Web or network-based (i.e., Internet, intranet, and extranet) courses. An LMS provides curriculum management for both resident and distributed learning. The primary high-level functions of an LMS include launching a course, student registration, report generation, scheduling, data gathering, and processing of student performance data. Ideally, there would be four views into the system through the LMS: Enterprise and Unit Level Management View, Site Administration View, Student/Instructor View, and Instructional Developer/Maintenance View. These views provide:

a. Enterprise and unit level management view. This level should provide administrative views (with proper access controls) to perform assessments and analysis on training issues in support of operational readiness. Unit level managers could make use of the LMS data to view training, requirements, and accomplishments for assigned personnel.
b. Site administration view. The LMS should handle functions for course and resource administration, to include: security administrative reports, all accounting functions, materials ordering, and other functions.
c. Student/instructor view. Students and instructors should have ready access to registration, course information, calendar/scheduling functions, reference resources, and other information.
d. Instructional Developer/maintenance view. This view must provide a means of developing course content and maintaining that content.

4.3.1.2 Course Management System. A CMS provides the direct interaction between the student and the courseware and is the presentation interface for the course. The CMS must support launching, tracking, and feedback procedures within a computer-based training program. Tracking information is typically comprised of lesson or exercise performance and completion

information. The CMS supports adaptive lesson or exercise navigation, automated remediation, and testing capabilities. Aggregate performance information is then passed up to the LMS for reporting mechanisms.

4.3.1.3 Courseware development/authoring tools. A training portal may include courseware development/authoring tools that provide a means of developing course content and maintaining that content. The courseware development/authoring tool used should provide standardized programming code to support most commonly required interactions, animated graphics, and common simulation elements to reduce the requirement for customized programming to the minimum required to support highly sophisticated interactivity, animated graphics, and simulations. This is essential to course maintenance and revision. Courseware/authoring tools must be able to develop performance and performance based exercises that provide adequate iterations of practice to develop mental skills required in job performance. Additionally, access to a repository for re-usable courseware objects should also be made available. Courseware development/authoring tools may include analysis, design, and pre-authoring course development capabilities.

4.3.1.4 Communications tools (both synchronous and asynchronous). Communications tools are used to enable instructor-to-student and student-to-student interaction (in both synchronous and asynchronous modes). Communication and therefore, learning can be fostered through several media (i.e., video, audio, text, and Internet) and face-to-face conversations. Students in a traditional instructor-led class can take advantage of these media and conversations in real time (synchronous communications) more so than students in an ADL environment. Asynchronous communications for some students (using both traditional classrooms and ADL virtual classrooms) can be implemented through e-mail, list servers, newsgroups, and Web-based forums when required to support the instructional objectives. However, students in an ADL environment can have the benefit of most auditory and visual stimulus received by traditional classroom students if they are properly programmed into the IMI module. For ADL students, physical classrooms may when required be replaced with virtual classrooms wherein instructor-to-student and student-to-student asynchronous or synchronous communications take place in a text-based or audio/video environment over the Internet. Detailed planning and coordination must occur to accommodate synchronous training across global time zones. Attempting to include considerable synchronous communications will reduce the ability of the student to access the instruction anywhere-anytime.

4.3.1.5 Reference resources. Other library and reference links should be included on a training portal in addition to the primary training links to the electronic classrooms, electronic forums, e-mail, etc. The training portal should be considered a "one-stop-shop" for the student's needs.

4.3.1.6 Desired features of a training portal. A robust training portal should provide all features of all components as described in Table 1. Table 1 can be used as a job aid to ensure

that the training portal possesses the minimum desired features and functions. This job aid can be modified to include additional features and functions.

TABLE 1. **Checklist for desired features and functions of a training portal.**

FEATURES AND FUNCTIONS	Features are applicable to:				
	Manager	Instructional Developer	IT Specialist	Instructor	Student
Job profiles.	X	X		X	X
Career path information.	X			X	X
Training requirement information.	X	X		X	X
Training events and exercises.				X	X
Education.	X			X	X
Advancement.	X			X	X
Qualification materials.	X	X		X	X
Certifications materials.	X				X
Associated training resource requirements.	X	X	X	X	X
Security.	X		X		
Administrative reports.	X				
Registration.					X
Course catalogs (on-line courses, downloadable courses)		X			X
Prerequisite enforcement.	X	X		X	X
Book/material ordering.	X	X		X	X

TABLE 1. **Checklist for desired features and functions of a training portal – Continued.**

FEATURES AND FUNCTIONS	Features are applicable to:				
	Manager	Instructional Developer	IT Specialist	Instructor	Student
Calendar and scheduling mechanism.	X			X	X
Student support services.		X			X
Transcripts service.	X				X
Feedback mechanism.		X	X	X	X
Third-party support.		X	X	X	X
Communications tools (synchronous and asynchronous)		X	X	X	X
Courseware development tools.		X	X	X	
Courseware delivery tools.		X	X	X	
Courseware maintenance tools.		X	X		
Access to reusable courseware objects.		X	X		
Reference resource services (links to reference sources).	X	X	X	X	X

4.4 Applying learning technologies. The features and functional descriptions of a training portal are best broken down between synchronous and asynchronous learning interaction. One of the keys to learning is proper communication of the message between the sender and receiver. This communication can be either synchronous or asynchronous. Synchronous refers to communication in which interaction between the participants is simultaneous. Types of synchronous interaction include two-way audio or video, computer document conferencing, and chat rooms. Today's training portals fail somewhat in their offerings for synchronous interaction. Asynchronous refers to communication in which interaction between the participants is not simultaneous. Examples of asynchronous interaction include voice mail, postal mail correspondence, facsimile, e-mail, and electronic forums or bulletin boards. Testing in an electronic environment is addressed later in this document (see 5.2.6.3).

4.4.1 Synchronous learning. Through modern technology, students log into class at a regularly scheduled time and date to engage in a real-time two-way communication among the instructor and other students, much like a real classroom. Assignments are given, questions are asked and answered, and exams and quizzes are taken. The advantages of synchronous learning events, such as face-to-face or on-line seminars, workshops, or lectures are:

a. The interactivity increases the student’s motivation.

b. Immediate feedback is available to the student.
c. The structure of the class is more rigid and is helpful to a student who has difficulty managing their time in a self-study environment.
d. A synergy in the learning process is gained.

4.4.1.1 Streaming technologies. Synchronous learning is benefited by the use of streaming technologies. New animation controls and streaming technologies allow Instructional Developers to add the dimension of sound and video to the learning material. The resultant audio and video presentations can add value to the learning process. Multimedia data streaming is a mechanism that starts to display the data before the entire file has been transmitted.

4.4.1.2 Video Teletraining (VTT). Video teletraining is a means of broadcasting to multiple sites through a traditional television broadcast medium. Use of ADL technologies presents the opportunity to mimic Video Teleconferencing Centers (VTC) and VTT on training portals at the student's desktop. Conference participants, given adequate bandwidth, will experience telephone-like audio quality and adequate video quality. The use of multi-conferencing units can easily emulate traditional VTCs and could supersede the use of some VTT applications.

4.4.1.3 Desktop conferencing. Desktop conferencing is a means of two-way electronic communication accomplished by using a personal computer. When appropriate, ADL course design should take full advantage of desktop videoconferencing. Desktop videoconferencing is a mature technology. One-on-one communications capability between an instructor and the student may sometimes be critical for a proper learning support environment. One-on-one communications allows focus to be placed on an individual student's problems without the embarrassment that might be experienced in a group. This form of coaching can be often used remedially, to deal with students' difficulties in understanding particular material, and is useful to instill or reinforce good practices.

4.4.2 Asynchronous learning. Asynchronous learning refers to programs where a student is engaged at a time other than one concurrent with the instructor or other students. Also used to indicate a learning event where the interaction is delayed over time, such as a correspondence course. Other forms of asynchronous learning include e-mail, listservs, audiocassette courses, videotaped courses, correspondence courses, and Internet courses. The advantages of asynchronous learning such as, e-mail and participating in threaded discussions are:

a. The student has the flexibility to participate as their schedule allows.
b. The ability to communicate only through electronic means reduces travel costs required to attend courses and reduces the time away work.
c. The structure of the class allows the student more time to think about the comments of other participants, and to develop ideas off-line that might not appear to them while in a synchronous environment.

d. A larger number of students can be supported at one time than in a synchronous environment.

4.4.2.1 Pre-recorded media. Pre-recorded media usually takes the form of Videocassette Recorder (VCR) tapes or audiotapes, which still have a place in the ADL arena; however, newer technologies can make use of a digital delivery mechanism.

4.4.2.2 Streaming audio/video. Live streaming audio or video can be digitally recorded and made available for on-demand use by students in an asynchronous mode. Video clips and audio clips meet these criteria.

4.4.2.3 Recorded classroom sessions. It may not always be possible for students to participate in virtual classrooms in a synchronous mode. For that reason, a recording of the classroom session is highly desirable so that students may review the session in an asynchronous mode.

4.4.2.4 Content downloads. In some cases, course content should be downloaded to the student's workstation to provide access to training material when it is not possible to maintain a connection to a training portal. This mechanism allows for self-paced, asynchronous learning at the student's convenience. Note when using a CMS, tracking features must be built-in to the downloaded modules so that the LMS can be updated.

4.4.3 Use of mobile code. Mobile code technologies are very useful in extending and enabling the sophisticated use of programs embedded in or bound to web pages, e-mail messages, word processor documents, and other content types. By using mobile codes dynamic and engaging instructional content can be designed that will provide the student with motivation to enhance the learning experience. For more detailed information about mobile code, see 5.2.3.2.6 and Appendix A.

4.4.3.1 Protecting from mobile code. Some mobile codes pose a threat to the security of the enclave. The enclave is usually under the control of a single authority and has a homogeneous security policy, including personnel and physical security. Local and remote elements that access resources within an enclave must satisfy the policy of the enclave. Mobile codes entering the enclave from systems outside the enclave boundary, pose a threat as they are transferred across a network, and then downloaded and executed on a local system without explicit installation or execution by the recipient. It is not always possible to block the downloading of mobile code. Mobile code may not be detected at an enclave boundary when it arrives over an encrypted channel or within e-mail. However, the execution of mobile code can usually be disabled in desktop software package such as browsers, e-mail, and office applications. The IT Specialist should be consulted as to how to best protect against risk from mobile code.

4.4.4 Multimedia. The primary reason for the use of multimedia should be to simulate the cues, interactions, stimuli, and responses occurring in the job environment to support

performance and performance-based demonstration, learning exercises, and tests. When the subject of multimedia is discussed typically, what comes to mind is audio, video, text, and simulation graphics. It would be better to think of multimedia as a means of enhancing communications in general, regardless of the presentation form. The reason robust multimedia techniques should be applied to DL training products is to better communicate to students the intended learning objectives through multi-sensory and motivation to learn outside of the traditional classroom environment.

4.4.4.1 Audio. The audio aspect of training has taken a back seat to discussions on video however, it is a critical component of nearly all DL technologies. In the traditional classroom setting, we can take advantage of the oral/aural connection between students and instructors and the synergy in learning that can ensue. Audio in general and speech in particular - as speech conveys semantics - assists in providing a robust learning environment. DL students are frequently removed in place and time from their instructors and peers subsequently; DL students are not afforded the benefits of the oral/aural connection prevalent in the traditional classroom.

4.4.4.2 Video. Video can play an important part in adding a new dimension to learning. Traditional Web page designs have been static representations of the material to be learned. New animation controls and streaming technologies allow curricula developers to add the dimension of sound and video to the learning material. The resultant audio and video presentations can add value to the learning process. These presentations can take the form of on-line seminars, instructor demonstrations, and playback clips of material that needs to be visualized for adequate learning.

4.4.4.3 Text. Even with a simple text-based interface, a surprising amount of useful education is possible. In subjects where the material lends itself naturally to text (e.g., literature, key terminology, language, etc.) the text interface may prove to be all that is needed. To make the web a more compelling medium, authors must have the ability to dynamically update content, change the appearance of content, and hide, show, and animate content-including text. Significant amounts of text-based transfers are used in multimedia and other DL products. These include on-line data entry for forms, forum entries, chat rooms, streaming test, and e-mail. Not all training portals offer forums, chat rooms, or even e-mail services between other students or instructors.

4.4.4.4 Graphics. Graphics animation and simulation comes in many forms. Simple animations can be created in Web-based training products. Graphic files may be delivered in a streaming fashion for many training products to increase display speed and thereby enhance the learning process.

4.4.4.5 Streaming. Streaming technologies are becoming increasingly important with the growth of the Internet and are a concern with ADL delivery, as many students may not have fast enough access to download large multimedia files quickly. With streaming, the client browser or plug-in can start displaying the data before the entire file has been transmitted. For streaming to work, the client-side receiving the data must be able to collect the data and send it as a steady stream

to the application that is processing the data and converting it to audio or video. If the streaming client receives the data more quickly than required, it needs to save the excess data in a buffer. If the data does not come quickly enough, however, the presentation of the data will not be smooth.

4.4.4.6 Data sharing. There are data protocols for sharing audio, graphics, text, animation, and full motion video. These can be accessed and used in support of many learning strategies including multimedia conferencing. The T.120-Series of Recommendations (i.e., International Telecommunication Union (ITU) protocols) collectively define a multipoint data communication service for use in multimedia conferencing environments. For more information on data protocols, see Appendix A.

4.5 Content creation. Content for use in an ADL environment can be created using a variety of software including software that generates something as simple as a slide presentation. Creation of course content includes all IMI products (e.g., animations, graphics, video, audio, etc.).

4.5.1 SCORM. To create SCORM conformant products IMI products are developed and metadata tags attached to instructional content in accordance with the SCORM. For more information about the SCORM and other Industry standards that relate to ADL see Appendix A.

4.5.1.1 Objects. Once metadata tagging is applied, the Sharable Content Objects (SCO) (see 5.2.2.4.1.1) can be cataloged and stored in repositories for future retrieval and reuse. For the purpose of this handbook whenever the term "SCO" is used it refers only to a SCO that is in conformance with the SCORM.

4.5.1.2 Repositories. A repository, as it applies to information technology, is a collection of large quantities of digitized data that are kept and maintained in a database. Content and the relationships among its components are stored in the repository for retrieval. The key to a successful data repository retrieval system is the metadata tagging featured in SCORM. It is not necessary for data to be housed in a single repository as long as all repositories use the same tagging system. A user with a SCORM conformant query system could access data in SCORM conformant repositories. A digital library can have many of the same functionalities of a repository. The terms "repository" and "digital library" are used synonymously in this document. From this point on repository will be used unless "library" is part of a proper noun.

4.6 Infrastructure considerations. Infrastructure must be a consideration for the successful delivery of instructional material in an ADL environment. Resources required to implement an ADL program include not only network communication infrastructure demands, but also individual access to the Web and to an Internet-capable computer for every DoD ADL participant. Infrastructure at existing Joint and individual Service education and training centers may need to be re-engineered to support a migration to Centers of Excellence (i.e., centers designated to promote new methods of instruction responsible for coordinating, supporting, developing, and delivering training to assist personnel in achieving academic and career goals)

for ADL. Numerous areas should be analyzed to ensure an adequate infrastructure, these areas include: security, networks, telecommunications, bandwidth, and hardware/software. For additional information regarding infrastructure, see 5.2.3.

5. ISD/SAT PROCESS AND ADL TEAM FUNCTIONS.

5.1 Guidance for selecting, designing, and developing products that support the ADL Initiative. This section provides information regarding issues to be addressed when procuring ADL products and systems. The ISD/SAT process for media selection is addressed in MIL-HDBK-29612-2, Section 7. The guidelines provided in MIL-HDBK-29612-3, Section 4 for the selection of specific IMI media are appropriate for the selection of media for an ADL program.

5.2 ADL team. A team specifically for development of ADL products should be established. Management practices should be reviewed to ensure that policies and procedures are in place and appropriate roles and responsibilities are identified and established. The ADL team should involve people such as managers, Instructional Developers, IT Specialists, evaluators, Subject Matter Experts (SME), and instructors. This team is involved with developing courses for multi-mode delivery (including remote delivery), delivering the courses, supporting the instructors in their delivery of courses, and supporting the students in their learning process. In an ADL environment, there are numerous considerations and issues for the student. Student considerations are included in the section that addresses the Instructional Developer's functions. In all likelihood, the ADL team members will be similar to those required for traditional courseware. However, the challenges facing each member of the ADL team are unique and the IT Specialist is included as an integral member of the ADL team. The functions of the ADL team members are described in the following paragraphs.

5.2.1 Managers. The primary purpose for the ADL manager is to ensure that the training being developed meets the training requirement. This involves ensuring that validation of the educational effectiveness of the courseware is conducted and changes are made until the instruction meets the requirement (supports the required change in performance). The manager should be cognizant of current and emerging DoD and Service concept statements affecting training. These statements define the changes in the global threat environment and the warfare concepts necessary to meet those threats. ADL is a major training response to these warfare concept statements. The manager is responsible for merging the ADL approach with Service guidance statements to enable the development of training appropriate to meet a defined mission. The manager has additional responsibilities for establishing policy and procedures to ensure that the following requirements are met. These include:

a. Determine if contractor resources are required and establish the working relationships between contractor and Government personnel.

b. Assemble tools for designing, developing, and authoring courseware to include data repositories, design tools, authoring tools, and graphics, audio, and video development software and hardware tools.
c. Establish and enforce the rules for cataloguing and editing resources as they are produced. Determine and enforce the level of interaction and media use, in concert with the developer, for various portions of the course. Ensure that original programming is minimized and documented.
d. Determine course and lesson strategies (i.e., collaborative student effort and instructor synchronous or asynchronous involvement). This should be performed through collaboration with the instructional developer.
e. Secure facilities and personnel for testing the courseware to ensure it works both technically and educationally with the target population in the environment where it will be delivered.
f. Ensure the long-term availability of broadcast and reception facilities for planned VTT portions of the training.
g. Ensure the course is entered appropriately into the Service student and resource management systems to support all phases or elements (DL and resident) of the course.
h. Link the LMS to the Service student management and personnel systems to ensure students are properly credited or credentialed.

5.2.1.1 Manager involvement. Early involvement of managers with an understanding of ADL concepts and potential benefits will aid in the successful acquisition and management of ADL products. Managers need to ensure that Internet rules, protocols, and other governing standards relative to an ADL environment are identified and complied with for application on their specific project. Additionally, the manager needs to ensure that the principles of the SCORM and all other relevant standards are applied as intended. When procuring instructional materials for an ADL program, managers should ensure all rules and standards requirements are adequately identified in the Request For Proposal (RFP). For procurement guidelines regarding instructional materials and the development of the RFP, refer to MIL-HDBK-29612-1. Examples of the ADL manager's functions are outlined in Table 2.

TABLE 2. **Manager functions.**

Plan	Execute	Evaluate
• Develop a Return On Investment (ROI) statement.		
• Assemble an ADL team.	• Ensure team members receive appropriate training.	• Assess team performance and make changes if required.
• After the Instructional Developers determine which courses to teach in an ADL environment, analyze the infrastructure requirements and impact on budget.	• Fund infrastructure requirements.	• Assess whether infrastructure is adequate.
• Develop an implementation plan. • Develop policies and procedures.	• Enforce policies and procedures.	
• Ensure program and product plan reflect the ADL implementation of the revolution in warfare and the reengineering of training.		
• Develop milestones.	• Monitor progress against milestones.	• Monitor progress against milestones.
• Secure funding.	• Secure funding.	• Budget for maintenance funding.

5.2.1.2 Planning. Acquisition managers are responsible for the planning of a training program designed to meet the goals set forth in the training requirements document or mission statement of the user activity. The acquisition manager must ensure the products of the acquisition meet the goals of the ADL Initiative. Through planning, managers identify appropriate technologies that will meet their training requirements. Managers need to have information about their student target population, including job tasks and job performance conditions, before they decide to use any form of technology requiring on-line interactive training. Managers should ensure that the training concept does not conflict with base/operational obligations. Managers should review the planning requirements in MIL-

HDBK-29612-2, Section 5 and MIL-HDBK-29612-3, Section 4 for application. An ADL manager needs to:

a. Determine staffing requirements and assemble an ADL team.
b. Develop an Implementation Plan.
c. Develop a Program Evaluation Plan (prepared by evaluator, executed under the supervision of the program manager) and a product Acceptance Plan.
d. Develop milestones.
e. Secure funding.

(1) Identify funding requirements.
(2) Determine infrastructure requirements (consider issues such as firewalls, bandwidth, facilities, etc.). Managers should present infrastructure requirements to the organizations that control the communication infrastructure. Those organizations will establish whether the ADL program conflicts with other requirements.
(3) Determine Military Construction (MILCON) requirements if facilities are insufficient.
(4) Determine the cost of producing new ADL courseware and redesigning existing courseware to an ADL format.
(5) Develop a ROI statement. Include predictions of effectiveness for the training program. Considerations when performing an ROI would include:

(a) Cost of Web Based Training (WBT).
(b) Infrastructure requirements.
(c) Availability of learning content.
(d) Amount and complexity of graphics and programming required.
(e) Length of training.
(f) Personnel required to perform the work.

f. Institute a "Train the Trainer" program. Instructors will need to be familiar with the many technologies used for delivering instructional materials via ADL. Managers need to determine the necessary type of training instructors must have to ensure they are effective instructors in an ADL environment.
g. Ensure that transmission of classified data to be presented in an ADL environment and transmission restrictions are addressed (e.g., firewall issues, mobile codes, requirement for Transient Electromagnetic Pulse Standard (TEMPEST) facilities, Secret Internet Protocol Router Network (SIPRNet), storage and disposal requirements, verifying student's level of security clearance (who is responsible in that activity?), etc.).
h. Determine computer laboratory requirements.
i. An integrated information system should be maintained to manage inputs, outputs, career paths, training requirements and events, education requirements and opportunities,

scheduling, advancement, qualifications, certifications, designations, and status reports from the individual to the unit level.

5.2.1.3 Infrastructure for an ADL environment. The manager is responsible for ensuring the development of an infrastructure that meets DoD required standards and guidelines. The manager coordinates with local IT Specialists to ensure application of current computer, information, and communication technologies essential to the development of a successful ADL program. Courseware developed in an ADL environment will require a form of electronic transmission (e.g., network, cable, satellite capability, etc.), the ability to manage the information received and transmitted, and must establish an adequate infrastructure within the using activities. A successful ADL program does not exclude any existing delivery method, however it may expand and complement legacy delivery systems. An assessment of infrastructure requirements, described below, should be conducted to determine whether a user's infrastructure is considered acceptable for ADL applications:

a. User personnel. An ADL team includes managers, Instructional Developers, IT Specialists, instructors, evaluators, and others. Managers need to determine the required skills and knowledge these team members must possess. Managers also need to determine appropriate staffing levels required to develop and maintain an effective ADL program.
b. IT Specialists. Consider if the available skills and expertise are capable of establishing, operating, and maintaining a functional and reliable computing environment.
c. Collaboration. Determine on-line data review, comment, edit, revision, system capabilities, and approval procedures.
d. Security requirements. Security is of critical concern when delivering sensitive information over an unsecured network. For further information on security as it applies to ADL, see 5.2.3.2.
e. Networks. Determine the networking capabilities (i.e., Internet, intranet, extranet, Wide Area Network (WAN), or Local Area Network (LAN)) that will be used in the ADL program. For information describing the various network applications, see 5.2.3.3.
f. Hardware. Determine the current and planned hardware available to support the ADL environment. For information and recommendations on hardware, see Appendix B.
g. Software. Software is probably the most critical element in an ADL program. Interoperability of software (e.g., WBT, Interactive Courseware (ICW), LMS, courseware developing/authoring tools, etc.) is a primary factor in achieving interoperability of instructional content. Both present and future software applications and availability must be determined. For information and recommendations on software, see Appendix B of this handbook.

5.2.2 Instructional Developers. The instructional developer is expected to apply all of the principles of good course and lesson design covered in Sections 7 and 8 of MIL-HDBK-29612-2 and in Section 6 of MIL-HDBK-29612-3. This section covers topics unique to ADL. For

example, Instructional Developers must consider issues of user interface and programming for high levels of interactivity when designing learning process and content. Also of importance to Instructional Developers of ADL products are the issues involved in the delivery of material in a Web-based environment and their specific interactions (e.g., bulletin boards, chat rooms, etc.). Teletraining, electronic classroom support, WBT, and their related equipment apply to ADL as described in this section. Functions of the Instructional Developer are outlined in Table 3.

TABLE 3. **Instructional Developer functions.**

Plan	Execute	Evaluate
• Determine which courses to teach in an ADL environment. • Determine with the team whether to redesign legacy courseware or produce new. • Determine a course development approach.	• Select a courseware development/authoring tools. • Set up, maintain, and manage functional aspects of the LMS and courseware development/authoring tools. • Develop content. • Develop courseware.	• Evaluate courseware by participating in formative and summative evaluations.
• Contribute milestone events and projected times.	• • Ensure coordinated development of all courseware elements. • Maintain schedule of milestone events.	• • Report problems representing risk to the project.
• Research available training portals/LMSs/CMSs. • Determine training portal/LMS/CMS requirements.	• Select a training portal/LMS/CMS.	• Test the training portal/LMS/CMS to determine proper performance.

TABLE 3. **Instructional Developer functions - Continued.**

Plan	Execute	Evaluate
• Establish with the team whether there is a requirement for SCORM conformance. • Plan with the team the granularity of SCOs.	• Ensure proper tagging of Course Structure Format and SCOs.	• Test SCORM conformance. • Evaluate effectiveness of SCO metadata tagging at appropriate level of granularity.
• Plan with the team issues regarding use of repositories.	• Identify available content repositories and obtain reusable content.	

5.2.2.1 Planning for instructional development. Instructional developers are responsible for analyzing data about the student target population, including job performance environments, and identifying appropriate technologies that will meet the training requirements. The Instructional Developer needs to:

a. Determine the most effective strategies and methods to provide instruction relevant to the job performance environment (i.e., "Train the soldier the way he will fight."). The job performance environment should be perceived with reference to Joint Vision 2020 and the Service Visions as well as the Service efforts to reengineer training. For additional information regarding instructional strategies and methods, see MIL-HDBK-29612-2, 4.3.4 (IDS/SAT phases).
b. Determine the most effective methods to assess the cost and effectiveness of instructional programs. See MIL-HDBK-29612-2, 4.3.4 (IDS/SAT phases).
c. Determine the most effective methods to measure and verify the capabilities and performance of students. When developing Web-based tests consult with the IT Specialist to determine procedures for authenticating the identity of the student and other security needs. See MIL-HDBK-29612-2, 4.3.4 (IDS/SAT phases).
d. Analyze the Terminal Learning Objectives (TLO) and the content of existing courses to ensure they fully support current job performance requirements. Remember, ADL usually involves a much different medium than traditional instruction. The learning objectives for traditional instruction were written within the limitations of the traditional instructional environment. It is essential that only objectives that can be accomplished within the limitations of ADL media are chosen for development and that instructional strategies and methodologies as representative of the job task environment as possible are utilized. ADL provides an excellent platform for providing active practice in mental skills through performance and performance based exercises. Ensure adequate iterations of distributed practice in all critical elements of performance are provided to develop the skill in long-term memory. See MIL-HDBK-29612-2, 4.3.4 (IDS/SAT phases).

e. Determine the types of instruction that lend themselves to an ADL environment (e.g., development, sustainment, and practice in and mental skills with visual or auditory cues, and observable performance measures, updates, refresher courses, recertification, etc.). Determine if there are types of instruction that might not be appropriate for delivery in an ADL environment (e.g., demonstration of gross motor skills, physical collaboration of personnel and equipment which cannot be adequately simulated, tasks which have olfactory/tactile cues or steps, interpersonal skills, etc.). See MIL-HDBK-29612-2, 4.3.4 (IDS/SAT phases).
f. Base the decision to redesign an existing course or begin a new development effort on the effectiveness and supportability of the current instruction. If existing instruction is educationally effective, is technically current content, meets the student load demands and can continue to be supported in its current form (i.e., manpower, resources and policy) it should be used as it is until one or more of those factors are no longer true. When an existing course has been determined to be deficient or decisions have been made to redesign a course to ADL media, analyze the following:

    (1) How technology can bring about specific instructional outcomes reliably, within as wide a range of instructional settings as possible.
    (2) The most effective methods to tailor pace, content, sequence, and style of instruction to the needs of individual students. The needs of the student include placing emphasis on the student's strengths and concentrating on areas where they need help.
    (3) The most effective methods to integrate technology within the existing instructional institutions and determine changes needed for these institutions to maximize ROI in technology.
    (4) The most effective methods to develop new instructional techniques, such as intelligent tutoring, tutorial simulations, and networked simulation, that take full advantage of the capabilities technology brings to instruction.
    (5) Explore with SMEs whether there is a more effective strategy to meet the conditions of the job task environment. For example, using simulations that will replace actual activities and practice toward team building skills.

g. Review the features and functions of the LMS, CMS, courseware development/authoring tools, communication tools, and reference resources of the training portal. See Tables 1 and 26 through 30 for job aids to assist in evaluating these products.
h. Choose a courseware development/authoring tool to take full advantage of the features and functions of the LMS, CMS, communication tools, and reference resources of the training portal. See Appendix C for a job aid to assist in the evaluation of a courseware development/authoring tools.

5.2.2.2 Training portal review and selection. Ideally, each Service will make use of a limited number of training portals. Prior to the acquisition of a new training portal, the

Instructional Developer must assess existing training portals to determine if the features and functions meet the training objectives. Recall from Section 4, that a training portal is comprised of an LMS, a CMS, courseware development/authoring tools, communication tools, and reference resources. See Appendix C for job aids that provide checklists for selecting the appropriate functions and features of the training portal components. The following paragraphs discuss the considerations for each component of the training portal.

5.2.2.2.1 LMS considerations. The Instructional Developer needs to select or design an LMS that will handle the administrative functions of managing a course. Administration of an ADL program is achieved by utilizing electronic and Web-enabled products (e.g., LMS, etc.) that aid administrators in managing and linking relationships between instructors, students, SMEs, jobs, and learning events. An LMS will aid administrators in the performance of essential repetitive administrative tasks from course registration to reporting. For students, an LMS offers access to everything from course catalogs to personal learning plans. Appendix C provides job aids to assist in the review and selection process. An LMS should:

a. Administer and deliver content as needed.
b. Generate data to be contained in the LMS's repository.
c. Gather and update student profiles and attendance records.
d. Track and report student progress.
e. Track and report student performance (e.g., Help, back-ups, problem flags, comments, etc.).
f. Administer and track testing.
g. Register and enroll students.
h. Schedule courses.
i. Calculate budgeting costs.
j. Manage dynamic course catalogs.
k. Launch Web-based classes.
l. Provide students with an integrated view of their entire active courseware, assignments, and progression in a syllabus that spans multiple courses.
m. Maintain security and access rights of the LMS.

5.2.2.2.1.1 Advantages of LMSs. Among the numerous advantages to utilizing an LMS is the capability of establishing a common blueprint and a set of data for managing instructional content and student performance data, thereby increasing opportunities to share instructional resources across isolated instructional systems. Also, LMSs utilize Web-server and client-server technology that allows administration over the Web. An additional advantage is that an LMS allows for the automated and integrated scheduling of physically dispersed resources. Further, LMSs allow the instructor to manage a student in a virtual classroom setting.

5.2.2.2.1.2 SCORM conformant LMS. The Instructional Developer needs to select an LMS that will accomplish the program objectives and meet the ADL Initiative requirements. Many

LMSs exist. Currently, LMSs are being developed to conform to the specifications in the SCORM. If it is determined that the instructional content will conform to the SCORM it must also be usable on all SCORM conformant LMSs. Many LMS systems will play many different kinds of courses developed in different courseware development/authoring tools. Most will at least provide data on entry and completion of a managed element (i.e., AICC Level 1 courseware). Some will even capture internal data on courses produced by different courseware development/authoring tools. For specific information regarding the SCORM refer to the ADL Web site at URL http://www.adlnet.org. To be SCORM conformant an LMS must be capable of:

a. Launching a known conforming course SCO.
b. Fully supporting the mandatory Application Program Interface (API).
c. Supporting the mandatory and optional data elements in the data model.

5.2.2.2.2 CMS considerations. The CMS provides the direct interaction between the student and the courseware. The CMS should provide, as a minimum:

a. Student pre- and post-assessment of the learning materials.
b. Testing modules.
c. Remediation mechanisms.
d. Bookmark features.
e. Student progress within the learning module.
f. Presentation interface for courseware.
g. Start, last visit, and finish dates.
h. High level of interactivity.
i. Multi-path navigation features.

5.2.2.2.3 Courseware development/authoring tools considerations. The Instructional Developer will often be faced with the task of selecting a courseware development/authoring tools. This handbook will not attempt to provide a review of specific courseware development/authoring tool applications. There are many reviews of courseware development/authoring tools available on the Internet. Courseware development/authoring tools are very dynamic. Companies producing these tools are continually updating and improving their products. Many organizations select a single tool in the hope of standardization. Standardization is supported by compliance with the JTA, SCORM, and the DoD Data Architecture (DDA) and Defense Data Dictionary System (DDDS). Prior to commencing with the development of a new course, it is important to determine whether the courseware development/authoring tool is capable of supporting the educational and training functionality required.

5.2.2.2.4 Communication tools considerations. Not all DL courses should be presented as self-paced, learner-centric presentation modules. Some courses still require the traditional

instructor-led environment, or the synergy that results with student interaction. Traditional Web-based training modules may be complemented with a cadre of communications and collaboration tools. Training portals may provide these tools to allow students to communicate with instructors, SMEs, and peers during the learning process. The degree to which these tools are used in a specific course will often be driven by practical factors related to supportability including:

a. How large a population will be supported with a specific course.
b. How large is the instructor staff.
c. Does the instructor staff have the skills and time required to handle large numbers of student interactions in written form on-line.
d. Does the target population have the time and skills to engage in on-line dialogue with the instructor and other students.
e. Will this be a supportable and sustainable strategy given the realities of reduced manpower and budget resources in Service schools.
f. Is this kind of interaction essential to meeting the objectives of the course. When this is true, ensure that the course is resourced with adequate instructors to support this strategy. Examples of robust communications tools that should be considered for training portal selection are:

    (1) Desktop videoconferencing.
    (2) Electronic forums.
    (3) Newsgroups.
    (4) E-mail and list server applications.
    (5) Chat rooms (all chat sessions are to be facilitated by the instructor).
    (6) Virtual classrooms.
    (7) Data sharing applications.

5.2.2.2.5 Reference resources considerations. Students will need a myriad of support services and reference materials to meet training objectives. The key is to ensure that the training portal can accommodate this feature in a manner that is transparent to the student. Technical manuals, directives, instructions, standards, specifications, and other traditional reference materials should be made available to the students through the training portal. Ideally, the capability to hyperlink these materials to any course content would be made available. When considering use of hyper-linking to reference resources, remember one of the implied objectives may be teaching the student how to find and use the data resource without hyper-linking (just as in the job environment). If this is the case, hyper-linking directly to the desired material may not provide the student practice in some critical job skills.

5.2.2.3 Technology advances. The Instructional Developer needs to ensure that full exploitation of current technology is employed in the development of the instructional program. Sharing and manipulating global databases, information, and instruction will be an immediate

spin-off of distributed training. Advances in electronic communication technologies allow the presentation of media in the form of standard text and sophisticated computer graphics. Random access to images, ease of changing and/or updating presentations, and the ability to create quality presentations with Personal Computers (PC) have eased the burden on Instructional Developers, instructors, and students alike. Networked computers provide instructors with a new level of media sophistication. Images normally presented with slides or transparencies can be digitized, cropped, color corrected, and a set of overlay labels created for each level of instruction. Images, label overlays, audio clips, and SCOs can be stored in a media repository for later access and reuse. Many uses of technology in lesson design are commendable because they generally expedite learning. Certain uses of technology are mandated by the strategies and methodologies necessary to replicate as closely as possible the job task environment. The distinction between technology strategies and methodologies must be considered when conducting cost-benefit analyses for ROI.

5.2.2.4 Reuse of content (i.e., reuse of objects). The Instructional Developer needs to ensure reusability of instructional materials and content. During the decision making process for the lesson design, the instructional developer needs to consider SCO specifications and metadata tagging requirements, as well as the level of granularity of SCOs within the lesson. A key ADL requirement for instructional content is the ability to reuse instructional components in multiple LMSs, courseware development/authoring tools, and environments regardless of the tools used to create them. SCORM provides the metadata tagging system to accomplish this requirement.

5.2.2.4.1 SCO content. An essential ingredient in creating or redesigning courseware for use in an ADL environment to be applied to an ADL program is conformance with the SCORM. The Instructional Developer determines the level of granularity and ensures that the courseware being developed/redesigned is organized into discrete SCOs. The level of granularity chosen can be by course, block, objective, media element, etc. The level of granularity determines the size of the SCO. Available SCO metadata tags include:

a. Mandatory tags as defined by the SCORM.
b. Optional tags as defined by the SCORM.
c. User-defined tags as required for extensibility.

5.2.2.4.1.1 Sharable Content Objects. As SCOs are self-contained chunks of instructional material (i.e., images, shapes, text, or groups of images, shapes, and text structured into instructional sequences, events, activities, lessons, modules, phases, or entire courses) that can be individually retrieved from a content repository and manipulated, and reused for a different purpose. SCOs are used as the building blocks of instruction required to compile the training and education needed for a specific student at a specific time. Using SCOs as building blocks, information can be assembled to develop classroom instruction, ICW, and WBT courses that include text, web pages, video, and audio. Instructional Developers need to provide the associated metadata tagging to the SCOs required by the SCORM. Attaching the SCORM

specified descriptive metadata tags to the SCOs will allow Instructional Developers to search repositories and achieve significant cost savings through reuse of existing SCOs. By capturing these data at the time of creation, the process of updating media files will be simplified. During the creation of the SCOs, it is important to maintain a list of the metadata tags required for each SCO in final deliverable format (i.e., compressed or uncompressed) as an element of the course or lesson as well as a list of the metadata tags required for each original uncompressed format media object. See the latest version of the SCORM for examples of the data stored as SCOs.

5.2.2.4.1.2 Level of granularity. The Instructional Developer will choose the level of granularity that is applied to the instructional material. This decision will be influenced by the complexity of the learning objective, content, and repository's database. It will be necessary for the Instructional Developer to work closely with the IT Specialist to determine whether a repository exists that meets the needs of the activity or if it is necessary to develop a repository. It is also necessary for the IT Specialist to inform the Instructional Developer of the specific requirements and restrictions repositories impose on activities that choose to use their site. Other factors that should be considered when determining the level of granularity include:

a. The likelihood that the SCO will be useful to others.
b. The expected lifetime/durability of the data within the SCO.
c. The additional workload associated with finer levels of granularity including configuration management and maintenance of the data within the SCO.
d. The classification/sensitivity of the data.

5.2.2.5 Redesigning legacy instructional material. The Instructional Developer will often be called upon to extend, revise, or redesign existing courseware to take advantage of current technology. The feasibility and options for redesigning legacy courseware to SCOs need to be addressed, as well as object-oriented standards that need to be imposed on new courseware to be developed, delivered, and warehoused. It should be noted that redesign for the purpose of reusability and transportability does not necessarily improve the instructional quality of the legacy course material. However, it does enable the custodian of a unit of instruction to make it transportable and reusable by others. This is particularly useful when an instructional unit is very successful and others want to use it instead of paying to develop their own versions, but are prevented by incompatibility.

5.2.2.6 Warehousing of SCORM conformant instructional material. The Instructional Developer will develop repositories of reusable instructional material and will want to access such material in other repositories. It is advisable to develop/utilize an information management system to catalog the ever-expanding instructional data in repositories. Warehousing of instructional data requires the following:

a. Collection and cataloging. Once collected and cataloged, data will be easily accessible for the retrieval, reuse, and modification of SCOs. SCOs remain available until specifically deleted.
b. Coordination. Once warehoused, SCOs are available for use in developing courseware and lessons. Indexing will provide a means of locating a particular course or course element. Cross-referencing will provide a means of identifying courses or lessons which make use of a given SCO.
c. Update. A revision and transaction control system will ensure updating of dependent SCOs. Automatic tagging of similar courses or lessons will enhance the review process.
d. Storage. Warehousing of data should be in multiple locations (i.e., distributed warehousing). Storage should be redundant for performance, backup, and reliability. Storage should be by content and presentation vehicle. Multiple versions of SCOs can be made available for access via an Internet, intranet, or extranet.
e. Safeguarding. Measures to ensure the security of warehoused data should protect against unauthorized access and/or manipulation of data. This may be accomplished by using validation via passwording, reverse Domain Name System (DNS), or public key encryption. Security is discussed in detail in the section for the IT Specialist.

5.2.2.6.1 Repositories and repository selection. Repositories store large quantities of retrievable digitized data maintained in an organized way. In the ADL (or DL) sense, this data will be SCOs (and their structure) that may be retrieved from different physically dispersed repositories via a central index. To encourage content reuse, repositories should be directly accessible for retrieval of files or documents. Repository selection can be based on an existing relational or object-oriented database system or can be developed new. The Defense Instructional Technology Information System (DITIS) maintains an index of repositories that have registered with DITIS. Before the decision to develop or fund new ICW, the DITIS database must be queried to determine what existing products meet or can be cost effectively modified to meet the training requirements. This is done by submitting the DITIS form (DD form 2568) with the information requested in sections A and B of the DITIS form.

5.2.2.7 Mix and match interoperability. The Instructional Developer will often want to use material from a variety of repositories. A major interoperability issue relates to instruction and the objects (i.e., SCO) that will make up the instruction. A standard interface, file format, and conformance to the SCORM provide the capability to mix and match content from different sources. Interoperability also requires the capability to read and write files between various types of IMI. Interoperability ensures ease of storage, retrieval, and reuse of information.

5.2.2.7.1 Course reusability. Often a course found in DITIS could work perfectly for another instructional purpose however, the Course Structure Format (CSF) is different from the CSF of the borrowing activity's LMS, and is therefore not transportable. If the CSF of the course has been mapped to the SCORM CSF, the borrowing activity will be able to use it in a SCORM conformant LMS. The SCORM CSF mapping translates the borrowed course CSF into one

playable by a SCORM conformant LMS. This means that the original course developer may develop the course using a CSF unique to the setting requirements of the original command and it will still be transportable to another course environment. SCORM CSF mapping provides for course development innovation while supporting the ADL principles of transportability and reusability.

5.2.2.8 Data transportability. The Instructional Developer will have the task of developing new databases and accessing the information in existing databases. New database management systems developed for use in DoD must comply with the DDA and DDDS. The DDA and is populated with Standard Data Elements (SDE) that can be used by the Instructional Developer in a database to document instructional information such as: technical course data, lesson data, student data, course administration data, task lists, learning objectives, test items, etc. This information and much more data required to operate in the training environment can be housed in a database. Legacy database management systems should be mapped to the DDA. The MIL-PRF-29612 Preparing Authority has been submitting training specific changes to the DDA and DDDS for the purpose of adding training SDEs. DoD has approved numerous training SDEs and is reviewing additional training SDEs for approval. As this is an ongoing effort; Instructional Developers should ensure that, when appropriate, data elements are submitted to the MIL-PRF-29612 Preparing Authority for submission to DoD. The MIL-PRF-29612 Preparing Authority has developed the Training and Education Data Element Dictionary (TEDED) which lists the SDE name, definition, field size, field type, and data links for each training data element (approved and in the process of review by DoD). The TEDED is a helpful tool for identifying the SDEs that relate specifically to training. The TEDED can be downloaded from http://dtswg.msiac.dmso.mil/ (click on MIL-PRF-29612).

5.2.2.8.1 Data collection. Data collection and content development have changed dramatically during the past decade. Due to new technology and information available on the Internet, it is now relatively easy to access digital information for instructional development. Useful resources are available via the Internet, intranets, or extranets that can be used to collect, evaluate, and select instructional materials. Information and services available include:

a. Data available on the Web includes:

(1) Schedules, policies, and documentation.
(2) Resource guides and bibliographies.
(3) Inter-repository loan information and requests.
(4) New book recommendations.
(5) Reference services.

b. Links to other repositories including:

(1) Internet reference collection.

(2) Electronic books.
(3) A multitude of other databases.

c. Electronic journals and newsletters, including:

(1) Scholarly journals.
(2) Literary collections.
(3) Showcases for local or organizational talent.
(4) News.
(5) Information services.

5.2.2.8.2 Data formats. Data that is collected and available in repositories may be in many different formats including:

a. Digital.
b. Analog recordings.
c. Paper-based.
d. Photographic images.

5.2.2.8.3 Use of non-standard data elements. It is anticipated that specific projects will have data requirements that are not included in the DDA and not in the TEDED as a proposed SDE. The Instructional Developer needs to ensure that any data elements that are not approved by DoD are properly tagged with metadata in the DoD approved format and become a permanent and integral part of DoD instructional materials. The Instructional Developer also needs to ensure that, when appropriate, data elements are submitted to the MIL-PRF-29612 Preparing Authority so they can be submitted to DoD for approval as training SDEs.

5.2.2.9 ADL program design. The Instructional Developer needs to ensure application of the ADL principles in the development of instruction. Instructional methodologies used in an ADL environment are designed to enhance learning and reduce student time away from the job as compared to traditional methods of classroom instruction. Additionally, the ADL program must have the capability of near-real-time individual management and provide individual student performance information. Instructional design that supports the ADL Initiative should allow an organization to start with an idea and then develop an instructionally sound interactive course tailored to its needs, or redesign legacy instructional materials.

5.2.2.9.1 WBT selection. The Instructional Developer, in concert with the ADL team controls the planning, analysis, design, development, implementation, and evaluation of the ADL program to meet its needs. MIL-HDBK-29612-2, Section 7 and MIL-HDBK-29612-3, Section 4 provide guidance for the selection of instructional media. There are also Commercial Off-the-Shelf (COTS) products that can be used to assist in the media selection process. The output of media selection identifies the appropriate media for supporting the specific learning objectives.

Table 4 describes factors to be considered when determining whether it is feasible to use WBT in the intended environment.

TABLE 4. **WBT selection factors.**

Element	**Factors**	**YES**	**NO**
Suitability	Will participants use the material on the job?		
	Does the design result in skills learned relative to job performance?		
Media	Does the media support the performance of the job task and instructional strategies? If no; state what type of media would be better:		
	Can (or are) open standards be used?		
	Are there bandwidth technology constraints? If yes; state constraints:		
Facilitation	Is the training user-friendly?		
	Is there a required degree of interactivity? If yes; state the required degree of interactivity:		
	Is the degree and type of interaction consistent with the job performance environment?		
	Does the class require a specific number of students to be effective? If yes, state how many students are needed to be effective without being unmanageable.		
Resources	Does the outline content make the most effective use of an organization's resources (e.g., infrastructure, hardware, software, instructors, etc.)?		
	Are collaboration tools available on the Internet? If yes, state how the tools can be utilized:		
	Is necessary equipment available to the user? If no, state what equipment is not available:		
	Will the user organization be required to purchase additional software or hardware in order to make use of the training?		

TABLE 4. **WBT selection factors – Continued.**

Element	Factors	YES	NO
	Is extra training required to learn to use the software or hardware before actual training can take place?		
	Are the materials and graphics relevant to the job performance environment?		
	Does the training contain an on-line help feature?		
Instructional issues	Are the various learning inputs incorporated (e.g., visual, auditory, kinesthetic, etc.) appropriate to the job performance environment?		
	Is adult learning theory addressed? (i.e., What's in it for me?)		
	Is the program pacing (i.e., synchronous or asynchronous) appropriate to the job performance environment?		
	Does the instructor have experience facilitating in a network environment?		

5.2.2.9.2 User interface. Instructional Developers ensure that the courseware is easy to use and supports the accomplishment of the learning objectives. Effective interfaces should be used to create and hold the interest of the student and to represent the job task environment. ADL introduces higher resolution Graphical User Interfaces (GUI) (refer to the JTA) and the use of more video and audio for desktop communications and collaborative interactions. Instructional courseware should be developed with attention to bandwidth requirements. The current focus of WBT development is on the use of available tools and organizing content into well-crafted teaching systems. Instructional Developers should take into consideration interface design and programming for high levels of interaction.

5.2.2.9.3 WBT delivery formats. Much of the courseware that Instructional Developers will be creating comes under the category of WBT. WBT is an approach to distance learning in which CBT is transformed and delivered using Internet technologies. Examples of WBT delivery formats are bit map, Cascading Style Sheets (CSS), Extensible Markup Language (XML), Hypertext Markup Language (HTML), Joint Photographic Experts Group (JPEG), Synchronized Multimedia Integration Language (SMIL), Extensible Style Sheets Language (XSL), and Portable Document Format (PDF). For a complete list and explanation of delivery formats refer to the JTA. ADL Initiative supported products should be developed in a browser compatible form and avoid proprietary file formats. Development of courseware products using proprietary file formats is discouraged as this eliminates reusability and interoperability. The choice of which programming language(s) and mobile code(s) are used should be made after consulting with an IT Specialist. The use of some programming language(s) and mobile code(s) are prohibited and some are acceptable, but are discouraged for system security reasons.

5.2.2.9.3.1 Browsers. The Instructional Developer may ensure the maximum reusability of instruction by making it browser-based regardless of how it is to be used in the immediate application. Managers and Instructional Developers should be aware that some browsers may not adequately support multimedia content. Instead, they rely on numerous plug-ins to do that and a variety of other functions. Browser extensions that are unique to a specific vendor are not acceptable. For specific information regarding the use of browsers, refer to the JTA.

5.2.2.9.3.2 Plug-ins. Plug-in applications are programs usually available free on the Internet that can easily be installed and used as part of the user's Web browser. A plug-in application is recognized automatically by the Web browser and its function is integrated into the main HTML file that is being presented. Non-HTML formatted instruction, which requires a browser "plug-in" to run is acceptable as long as the final product is exportable to HTML format. Plug-ins themselves are without standards although there may be some de facto standards. Before selecting and downloading a plug-in, the local IT Specialist should be contacted for local rules and regulations. For specific information regarding the use of plug-ins, refer to the JTA.

5.2.2.9.3.3 Streaming. Streaming is advantageous as it allows large audio and video files to be played or viewed as they arrive on the computer through the Internet connection rather than having to wait for the file transfer to complete. This makes for a more responsive user interface. Streaming media requires plug-ins. Managers and Instructional Developers should be aware that committing to a particular non-standard video solution might require switching later. For specific information regarding streaming, refer to the JTA.

5.2.2.9.3.4 Server resident WBT. Web-based instructional products can be designed to deliver courses without the need for a network connection while using a common Web browser to view content and take tests. The software lets users easily download courses from a specified server for viewing any time. Users can also load a Compact Disk-Read Only Memory (CD-ROM) containing the courses and use a standard Web browser to access the content. Training materials designed for the server can be rapidly published for users without re-authoring the content. This type of software can be made to operate on a local Web server and allow users to access courses using their Web browser. Switching between the use of on-line and off-line materials becomes a seamless operation that eliminates any need for retraining.

5.2.2.10 Student considerations. The Instructional Developer will need to be mindful of the student while designing and developing instructional material for delivery in an ADL environment. For the student to be successful they will need to be motivated, plan their time well, and have the ability to apply the instructional content. An ADL program offers additional challenges because students are often separated from others sharing their backgrounds and interests, and have few opportunities to interact with instructors outside of the teaching environment. Some student specific issues to be addressed are:

a. Registration.

b. Test taking.
c. Hardware and software requirements for students.
d. Number of students with PCs.
e. Digital resources (e.g., repositories, servers, network access, etc.).
f. Difficulties in obtaining Internet access for course assignments.
g. E-mail account set up. Deadline requirements for setting up an e-mail account and steps to set up e-mail accounts for students.
h. Prerequisite Internet knowledge requirements.
i. Access to various domain addresses (e.g., ".mil", ".gov", ".net", ".edu", ".org", etc.).
j. Download restrictions (e.g., modem speed, ISP speed, file format, file size, etc.).
k. Browser requirements and procedures for using.
l. Collaboration tools and procedures.
m. Computer laboratory availability.
n. Number of students who would rely on a computer laboratory.

5.2.2.10.1 Advice for the student. The student will benefit by embracing the new technologies available. If the student enjoys the challenging aspects of this medium, their learning experience will be enhanced. Individuals that are resistant to using computer technology will find learning in an ADL environment very frustrating. Consider that another type of instructional delivery method (e.g., classroom, paper-based correspondence courses, etc.) might suit those students better than ADL. Table 5 is a self-assessment job aid that should be provided to students so they can rate the skills that will be required. The information received after the student rates their skills will assist in determining how best to modify the instructional strategy to suit all the students. The results of the self-assessment can also be used to determine if the student needs additional prerequisite courses (e.g., basic keyboarding skills, a familiarization course for Internet/intranet usage, etc.) prior to registering for this course.

TABLE 5. **Self-assessment job aid for students in an ADL environment.**

SKILLS/KNOWLEDGE	**SKILL LEVEL**				
	POOR		**AVERAGE**		**EXCELLENT**
	1	**2**	**3**	**4**	**5**
Familiarity with Internet environment.					
Ability to search and navigate the Internet using a browser.					
Ability to use electronic bookmarks.					
Ability to send and receive e-mail.					
Ability to attach files to e-mail.					
Ability to download files.					
Ability to zip and unzip large files.					

TABLE 5. **Self-assessment job aid for students in an ADL environment – Continued.**

SKILLS/KNOWLEDGE	SKILL LEVEL				
	POOR		AVERAGE		EXCELLENT
	1	2	3	4	5
Knowledge of computer/Internet/network terminology (e.g., bulletin board, forum, chat, browser, etc.).					
Prior on-line experience: chats, bulletin boards, forums, e-mail.					
Familiarity with various search engines that are to be used for research.					
Familiarity with Netiquette. (The success of an on-line course depends on successful interaction between all parties. Netiquette is simply an informal but recognized set of etiquette rules/practices that have made exchanges via an electronic means a bit more civil. Numerous web sites and books deal with the subject.)					
Level of comfort with using a computer and the Internet/intranet to gain knowledge.					
Level of comfort with interacting with the instructor, classmates, teaching assistants, and others solely through electronic telecommunications.					
Willingness to dedicate 8+ hours per week to successfully participate in this course.					
Ability to troubleshoot technical problems and ask for help when necessary.					
Assess time management skills. (ADL is time consuming.)					
Level of self-motivation.					
Independent learning skills.					
Written communication skills.					
Keyboarding skills.					

5.2.3 IT Specialist. IT Specialists manage the technical resources of the ADL program. The IT Specialist needs to be familiar with infrastructure requirements, hardware, and software that will adequately support the ADL program. Additionally, until the SCORM is refined and the application of the metadata tagging is simplified, it is essential the IT Specialist be an active

member during the design and development of SCORM conformant instructional materials. Functions of the IT Specialist are outlined in Table 6.

TABLE 6. **IT Specialist functions.**

Plan	Execute	Evaluate
• Provide guidance to the manager regarding infrastructure considerations.	• Assist Instructional Developer with selection of LMS by providing the technical requirements. • Set up, maintain, and manage technical aspects of the LMS.	• • Evaluate functionality of system against Evaluation Plan requirements.
	• Assist Instructional Developer with the selection of courseware development/authoring tools by providing the technical requirements. • Arrange for access to repositories. • Set up and maintain the technical aspects of courseware development/authoring tools.	• • Evaluate functionality of software against Evaluation Plan requirements.
	• Analyze and select hardware. • Set up, maintain, and manage the hardware. •	• • Evaluate functionality of hardware against Evaluation Plan requirements.
• Advise team regarding standards and activity regulations.	• Make all necessary arrangements for the network. • Set up network. • Maintain the network.	

TABLE 6. **IT Specialist functions - Continued.**

Plan	Execute	Evaluate
• Advise team on bandwidth and mobile code policy and requirements.	• Provide technical assistance. • Assist Instructional Developer with web design, graphics, and layout by providing the technical requirements. • Manage passwords and user privileges. • Identify computer laboratories available to support students. • Monitor and update FAQs.	• Analyze queries for technical assistance and evaluate existing data/service and improve as necessary.
	• Assist Instructional Developer with metadata tagging by providing the technical requirements.	• Evaluate the technical performance of SCORM conformant courseware in the hardware suite.

5.2.3.1 IT department involvement. It is important to obtain the involvement of IT department personnel early in the process of selecting courseware to be accessed over the Internet or intranet. IT Specialists collaborate with Instructional Developers during the determination of infrastructure requirements. IT Specialists should also work with managers to provide input for budgeting, and provide guidance and ensure that managers are informed about security (e.g., firewalls, malicious code, mobile code, etc.). The IT Specialist may also perform some administrative functions by managing and coordinating dynamic course catalogs, course requests, enrollment, and launch of Web-based classes. These IT administrative duties may include:

a. Manage, create, delete, and change student passwords and e-mail accounts.
b. Assign and suspend user privileges (e.g., log-in, access, etc.).
c. Manage and monitor user activity on the network (i.e., Internet, extranet, intranet, LAN, or WAN).
d. Monitor user activity for the organization.
e. Schedule use of facilities for computer laboratories, videoteletraining, etc.
f. Access privileged pages.
g. Conduct on-line surveys.
h. Perform course diagnostics and statistical analyses.
i. Generate reports and process grade reports.

j. Secure copyright clearances.

5.2.3.2 Security. The IT Specialist is critical to the design of an instructional program that will ensure the security of the facility, course content, and student information. The inherent design of the Internet as an open free exchange of information across cyberspace poses a security risk. Techniques for ensuring that data stored in a computer cannot be read or compromised should be assessed. Some Web applications pose threats to security. For instance, "push" technology (also known as webcasting or pointcasting) sends information directly to the user's computer rather than forcing the machine to go and get the information. Most of today's vendors actually use a glorified "pull" system. They notify the user of new information, and then the user has the option of whether or not to go and get it. Push technology is prohibited on all Government computers because of the security risks involved. Another issue of critical concern to security is when sensitive information is being delivered over an unsecured network. This issue is especially relevant to providing testing over the network when social security numbers are collected. The IT Specialist's job includes providing guidance to the Instructional Developer on security related issues that may include:

a. Firewalls.
b. Passwords.
c. Encryption.
d. Gateways.
e. Servers.
f. Viruses.
g. Mobile codes.

5.2.3.2.1 Firewalls. A firewall acts as a shield to protect system integrity between a user's computer or host network and the Internet by blocking messages that do not meet specified security criteria. An installed firewall on a computer network serves two purposes. It controls or prevents access to the network from outside servers and the transfer of information from the network to the outside servers. Firewalls can be implemented in both hardware and software, or a combination of both. Since firewalls can cause problems with importing and exporting instructional materials, managers should be aware of firewall restrictions for their particular location and select training that can be utilized within the confines of the established firewall.

5.2.3.2.2 Passwords. As passwords are used to log into a secured computer system and access a file, computer, or program it is important for the IT Specialist to provide guidance to the Instructional Developer on the development, use, and security of passwords.

5.2.3.2.3 Encryption. Encryption is the most effective way to achieve data security and protect classified or sensitive information from unauthorized users. Encryption is merely the scrambling of data to make it unreadable. Unencrypted data is called plain text. Encrypted data

is referred to as cipher text and requires a secret key or password to enable decryption. There are two main types of encryption: asymmetric encryption and symmetric encryption.

5.2.3.2.3.1 Asymmetric and symmetric encryption. Asymmetric encryption (public-key encryption) is a cryptographic system utilizing two separate keys. A message is sent using a public key to encrypt the message and the recipient uses a private key to decrypt it. An important element to this system is that both public and private keys are related in such a way that only the public key can be used to encrypt and only the private key can be used to decrypt. The symmetric encryption (private-key encryption) system is different in that it requires the same key to encrypt and decrypt.

5.2.3.2.3.2 Public Key Infrastructure (PKI). A PKI is a system that enables users of a unsecured public network (i.e., Internet) to securely and privately exchange data through the use of a public and private cryptographic key pair obtained and shared by a trusted authority. The PKI assumes the use of public key cryptography. Traditional cryptography involves the creation and sharing of a secret key for encryption and decryption of data. For this reason, public key cryptography and the PKI is the preferred approach on the Internet.

5.2.3.2.3.3 SIPRnet. SIPRnet is a WAN that is separated both physically and logically from other networks. It is a secret router that serves as the backbone network for long distance transmission data security in support of national defense. Each access circuit and backbone trunk is encrypted to ensure integrity of information. The SIPRnet has been tested and is proven safe for transmission of classified instructional material.

5.2.3.2.3.4 Unclassified but Sensitive Internet Protocol Router Network (NIPRnet). The NIPRnet is an Internet protocol network that connects several LANs and users through the use of routers and Asynchronous Transfer Mode (ATM) switches. Access is restricted to authorized users by the use of an authentication control system that requires a login and password.

5.2.3.2.3.5 Application and circuit-level gateways. The application gateway applies security mechanisms to specific applications, such as File Transfer Protocol (FTP) and Telnet servers. Though effective, it can impose performance degradation. The circuit-level gateway applies security mechanisms when a Transmission Control Protocol (TCP) or User Datagram Protocol (UDP) connection is established. When the connection is made, packets flow between hosts without further checking.

5.2.3.2.4 Proxy server. A proxy server intercepts all messages entering and leaving the network. The proxy server effectively hides the true network addresses.

5.2.3.2.5 Viruses. A virus is designed to spread and replicate within a system by attaching to other programs or the boot sector of a hard drive after downloading executable files or by transferring from a floppy disc or CD-ROM. A virus can compromise or erase existing files or

render them unusable, in turn creating excessive system downtime to repair the damage. There are two types of viruses: file viruses and boot sector viruses. A file virus will attach itself to ordinary program files through either a direct action virus or a resident virus. Direct action viruses search other programs and infect each time that program is executed while resident viruses hide within the memory and infect when the infected program executes in-turn infecting other programs. A boot sector virus will infect while the computer is being loaded. It monitors all of the processes in the computer and modifies them. Attempts to erase, replace, or modify the boot area are intercepted and cancelled. A virus is designed to infect with the user unaware of its existence.

5.2.3.2.6 Mobile codes. It is the job of the IT Specialist to make Instructional Developers aware of restrictions and prohibitions with regard to mobile codes. Mobile code technologies are very useful in extending and enabling sophisticated use of programs embedded in or bound to web pages, e-mail messages, word processor documents and other content types, however they can also serve as vehicles for security compromise. They can be used maliciously to deny service, corrupt or expose sensitive information, and destroy data. This security issue needs to be considered when developing instructional material to be presented in an ADL environment. The IT Specialist should be aware of current mobile code policy (e.g., Policy Guidance for use of Mobile Code Technologies in DoD Information Systems, Service specific mobile code policy, etc.).

5.2.3.2.6.1 Malicious code. Malicious codes are software modules designed, employed, distributed, or activated with the intention of compromising the performance or security of information systems and computers, increasing access to those systems, disclosing unauthorized information, corrupting information, denying service, or stealing resources.

5.2.3.3 Networks. Transmission options available for WBT include Integrated Services Digital Network (ISDN) lines that are a portion of a T-1 line (which are high bandwidth); modems (which are low bandwidth); cable modems, personal digital satellite receivers, and Asymmetric Digital Signal Loop (ADSL) connections (which are low to medium broadband transmission). For information regarding requirements for bandwidth, see 5.2.3.4. Networks include:

a. LAN. A LAN is the term applied to all the physical hardware and software that drives a data communications computer system confined to a limited geographic area. A LAN could be used to deliver DL content to students in a computer laboratory or an electronic classroom. For more information about LANs, see 5.2.3.4.5.
b. WAN. A WAN is similar in function to a LAN, however it is a more geographically dispersed telecommunications network much broader than that of a LAN. For more information about WANs, see 5.2.3.4.6.

5.2.3.3.1 Network communications. The IT Specialist will advise on the capabilities of the existing infrastructure and the requirements for enhancing the infrastructure to accomplish

instructional goals. An operational ADL program will require a robust data network infrastructure between the decentralized databases and repositories for digital courseware and geographically dispersed or mobile students. This network infrastructure must be interoperable between force components, echelons, delivery platforms, and user terminals. The network infrastructure should be capable of deploying sufficiently high bandwidth communication systems to remote deployed sites. The network infrastructure must be compliant with the JTA, and should be transparent to Instructional Developers, administrators, users, and managers and should build on the existing infrastructure.

5.2.3.3.2 Telecommunications standards. Telecommunications standards are required for the modems, cable modems/ADSL, ISDN, T-1/fractional T-1 lines, and E1 lines. These modes of telecommunications are described below:

5.2.3.3.2.1 Modem. 28.8 Kilobits per second (Kbps) and 56.7 Kbps modems are low bandwidth and may or may not be sufficient for a specific training product. Audio and video compression schemes used for these bandwidths can be lossy. (Lossy refers to data compression techniques in which some amount of data is lost. Lossy compression technologies attempt to eliminate redundant or unnecessary information. Most video compression technologies, such as Moving Picture Experts Group (MPEG), use a lossy technique.) Compression technologies should be evaluated to ensure that the least lossy technique that will satisfy the learning objective is chosen.

5.2.3.3.2.2 Cable modems/satellite/ADSL. Low to medium broadband transmission includes cable modems, personal digital satellite receivers, and ADSL connections. These transmission connections are described below.

5.2.3.3.2.2.1 Cable modems. High-speed cable modems are available that are certified to adhere to the Data Over Cable Service Interface Specification (DOCSIS) standard (which is an ITU standard). This is a significant milestone because, instead of leasing proprietary cable modems from cable operators, consumers now can purchase standardized, interoperable modems through the retail channel. Certified cable modems have a high likelihood of working with any cable vendor in the nation that makes the Internet available to subscribers. The standard cable modem architecture now has high-speed data capability of up to 38 million bits per second throughput per standard cable channel.

5.2.3.3.2.2.2 Personal digital satellite receivers. Direct Broadcast Satellites (DBS) are comprised of a network of satellites that broadcast digital data. DBSs are used to broadcast digital television signals as well as instructional material to privately owned small satellite dishes. This allows an instructor to be in a studio, remote from the students, and reach a large number of students at home or in classrooms in a widely dispersed geographic area all occurring in real-time. With this method of transmission, it is desirable to have backup instructional materials in the event the satellite signal is disrupted due to weather or other technical problems.

5.2.3.3.2.2.3 ADSL. ADSL is a new technology that allows more data to be sent over existing copper telephone lines (i.e., Plain Old Telephone System (POTS)) at data rates of from 1.5 to 9 Megabits per second (Mbps) when receiving data (known as the downstream rate) and from 16 to 640 Kbps when sending data (known as the upstream rate). ADSL requires a special ADSL modem.

5.2.3.3.2.3 ISDN. ISDN lines (64 Kbps channel) which are portions of a T-1 line (total of 1.5 Mbps) are leased by many mid-size to large organizations for Internet connections through their LAN. ISDN is an international communications standard for sending voice, video, and data over digital telephone lines or normal telephone wires. ISDN supports data transfer rates of 65 Kbps. Most ISDN lines offered by telephone companies provide two lines at once, called B channels. One B channel can be used for voice and one for data, or both lines can be used for data to increase the data rate to 128 Kbps, this is three times the data rate provided by today's fastest modems (i.e., 28.8 Kbps through 56.7 Kbps).

5.2.3.3.2.4 T-1/fractional T-1 line. A T-1 is a dedicated phone connection supporting a data rate of 1.544 Mbps. A T-1 line actually consists of 24 individual channels, each supports 64 kilobits per second. Each 64 Kbps channel can be configured to carry voice or data traffic. Most telephone companies allow the purchase of some of these individual channels, known as fractional T-1 access. T-1 lines are a popular leased line option for businesses connecting to the Internet and for Internet Service Providers (ISP) connecting to the Internet backbone. The Internet backbone itself consists of faster T-3 connections. T-1 lines are sometimes referred to as DS1 lines.

5.2.3.3.2.4.1 E1 line. Similar to the North American T-1, the E1 is the European format for digital transmission. E1 carries signals at 2.048 megabits per second (32 channels at 64 kilobits per second), versus the T-1, which carries signals at 1.544 megabits per second (24 channels at 64 kilobits per second). E1 and T-1 lines may be interconnected for international use.

5.2.3.4 Bandwidth needs. Bandwidth limitation is of primary importance. This limitation may influence the design of instructional material and affect the use of program design (e.g., graphics, video, audio, banners, etc.). The IT Specialist should consult with the Instructional Developer and provide guidance regarding bandwidth availability and usage. Asynchronous training requires significantly more robust content with generous use of audio and video to stimulate the senses in order to maintain high motivation learning, therefore, use of streaming audio and video are highly desirable. With advancements in video and audio streaming technologies and the newer interactive Web languages (JavaScript, Java, ActiveX, XML, etc.) and the common client software (Web Browsers), WBT appears to be the best way to reach the most students anytime/anywhere, on-demand. Again, the limitation of using WBT especially on the Internet is a bandwidth issue.

5.2.3.4.1 Bandwidth requirements. With near-term emerging technologies, WBT through the Internet is becoming more feasible. Many mid-size to large organizations lease ISDN lines (64

Kbps/channel) portions of a T-1 line (total of 1.5 Mbps) for Internet connections through their LAN. Some smaller companies and most individuals use modem technology. Low bandwidth modems (i.e., 28.8 Kbps through 56.7 Kbps) may or may not be sufficient for a specific training product. The Internet can be used successfully for ADL applications; the limiting factor is bandwidth. Making use of Internet connection resources within an organization (384 Kbps or greater) is more than sufficient for receiving WBT. However, students that are to receive training while at stateside activities, deployed, and home with minimal resident time can utilize low to medium broadband transmission (i.e., cable modems, personal digital satellite receivers, and ADSL connections). Training provided on in-house servers (i.e., intranets) is the most flexible because they are LAN-based and have inherently higher bandwidths than Internet based connections.

5.2.3.4.1.1 Low bandwidth. Modems typically come to mind when thinking in terms of low bandwidth. The maximum connection speed on standard telephone lines is 53 Kbps. This is the maximum speed allowed by the Federal Communications Commission, even though modems are labeled 56 Kbps. A significant number of training products have been developed for low bandwidth applications, but these types of products, in some cases, are less than optimal training courses. These courses are typically WBT with little or no animation or interactivity. Some Learning Objectives (LO) lend themselves to this mode of training.

5.2.3.4.1.2 Low to medium bandwidth. Broadband data transmission is accomplished by a single medium (e.g., cable, fiber, etc.) carrying several channels at once. New broadband technologies are now becoming increasingly available for residential use. These new technologies include satellite systems, cable modem, and ADSL. Using these technologies there is a good chance that military personnel could have access to sufficient bandwidth to receive ADL at home.

5.2.3.4.2 Internet. The Internet is a public, cooperative, and self-sustaining facility that can be accessed for the exchange and transfer of data using a set of protocols called TCP/IP and Hypertext Transfer Protocol (HTTP). For information on Internet standards, see Appendix A of this handbook.

5.2.3.4.2.1 World Wide Web. The most widely used part of the Internet is the Web. Using the Web, users have access to millions of pages of information. Web sites contain "clickable" icons, images or portions of images, and text in a color different than the rest of the text in the site. When an icon or text is selected, the user will be transferred to the site or page that is linked to that icon or text. Web surfing is done with a Web browser. The appearance of a Web site may vary slightly depending on the browser used. With this ease of use, the Web is a natural medium for asynchronous training.

5.2.3.4.2.2 Routers. On the Internet, a router is a device or, in some cases, software in a computer, that determines the next network point to which a packet should be forwarded toward its destination. The router is connected to at least two networks and decides which way to send

each information packet based on its current understanding of the state of the connected networks.

5.2.3.4.3 Intranet. An intranet uses Internet technologies to share information. An intranet is a network with sites that look and function like those on the Internet but is specifically developed for and belongs to an organization. An intranet may be interlinked with various LANs and/or be linked to a WAN. This allows users to centralize information that is easily, quickly, and efficiently accessed through a variety of PC platforms. They can be rendered secure by utilizing firewalls, password authentication, and other techniques that prevent unauthorized access. The organization determines who is authorized access.

5.2.3.4.3.1 Intranet and Electronic Performance Support Systems (EPSS). Intranets are increasingly being used as the technology platform for an EPSS. Once a performance need and type of support is determined, software applications can be used to develop an interactive tool that can be made accessible via the intranet that will assist people to perform their work. The EPSS can be in the form of tools, reference, advice, instructional resources, or any other resource. For detailed information on EPSSs, refer to MIL-HDBK-29612-3, Section 6.

5.2.3.4.4 Extranets. An extranet can be viewed as part of an organization's intranet that is made accessible to other organizations, the public, or components that enable collaboration with other organizations. Secure extranets use methods such as access authentication, encryption, and filtering to control access.

5.2.3.4.4.1 ADL uses of extranets. In keeping with goals of the ADL Initiative, extranets can be used as private newsgroups that cooperating organizations use to share experiences and ideas. On-line instructional programs or other educational material may be developed, made available on the extranet, and shared with other organizations. Joint program management and control for organizations can be achieved as part of a common work project or campaign.

5.2.3.4.5 LANs. A LAN can be used to deliver ADL content to students in a computer laboratory, electronic classroom, or at their workstation. The limited geographic area served by a LAN may consist of a single building, a cluster of buildings, or a campus type arrangement. Typically, the LAN server may contain various computer applications and data storage that is shared by multiple workstation users. Typically, Ethernet LANs are used by the Government and mid-size to large businesses. Ethernet LANs are by far the most prevalent (70 percent), and are based on the TCP/IP protocol developed for the Internet.

5.2.3.4.5.1 LAN requirements for ADL. Most Ethernet LAN installations are 10 Mbps although Fast Ethernet (100 Mbps) capabilities are available. Multimedia applications can take a toll on LANs. For example, uncompressed video quality requires optimally 160 Mbps for television-like quality (30 frames/second National Television Standards Committee (NTSC) or Phase Alternation by Line (PAL) standards). For these purposes, even a Fast Ethernet (100

Mbps) is insufficient. New video and audio compression technology now makes it possible for audio and video training clips to be incorporated into DL deliverables and to be played on LANs. The minimum baseline for any LAN used in a DL environment is 10 Mbps. However, only a few students making use of high quality audio and video streams could incapacitate a 10 Mbps LAN. Therefore, consideration should be given to upgrading existing LANs to a minimum of 100 Mbps, whether that is an Ethernet to Fast Ethernet configuration or making use of other technologies such as a Fiber Distributed Data Interface (FDDI) Token Ring configuration.

5.2.3.4.6 WANs. As a WAN's telecommunications network is more geographically dispersed and much broader than that of a LAN it requires the use of switching equipment from Public Telephone Operators (PTO) and Public Network Operators (PNO). A WAN may be privately owned or rented, but more commonly includes public (shared user) networks. The majority of WANs utilize leased T-1 lines for service.

5.2.3.4.6.1 WAN requirements for ADL. WANs require the use of switching equipment from PTOs or PNOs. Current WANs are limited by the switch speed employed by PTOs. The majority of WANs utilize leased T-1 lines for service. WANs of the near future will probably use the ATM network and switching will instead be provided by the PNOs. Currently, WAN architectures are being specified by the Government. Fortunately, for the most part, they share a common architecture of using TCP/IP over ATM on a Synchronous Optical Network (SONET) backbone. This means that Government-owned long haul communications will be available on which students will be able to take advantage of ADL curriculum.

5.2.3.4.7 Servers. A server is a computer program that services other computers. The computer that physically contains the server program is commonly called the "server." Training data (e.g., WBT, ICW, CBT, etc.) can be stored and executed electronically on the server.

5.2.3.4.7.1 Client/server. A client/server describes the relationship between two computer programs in which one program, the client, makes a service request from another program, the server, which fulfills the request. Although the client/server feature can be used by programs within a single computer, it is a more important feature in a network. In a network, the client/server model provides a convenient way to interconnect programs that are distributed efficiently across different locations.

5.2.3.4.7.1.1 Client/server architecture. Client/server architecture refers to an infrastructure that allows downloading of information or programming to a client. This maximizes the total throughput of the system instead of having all processing handled by a central server. Distributed storage provides more flexibility and efficient use of network resources. Users should look for systems that can be configured to take advantage of the processing power of their network, not just the processing power on their servers. This is important for scalability because as an organization expands, adding clients that can handle some of the processing rather than burdening the central server can actually add to the overall power of the network.

5.2.3.4.8 Integrated networked systems. An integrated network system provides high-speed network connectivity for specified users to multiple existing computers and network systems. The sharing of a communication infrastructure brings together various sources of information and makes them more accessible to users.

5.2.3.4.9 Other delivery technologies. The IT Specialist should also be prepared to call upon knowledgeable authorities for capabilities and services outside his control or experience. The ever-growing complexity of modern weapon systems demand that the Services re-engineer their education and instructional systems to take advantage of information-age technologies. In addition to network connectivity, information can be presented in a convenient format, employing varied instructional techniques, and taking advantage of the latest interactive multimedia technologies.

5.2.3.4.9.1 Industry compression technologies. Compression is the reduction in size of data in order to save space or transmission time. For data transmission, compression can be performed on just the data content or on the entire transmission unit depending on a number of factors. Large text or graphic files, either singly or with others as part of an archive file, may be compressed and sent or received over the Internet. A few examples of the various compression products available are Zip™, tar, gzip, and BinHex™. Fortunately, new video and audio compression technology now makes it possible for audio and video rich content to be delivered without an enormous impact on bandwidth. For specific information regarding the use of compression technologies, refer to the JTA.

5.2.3.4.9.2 Satellite, ADSL, and cable modems. Satellites and ADSL are technologies for low to medium broadband transmission. A satellite is a specialized wireless receiver/transmitter that is launched by a rocket and placed in orbit around the earth. They are part of an ADL program in that they relay various communications formats (e.g., television broadcast, Internet communications, etc.). Personal satellite systems provide up to 400 Kbps download capacity and 56 Kbps for uploads (modem required). Cable modems are becoming increasingly prevalent throughout the U.S. These types of modems typically provide up to 1.2 Mbps download capacity and 384 Kbps upload capacity. ADSL has been slower to permeate the residential market, but it is anticipated to eventually overtake cable modem installations. Download speeds for ADSL is typically 1.5 Mbps and the speed for uploads is 256 Kbps.

5.2.3.4.9.3 Advanced audio technologies. Audio can be used at a distance as a delivery method or an interaction tool. Advanced technologies include computers through the use of audio cards installed in PCs and audio streaming; audiotapes used to augment an instructional package; radio, and telephone through the use of conference bridges. An audio conference bridge allows three or more telephone lines to be connected in a single conference.

5.2.3.4.9.4 Asynchronous Transfer Mode. ATM is a dedicated-connection switching technology that organizes digital data and transmits them over a medium using digital signal technology. ATM is designed to be easily implemented by hardware (rather than software), making faster computing processing speeds possible.

5.2.4 Evaluators. The MIL-HDBK-29612-2, Section 10 provides evaluation guidance for instructional products. The MIL-HDBK-29612-3, Section 7 outlines the evaluation process for IMI that may apply to an ADL program. A new requirement for evaluation of products used in an ADL program is the requirement to test software for conformance with the SCORM (only if the product is intended to be in conformance with SCORM). Functions of the evaluator are outlined in Table 7.

TABLE 7. **Evaluator functions.**

Plan	Execute	Evaluate
• Contribute milestone events and projected times.		
• Assist the manager in the development of the program Evaluation Plans.	• Establish criteria for milestone reviews.	• Conduct milestone reviews.
• Assist the manager in the development of product Evaluation Plans.	• Establish criteria for in-progress reviews and acceptance testing.	• Conduct in-progress reviews and acceptance testing.
• Assist in planning requirements for a student evaluation of the product.	• Establish survey instrument and criteria for evaluation of product.	• Conduct student survey.
• Assist in the development of a Training Effectiveness Evaluation (TEE) Plan.	• Ensure the product will support the LOs and is easy to use. • Participate during in-process reviews and acceptance testing. • Establish job performance criteria for the TEE.	• Conduct TEE.

TABLE 7. **Evaluator functions - Continued.**

Plan	Execute	Evaluate
• Assist in ensuring that all products meet applicable standards.	• Establish the criteria to determine compliance.	• Conduct tests and determine acceptability by comparing with the established criteria.

5.2.5 Subject Matter Experts. SMEs collaborate with Instructional Developers during the task analysis process and in the development of the LOs. Functions of the SME are outlined in Table 8. SMEs may assist the Instructional Developer in identifying:

a. Cues.
b. Conditions of the job.
c. Level of difficulty for the task.
d. Team/individual requirements for the task.
e. Resources available (e.g., personnel, libraries, hardware, software, etc.) in the job environment.
f. Requirements for laboratory facilities.
g. Time required to learn the task.
h. The amount of hands-on training is required (i.e., On the Job Training (OJT) requirements) for the task.
i. Acceptable time delays in performing the task.
j. Whether the course is suitable for on-line learning (i.e., in an ADL environment).
k. If theory or practical application, or a combination of the two, is required.

TABLE 8. **SME functions.**

Plan	Execute	Evaluate
• Possess knowledge of the subject to be covered in the course content and the ability to develop and verify task list.	• Provide knowledge of cues, conditions, and other task specific information to the Instructional Developer.	• Ensure accuracy of course content.

5.2.6 Instructors. The efforts of the instructors contribute directly to the success of any educational program. The instructor for an ADL environment faces many of the same challenges as those in a traditional environment discussed in MIL-HDBK-29612-2 and 3. The instructor needs to be capable of adapting a teaching style that is effective to teach multiple, diverse, and remote audiences. Functions of the instructor are outlined in Table 9.

TABLE 9. **Instructor functions.**

Plan	Execute	Evaluate
• Assist in planning course content and flow.	• Provide assistance, as needed, to Instructional Developer. • Make face-to-face contact with student when possible.	
	• Develop student orientation for the course. • Contact all students and require them to review the course orientation.	
	• Attend train-the-trainer course. • Assign students a series of small tasks such as complete a survey.	
	• Complete the checklist in Table 10 to assess skills. • Teach course.	• Provide input to evaluator on course content, technology, problems, etc.
	• Learn about network/Web technologies and how they will be used in the classroom.	

5.2.6.1 Instructors and technology. Instructors should be familiar with delivery technology since they may occasionally be required to act as a facilitator to assist students in navigation on network-based instructional sites. Familiarity with technical standards for Internet-based teaching and instructional environments equips instructors with the knowledge to select and use commercial products that will provide greater functionality and choice of instructional materials, with less technical difficulties for both instructor and student.

5.2.6.1.1 Advice to the instructor. An instructor teaching in an ADL environment will benefit by embracing the new technologies available. Though not essential, it certainly helps to enjoy the challenging aspect of this medium. There will be skills to be learned and technical problems to be solved. Table 10 is a job aid for the instructor to perform a self-assessment of basic skills for teaching in an ADL environment. Rating skill levels from poor to excellent will help the instructor pinpoint areas that need self-improvement.

TABLE 10. **Self-assessment job aid for the instructor.**

SKILLS/KNOWLEDGE	SKILL LEVEL				
	POOR		AVERAGE		EXCELLENT
	1	2	3	4	5
Familiarity with Internet environment.					
Ability to search and navigate the Internet using a browser.					
Ability to use electronic bookmarks.					
Ability to send and receive e-mail.					
Ability to attach files to e-mail.					
Ability to download files.					
Ability to zip and unzip large files.					
Knowledge of computer/Internet/network terminology (e.g., bulletin board, forum, chat, browser, etc.).					
Prior on-line experience: chats, bulletin boards, forums, e-mail. (It is desirable that the instructor have some personal experience as an on-line student.)					
Familiarity with on-line resources for research (e.g., glossaries, search engines, etc.).					
Familiarity with Netiquette. (A successful on-line course depends on successful interaction between all parties. Become reacquainted with Netiquette. Numerous web sites and books deal with this subject. Be prepared to instruct students in Netiquette.)					
Familiarity with delivery platforms (e.g., WebCT, Topclass, etc.) used on the course.					
Knowledge of e-mail program(s) to be used.					
Familiarity with forum/bulletin board, chat rooms, videoteletraining equipment, and techniques.					
Familiarity with navigation tools for CD-ROM(s) that may be used in the course.					

TABLE 10. **Self-assessment job aid for the instructor - Continued.**

SKILLS/KNOWLEDGE	SKILL LEVEL				
	POOR		AVERAGE		EXCELLENT
	1	2	3	4	5
Ability to troubleshoot instructional technical problems and student problems.					
Time management skills. (Initially, on-line teaching is much more time consuming than classroom teaching.)					
Written communication skills.					
Knowledge of course content. (Items to consider: How is it sequenced? Is it linear? Are there multiple entry and exit points?)					
Ability to communicate technical information in plain English.					
Knowledge of support personnel and the many ways they can provide assistance when problems/questions arise.					

5.2.6.2 Instructional strategies for the virtual classroom. Instructional strategies impact the design of the instructional activities and the learning process. Selection of the instructional strategy needs to be consistent with learning objectives and the job task environment. The instructional strategy also needs to support the instructional goals and overall instructional concept. The process of identification, selection, and development of instructional strategies is covered in MIL-HDBK-29612-2, Section 7 and MIL-HDBK-29612-3, Section 6. Training should be performance or performance-based, aimed at a tangible result relevant to the job task environment. It should focus on the process of learning rather than simply presenting information. Teaching styles, content, and instructional strategies can be modified to meet the interactivity requirements. Instructional methods for ADL require a cultural change. Much of the existing curriculum is in a page-based format and is intended to be presented by an instructor. Instructional methods for ADL use will require establishing value for what is being learned, interaction with the content during presentation and demonstration, practical exercises, and testing in a virtual classroom. Some ways to utilize the virtual classroom are:

a. Lecture.
b. Discussion.
c. Discovery.
d. Collaboration.
e. Team training.
f. Exercise.
g. Practice.

5.2.6.2.1 Student-to-student and student-to-instructor interface. The ability to have adequate interface within an ADL environment is being expanded upon constantly. Numerous electronic communications tools are available that enhance learning and improve performance. Some methods for synchronous and asynchronous interface include:

a. E-mail. E-mail can be used for communication between and among students and instructors. E-mail is a convenient vehicle for delivery of mass communication and additional instructional materials by using an established group list on a preset schedule.
b. Bulletin boards. Electronic message centers accessed by modem, for the purpose of exchanging messages and other files. Instructors and can post information on a virtual bulletin board. Various folders (i.e., information areas) can be established on different topics and students can access those areas to participate in the dialogue.
c. Chat rooms. Before deciding to use chat rooms, the IT Specialist should be contacted for local rules and regulations (chat rooms may be prohibited). Chat room discussions should be facilitated by the instructor and have a specific purpose that furthers the instructional goal. Chat rooms allow participants to join in an electronic discussion with other participants simultaneously via chat rooms or chat sites. Chat rooms provide on-line, real-time group activity, from text chat to three-dimensional worlds with participant avatars (i.e., role playing characters).
d. Discussion groups. Unlike chat rooms, discussion groups provide a forum for asynchronous communication with a group. One individual may pose a question or answer another's while all other members of the group benefit from the interactivity.
e. Links to SMEs, instructors, and related instructional material.
f. Performance aiding (i.e., by using Interactive Electronic Technical Manuals (IETM)).
g. Electronic conferencing includes:

    (1) Teleconferencing. Teleconferencing involves the use of telephone technology (i.e., participants are connected via standard telephone connection and use a speaker phone for audio relay) among two or more participants.
    (2) Videoconferencing. Videoconferencing allows the transmission of video and audio for simultaneous communication. Videoconferencing requires more equipment and special arrangements, higher bandwidth, special telecommunication arrangements for both transmitting and receiving.
    (3) Collaborations tools. Collaboration tools are Web-based software that allow meeting participants to contribute their viewpoints on-line, simultaneously, in a shared workspace via a network (e.g., Internet, intranet, extranet, LAN, etc.). It may include audio, video, chat, whiteboard, and the sharing of files where all participants view the same thing.

5.2.6.2.2 Techniques for instructors. In an ADL environment students will generally work independently. The likelihood for student failure is higher in independent study than in

traditional classroom instructor-led courses. It is the instructor's responsibility to establish an appropriate mix of synchronous and asynchronous instruction and to arrange for the students to meet, face-to-face if possible or at least on-line, and to foster an attitude of inclusion and participation. The following are suggested methods to encourage participation, set the tempo of the course, and maintain the momentum as the course progresses:

a. Require students to complete a questionnaire to gather information about their background, goals, scheduling conflicts that might interfere with synchronous activities, and perhaps include a digital photo.
b. Require everyone to introduce themselves in the forum (including yourself) or via e-mail. Consider making the first on-line discussion an icebreaker (i.e., ungraded). This will allow students an opportunity to gain confidence in the use of a technology that may be unfamiliar to them.
c. Emphasize the interactive nature of the medium; make it known that contributions to on-line class discussions will be graded.
d. Ensure that everyone is comfortable (at ease with course navigation, software, and communication tools) with studying and conversing in an ADL environment. Review the completed student surveys (see job aid for basic skills as shown in Table 5) to determine information about each student's level of proficiency.
e. Ensure that instructions, processes, content, navigation, assessment, dates, and any other Frequently Asked Questions (FAQ) are answered and clearly understood.
f. Answer all initial e-mails and forum postings.
g. Be encouraging.
h. Foster inter-student communication.
i. Develop a class web page with participation from all students.
j. Use humor and emoticons. Bear in mind humor is often difficult to convey properly when the medium is electronic communication. Language, different communication styles, and cultural differences make humor via computer modem difficult at times. It is necessary to be sensitive to varied cultural backgrounds. Remember, that humor is often difficult to convey even in a face-to-face situation.
k. Have regularly scheduled real-time meetings via instructor-facilitated chat room (if possible).
l. Use Immediate Messaging (IM) for individual contact with students (if possible).
m. Be proactive and encourage discussion (play the devil's advocate if necessary or ask individuals for responses/opinions).
n. Use open questions in e-mails and forum postings.
o. Invite a guest on-line lecturer/facilitator.

5.2.6.2.3 Orientation. Early communication between the instructor and students is essential. If possible, meet each student in a face-to-face familiarization session/interview. To eliminate answering the same questions for each student, prepare a course orientation session that each student should complete. Instructors should provide students not only the basic outline

of the course but requirements for participating on-line, grading, submittal of assignments, and the method they will use to access the website for their grades. It is also essential that the student understand what methods they have at their disposal for assistance in case of technical difficulties. Table 11 is an example of topics that should be covered in an orientation. This job aid can be used in the development of an orientation or to determine if an existing orientation is adequate.

TABLE 11. **Orientation checklist.**

ORIENTATION TOPICS/FEATURES	HAVE	NEED
1. Provide specific course data that includes:		
a. Course content.		
b. Navigation tools of delivery platform.		
c. Curriculum schedule and deadlines.		
d. Testing methods. Include the weighting of assignments and tests, participation in chat rooms, participation in synchronous on-line class discussions, posting of messages, etc. Provide students with an approximate date and time that scores will be posted or assignments will be returned with comments.		
e. Develop FAQs that answer questions about the course and "how to" questions regarding topics such as, communications, downloading course data, submitting assignments, checking grades, etc.		
f. Background information (i.e., biography, including a picture when possible) on the instructor and the instructor's assistant, if appropriate.		
g. Instructors expectations of the student. (e.g., a professional attitude, respect for the instructor and other students, utilizing Netiquette, timely responses to e-mail, assignments turned in on time, being prepared and on time for synchronous activities, the persistence to resolve technical problems independently (by utilizing FAQs, instructional assistants, and other sources) before asking the instructor to solve the problem, etc.).		
h. Points of contact for lecturers, support staff, and technical staff.		
i. Length of course. Date and times (specify a time zone) for synchronous instruction/discussions.		
j. Communication requirements and methods for students to communicate with other students and with the instructor. Provide requirements for synchronous and asynchronous portions of the course. State whether or not participation will be graded.		

TABLE 11. **Orientation checklist – Continued.**

ORIENTATION TOPICS/FEATURES	HAVE	NEED
k. Location and availability of computer laboratories (i.e., facilities equipped with the appropriate computer hardware, software, and communications access) that may be required for students to participate in on-line training. When computer laboratories are available for students, instructors should ensure that: (1) Students are informed of the location of computer laboratory facilities and hours of operation as well as the dates that they can utilize the laboratory. (2) Students are informed of procedures required to schedule laboratory time.		
l. Links to help resources (e.g., FAQs, instructional assistant, digital repositories, search engines, research sites, etc.).		
2. Test students on-line and determine:		
a. Their capability to login to the course.		
b. Their ability to gain access to the course using required user ID/password.		
c. Basic functions such as sending an e-mail, visiting a website as instructed, downloading a file from the instructor, participating in a chat room, and perhaps even filling out the student survey and returning it to the instructor by a deadline.		
3. Lessons learned. This information could provide students with insight from course graduates regarding problems they faced (e.g., ISP connections, access to computers/Internet connections, time management, accessing the course web site for grades, etc.) and resolutions to those problems. This is a more personal version of an FAQ and can include additional data such as URLs that the students found particularly helpful in their research. (This information should be gained from graduating students as part of an exit survey.)		

5.2.6.2.3.1 Strategies for handling students who dominate electronic communications. In a synchronous environment, the group will usually correct the problem of an individual who attempts to monopolize the forum. In some cases, it may be necessary for the instructor to "discipline" someone who attempts to take charge of chat sessions. In a chat room, it is best to encourage as much interaction as possible. However, it may be a good idea to establish and post ground rules at the beginning of a Web discussion. Some strategies are:

a. Wait patiently to see if the group brings peer pressure on the dominating participant.
b. Ask specific questions that will keep the participants on the topic and address it to specific participants or to specific groups of participants.
c. Politely explain to the disruptive participant that it is important to hear from everyone.
d. Summarize on-task contributions from others and ask for comments and additional thoughts.
e. Tell the disrupter (if possible) through a personal (i.e., non-public) e-mail that their comments are not on topic and are disruptive.
f. Repeatedly model productive participation by making targeted comments.
g. When the ground rules and strategies have failed to maintain order, point out to the participants that this is not a productive session and it is time to review and discuss the ground rules.

5.2.6.2.3.2 The following may help when establishing ground rules. It may be a good idea to establish and post ground rules at the beginning of a Web discussion. The following are provided as a starting point:

a. Keep conversations centered on the topic.
b. Suggest that individuals try not to dominate.
c. Impose an "air-time" limit to participants.
d. Invite other participants to suggest additional guidelines.
e. Assign students to serve as moderators for on-line discussions. Rotate the moderator responsibility for initiating discussion and maintaining the focus.

5.2.6.2.4 Simulated practical exercises. Enhanced modeling and simulation of the battlespace can improve the realism of training, upgrade the levels of day-to-day readiness, and increase the opportunities to test innovative concepts and new strategies. Simulations can be interconnected globally, creating a near-real-time interactive simulation superhighway among the Armed Forces in every theater. Various kinds of practical exercises provide the practice opportunities that cause learning to occur in the virtual classroom. The more these exercise simulate real job and mission cues, conditions, and outputs the greater will be the transfer of learning. These exercises must provide actual practice in all of the critical elements of the instruction with enough iterations of practice to impact long-term memory. The practical exercises should build on one another and increase in complexity until they address the terminal objectives of instruction effectively and mirror the test which will be used to determine mastery. Team training would benefit from synchronous participation by all members in scenarios. However, members of the team might be in different organizations and time zones making scheduling difficult. Simulation can be used to mitigate the loss of key role members or opposing players in live participation exercises.

5.2.6.3 Electronic testing. Testing (i.e., tests or quizzes) that evaluates the student's progress and reinforces knowledge while taking the course can be administered on-line. For tests that are

taken at a remote site and a proctor is required, a proctor nomination form should be sent to the student with adequate time for the form to be completed by the proctor. When the form is completed, it can be returned via e-mail, mail service, or by FAX (if signature is required). The test should be provided to the proctor and rules for how the test will be administered should be provided to both the student and the proctor. Security and special test resources are just two areas for consideration that should be planned for in an ADL environment (e.g., proctored test, ensuring identity of student, security of testing materials, random selection of test items). On-line testing must be as performance or performance-based as the terminal exercises. Testing must establish mastery of mental skills and critical knowledge required in job performance as stated in the terminal objectives for the instruction. Information regarding electronic testing is also addressed in MIL-HDBK-29612-3, Section 6.

5.2.6.4 Teletraining as ADL. Teletraining can be used as an effective ADL instructional format. It involves the use of television technology to provide either passive or interactive instruction. Passive teletraining can be conducted live or involve pre-produced programs stored on videotape or other video technology medium that can be distributed via cable, satellite, Ultra High Frequency (UHF), or Very High Frequency (VHF) broadcast. Interactive teletraining allows interactive communication of the viewer with another participating student or a live instructor. It may be developed to provide instruction for a single lesson, a group or unit of lessons, or an entire course. Factors of importance for teletraining and conferencing include:

a. Course management. Time is critical in this type of format so lessons need to be planned to take advantage of the time allotted.
b. Instructors teaching ability. As in the classroom setting, effective instructors should exhibit energetic and dynamic qualities to capture and hold student interest.
c. Out of class communication with the instructor. Student feedback provides the instructor with information concerning training effectiveness.
d. Support services. Ensure audiovisual tools are available to students.
e. Technology. Professionally produced teletraining programs appear polished and ensure clarity of video and audio.
f. Alternate plans in case of communications failure. Instructor should provide for productive use of student time in case of communications failure during all or part of a scheduled lesson.

6. NOTES.

6.1 Intended use. This handbook is intended to be used in conjunction with MIL-PRF-29612, MIL-HDBK-29612-1, -2, -3, and -4 to aid in the acquisition of ADL products.

6.2 Subject term (key word) listing.

Architecture

Assignable Unit (AU)
Asynchronous training
Computer Managed Instruction (CMI)
Courseware Managed System (CMS)
Distributed Learning (DL)
Electronic Performance Support Systems (EPSS)
Interactive Courseware (ICW)
Interactive Multimedia Instruction (IMI)
Learning Management System (LMS)
Multimedia
Sharable Content Object (SCO)
Sharable Content Object Reference Model (SCORM)
Synchronous training
Training
Web Based Training (WBT)

APPENDIX A

COMMON INDUSTRY STANDARDS/STANDARDS WORKING GROUPS

A.1 SCOPE

A.1.1 Scope. This appendix addresses standard granting bodies and working groups and the common industry standards supporting ADL.

A.2 APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

A.3 DEFINITIONS

The definitions in MIL-HDBK-29612-4 apply to this appendix.

A.4 COMMON INDUSTRY STANDARDS/STANDARDS WORKING GROUPS

A.4.1 Common Industry standards. As potentially one of the largest users of courseware-development, delivery, storage, and management systems, the DoD can and does influence Industry trends. The following paragraphs describe the various standards granting bodies and working groups that are collaborating to create common standards, specifications, and guidance that support the ADL Initiative. Evaluations for ADL products must avoid proprietary standards and make maximum use of industry standards supporting the underlying technologies. De facto standards would be acceptable, but common released standards are optimal. This information is provided as a reference for specifications and standards data. As with all references data can become outdated. It is very important to verify this information before applying it in an acquisition.

A.4.2 Institute of Electrical and Electronic Engineers. The IEEE is a non-profit, technical professional association that develops standards in areas of computer engineering, biomedical technology and telecommunications, electric power, aerospace and consumer electronics. The standards set by IEEE include standards for most types of electrical interfaces. As an example, IEEE Recommended Standard (RS)-232C is important to ADL in that it defines the interface for serial communication used by most modems, and a number of other devices, including display screens and pointing devices. Additionally, within IEEE the Learning Technology Standards Committee (LTSC) sponsors standards development in a number of areas of learning technology. Within the LTSC, there are various working groups that are developing technical Standards, Recommended Practices, and Guides for software components, tools, technologies, and design methods that facilitate the development, deployment, maintenance, and interoperation of computer implementations for education and training components and systems. The LTSC has

been chartered by the IEEE Computer Society Standards Activity Board. Many of the Standards developed by LTSC will be advanced as international standards. When approved, these developing standards will have a significant impact on ADL requirements in the future. The LTSC working groups have the benefit of being able to develop, support, promote, and sponsor standards that are relevant to learning technology and that will ensure interoperability. For specific information regarding IEEE standards, refer to the IEEE Web site at URL http://standards.ieee.org. IEEE standards and LTSC draft standards being developed by working groups and study groups that apply to ADL are provided in Table 12.

TABLE 12. **IEEE standards/specifications that apply to ADL.**

Specification/standard title and number	Relationship to ADL
RS-232C EIA-232-D EIA/RIA-232-E	RS-232C is a standard interface approved by the Electronic Industries Association (EIA) for connecting serial devices. Almost all modems, PCs, screens, mice, and serial printers are designed to conform to the EIA-232 standard. In 1987, the EIA released a new version of the standard and changed the name to EIA-232-D. In 1991, the EIA teamed up with Telecommunications Industry Association (TIA) and issued a new version of the standard call EIA/TIA-232-E. Many people, however, still refer to the standard as RS-232C, or just RS-232. Although, EIA-232 is still the most common standard for serial communication, the EIA has recently defined successors to EIA-232 called RS-422 and RS-423. The new standards are backward compatible so that RS-232 devices can connect to an RS-422 port.
RS-422	RS-422 is a standard interface approved by the EIA for connecting serial devices. The RS-422 standard is designed to replace the older RS-232 standards because it supports higher data rates and has greater immunity to electrical interference. All Apple Macintosh computers contain an RS-422 port that can also be used for RS-232C communication. RS-422 supports multipoint connections.
RS-423	RS-423 is a standard interface approved by the EIA for connecting serial devices. The RS-423 standard is designed to replace the older RS-232 standards because it supports higher data rates and has greater immunity to electrical interference. RS-423 supports only point-to-point connections.
IEEE 1484.11 – IMS Enterprise Interoperability Best Practices and Implementation Guide	Supports interoperability between LMSs (residing within the same enterprise or organization) and the following classes of Enterprise Systems: • Human Resource Systems. • Student Administration Systems. • Training Administration Systems.

TABLE 12. **IEEE standards/specifications that apply to ADL – Continued.**

IEEE Learning Technology Standards Committee Working Groups (WG) and Study Groups (SG)	
GENERAL:	
IEEE 1484.1	**Being developed by:** Architecture and Reference Model WG **Full Name of Standard:** Standard for Information Technology – Education and Training Systems – Architecture and Reference Model
IEEE 1484.3	**Being developed by:** Glossary WG **Full Name of Standard:** Standard for Information Technology – Learning Technology -- Glossary
LEARNER-RELATED:	
IEEE 1484.2	**Being developed by:** Learner Model WG **Full Name of Standard:** Standard for Information Technology – Learning Systems – Learner Model
IEEE 1484.13	**Being developed by:** Student Identifier WG **Full Name of Standard:** Standard for Information Technology – Learning Systems – Student Identifier
IEEE 1484.19	**Being developed by:** Quality System for Technology-Based Life-Long Learning SG **Full Name of Standard:** Standard for Information Technology – Learning Technology – Quality System for Technology-Based Life-Long Learning
IEEE 1484.20	**Being developed by:** Competency Definitions WG **Full Name of Standard:** Standard for Information Technology – Learning Technology – Competency Definitions
CONTENT-RELATED:	
P1484.10	**Being developed by:** CBT Interchange Language WG **Full Name of Standard:** Standard for Information Technology – Learning Systems – CBT Interchange Language
P1484.6	**Being developed by:** Course Sequencing WG **Full Name of Standard:** Standard for Information Technology – Learning Systems – Course Sequencing
P1484.17	**Being developed by:** Content Packaging WG **Full Name of Standard:** Standard for Information Technology – Learning Technology – Content Packaging
DATA AND METADATA:	
No standard # assigned.	**Being developed by:** IEEE Standard Upper Ontology SG **Full Name of Standard:** Unknown at this time.
P1484.12	**Being developed by:** Learning Object Metadata WG **Full Name of Standard:** Standard for Information Technology – Education and Training Systems – Learning Objects and Metadata

TABLE 12. **IEEE standards/specifications that apply to ADL – Continued.**

IEEE Learning Technology Standards Committee Working Groups (WG) and Study Groups (SG) - Continued	
DATA AND METADATA: - Continued	
P1484.9	**Being developed by:** Localization WG **Full Name of Standard:** Standard for Information Technology – Learning Technology – Localization
P1484.14	**Being developed by:** Semantics and Exchange Bindings WG **Full Name of Standard:** Standard for Information Technology – Learning Technology – Semantics and Exchange Bindings
P1484.15	**Being developed by:** Data Interchange Protocols WG **Full Name of Standard:** Standard for Information Technology – Learning Technology – Data Interchange Protocols
MANAGEMENT SYSTEMS AND APPLICATIONS:	
P1484.11	**Being developed by:** Computer Managed Instruction WG **Full Name of Standard:** Standard for Information Technology – Learning Systems – Computer Managed Instruction
P1484.18	**Being developed by:** Platform and Media Profiles WG **Full Name of Standard:** Standard for Information Technology – Learning Technology – Platform and Media Profiles
P1484.7	**Being developed by:** Tool/Agent Communication WG **Full Name of Standard:** Standard for Information Technology – Learning Systems – Tool/Agent Communication

A.4.3 Aviation Industry CBT Committee. The AICC is an international association of technology-based training professionals that develop guidelines for aviation industry in the development, delivery, and evaluation of CBT and related training technologies. All newly procured CMI tools should be compliant with the current revision of the AICC CMI guidelines for software interoperability (i.e., CMI001, IEEE 1484.11). The guidelines address both file-based (i.e., standalone and LAN) and Web-based (i.e., Internet/intranet) applications. The interoperability standards established by the AICC have been accepted by various industries. The AICC guidelines provide a method for seamless data flow between different CBT lessons and CMI systems, between different CMI systems, and from CBT lessons created with different authoring systems to a common data store and off-the-shelf analysis tools. For specific information regarding the AICC, refer to their Web site at URL http://www.aicc.org. AICC standards that apply to ADL are provided in Table 13.

TABLE 13. **AICC standards/specifications that apply to ADL.**

Specification/standard title and number	Relationship to ADL
CMI001	Provides guidelines for interoperability by providing an option for training developed for a traditional LAN environment to be run over the Internet with little or no change. Allows users of current CBT content and technology to remain current as new technology emerges.

A.4.4 IMS Global Learning Consortium, Inc. The IMS consortium is made up of members from educational, commercial, and government organizations collaborating to define technical standards and specifications for interoperability of applications in distributed learning. IMS specifications are concerned with standards for instructional servers and instructional content. IMS specifications provide general guidelines and requirements for Web-based instructional systems that focus on interoperability of data, the use of metadata, the development of content, interoperability of management systems, and the interoperability between question and test systems. For specific information regarding IMS specifications refer to their Web site at URL http://www.imsproject.org. IMS standards that apply to ADL are provided in Table 14.

TABLE 14. **IMS standards/specifications that apply to ADL.**

Specification/standard title and number	Relationship to ADL
IMS Enterprise Interoperability Best Practices and Implementation Guide	This specification is made up of three documents: 1. IEEE 1484.11, which describes how the IMS Enterprise Information Model and XML Binding specifications can be applied to specific types of interoperability scenarios. 2. IMS Enterprise Information Model – Version 1.0, which describes the data structures that are used to provide interoperability of Internet-based instructional management systems with other systems that are used to support the operations of an organization. 3. IMS Enterprise XML Binding – Version 1.01, which describes the XML binding for Enterprise/LMS data interoperability. This document specifies the binding of the Enterprise/LMS data interoperability in XML.

A.4.5 International Standards Organization (ISO). ISO establishes and promulgates standards throughout the world. ISO 9000 is a systems design standard. Z1.11 is the supplement that applies ISO 9000 in education and training settings. For specific information regarding the ISO refer to their Web site at URL http://www.iso.ch. ISO standards that apply to ADL are provided in Table 15.

TABLE 15. **ISO standards/specifications that apply to ADL.**

Specification/standard title and number	Relationship to ADL
ISO 9000	Quality Assurance.
Z1.11	Supplement to ISO 9000 in education and training.
ISO/International Engineering Consortium (IEC) 14772	Virtual Reality Modeling Language (VRML) is a specification that produces a hyperspace, a three dimensional space that appears on the display screen. It is possible to move figuratively up, down, right, left, forwards, and backwards within this space. It gives the impression that movement is actually occurring in real space.

A.4.6 Advanced Television Systems Committee (ATSC). ATSC is an international organization that establishes voluntary technical standards for advanced television systems. ATSC digital television standards include digital High Definition Television (HDTV), Standard Definition Television (SDTV), and satellite direct-to-home broadcasting. For specific information regarding ATSC, refer to their Web site at URL http://www.atsc.org. ATSC standards that apply to ADL are provided in Table 16.

TABLE 16. **ATSC standards/specifications that apply to ADL.**

Specification/standard title and number	Relationship to ADL
A/64, Transmission Measurement and Compliance for Digital Television	Describes specifications for maximum out-of-band emissions, parameters affecting the quality of the inband signal, symbol error tolerance, phase noise and jitter, power, power measurement, frequency offset and stability. Established Digital Television (DTV). Describes methods for testing, monitoring, and measurement of the transmission subsystem intended for use in the DTV system adopted as the U.S. Standard by the Federal Communications Commission.
A/65A, Program and System Information Protocol (PSIP) for Terrestrial Broadcast And Cable	Defines a standard for System Information (SI) and Program Guide (PG) data compatible with digital multiplex bit streams constructed in accordance with ISO/IEC 13818-1 (MPEG-2 Systems). The document defines the standard protocol for transmission of the relevant data tables contained within packets carried in the Transport Stream multiplex. This document describes tables that are applicable to terrestrial (over-the-air) and cable signals.
A/80, Modulation and Coding Requirements for Digital TV (DTV) Applications over Satellite	Defines a standard for modulation and coding of data delivered over a satellite for DTV applications. The data can be a collection of program material including video, audio, data, multimedia, or other material generated in a digital format. It includes digital multiplex bit streams constructed in accordance with ISO/IEC 13818-1 (MPEG-2 systems), but is not limited to these and makes provision for arbitrary types of data as well.

A.4.7 Moving Picture Experts Group. The MPEG is a working group of the ISO/IEC in charge of the development of standards for coded representation of digital audio and video. MPEG is comprised of experts accredited by an appropriate National Standards Body and includes representatives from more than 200 companies in more than 20 countries. The group has produced standards that are used to develop products such as video Compact Disks (CD), MPEG audio layer 3 (MP3), Digital Versatile Disk (DVD), and multimedia for use on the Web. For specific information regarding MPEG, refer to their Web site at URL http://www.cselt.it/mpeg. MPEG standards that apply to ADL are provided in Table 17.

TABLE 17. **MPEG standards/specifications that apply to ADL.**

Specification/standard title and number	Relationship to ADL
MPEG-1	The most common implementation of MPEG-1 is for video resolution of 352x240 at 30 frames per second (fps). This produces video quality slightly below the quality of conventional VCR videos. This standard also provides video capture, edit, and compression for PCs and is used to support VTT.
MPEG-2	Sets audio and visual compression and transmission. Similar to MPEG-1, but contains 3 parts, video, audio, and systems. Offers resolutions of 720x480 and 1280x720 at 60 fps, with full CD quality audio. This is sufficient for all major television standards, including NTSC, and even HDTV. This standard is used by DVDs. MPEG-2 can compress a 2-hour video into a few gigabytes. While decompressing an MPEG-2 data stream requires only modest computing power, encoding video in MPEG-2 format requires significantly more processing power.
MPEG-4 (formal ISO/IEC designation is ISO/IEC 14496)	Provides a set of technologies to satisfy the needs of authors, service providers, and end users alike. Targets the Very Low Bit rate applications. This standard is used in low bit rate videophones over analog telephone lines. Provides the standardized technological elements enabling the integration of the production, distribution, and content.

A.4.8 SCORM. The SCORM was developed by the ADL TWG to detail specifications for ADL Initiative supported products. The SCORM defines a reference model for courseware "objects" that meet the ADL Initiative's high-level requirements. SCORM makes it possible to map existing instructional models to a common CSF that will operate on SCORM conformant LMSs. The SCORM makes it possible to access information in repositories by course, block, SCO, learning objective, and raw media element. Each of these must be tagged with SCORM required metadata in order to make them into reusable objects. A suite of conformance-test software is now available. These products will permit content and authoring tool developers to verify that their work products conform to the SCORM specification and are reusable, interoperable, accessible, and durable. Additionally, a standard for a SCORM conformant LMS

is in work as an extension of the basic SCORM. The full SCORM documentation and its associated software development kit as well as the SCORM conformance Test Suite (Self Test) are available for download at htttp://www.adlnet.org/Scorm/downloads.cfm. When using the test suite to ensure that content and LMSs conform to the SCORM, it is important to ensure that the version number of the test suite is the same as the version number of the SCORM that was used to produce the content or LMS. DoD specifications that apply to ADL are provided in Table 18.

TABLE 18. **SCORM standards/specifications that apply to ADL.**

Specification/standard title and number	Relationship to ADL
SCORM (The SCORM is currently in a testing phase.)	Provides required metadata tags for accessing course structure elements as learning objects for reuse. Establishes a framework of guidelines for implementation of interoperable courseware sharing instructional systems. In addition to being a reference model, it provides examples of Web-based code (i.e., metadata tagging of SCOs, also referred to as Assignable Units (AU)) that implement the guidelines. This code allows for the creation of a course structure, the content of a course element and the course, and content metadata so that content can be identified and found in repositories, delivered over the Web, and managed by an LMS.

A.4.8.1 Metadata. Metadata is the definition or description of data (i.e., data about data). Metadata describes how and when and by whom a particular set of data was collected, and how the data is formatted. Metadata is essential for understanding information stored in repositories.

A.4.8.1.1 Metadata tags. Typically, a metadata tag is a hidden tag that lives in the head of an XML or Standard Generalized Markup Language (SGML) (i.e., SCO) document. Instructional Developers use metadata tags to supply additional information about a SCO. The metadata tag contains descriptive data about the content independent of a particular course.

A.4.8.1.1.1 Metadata tagging for SCORM conformance. The SCORM provides specifications for code to be used in metadata tags. This metadata is used to facilitate reuse and discoverability of such content within a media repository. SCORM metadata tags are in the process of maturation and technically challenging, for this reason it is imperative that IT personnel be closely involved to provide technical expertise during the ADL development process. SCORM tagged metadata is used to facilitate reuse and discoverability of such content within a media repository.

A.4.9 International Telecommunication Union. ITU is an intergovernmental organization through which public and private organizations develop telecommunications. The ITU was established to develop a standard set of rules governing the use of all forms of communication systems (i.e., wire, radio, optical). Based out of Geneva, the ITU is a specialized agency of the

United Nations with membership from all parts of the world. It is responsible for adopting international treaties, regulations, and standards governing telecommunications. The standardization functions were formerly performed by a group within the ITU called Comité Consultatif International Téléphonique et Télégraphique (CCITT), but after a 1992 reorganization, the CCITT no longer exists as a separate body. For specific information regarding ITU standards refer to the ITU Web site at URL http://www.itu.int.org. ITU standards that apply to ADL are provided in Table 19.

TABLE 19. **ITU protocols that apply to ADL.**

Specification/standard title and number	Relationship to ADL
Group 3	The universal protocol for sending fax documents across telephones lines. The group 3 protocol specifies CCITT T.4 data compression and a maximum transmission rate of 9,600 baud. There are two levels of resolution 203x98 and 203x196.
Group 4	The protocol for sending fax documents across ISDN networks. The group 400 protocol supports images of up to 400 dpi resolution.
V.32	The standard for full-duplex modems sending and receiving data across telephone lines at 4,800 or 9,600 bps. V.32 modems automatically adjust their transmission speeds based on the quality of the lines.
V.32bis	The V.32 protocol extended to speeds of 7,200, 12,000, and 14,400 bps.
V.34	The standard for full-duplex modems sending and receiving data across telephone lines at up to 28,800 bps. V.34 modems automatically adjust their transmission speeds based on the quality of the lines.
V.42	An error-detection standard for high-speed modems. V.42 can be used with digital telephone networks.
V.42bis	A data compression protocol that can enable modems to achieve a data transfer rate of 34,000 bps.
V.90	The standard for full-duplex modems sending and receiving data across telephone lines at up to 56,000 bps.
X.25	The most popular packet-switching protocol for WANs.
X.400	The universal protocol for e-mail. X.400 defines the envelope for e-mail messages so all messages conform to a standard format.
X.500	An extension to X.400 that defines addressing formats so all e-mail systems can be linked together.
H.261	Video codes for audiovisual services at Px64 Kbps.
H.263	Video coding for low Bit rate communications.

TABLE 19. **ITU protocols that apply to ADL – Continued.**

Specification/standard title and number	Relationship to ADL
H.320, H.323, H.324, T.120	These standards comprise the core technologies for multimedia teleconferencing: H.324 - Addresses high quality video and audio compression over POTS modem connections. T.120 - Addresses data protocols for multimedia conferencing (audiographics). H.320 - Addresses ISDN videoconferencing. H.323 - Addresses video (audiovisual) conferencing. The following are two Recommendations to H.323: G.711 – Pulse Code Modulation (PCM) of voice frequencies. G.775 – Addresses Loss of Signal (LOS), Alarm Indication Signal (AIS), and Remote Defect Indication (RDI) defects (complements G.730, G.740, and G.750 series Recommendations.

A.4.10 Internet standards. The Internet is a worldwide system of computer networks in which a user at one computer can obtain information from another computer. The IETF is a large open international community of network designers, operators, vendors, and researchers concerned with the evolution of the Internet architecture and the smooth operation of the Internet. Organizations sometimes submit their independently developed protocols to the IETF for approval as a standard. Technically, what distinguishes the Internet is its use of a set of protocols (i.e., rules) called TCP/IP that govern the electronic transmission and receipt of data. Two adaptations of Internet technology, the intranet and the extranet, also make use of the TCP/IP. For specific information, regarding Internet standards refer to the IETF Web site at URL http://www.ietf.org. IETF protocols that apply to the Internet are provided in Table 20.

TABLE 20. **IETF protocols that apply to ADL.**

Specification/standard title and number	Relationship to ADL
Transmission Control Protocol (TCP)	TCP uses a set of rules to exchange messages with other Internet points at the information packet level.
Internet Protocol (IP)	IP uses a set of rules to send and receive messages at the Internet address level.
Hypertext Transfer Protocol (HTTP)	HTTP is a set of rules for exchanging files (e.g., text, graphic images, audio, video, other multimedia files, etc.) on the Web. Relative to the TCP/IP suite of protocols (the basis for information exchange on the Internet), HTTP is an application protocol. Essential concepts that are part of HTTP include the idea that files can contain references to other files whose selection will elicit additional transfer requests.

TABLE 20. **IETF protocols that apply to ADL – Continued.**

Specification/standard title and number	Relationship to ADL
Secure Hypertext Transfer Protocol (S-HTTP)	S-HTTP is an extension to the HTTP protocol and was designed to transmit individual messages securely. Secure Sockets Layer (SSL) is a more prevalent protocol for sending secure transmissions however; SSL and S-HTTP have very different designs and goals so it is possible to use the two protocols together.
Secure Sockets Layer (SSL)	SSL is designed to establish a secure connection between two computers. SSL works by using a private key to encrypt data that is transferred over the SSL connection. SSL is used for transmitting private documents via the Internet or between a client and a server.
Asynchronous Transfer Mode (ATM)	ATM technology allows the transfer of data in packets of a fixed size. The cell used with ATM is relatively small compared to units used with older technologies. This small, constant cell size allows ATM equipment to transmit video, audio, and computer data over the same network. ATM supports data transfer rates of from 25 to 622 Mbps compared to a maximum of 100 Mbps for Ethernet.

A.4.11 The future of Web-based standards. The World Wide Web Consortium (W3C) does not develop standards, however, the W3C does review existing standards and make recommendations for improvement of current technologies and their future development. Since its inception, the W3C has published more than twenty "Recommendations" that outline the future course for Web technologies (e.g., HTML, SMIL, XML, etc.). For specific information regarding the W3C, refer their Web site at URL http://www.w3.org. Recommendations for technology standards/specifications that apply to ADL are provided in Table 21.

TABLE 21. **W3C Technology standards/specifications that apply to ADL.**

"RECOMMENDATIONS"	**DATE**
Extensible Markup Language (XML) 1.0 (Second Edition)	10/6/00
XHTML 1.0: The Extensible HyperText Markup Language (XHTML) – A Reformulation of HTML 4 in XML 1.0	1/26/00
HTML 4.01 Specification	12/24/99
Synchronized Multimedia Integration Language (SMIL) 1.0	6/15/98
WORKING DRAFT "RECOMMENDATIONS"	
Modularization of XHTML	10/4/00
SMIL 2.0 Specification	9/21/00
XML Schema Part 0: Primer	9/22/00
XML Schema Part 1: Structures	9/22/00
XML Schema Part 2: Datatypes	9/22/00
XML – Signature Syntax and Processing	9/18/00

A.4.12 Mobile code standards. DoD has approved the Policy Guidance for use of Mobile Code Technologies in DoD Information Systems. This policy provides information about mobile code technology risks and specifies restrictions for the use of mobile code. Mobile codes, allow for dynamic instructional design which in-turn enhances the students learning experience. However, this presents a security risk to the host enclave from mobile codes entering the system from outside of the enclave boundary without explicit installation or execution by the recipient. The use of some mobile codes may be prohibited. Therefore, it is imperative that the IT Specialist should be consulted about the restrictions regarding the use of mobile codes. The Policy Guidance for use of Mobile Code Technologies in DoD Information Systems may be downloaded from URL http://www.c3i.osd.mil/org/cio/doc/mobile-code11-7-00.pdf. Mobile codes that apply to ADL include:

a. ActiveX Windows Scripting Host, when used to execute mobile codes.
b. Unix shell scripts, when used as mobile code.
c. DOS Batch scripts, when used as mobile code.
d. Java applets and other Java mobile code.
e. Visual Basic for Applications (VBA).
f. LotusScript.
g. PerfectScript.
h. Postscript.
i. JavaScript (include Jscript and ECMAScript variants).
j. VBScript.
k. PDF.
l. Shockwave/Flash.
m. Applets or scripts associated with VRML worlds.

A.4.13 De facto standards/protocols. De facto standards and protocols are those developed by a specific vendor or consortium of vendors. De facto standards/protocols have extensive, ideally long-term use in the market. Examples of de facto standards and protocols that apply to ADL are provided in Table 22.

TABLE 22. **De facto standards that apply to ADL.**

Specification/standard title	Relationship to ADL
Hayes compatible	Hayes compatible refers to a language, called the AT command set, that was developed for controlling modems and has become the de facto standard. Modems that recognize Hayes modem commands are Hayes compatible. This is very useful as most communications programs recognize Hayes modem commands.

TABLE 22. **De facto standards that apply to ADL –Continued.**

Specification/standard title	Relationship to ADL
Kermit Communications Protocol	Kermit is a communications protocol and set of associated software utilities developed at Columbia University. Kermit is noted for its transmission accuracy and slow transmission speeds due to its default settings that optimize for accuracy. However, it can also be tuned to transfer data as quickly as any other data transfer protocol. It is frequently used with modem connections, although it also supports communications via other transport mechanisms such as TCP/IP. (NOTE: Columbia University allows the use of this protocol at no charge even though it is not in the public domain.)
Xmodem Communications Protocol	Xmodem is one of the most popular file transfer protocols. Although Xmodem is a relatively simple protocol, it is effective at detecting errors. Xmodem can be implemented either in software or in hardware. It is useful only at relatively slow data transmission speeds (less than 4,800 bps). Many modems, and almost all communications software packages, support Xmodem. Enhanced versions of Xmodem that work at higher transmission speeds are known as Ymodem and Zmodem.
Ymodem Communications Protocol	Ymodem is an asynchronous communications protocol that is an enhanced version of Xmodem. It differs from the Xmodem by enabling the user to specify a list of files and send them all at one time, vice sending only one file at a time.
Zmodem Communications Protocol	Zmodem is an asynchronous communications protocol that provides faster data transfer rates and better error detection than Xmodem. Zmodem supports larger block sizes and enables the transfer to resume where it left off following a communications failure.
Hewlett-Packard Printer control Language for laser printers	It is a language for describing and controlling the layout and contents of a printed page. Both Hewlett-Packard and PostScript are used to control laser printers.
PostScript page description language for laser prints	It is a language for describing the layout and contents of a printed page. Both PostScript and modern versions of printer control language are object-oriented, meaning that they describe a page in terms of geometrical objects such as lines, arcs, and circles.

APPENDIX B

ADL PROGRAM HARDWARE AND SOFTWARE RECOMMENDATIONS AND SELECTION.

B.1 SCOPE

B.1.1 Scope. This appendix addresses hardware and software configurations to support ADL.

B.2 APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

B.3 DEFINITIONS

The definitions in MIL-HDBK-29612-4 apply to this appendix.

B.4.0 ADL PROGRAM HARDWARE AND SOFTWARE RECOMMENDATIONS AND SELECTION.

B.4.1 ADL program hardware and software. The concept of a successful ADL program should work in the user's existing environment. The rapid rate of technological change has made it necessary to update instructional materials continually to keep pace with changes in the underlying software and hardware. The ADL Initiative is a collaborative effort to expedite production of instructional materials and tools that are reusable, can run on a broad range of hardware platforms, and can be accessed and modified over a communications network. This appendix provides recommended minimums for hardware components and software. It is important that software and hardware selection should be evaluated as a package to ensure compatibility and therefore full use of the total system's capabilities.

B.4.1.1 ADL program hardware recommendations. In keeping with DoD initiatives for ADL technology, a standard desktop computer platform for IMI development is recommended. In addition to recommendations provided in the Joint Interoperability and Engineering Organization (JIEO) Report, the paragraphs below outline recommendations for hardware (e.g., PC, laptop, palm computers, etc.) that may be used in an instructional system. Hardware architectures are described as follows:

a. System architecture. The term architecture refers to the design and interaction of components in a computer system and can be used in reference to either hardware or software. Developing a common architecture will ensure interoperability of models and

simulations in collective training. Architecture involves the framework of how the system is constructed and may define precise mechanisms in the system.

b. Open architecture. Open architecture refers to the ability of devices to be easily connected to programs made by different manufacturers. Closed or proprietary architecture makes connecting to the system difficult and is in direct conflict with ADL Initiative goals. Open architectures use COTS hardware and software and conform to approved standards. Specifications for open architecture are public and accessible to the purchasers.

c. Plug and Play (PnP) portability. PnP refers to the capability of add-in computer hardware to be purchased and plugged into an existing computer system without the user's having to be concerned with configuration elements before being able to use it. PnP enables devices within the computer to work together without conflicting with each other. This capability increases the functionality and lifetime of the computer system and decreases the time required for technical management and maintenance.

B.4.1.1.1 ADL program hardware selection. A properly configured ADL program takes advantage of different components to provide performance improvements. Overall performance depends as much on the balance between system components as it does on the relative performance of any one component.

B.4.1.1.1.1 PC equipment minimums. Selecting the proper disk drive can improve performance significantly during input/output (I/O) related activities. Clock speed itself does not provide an accurate picture of Central Processing Unit (CPU) performance. The clock speed of the CPU is only important if high-speed caching and main memory support the clock speed. Table 23 lists the recommended hardware components intended to support an ADL program and related IMI development.

TABLE 23. **Recommended hardware components.**

ITEM	**Specification**
System board.	100 MHz bus.
Processor.	500 MHz Pentium III minimum.
Random Access Memory (RAM).	128 MB minimum (expandable to 1-4 GB). 256 MB recommended.
Storage: • Floppy drive(s). • Zip™ drive equivalent. • Hard Disk Drive.	 • 1.44 MB 3.5-inch. • 250 MB/backward compatible with 100 MB. • 9 GB or larger.
Video • Card. • Monitor.	 • PCI/AGP 16 MB or better with 3D. • 19-inch viewable Multisync, (.26 mm dot pitch) for the student. • 21 to 24-inch viewable Multisync, (.26 mm dot pitch) for the Instructional Developer.

TABLE 23. **Recommended hardware components – Continued.**

ITEM	Specification
Audio	
• Sound card.	• 32-bit or better.
• Speakers/headphones.	• Compatible with sound card.
• Microphone.	• Noise canceling, free-standing or built-into headphone
Other standard features	
• L2 cache.	• 512 KB minimum.
• Keyboard.	• Standard Windows compatible.
• Mouse.	• Standard Windows compatible.
• CD-ROM.	• 32x (without R/RW drive).
• Operating System.	• Windows 2000/NT (or current standard).
Option.	
• CD-ROM.	• 32x.
• CD-R/CD-RW.	• 6x read/6x rewrite minimum.
• DVD.	• Not applicable.
• Network card.*	• 10/100 Mbp.
• Modem.**	• V90 compatible.

* Network card selection should meet local information management specific requirement.
** Modem use must be approved by local information management because of phone line requirements.

ACRONYMS USED IN THIS TABLE:

CR-R	CD-Recordable
CR-RW	CD-Rewriteable
GB	Gigabyte
KB	Kilobyte
Mbp	Megabits per
MHz	Megahertz
NT	New Technology
PCI/AGP	Peripheral Component Interconnect/Accelerated Graphics Port
R/RW	Read/Rewriteable

B.4.1.1.1.2 Hardware specifications. Hardware selections for an ADL/IMI platform are based in part on the "Courseware Delivery Stations: Hardware" recommendation of the AICC (AICC Guidelines and Recommendations (AGR): AGR 002, 14 Jan 1999, Version 8.0). The rationale for selecting these components is discussed below.

B.4.1.1.1.2.1 System board CPU. The newer fast processor architecture requires a minimum of a 100 MHz system board to take advantage of the Pentium II/III/Next Generation chipsets. All machines with Pentium II/III processors come with this minimum system board speed. However, older boards (those found on 486/Pentium machines) may not support this speed (i.e., 66 MHz) and attempts to upgrade the processor to a Pentium II/III should not be undertaken.

B.4.1.1.1.2.2 500 MHz Pentium III recommendations. The 500 MHz processor is recommended for IMI development because of its processing power and programmed routines specifically designed for multimedia. Part of the rationale is that IMI should be developed on a high-end machine because of the multi-tasking required for developing IMI materials. Most of these products will be delivered on machines considered lower end, by today's standards, though much more powerful than the earlier developed 486 and Pentium I/II machines. Unfortunately, as the processing power increases, software developed for them may not be compatible with earlier generation systems. This is another reason for recommending upgrade to the Pentium III family. In addition to the power advantages of the Pentium III is the optimized speed processing of Internet material. Since ADL content material will be designed to operate in a web browser interface, using the higher speed processors will yield improvements in speed and quality of IMI performance in an ADL environment.

B.4.1.1.1.2.3 RAM requirements. The most important reason for requiring a minimum of 128 MB of RAM is that IMI development is a memory intensive process and additional memory beyond the minimum recommendations for the Windows™ operating system (95/98/NT/2000) enhances system operation. Another benefit of the increased RAM is improved software operation. The current Industry standard includes 128 MB with Pentium III systems.

B.4.1.1.1.2.4 Disk drives. Disk drives store and provide access to data on an electromagnetically charged surface or set of surfaces in a computer system. The following paragraphs describe the types of disk drives.

B.4.1.1.1.2.4.1 Hard Disk Drives (HDD). The availability of increasingly larger HDDs installed as standard equipment on PCs allows for the installation of software requiring large quantities of storage space. Larger size (13+ GB) HDDs are considered standard. Even larger sizes are available for relatively low cost when included with an initial PC system purchase. A 9 GB minimum HDD size is recommended to accommodate both the storage required for standard operating system files, office suite files, IMI authoring tool files, and data files. It is recommended to purchase as much storage space as affordable keeping in mind that it is cheaper to buy it up front than to add it later.

B.4.1.1.1.2.4.2 Removable media disk drives. There are numerous types of drives available that accept portable storage media. These types are discussed below and their capacities are described in Table 24.

a. The 3.5-inch floppy drive is considered standard and will be found included with almost any system purchased. However, this storage method is inadequate for the files associated with IMI.
b. A Zip™ drive equivalent floppy disk system is recommended in addition to the 3.5-inch floppy drive as part of the purchased system because of the large numbers of files of

varying size resulting from IMI development. The larger capacity of a Zip™ drive equivalent allows most, if not all, course files to be stored on a single disk. Using a Zip™ drive equivalent provides an economical means of transferring files between Instructional Developers, reviewers, and others involved in the IMI development and production process. The Zip™ drive equivalent can also be used to distribute the finalized IMI (provided the economics are right for this format as opposed to others such as CD-ROM).

c. CD-ROM drives. Most vendors include a CD-ROM drive as standard equipment. When a system with only CD-ROM capability is chosen, the selection of the fastest CD-ROM drive available, a minimum of 32x, is recommended. If a CD-ROM is elected over adding a DVD drive, there are several different avenues that may be taken. It is recommended that a flexible platform be adopted. In terms of flexibility, a successful IMI development station will benefit by having both a DVD drive and a CD-RW drive available.

d. CD-Rewriteable/CD-Recordable drives. For the Instructional Developer, another alternative to consider is a CD-RW drive. This allows users to utilize rewriteable CD media for different purposes (e.g., storage of files, storage of IMI, "master" for IMI duplication, etc.). If the CD-RW option is elected it should have a minimum of 6x read/6x rewrite capability and should be capable of reading CD-R disks.

e. JAZ™ drive. The JAZ™ drive is a removable disk drive and has cartridges that can hold up to 2 GB of data. The fast data transfer rates and large storage capacity make it a viable alternative for backup storage as well as everyday use. This drive would probably not be necessary for a student but would be a tremendous asset to the Instructional Developer.

f. DVD drives. Computer manufacturers are beginning to offer DVD as a standard component on many systems. It can come as either a separate drive in addition to a CD-ROM drive or as a single multi-function drive for both DVD and CD-ROM. A multi-function DVD drive reads CD audio, CD-ROM, and DVD formats and is a definite plus that should be given serious consideration for replacing or supplementing a CD-ROM drive. In short, a multi-function DVD drive is a good thing to have, so take the option when available. DVD considerations are:

    (1) DVD incompatibility. Some operating systems have incompatibilities and may not be certified by vendors to will work with DVD. The Instructional Developer needs to analyze and determine whether DVD applications can be developed to work on local network operating systems before acquiring the technology. However, a multipurpose DVD/CD drive unit will playback DVD video disks and serve as a data-storage device, as well as providing the usual CD-ROM functionality.

    (2) Rewriteable DVD (DVD-RW). There are several competing DVD standards governing DVD-RW. Currently, there is no clear Industry-favored DVD-RW drive. Additionally, there is no economical DVD-RW drive unit available for PCs at this time; consequently, DVD-RW drives are not recommended.

TABLE 24. **Portable storage media capacity.**

Storage type	**Capacity**
3.5 inch floppy	1.44 MB
Zip™	250 or 100 MB
CD-R	600 MB
CD-RW	600 MB
JAZ™	2 GB
DVD	4.7 GB

B.4.1.1.1.2.5 Video card. The selection of a 16 MB video card as the minimum standard reflects the Industry trend in increased performance and system configuration as well as the decline in RAM cost. This also offers more versatility to support different screen effects that can be used with IMI. A 16 MB card supports faster screen refresh rates and higher screen resolution levels, all pluses when used as an IMI development or delivery platform. In addition to the minimum 16 MB video, 3D capability of the video card to take advantage of COTS software, changes in operating systems and other software, and the capabilities of Web and other IMI courseware development/authoring tools is recommended. Including the 3D capability on the video card itself eliminates the need for an additional video accelerator card in many instances.

B.4.1.1.1.2.6 Monitor. A 17-inch viewable, multisync monitor with .26 mm dot pitch, is based on what Industry is including as "standard" with most desktop systems. While a 17-inch monitor is the standard, the optimum would be a 19-inch monitor for the student and a 21 to 24-inch monitor for the Instructional Developer. The term "viewable" refers to actual viewing area of the monitor, keeping in mind that the diagonal screen measurements are often greater than the area actually seen. Dot pitch is also a critical factor because it bears a direct relation to on-screen clarity. The general rule of thumb is "the smaller the pitch, the clearer and sharper the image." Sharpness and clarity are two attributes that are critical in developing any computer application and IMI is no exception.

B.4.1.1.1.2.7 Audio card. There is an increasing use of audio in IMI products, usually accompanying video. Developments in sound card technology and pricing have followed other Industry trends leading to more cost-effective training. The 32-bit sound card is becoming the de facto standard. The 32-bit sound card is the recommended minimum because it is cost-effective and allows more versatility to support IMI and other uses than does a 16-bit card.

B.4.1.1.1.2.8 Speakers. Most manufacturers ship speakers paired with the installed sound card. Generally, these are lower-end speakers that are adequate for most uses. However, if higher-end speakers are needed it is best to look at available system upgrades and select them at the time of purchase if possible.

B.4.1.1.1.2.9 Headphones. Headphones may be an alternative audio device in place of speakers. They make good sense in a multi-user office environment. Their sound reproduction quality equals that of many speakers and in some cases exceeds them. Speakers or headphones used separately or together can be selected as the teaching conditions and environment warrant.

B.4.1.1.1.2.10 Other standard features. Little is required for the description of the other standard features such as the keyboard and mouse. However, there are usually some different mouse options available (e.g., touch pads, trackballs, microphones, etc.) and selecting one of these in lieu of a mouse is a personal choice. The bottom line is that a "pointing device" (generally assumed to be a mouse) is required.

B.4.1.1.1.2.11 Connectivity. The two options are network cards and modems. These provide connectivity to the Internet, intranet and extranet as well as user's LAN and WAN.

a. Network cards. Most users will need a network card for connection to their LAN. The type of card needed varies from location to location depending on the regulations imposed by the local information technology managers. Before selecting and ordering a network card for a new system, the local IT Specialist should be contacted for local rules and regulations.
b. Modems. A modem may be required for providing connectivity to the Internet. Modems convert data analog signals received through the telephone network and convert it to digital data for use on a user's computer. A modem is recommended when there are geographically separated units that do not have LAN access. The type of modem needed varies from location to location depending on the regulations imposed by the local information technology managers. The fastest state-of-the-art or current Industry standard, compatible modem is recommended. Before selecting and ordering a modem for a new system, the local IT Department should be contacted for local rules and regulations.

B.4.1.1.2 Laptop computers. There have been great strides in laptop capabilities in recent years. In terms of performance, they equal and sometimes exceed that of some installed desktop PCs. In some areas, laptops are being used rather than desktop PCs. Some may consider laptops as their main workstation due to varying requirements. For the purposes of this document, comments are focused on the acquisition of new laptops and the desired configurations so they may be used for IMI development or delivery as well as the usual range of computer applications. Table 25 lists the recommended laptop configuration intended to support an ADL program and related IMI development.

TABLE 25. **Recommended laptop configuration.**

Item	**Specification**
System board.	100 MHz bus.
Processor.	400 MHz Pentium II minimum.
RAM.	• 128 MB minimum (expandable to 384 GB). • 256 MB recommended.
Storage • Floppy drive(s). • Hard Disk Drive.	 • 1.44 MB 3.5-inch. • 8 GB or larger.
Video • Card. • Monitor.	 • PCI/AGP 16 MB or better with 3D. • 14.1-inch XGA-TFT color display.
Audio • Card. • Speakers/headphones. • Microphone.	 • 32-bit or better. • Integrated/compatible with sound card. • Built-in or included in headset.
Other standard features • L2 cache. • Operating system. • Pointing device. • CD-ROM. • Operating System. • Expansion slot.	 • 256 KB minimum. • Standard Windows 2000/NT (or current). • Touch-pad, built-in joystick, external mouse. • 32x or faster. • Windows 98/NT (or current standard). • PCMCIA.
Options • Zip™ drive equivalent. • DVD. • Network card.* • Modem.** • Docking station.	 • 250 MB/backward compatible with 100 MB. • In lieu of CD-ROM. • 10/100 Mbp. • V90 compatible. • Laptop specific, provides full size keyboard, mouse, and monitor connections.
* Check with local IT Department for specific requirement. ** Modem use must be approved by local IT Department because of phone line requirements. ACRONYMS USED IN THIS TABLE: PCMCIA Personal Computer Memory Card International Association XGA-TFT Extended Graphics Array-Thin Film Transistor	

B.4.1.1.2.1 Laptop performance. Currently, most of the processors used are 50 to 100 MHz, "slower" than the high-end processors available for desktop PCs. A 400 MHz Pentium III CPU (or higher) chip should have all the capacity needed for both developing and running IMI. Most of the processor differences are internal and driven by the power and other requirements for operating in the laptop environment.

B.4.1.1.3 Palmtop computers. A palm computer is a small computer that literally fits in the palm of the hand. Compared to full-size computers, palmtops are severely limited, but they are practical for certain functions such as phone books and calendars. Palmtops that use a stylus rather than a keyboard for input are often called hand-held computers. Because of their small size, most palmtops do not include disk drives. However, many contain slots in which disk drives, modems, memory, and other devices can be inserted. Palmtops can be used as an alternative solution for mobile users. They extend remote network access beyond the PC.

B.4.1.1.4 Other hardware. Computers are not the only hardware tools involved in the development and maintenance of a successful ADL program. Examples of additional hardware are as follows:

a. Studio cameras.
b. Overhead cameras (functions as replacement for white board or to show three-dimensional objects).
c. Video sources (e.g., CD-ROM player, Compact Disc-Interactive (CD-I), laser disk player, etc.).
d. Televisions/keypads.
e. Telephone lines.
f. Digital data projectors.

B.4.1.2 ADL Initiative supported software. Software is probably the most critical element in an ADL program. Software is a primary factor in achieving interoperability of instructional content. Both present and future software applications and availability must be determined. The following is a list of currently available types of software packages that can be used to develop an ADL program:

a. Courseware development/authoring tools.
b. Computer-based instructional material.
c. Intelligent tutors.
d. Mentoring systems for students and workers.
e. Modeling and simulation tools.
f. Performance aiding tools.
g. Real-time, in depth learning management systems.
h. Training management software.

APPENDIX C

JOB AIDS FOR SELECTING COMPONENTS OF A TRAINING PORTAL

C.1 SCOPE

C.1.1 Scope. This appendix provides job aids to assist in the review and evaluation of training portal components.

C.2 APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

C.3 DEFINITIONS

The definitions in MIL-HDBK-29612-4 apply to this appendix.

C.4.0 JOB AIDS FOR SELECTING COMPONENTS OF A TRAINING PORTAL

C.4.1 Job aids for selecting components of a training portal. The components of a training portal can be acquired with a myriad selection of functions and features. Tables 26 through 30 are provided to simplify the review and evaluation of an existing LMS or to document the desired functions and features of an LMS that is to be procured. These checklists can be modified to suit a specific selection/acquisition.

C.4.1.1 LMS selection. One of the keys to a successful on-line learning program is the selection and application of a robust LMS. The LMS should be easy to learn, easy to use, flexible, integrate with other software, easily upgraded to future versions, and provide sufficient features for instructors, administrators, and students. Table 26 provides a sample checklist that can be modified and used to evaluate an existing LMS or to document the desired functions and features of an LMS that is to be procured.

TABLE 26. **Sample LMS evaluation checklist.**

Evaluator's name:	Date evaluated:	
Name of product:	Version:	
Cost of software: Per course: $ Per student: $	Maximum number of students product can support:	
BASIC QUESTIONS:	**YES**	**NO**
Can the LMS launch courseware developed in multiple courseware development/authoring tools?		
Can the LMS track courseware developed in multiple courseware development/authoring tools?		
Can the LMS report student tracking data created in courseware developed in multiple courseware development/authoring tools?		
Does the LMS comply with the SCORM?		
Does the LMS comply with the JTA?		
Does the LMS comply with the HLA?		
Does the LMS comply with IEEE 1484?		
Do the Standard Data Elements used by the product comply with the DoD Data Architecture (DDA) and Defense Data Dictionary System (DDDS)?		
Is training on the use of the product provided? • If training is provided, what is the cost? $		
Can the product be customized?		
Is technical support available 24/7 for administrators?		
Is technical support available 24/7 for Instructional Developers?		
Is technical support available 24/7 for instructors?		
Is technical support available 24/7 for students?		
Does the browser require a plug-in?		
Is a run-time version required?		
Does the product support courseware that is instructor-led?		
Does the product support courseware that is used for independent study (vice instructor-led)?		
Does the LMS have the ability to record and report student performance data necessary for diagnosis of problems?		

TABLE 26. **Sample LMS evaluation checklist – Continued.**

Does the product have the ability to distribute the LMS across multiple servers?		
Does the product support a third party database?		
Does the product database comply with Open Database Compliancy (ODBC) requirements?		
Does the product support interfacing with enterprise resources and other external systems (e.g., training and personnel management systems, Government Owned Training Systems (GOTS)?		
Does the product support managing various media options (e.g., VTT, threaded discussions, project collaboration, audio conferencing, independent student chat rooms, etc.)?		
Does the product support interfacing with data repositories?		
Does the product support the ISD/SAT processes?		
Does this software provide the following features?	**YES**	**NO**
Collect and return assignment submissions		
Grade assignment submissions		
Administer tests and learning exercises (e.g., multiple choice, drag and drop, simulations, team exercises, free play, etc.)		
Student performance data (e.g., time spent, times accessed, grades, etc.)		
Maintain class roster		
Auto remind		
On-line course catalog		
Supports multiple courses		
Search engine		
Multiple Job profile, career paths, and training requirements		
Qualifications and certifications		
Prerequisites		
Course calendar/daily planner tool		
File management:		
• Instructor file storage		
• Batch upload		
• Batch delete		
Instructor guide		
Student home pages		
Resource management for distributed learning (e.g., scheduling of computer/network access and availability, staff, computer learning facilities, and identification of expendables, etc.)		

TABLE 26. **Sample LMS evaluation checklist – Continued.**

Resource management for resident learning (e.g., scheduling of operational and training equipment, ranges, expendables, computer learning facilities, staff and infrastructure, etc.)		
Does the software provide any courseware development/authoring tool functions? If so, refer to Table 28.	**YES**	**NO**
Does the software provide the following learning management features above the module level?	**YES**	**NO**
Instructor information pages		
Course information/syllabus		
Establish individual and group learning paths		
Announcements/bulletins		
Student management above the module level:		
• Student presentation pages		
• Registration and course cancellation		
• Authentication of student registration		
Student progress tracking:		
• Participation tracking		
• Attendance		
• Grade book/transcripts		
• Student access to own data		
• Automatic assignment progress tracking		
• Assignment reminders		
• Automatic grade calculation		
• Class averages auto calculation		
Assessment:		
• Produces interactive quizzes		
• Have random test generation capability		
• Produces quizzes/exercises:		
o Timed		
o Untimed		
o Repeatable		
Course archive/backup		
Course replication		
Course revision		
Online Help/Frequently Asked Questions (FAQ)		

TABLE 26. **Sample LMS evaluation checklist – Continued.**

Does the software provide any course management features below the module level? If so, refer to Table 27.	**YES**	**NO**
Does this software provide the following administration features?	**YES**	**NO**
Automated registration		
Security:		
• Authentication		
• Passwords		
• Firewalls		
• Secure administration accounts		
• Secure student accounts		
Technical support		
Report generation		
Ability to support third party reporting tools		
Student transcript		
Does this software provide the following learning tools?	**YES**	**NO**
Student area		
Shared work		
Team building		
Student guide		
Self-assessment exercises		
Study skills building		
Does this software provide the following collaboration tools?	**YES**	**NO**
Discussion options:		
• Asynchronous:		
o E-mail (one to one)		
o List Servs (many to many)		
o Text-based conferencing (many to many)		
o Bulletin board (one to many)		
• Synchronous:		
o Chat:		
▪ Archive		

TABLE 26. **Sample LMS evaluation checklist – Continued.**

File sharing:		
• E-mail attachments		
• Message attachments		
• File storage		
• File Transfer Protocol (FTP)		
Student area:		
• Work group areas		
• Group Web pages		
• Team building		
Orientation		
EVALUATOR'S COMMENTS:		

C.4.1.2 CMS selection. The CMS should provide an easy to use interface for the student, integrate with other software, and provide sufficient features for instructors, administrators, and students. Table 27 provides a sample checklist that can be modified and used to evaluate an existing CMS or to document the desired functions and features of a CMS that is to be procured.

TABLE 27. **Sample CMS evaluation checklist.**

Evaluator's name:	Date evaluated:	
Name of product:	Version:	
Cost of software: Per course: $ Per student: $	Maximum number of students product can support:	
BASIC QUESTIONS:	**YES**	**NO**
Can the CMS launch lessons or exercises developed in multiple courseware development/authoring tools?		
Can the CMS track lessons or exercises developed in multiple courseware development/authoring tools?		
Can the CMS report student tracking data created in lessons or exercises developed in multiple courseware development/authoring tools?		
Does the CMS comply with the SCORM?		

TABLE 27. **Sample CMS evaluation checklist – Continued.**

Does the CMS comply with the JTA?		
Does the CMS comply with the HLA?		
Does the CMS comply with IEEE 1484?		
Do the Standard Data Elements used by the product comply with the DoD Data Architecture (DDA) and Defense Data Dictionary System (DDDS)?		
Does the product allow for customization?		
Does the product support courseware that is instructor-led?		
Is technical support available 24/7 for administrators?		
Is technical support available 24/7 for Instructional Developers?		
Does the product support courseware that is used for independent study (vice instructor-led)?		
Does the product have the ability to record and report student performance data necessary for diagnosis of problems?		
Does the product have the ability to verify client's conformance with system requirements?		
Does the product support sustainability?		
Is the product easy to use?		
Does this software provide the following features?	**YES**	**NO**
Instructor information pages		
Student performance data (e.g., number of times module is repeated, poor performance reports, remediation flags, etc.)		
Course information/syllabus		
Course calendar/schedule		
Student progress tracking:		
• Participation tracking		
• Student access to own data		
• Automatic assignment progress tracking		
• Grade assignments submissions		
• Automatic grade calculation		
Assessment:		
• Produces interactive quizzes		
• Have random test generation capability		
• Have intelligent test generation capability		
• Administer tests and learning exercises (e.g., multiple choice, drag and drop, simulations, team exercises, free play, etc.)		

TABLE 27. **Sample CMS evaluation checklist – Continued.**

• Produces quizzes/exercises:		
o Timed		
o Untimed		
o Repeatable		
Ability to support third party reporting tools		
Course revision capability		
Security:		
• Passwords		
• Firewalls		
Does this software provide the following learning tools?	**YES**	**NO**
Bookmarking		
Session resumption tool		
Student area		
Annotation (markup) capability		
Glossary help (student generated)		
Collect data on student performance at specific points in the courseware		
Student guide		
Self-assessment exercises		
EVALUATOR'S COMMENTS:		

C.4.1.3 Courseware development/authoring tool selection. Among other functions, the courseware development/authoring tool should provide templates with the capability of defining and storing additional templates or customizing existing templates. Table 28 provides a sample checklist that can be modified and used to evaluate an existing courseware development/authoring tool or to document the desired functions and features of a courseware development/authoring tool that is to be procured. The following should be considered when selecting a courseware development/authoring tool:

a. Intended product. What is to be produced with the tool?
b. Ease of use. Whenever possible test the software. There are products that can be obtained for free trial use (download) or a tour of the software's capabilities can be accessed on the Internet.

c. Presentation tools. When creating a course to be put on the Web, a presentation tool can be used. However, this will provide limited choices as to what can be included in the course. A fully functional courseware development/authoring tool will offer more design options.

TABLE 28. **Sample courseware development/authoring tool evaluation checklist.**

Evaluator's name:	Date evaluated:
Name of product:	Version:
Cost of Software: Per course: $	Per student: $

Course format structure for the Web: (fill in as applicable for tool being evaluated)			
Language(s) available:	**Mobile codes available:**	**Plug-ins used:**	**Other**

BASIC QUESTIONS:	**YES**	**NO**
Does the software produce courseware that is SCORM conformant?		
Does the product comply with the JTA?		
Does the product comply with the HLA?		
Does the product comply with IEEE 1484?		
Do the Standard Data Elements used by the product comply with the DoD Data Architecture (DDA) and Defense Data Dictionary System (DDDS)?		
Is training on the use of the product provided? • If training is provided, what is the cost? $		
Can the product be customized?		
Is technical support available 24/7 for administrators?		
Is technical support available 24/7 for Instructional Developers?		
Does the output require a plug-in?		
Does the browser require a plug-in?		
Output accepts Plug-ins (e.g., VRML, RealVideo, Real Audio/Flash, etc.)		
Is an interface other than a browser required?		
Displays output consistently across browsers		
Is a run-time version required?		

TABLE 28. **Sample courseware development/authoring tool evaluation checklist – Continued.**

Does the courseware require the use of a COTS product as part of the authoring approach?		
Does the software provide templates?		
Can the software develop templates?		
Is the development of templates easy?		
Does the product support courseware that is instructor-led?		
Does the product support courseware that is used for independent study (vice instructor-led)?		
Does the software produce courseware that promotes collaborative learning?		
Are there various entry points (e.g., analysis, design, development, etc.) for the tool?		
Are there provisions for all data inputs (e.g., job tasks, cues, conditions, etc.)?		
Will the tool produce data outputs for required approval documents?		
Does the product support a third party database?		
Distributes "standard web output" to other courseware development/authoring and editing systems?		
Can web pages be developed from a web server database (thin client approach)?		
Does this software provide the following features?	**YES**	**NO**
Grade assignments submissions		
Administer tests		
Student performance data (e.g., poor performance reports, remediation flags, adaptive navigation, branching, etc.)		
Provide alternate Web links		
Auto remind		
Computerized grading for multiple choice question objects		
Computerized grading for fill-in-the-blank question objects		
Customized feedback to tutorial questions		
Redirect path of tutorial based on student answers		
On-line marking and grades management of quizzes		
Search engine for course material		
Context-sensitive on-line help		
Drop and drag		
Course design tools/wizards (i.e., templates)		

TABLE 28. **Sample courseware development/authoring tool evaluation checklist – Continued.**

Automated glossary		
Automated course Table Of Contents (TOC)		
Automated course index		
Instructor guide		
Multimedia capability:		
• Presentation (ability to display, show, and hide):		
o Text		
o Tables as Text		
o Audio		
o Video		
o Graphics		
o Animation		
Graphics integration:		
• Low Level Simulation		
WYSIWYG		
Instructor information pages		
Course information/syllabus		
Automatic grade calculation		
Assessment:		
• Produces interactive quizzes		
• Have random test generation capability		
• Produces quizzes/exercises:		
o Untimed		
o Repeatable		
Course revision		
Does the software provide any course management features below the module level? If so, refer to Table 27.	**YES**	**NO**
Does this software provide the following administration features?	**YES**	**NO**
Passwords		
Technical support		
File management:		
• Instructor file storage		
• Batch upload		
• Batch delete		
Does this software provide the following learning tools?	**YES**	**NO**

TABLE 28. **Sample courseware development/authoring tool evaluation checklist – Continued.**

Bookmarking		
Collect data on student performance at specific points in the courseware		
Student guide		
Study skills building		
Does this software provide the following collaboration tools?	**YES**	**NO**
Discussion options:		
• Asynchronous:		
o Video		
o Audio		
• Synchronous:		
o Video		
o Audio		
Getting started tutorial (i.e., orientation):		
• Has print capability		
Does this software require the following?	**YES**	**NO**
Knowledge and use of Scripts (e.g., JavaScript, LotusScript, PerfectScript, Postscript, etc.)		
Knowledge and use of Java applets		
Knowledge and use of Visual Basic for Applications (VBA)		
Knowledge and use of Shockwave/Flash		
Knowledge and use of ActiveX		
Knowledge and use of plug-ins		
EVALUATOR'S COMMENTS:		

C.4.1.4 Communications tools selection. The communications tools should allow for various modes of synchronous and asynchronous communication for student-to-instructor and instructor-to-instructor interaction. Table 29 provides a sample checklist that can be modified and used to evaluate existing communications tools or to document the desired functions and features of communications tools that are to be procured.

TABLE 29. **Sample communications tools evaluation checklist.**

Evaluator's name:	Date evaluated:	
Name of product:	Version:	
Cost of software: Per course: $ Per student: $	Maximum number of students product can support:	
BASIC QUESTIONS:	**YES**	**NO**
Does the product comply with the JTA?		
Does the product comply with the HLA?		
Does the product comply with IEEE 1484?		
Do the Standard Data Elements used by the product comply with the DoD Data Architecture (DDA) and Defense Data Dictionary (DDDS)?		
Is training on the use of the product provided? • If training is provided, what is the cost? $		
Can the product be customized?		
Is technical support available 24/7 for administrators?		
Is technical support available 24/7 for Instructional Developers?		
Is technical support available 24/7 for instructors?		
Is technical support available 24/7 for students?		
Does the browser require a plug-in?		
Is a run-time version required?		
Does the product support courseware that is instructor-led?		
Does the product support courseware that is used for independent study (vice instructor-led)?		
Does the product support interfacing with enterprise resources and other external systems?		
Does this software provide the following features?	**YES**	**NO**
Collect and return assignment submissions		
Administer tests		
Maintain class roster		
Provide alternate Web links		
Auto remind		
Multimedia capability		
Student management:		
• Student presentation pages		

TABLE 29. **Sample communications tools evaluation checklist – Continued.**

Security:		
• Passwords		
Technical support		
Learning tools:		
• Shared work		
• Team building		
Does this software provide the following collaboration tools?	**YES**	**NO**
Discussion options:		
• Asynchronous:		
o E-mail (one to one)		
o List Servs (many to many)		
o Text-based conferencing (many to many)		
o Bulletin board (one to many)		
o Video		
o Audio		
• Synchronous:		
o Chat:		
▪ Archive		
o White board:		
▪ Archive		
o Video		
o Audio		
o Teleconferencing		
File sharing:		
• E-mail attachments		
• Message attachments		
• File Transfer Protocol (FTP)		
EVALUATOR'S COMMENTS:		

C.4.1.5 Reference resources selection. The reference resources should provide the instructor and students access to related web sites and other digital reference materials available through the Internet and intranet. Table 30 provides a sample checklist that can be modified and used to evaluate existing reference resources or to document the desired functions and features of reference resources that are to be procured.

TABLE 30. **Sample reference resources evaluation checklist.**

Evaluator's name:	Date evaluated:	
Name of product:	Version:	
Cost of software: Per course: $ Per student: $	Maximum number of students product can support:	
BASIC QUESTIONS:	**YES**	**NO**
Does the product comply with the JTA?		
Does the product comply with the HLA?		
Does the product comply with IEEE 1484?		
Do the Standard Data Elements used by the product comply with the DoD Data Architecture (DDA) and Defense Data Dictionary System (DDDS)?		
Can the product be customized?		
Is technical support available 24/7 for administrators?		
Is technical support available 24/7 for Instructional Developers?		
Is technical support available 24/7 for students?		
Does the browser require a plug-in?		
Is a run-time version required?		
Does the product support a third party database?		
Does the product support interfacing with enterprise resources and other external systems?		
Does this software provide the following features?	**YES**	**NO**
Provide alternate Web links		
Search engine		
Job profile, career paths, and training requirements		
Qualifications and certifications		
Automated glossary		
Web search tools		
Access to course calendar/schedule		
Access to student management tools:		
• Instructional materials ordering		
• On-line Help/Frequently Asked Questions (FAQ)		
Does this software provide the following learning tools?	**YES**	**NO**

TABLE 30. **Sample reference resources evaluation checklist – Continued.**

Bookmarking		
Reference resource and information access		
Does this software provide the following collaboration tools?	**YES**	**NO**
Discussion options:		
• Asynchronous:		
o Video		
o Audio		
• Synchronous:		
o Video		
o Audio		
File sharing:		
• File Transfer Protocol (FTP)		
Public file reference resource		
EVALUATOR'S COMMENTS:		

CONCLUDING MATERIAL

Custodians:
- Army - AV
- Navy - AS
- Air Force - 94
- Marine Corps - MC
- DLA - DH

Review Activities:
- Army - TM
- Navy - SH, EC, TD
- Air Force - 11
- DLA - CC, GS, IS, DP
- NSA - NS

Preparing Activity:
Navy - AS
(Project SESS-0019)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.

2. The submitter of this form must complete blocks 4, 5, 6, and 7, and send to preparing activity.

3. The preparing activity must provide a reply within 30 days from receipt of the form.

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I RECOMMEND A CHANGE:	**1. DOCUMENT NUMBER** **MIL-HDBK-29612-5**	**2. DOCUMENT DATE** (*YYYYMMDD*) **20010831**

3. DOCUMENT TITLE
ADVANCED DISTRIBUTED LEARNING (ADL) PRODUCTS AND SYSTEMS (PART 5 OF 5 PARTS)

4. NATURE OF CHANGE (*Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.*)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (*Last, First, Middle Initial*)	b. ORGANIZATION	
c. ADDRESS (*Include ZIP Code*)	d. TELEPHONE (*Include Area Code*) (1) Commercial (2) DSN (*If applicable*)	**7. DATE SUBMITTED** (*YYYYMMDD*)

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a. NAME COMMANDER NAVAL AIR WARFARE CENTER AIRCRAFT DIVISION	b. TELEPHONE (*Include Area Code*) (1) Commercial (732) 323-2947 (2) DSN 624-2947
c. ADDRESS (*Include ZIP Code*) CODE 414100B120-3 HIGHWAY 547 LAKEHURST, NJ 08733-5100	**IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:** Defense Standardization Program Office (DLSC-LM) 8725 John J. Kingman Road, Suite 2533 Fort Belvoir, Virginia 22060-6221 Telephone (703) 767-6888 DSN 427-6888