



Advanced Distributed Learning (ADL)

Acquisition Guidance

August 9, 2006

Version 1.0

Purpose

The purpose of this document is to aid government personnel in successfully acquiring interoperable, accessible, reusable, durable, maintainable, and adaptable distributed learning (DL) products. This document is not intended to be a substitute for acquisition documents, such as DoDD 5000.1, DoDI 5000.2¹, Service specific documents, etc. Rather, it is a supplement to these documents.

Target Audience

Department of Defense (DoD) personnel responsible for acquiring DL courseware and systems that store, manage and run DL courseware, heretofore referred to as acquisition professionals.

¹ DoD Directive 5000.1, DoD Instruction 5000.2. Retrieved July 15, 2005 from <http://akss.dau.mil/dapc/index.html>

Table of Contents

1.0	Introduction.....	6
1.1	Document Overview	6
1.2	Key References	7
2.0	Front-End Analysis.....	9
2.1	Relevant Policy	9
2.2	Points of Consideration.....	9
2.2.1	Choosing Distributed Learning (DL).....	9
2.2.2	Content Sharing and Reuse.....	10
2.3	Products.....	10
2.3.1	Training Situation Document.....	10
3.0	Program Management	11
3.1	Relevant Policy	11
3.2	Points to Consider	13
3.2.1	The ADL Team	13
3.2.2	DoD Instruction Compliance Considerations	13
3.2.3	Hosting Strategy.....	14
3.2.4	Repository Strategy.....	14
3.2.5	Content Testing Strategy.....	15
3.2.6	Content Complexity Cost Factors	15
3.2.7	Content Instructional Quality.....	16
3.2.8	Information Assurance (IA).....	16
3.3	Products.....	16
3.3.1	Instructional Products	16
3.3.2	Software/Systems Products.....	17
4.0	Procurement Planning	18
4.1	Relevant Policy	18
4.2	Points to Consider	18
4.2.1	Government Use and Intellectual Property Rights	18
4.2.2	Contractor qualifications.....	19
4.2.3	Content Packages	19
4.2.4	SCORM Versions, Editions and Addendums.....	20
4.2.5	Metadata.....	20
4.2.6	Run-Time Environment (RTE).....	21
4.2.7	Sequencing.....	22
4.2.8	Navigation.....	22
4.2.9	Tools, Utilities, and Authoring Environments.....	22
4.2.10	Learning Management System (LMS) Planning	23
4.2.11	Applying MIL-PRF-29612B Specification for Training Data Products.....	23
4.3	Acquisition Package Products.....	24
4.3.1	Source Selection Plan	24
4.3.2	Independent Government Cost Estimate (IGCE)	25
4.3.3	Contract Data Requirements List (CDRL)	25
4.3.4	Contract Schedule	26
4.3.5	Conventional Contracting Request for Proposal (RFP).....	26

4.3.6	Performance-based Contracting Request for Proposal (RFP)	28
5.0	Analysis	29
5.1	Relevant Policy	29
5.2	Points of Consideration.....	29
5.2.1	Task Analysis.....	29
5.2.2	Media Selection	29
5.3	Products.....	29
5.3.1	Instructional Performance Requirements Document	30
5.3.2	Instructional Media Requirements Document	30
6.0	Design.....	31
6.1	Relevant Policy	31
6.2	Points to Consider	32
6.2.1	Metadata Strategy	32
6.2.2	Sharable Content Object (SCO) Size	33
6.2.3	Content Reuse	33
6.2.4	Realizing the Instructional Strategy.....	33
6.3	Reviews, Meetings and Conferences	34
6.3.1	Kick-off meeting.....	34
6.3.2	Instructional Reviews, Meetings and Conferences.....	35
6.3.3	Software/System Reviews, Meetings and Conferences.....	35
6.4	Products.....	36
6.4.1	Instructional Products	36
6.4.2	Software/System Products	37
7.0	Development.....	40
7.1	Relevant Policy	40
7.2	Points to Consider	40
7.2.1	Content Packages	40
7.2.2	ADL Testing Terminology	40
7.2.3	Testing Content.....	41
7.2.4	SCORM Conformance Testing.....	41
7.2.5	ADL Certification	42
7.2.6	ADL-R Required Metadata.....	42
7.2.7	SCORM Conformance Test Suite.....	42
7.3	Reviews, Meetings and Conferences	42
7.3.1	Instructional Reviews, Meetings and Conferences.....	43
7.3.2	Software/System Reviews, Meetings and Conferences.....	43
7.4	Products.....	44
7.4.1	Instructional Products	44
7.4.2	Software/System Products	45
8.0	Implementation.....	46
8.1	Relevant Policy	46
8.2	Points to Consider.....	47
8.2.1	Content Repositories.....	47
8.2.2	ADL Registry (ADL-R).....	47
8.3	Reviews, Meetings and Conferences	48
8.3.1	Instructional Reviews, Meetings and Conferences.....	48

8.3.2	Software/System Reviews, Meetings and Conferences.....	48
8.4	Products.....	49
8.4.1	Instructional Products	49
8.4.2	Software/System Products	50
9.0	Lifecycle Support	51
9.1	Relevant Policy	51
9.2	Points to Consider	51
9.2.1	SCORM updates	51
9.2.2	Registration Update	52
9.2.3	Repository Management	52
9.3	Reviews, Meetings and Conferences	52
9.3.1	Operational Evaluation	52
9.4	Products.....	52
9.4.1	Configuration Management (CM) Plan	52
10.0	Terms and Definitions	55
11.0	Product Checklist.....	59
12.0	Reviews, Meetings and Conferences Checklist.....	61

1.0 Introduction

DoD Instruction 1322.26, “Development, Management and Delivery of Distributed Learning”, has recently been signed. This Instruction provides guidance and procedures for implementing the ADL Initiative’s Sharable Content Object Reference Model (SCORM®) for Distributed Learning (DL). Since DL consists of instructional products implemented in software, the DL acquisition process can be viewed as a blend of the Analysis, Design, Development, Implementation, and Evaluation (ADDIE) Instructional Systems Design (ISD)² and training systems engineering (with emphasis on software) processes. This is the context in which this guidance document is presented as we address acquiring and developing DL content in light of the new DoD Instruction.

DoD Instruction 1322.26 states, “All acquired or developed DoD systems shall conform to SCORM (current version) to ensure accessibility, durability, reusability, maintainability and interoperability”. The Instruction applies to the whole DL training system, including the courseware content, and the chosen Learning Management System (LMS).

For updates and the latest DoD ADL acquisition performance support, this document will refer the reader to the Support area of the Joint ADL Co-Lab website.³

1.1 Document Overview

This document is arranged around the major phases of a DoD acquisition. Although much of the discussion is focused on DL content acquisition, some aspects of DL training system acquisition are covered as well. For each of the acquisition phases, the following topics are addressed:

- **Relevant Policy** from DoD 1322.26
- **Points to Consider** when implementing ADL technology
- **Reviews, Meetings and Conferences** as related to expectations from an ADL perspective (for applicable phases)
- **Products** that can be used in the ADL acquisition effort

Separate sections are included on program management (towards the beginning of the document) and life cycle management (at the end of the document). DoDI 1322.26 has some specific language that may affect the management decisions on an ADL project. The Products sections of the Program Management, Design, Development and Implementation chapters are further broken down into Instructional and Software/Systems to reflect the unique nature (part instructional material; part software product) of DL content and systems. The reader may note that there is some overlap among the recommended products. The acquisition professional is expected to tailor the requirements for individual data products, and the data products themselves according to the demands of each particular program and project. Reviews, Meetings, Conferences, and Products checklists are provided at the end of the document as a job aide for identifying and tracking activities necessary to a specific program.

² MIL-HDBK-29612-2A **Instructional Systems Development/Systems Approach to Training and Education**, 31 August 2001 <http://dtswg.fedsun.navy.mil/documents.htm>

³ <http://www.JointADLCoLab.org/>

Finally, the reader will note that many of the recommended instructional contract deliverable products are based on MIL-PRF-29612B **Performance Specification for Training Data Products** per the Instruction⁴. (From DoDI 1322.26, “*E4.7.3 Acquisition personnel are encouraged to follow the general structure and intent of Performance Specification for Training Data Products ...*”) While MIL-PRF-29612B and the MIL-HDBK-29612 handbooks⁵ are excellent resources, they were written at a time when an earlier version of SCORM was in effect. Consequently, some of the terminology in these documents is obsolete and no longer exists in the current version of SCORM. Two of the most conspicuous cases of this are as follows:

- **Course Structure Format (CSF)** – This term no longer exists in the current version of SCORM (SCORM 2004). The CSF was replaced by the *Organizations* component in the manifest with the advent of content packaging.⁶
- **Sharable Course (or Courseware) Object (SCO)** – This term was updated to Sharable Content Object (SCO) to better reflect the fact that the specifications contained in and referenced by SCORM apply to various levels of courseware components (e.g. content) as well as entire courses.⁷

The acquisition professional is cautioned against invoking the Data Item Descriptions (DIDs) for these products without addressing this outmoded language.

1.2 Key References

The preceding paragraph discusses MIL-PRF-29612B as an important reference in the application of the Instruction from the perspective of Instructional System Design (ISD) oriented deliverables. There are other key references cited in this document, and the reader is encouraged to access these for expanded discussion on the topics they cover as the need arises. Those references are as follows:

- **Defense Acquisition Guidebook** – The purpose of the Guidebook is to provide members of the acquisition community and industry partners with a definitive, interactive, on-line reference to policy and discretionary best practice. Hosted and maintained by Defense Acquisition University, the Guidebook is combined with other acquisition references and performance support material. The Defense Acquisition Guidebook can be accessed at <http://akss.dau.mil/dag/>.
- **IEEE/EIA 12207, “IEEE Standard for Industry Implementation of International Standard ISO/IEC 12207: 1995 Standard for Information Technology – Software life cycle processes”** – The Institute for Electrical and Electronics Engineers (IEEE) and the Electronic Industries Alliance (EIA) created this national implementation of the International

⁴ MIL-PRF-29612B **Performance Specification Training Data Products**, 31 August 2001 retrieved from <http://dtswg.fedsun.navy.mil/documents.htm>.

⁵ MIL-HDBK-29612 Parts 1A-5A, 31 August 2001 retrieved from <http://dtswg.fedsun.navy.mil/documents.htm>.

⁶ **Sharable Content Object Reference Model, Version 1.2, The SCORM Content Aggregation Model**, 1 October 2001, Advanced Distributed Learning Initiative, p. 2-101. <http://www.adlnet.gov/scorm/index.cfm>.

⁷ **Sharable Content Object Reference Model, Version 1.2, The SCORM Overview**, 1 October 2001, Advanced Distributed Learning Initiative, p. 1-8, <http://www.adlnet.gov/scorm/index.cfm>.

Organization for Standardization (ISO) and International Electrotechnical Commission (IEC) common framework for developing, operating, and maintaining software as well as its acquisition and supply (ISO/IEC 12207). DoD adopted the standard in May 1998. IEEE/EIA 12207 follows a long line of software engineering standards efforts intent on providing structure around the acquisition and development of software products. The idea behind the standard is not to define a lockstep process to follow, but to provide a framework and a set of data products that can be tailored to software engineering and development efforts of all sizes. Likewise, the reader should use this reference to do the same for DL acquisitions and developments. These Guidelines seek to highlight only a minimal set of software oriented products and process events that should be considered. IEEE/EIA 12207 is available from IEEE at <http://www.ieee.org>.

MIL-HDBK-29612 (Parts 1A, 2A, 3A, 4A and 5) – This five-part series of documents provides a comprehensive discussion on the acquisition and development of training products for DoD, especially as it pertains to computer-based training. The series was created by the Defense Training Systems Working Group (DTSWG). Part 5 in the series is titled “**Advanced Distributed Learning (ADL) Products and Systems,**” and provides good discussion of the program management aspects of procuring DL content and systems. Other parts provide discussion of instructional systems design and evaluation processes. MIL-HDBK-29612 documents can be accessed at <http://dtswg.fedsun.navy.mil/documents.htm>.

- **Sharable Content Object Reference Manual (SCORM)** – All of the SCORM specifications and support documents can be obtained from <http://www.ADLnet.gov>.

2.0 Front-End Analysis

The purpose of front-end analysis (FEA) is to determine the learning or training need, the audience, the organizational training philosophy and environment, and whether or not learning content already exists in whole or in part that addresses the need. Once the requirement to develop learning content is firmly established, further analysis produces high level knowledge, skills, attitudes and learning objectives for the tasks that have been selected for training. In the sections below we describe the policy relevant to the FEA, and some points for the analyst to consider that are relevant to ADL.

2.1 Relevant Policy

From DoDI 1322.26:

4.1. Embedded training and distributed learning shall be considered as the first option to meet training requirements of defense technology projects and acquisition programs.

4.2. The DoD Components shall share training resources to the maximum extent possible. A joint architecture and common standards for training technology shall be developed.

4.3 Information is shared as broadly as possible except where limited by law, policy, or security classification. Data assets produced as a result of the assigned responsibilities are visible, accessible and understandable to the rest of the Department of Defense as appropriate and in accordance with DoD Directive 8320.2, "Data sharing in a Net-Centric Department of Defense"....

6.1. Distributed learning content shall be developed using a front-end analysis (FEA) to identify costs, target audience(s), content, learning objectives, and optimal delivery method(s).

6.3.3.2. The ADL Registry (ADL-R) shall be searched prior to beginning any new distributed learning content development or acquisition to identify available content suitable for sharing, reuse or repurposing, through minor revisions, as part of the formal FEA process. The Defense Automated Visual Information System/Defense Instructional Technology Information System shall also be searched for learning content in other media.

2.2 Points of Consideration

2.2.1 Choosing Distributed Learning (DL)

The Instruction states that DL shall be considered as the first option to meet the training requirements. The analysis phase will determine for which training needs DL is practical. If DL is not appropriate to meet the requirement or agency need, then the analysis should thoroughly document why this is so.

2.2.2 Content Sharing and Reuse

The intent of the Instruction, paragraphs 4.2 and 4.3, is to maximize the sharing of training resources. Content sharing and reuse can save time required to meet new training requirements as well as the cost of doing so. ADL provides many technical enablers to accomplish this goal, but no overarching strategy for obtaining it. The intent of the Instruction, paragraph 6.3.3.2, is to lessen the costs of new content development or acquisition leveraging existing suitable content by first searching: the ADL Registry (ADL-R);⁸ the Defense Automated Visual Information System/Defense Instructional Technology Information System (DAVIS/DITIS);⁹ and documenting what content is, and is not already available. From this activity, decisions regarding reuse can be made or otherwise justified if not appropriate. Each project or program analysis should take into account efforts by the Services and other DoD Components to institutionalize content reuse, and include a strategy for doing so on an individual level to the extent that this makes logical sense.

2.3 Products

<i>Instructional</i>
• Training Situation Analysis (TSA), Training Situation Document

Table 1. Analysis Products

NOTE: The following documents comprise a comprehensive FEA required by the Instruction prior to a DL content development effort. While this analysis can certainly be contracted out, it can also be performed by Government personnel prior to contracting for training production.

2.3.1 Training Situation Document

The Training Situation Document documents the Training Situation Analysis (TSA) and verifies the efficiency of a training system to meet existing training needs, and records training programs survey results data and analysis results on technologies applicable to new training needs. While the Instruction and ADL have no specific guidance or impact on this product, previously developed DL content, infrastructure and systems (such as LMSs and repositories) should be discussed in the section of the document pertaining to the existing situation.¹⁰

⁸ ADL Registry Portal, <https://adlregistry.dtic.mil> or www.adlregistry.org.

⁹ Defense Automated Visual Information System/Defense Instructional Technology Information System (DAVIS/DITIS), <http://dodimagery.afis.osd.mil/davis/>.

¹⁰ **Performance Specification Training Data Products**, Mil-PRF-29612B, Data Item Description, Training Situation Document, Number: DI-SESS-81517B, 31 August 2001, <http://dtswg.fedsun.navy.mil/documents.htm>.

3.0 Program Management

The Project Manager (PM) is the project leader and responsible for accomplishing project requirements in accordance with applicable DoD policies and procedures. The first step in the acquisition management process is to form an Integrated Project Team (IPT) to execute the project consisting of Defense Acquisition Workforce Improvement Act (DAWIA) certified representatives from Program Management, Contracts, Logistics and Research and Engineering competencies.¹¹ There are systems¹² and instructional design plans¹³ that are important to the acquisition of DL, and customarily, written at this stage. Management and evaluation strategies are defined during the planning process, as well as, resource requirements.

3.1 Relevant Policy

From DoDI 1322.26:

1. PURPOSE

This instruction implements DoD policies, assigns responsibilities, prescribes procedures, and establishes information requirements to develop, manage, and deliver distributed learning for DoD personnel...

2. APPLICABILITY

2.1 This Instruction applies to the Office of the Secretary of Defense, the Military Departments, the Chairman of the Joint Chiefs of Staff, the Combatant Commands, the Office of the Inspector General of the Department of Defense, the Defense Agencies, the DoD Field Activities, and all other organizational entities within the Department of Defense (hereafter referred to collectively as “the DoD Components”).

2.2. This instruction excludes:

2.2.1. Full-scale simulators, part-task training aids and devices, unless there is a structured learning component.

2.2.2. Interactive Multimedia Instruction and courseware developed in a non-digital format or media (i.e. paper, film, and magnetic tape), according to DoD Instruction 1322.20.

¹¹ **Acquisition Guide**, NAVAIR Orlando Training Systems Division (TSD), “Acquisition Management” section, <http://www.nts.navy.mil/Resources/Library/Acqguide/acquisition.htm>.

¹² **Defense Acquisition Guidebook**, Section 4.5.1. Systems Engineering Plan, http://akss.dau.mil/dag/DoD5000.asp?view=document&rf=GuideBook\IG_c4.5.1.asp

¹³ **Instructional Systems Development/Systems Approach to Training and Educations (Part 2 of 5 parts)**, MIL-HDBK-29612-2A, <http://dtswg.fedsun.navy.mil/documents.htm>.

2.2.3. Those portions of instructor and faculty-led web-based instruction incorporating instant messaging, e-mail, live telecasts, web casts, or interactive television.

5.2 The Under Secretary of Defense for Acquisition, Technology, and Logistics (USD (AT&L)) shall:

5.2.1. Require DoD acquisition category level I programs initiated after the effective date of this Instruction to comply with this Instruction. This includes embedded training and performance aiding, per subparagraph 5.1.6 of reference (a). Acquisition category level II and III programs initiated after the effective date of this Instruction should comply where appropriate and cost effective.

6.2. All acquired or developed DoD systems shall conform to the SCORM (current version) to ensure accessibility, durability, reusability, maintainability and interoperability. This includes DoD systems designed to:

6.2.1. Deliver, track, report on and manage distributed learning content, learner progress and learner interactions.

6.2.2. Deliver, track, report on and manage content and systems.

6.3. All acquired or developed SCORM-conformant content packages (CPs) shall:

6.3.1. Include metadata.

6.3.2. Be registered in the ADL-R according to enclosure 3.

6.3.3. Be maintained in DoD Components' repositories that are searchable and accessible, consistent with DoD information security and information technology policies according to DoD CIO Memorandum (Reference (e)).

6.3.3.1. These repositories shall be registered in the ADL-R according to Enclosure 3. Content with classified metadata is exempted from registering in the ADL-R under this subparagraph pending published guidance for alternative content management.

6.3.3.2. The ADL-R shall be searched prior to beginning any new distributed learning content development or acquisition to identify available content suitable for sharing, reuse, or repurposing, through minor revisions, as part of the formal FEA process. The Defense Automated Visual Information System/Defense Instructional Technology Information System shall also be searched for learning content in other media.

E.4.7.3. Acquisition personnel are encouraged to follow the general structure and intent of Performance Specification for Training Data Products and Development of IMI, in procuring distributed learning content.

3.2 Points to Consider

3.2.1 The ADL Team

The Project Manager for an ADL program needs to assemble an ADL Integrated Product Team (IPT)¹⁴ and ensure they have had, or will receive training in available technologies and applicable standards such as SCORM. The ADL IPT should include managers, instructional designers, software engineers, IT specialists, evaluators, and Subject Matter Experts (SMEs). Communication between the team members is important for successful design and development of good courseware.¹⁵ Since DL consists of both software and instructional material, an instructional designer and a software engineer are both vital to the acquisition effort. The instructional designer is responsible for ensuring the instructional integrity of the learning content beginning with follow-on needs and audience analysis down to review of the final materials.¹⁶ The software engineer is responsible for ensuring that the software products, both content and systems, satisfy the learner's needs from a functional perspective and adhere to all applicable specifications and standards including SCORM. Typically the engineer would receive more extensive training in SCORM than the rest of the team: however, the software engineer and the instructional designer both need to understand the capabilities that are available with SCORM in order to take full advantage of this specification for the application. Another important member of the team includes legal counsel. During the writing of the contract, a contracts attorney should be sought to make sure the contract clarifies appropriate government rights to the work products.

3.2.2 DoD Instruction Compliance Considerations

This DoD policy applies to all ACAT 1 programs initiated after the effective date of the Instruction. Further, ACAT level II and III programs initiated after the effective date of the Instruction should comply where appropriate and cost effective. For these programs, cost trade-offs should be conducted.

In addition, the instruction does not apply to the following systems:

- full-scale simulators
- part-task training aids and devices (unless there is a structured learning component as part of the system)

¹⁴ **DoD Handbook, Advanced Distributed Learning (ADL) Products and Systems**, MIL-HDBK-29612-5, section 5.2, page 20, retrieved August 2, 2005 from <http://dtswg.fedsun.navy.mil/Documents.htm>

¹⁵ *Understanding SCORM: How To Perform Effectively On a SCORM-Compliant Project Team* presentation, Carnegie Mellon University (CMU) Learning Systems Architecture Lab (LSAL), retrieved from <http://lsal.org/lsal/expertise/projects/developersguide/present.php>

¹⁶ **SCORM Best Practices Guide for Content Developers**, 1st Edition, 28 February 2003, retrieved from <http://lsal.org/lsal/expertise/projects/developersguide/>, pp. 13-14.

- IMI and courseware developed in a non-digital format or media
- instant messaging, e-mail, live telecasts, web casts or interactive television portions of web-based instruction

These systems will continue to be an integral part of DoD training; however they do not need to comply with this Instruction.

3.2.3 Hosting Strategy

A key decision for any ADL program is where the content will be hosted. In general, there are three main options: (1) a Program Office can develop a system (most likely through an acquisition effort) as part of the overall training solution; (2) purchase the system on which the content will be managed; or (3) elect to host the content on an already existing system. The first provides more control over the learning process with the added complexity and expense of having to create the learning environment. The second sacrifices highly customized solutions for an off-the-shelf one, but still provides a fair amount of control. The last has the advantage of targeting content management on a potentially mature system without the purchase and integration costs (hardware and software), but with the probability of compromising control over the learning process. A key component in the DL system is a class of products known as Learning Management Systems (LMS) whose functionality is covered in detail in other publications.¹⁷ Another class of products known as Learning Content Management Systems (LCMS) often provides LMS functionality along with the ability to manage content to a higher degree, and sometimes develop it. At this writing, the Services are moving towards more enterprise approaches to delivering and managing DL, so an individual activity may need to comply with overarching organizational business rules. More detail concerning Service programs can be found in the Support area of the Joint ADL Co-Lab website.¹⁸

The Instruction mandates that all newly acquired or developed DoD systems designed to deliver, track, report on and manage DL content, as well as the content itself, shall conform to the latest version of SCORM. This means that the target hosting system must be conformant to the latest version of SCORM if the intention is to create new content for that system. While not required to attain SCORM conformance, it is strongly recommended that the PM verify that the target hosting system includes an ADL Certified LMS because of the complex nature of LMS conformance testing. A listing of certified LMSs can be found in the Support area of the Joint ADL Co-Lab website.¹⁸ The PM must give these issues consideration when making the hosting decision for a new DL system or content.

3.2.4 Repository Strategy

The Instruction requires that all DL content reside in an approved repository that is “searchable and accessible,” and managed by a DoD Service component with a designated proponent. Metadata describing the content entered into these repositories must be registered in the ADL Registry (ADL-R). At this writing, business rules concerning the approval of repository systems and designation of proponents are still being developed. More information on complying with this requirement can be obtained from the ADL Registry Portal.¹⁹

¹⁷ DoD Handbook, *Advanced Distributed Learning (ADL) Products and Systems*, MIL-HDBK-29612-5, section 4.3.11, page 12, retrieved August 2, 2005 from <http://dtswg.fedsun.navy.mil/Documents.htm>.

¹⁸ *Joint ADL Co-lab Website*, www.JointADLCoLab.org.

¹⁹ ADL Registry Portal, <https://adlregistry.dtic.mil> or www.adlregistry.org.

3.2.5 Content Testing Strategy

The Instruction mandates that all newly acquired or developed DoD DL content shall conform to the latest version of SCORM. Content certification is one way to determine conformance, but this is not required. Content conformance can be tested using the freely available (from the ADL Program) SCORM Conformance Test Suite¹⁸ by anyone with a moderate amount of computer skills, although adequate testing can be manpower intensive depending on the nature and amount of content. For this reason, the PM may elect to outsource content testing according to a developed test plan. Content conformance testing only assesses technical SCORM conformance requirements, and does not verify or validate the content subject matter. The Conformance Test Suite will run on a typical office workstation provided the user has the permissions to install the software.

3.2.6 Content Complexity Cost Factors

DL projects have similar cost factors as other projects. Some examples include the skill level of the developer team, the development environment and tools available, and SME availability. Some cost factors that specific to DL are discussed below. Other variables and additional discussion is provided in MIL-HDBK-29612-3A “Development of Interactive Multimedia Instruction (IMI).”²⁰

- **IMI level** – Complexity of the learning environment can range from a simple text or power point page-turner (IMI level 1), to a full simulation (more complex IMI level), or any complexity in between. Complexity of the training domain is another factor. Some training tasks involve simple procedures; others high-level concepts. These factors will affect the number and type of lessons, assessments and interactions required. Task analysis will determine the number of learning objectives which also affect cost.
- **Media selection** – The cost of video in a course can run as high as \$1000 per minute. Audio production for a narrative soundtrack can also significantly increase costs. Applying Web technologies, images and commercial development tools can all affect costs. Simulations and interactive content increases the IMI level, but also the complexity and cost of the development effort.
- **Metadata requirements** – Tools that enable easy insertion and extraction of the metadata elements can help reduce the cost of producing metadata. The metadata specification can also accommodate unique tagging requirements by allowing for the addition of elements, known as *extensions*.
- **Student tracking requirements** – Student progress tracking can also affect the complexity of developed content and, therefore, the cost. Progress tracking is accomplished via the SCORM Application Programming Interface (API) and a defined list of tracking elements known as the *data model*.

²⁰ DoD Handbook, Development of Interactive Multimedia Instruction (IMI), MIL-HDBK-29612-3A, section 4.11.2.1, page 18, retrieved August 2, 2005 from <http://dtswg.fedsun.navy.mil/Documents.htm>

- **Content adaptability** – Student progress tracking enables the content developer to collect metrics about individual learning experiences so that content can be designed to be dynamically tailored to the learner through *sequencing rules*. In instructional design parlance this is known as *branching*. The implementation of sequencing can greatly increase the complexity of developed content and, therefore, the cost.

3.2.7 Content Instructional Quality

Effective instructional quality is best implemented across the entire content development lifecycle. *Quality Evaluation Tool for Computer and Web Delivered Instruction*²¹ helps instructional developers and program managers quantitatively determine the quality of their instructional products, both during development and at project completion.

3.2.8 Information Assurance (IA)

IA is an important life cycle consideration since DL content and systems are software intensive. Details of the DoD IT Security Certification & Accreditation Process (DITSCAP) can be found in DoDD S-3600.1²², DoDD 8500.1, DoDI 8580.1, and DoDI 5200.40²³.

3.3 Products

<i>Instructional</i>
• Training Program Structure Document
<i>Software/System</i>
• Systems Engineering Plan

Table 2. Program Management Products

3.3.1 Instructional Products

3.3.1.1 Training Program Structure Document

The Training Program Structure Document (TPSD)²⁴ provides training planning data and training course control data. This information is relative to long-range training program resource requirements for personnel and equipment, and their implementation. The product documents the detailed configuration baseline of a training course. The resources should include an IPT team that is knowledgeable about SCORM requirements. See Section 1.1 **Document Overview** of the TPSD for discussion on use of the DID for this product.

²¹ Hayes, R., Stout R., Ryan-Jones, D. *Quality Evaluation Tool for Computer and Web Delivered Instruction*, retrieved July 15, 2005 from Support area, <http://www.jointadlcolab.org>

²² **Defense Acquisition Guidebook**, Section 4.4.4, http://akss.dau.mil/dag/DoD5000.asp?view=document&rf=GuideBook\IG_c4.4.4.asp

²³ **Defense Acquisition Guidebook**, Section 7.5.2, <http://akss.dau.mil/dag/DoD5000.asp?view=document>

²⁴ **Performance Specification Training Data Products**, MIL-PRF-29612B, Data Item Description, Training Program Structure Document, Number: DI-SESS-81521B, 31 August 2001, <http://dtswg.fedsun.navy.mil/documents.htm>

3.3.2 Software/Systems Products

3.3.2.1 Systems Engineering Plan (SEP)

The Systems Engineering Plan²⁵ guides all technical aspects of the acquisition program. The SEP contains systems engineering activities, addressing both government and contractor technical activities and responsibilities. Metrics and success criteria should include SCORM conformance for the content package. This product documents the ADL Team (discussed in section 3.2.1), the hosting strategy (section 3.2.3), the repository strategy (section 3.2.4), the content testing strategy (section 3.2.5) and other strategic program and project decisions (sections 3.2.6-3.2.8).

²⁵ **Defense Acquisition Guidebook**, Section 4.5.1. Systems Engineering Plan,
http://akss.dau.mil/dag/DoD5000.asp?view=document&rf=GuideBook\IG_c4.5.1.asp

4.0 Procurement Planning

The primary objective of the procurement planning phase is to create an acquisition package, and assemble all documents needed to acquire DL content or systems. The acquisition package needs to satisfy approved requirements in a timely, efficient manner and at the most reasonable cost to the Government. If care is not given to the complete and thorough expression of the requirements, the result is often the failure to meet mission needs or cost overruns (obviously undesirable outcomes). Acquisition packages contain documents that are used internally by the government, and also other documents (made available to the public) that are included in the official solicitation. The solicitation generally takes the form of a Request For Proposal (RFP). The following discusses the issues that should be addressed from the perspective of SCORM and ADL to ensure an optimal result.

4.1 Relevant Policy

From DoDI 1322.26:

6.4 Intellectual property rights shall be described in the ADL-R. Contract documents for distributed learning content shall invoke DFARS Subpart 227.71 and 227.72 to obtain the rights needed for the Government to be able to secure the minimum necessary rights and/or product.

6.5 Distributed learning content creation, sequencing, online display, and delivery software and licenses shall be acquired or procured on an upfront royalty basis. The Government shall not agree to pay royalties, recurring license or run-time fees, use tax, or similar additional payments for distributed learning content developed for and by the Department of Defense in other than unusual circumstances, such as intellectual property disputes.

And Also:

E4.7.1 The contracting officer is encouraged to use the clause DFARS 252.227-7020 in contracts to deliver distributed learning products when it is necessary so that the service provider, as one of the contract deliverables, copyright the resulting work and/or product and assign the copyright in its entirety to the Government.

E4.7.3. Acquisition personnel are encouraged to follow the general structure and intent of Performance Specification for Training Data Products and Development of Interactive Multimedia Instruction (IMI) in procuring distributed learning content.

4.2 Points to Consider

4.2.1 Government Use and Intellectual Property Rights

DL created by and for DoD shall not incur recurring costs for using that content. Furthermore, the Government must be assigned the copyright for DL content for which it paid the

development costs. To accomplish these goals, these intentions should be clearly stated in the RFP (to ensure accurate bid pricing), and must be articulated in the contract (to ensure that it is legally accomplished). Consultation with legal counsel is strongly recommended regarding the statement and wording of this requirement in contract documents beyond those from the Instruction (provided in Section 4.1.) Intellectual property rights are articulated in ADL-R metadata.²⁶

4.2.2 Contractor qualifications

To minimize risk to a DL project, the contractor should have experience in developing and testing SCORM conformant content from both the instructional and software design and development perspectives. This qualification should be clearly articulated in the source selection criteria and be a major weighing factor for optimal chances of program and project success. The reader is referred to the reference publications for detailed discussion of contractor qualifications from an ADL perspective.^{16, 27} Evidence that an offeror has an established systems engineering process, especially as it relates to software development, should also rate highly on the selection criteria.²⁸

4.2.3 Content Packages

Once learning content is designed and built, there is a need to make the content available to learners, authoring tools, repositories or Learning Management Systems (LMSs). The purpose of the Content Package (CP) is to provide a standardized way to exchange learning content between different systems or tools. The CP also provides a place for describing the structure (or organization) and the intended behavior of a collection of learning content. SCORM Content Packages provide explicit requirements and implementation guidance for packaging Assets, Sharable Content Objects and Content Organization. Content packages are expected to be used to move learning content or collections of learning content between LMSs, development tools and content repositories.²⁹ Consequently, the deliverable for any DL content procurement is one or more Content Packages. Also, ADL-R operating procedures require that content be registered by the CP, and is identified by the CP during subsequent searches.³⁰ There are two high-level approaches to specifying Content Packages that should be articulated in the RFP and subsequently in the contract: choice of application profiles and specification of the Package Interchange Format.

4.2.3.1 Application Profiles

Content Packages can be described in two different forms referred to in SCORM as application profiles:

- Resource Package

²⁶ **ADL Registry Content Object Registration Information Model and XML Binding**, Version 1.0 DRAFT October 28, 2005 retrieved from <https://adlregistry.dtic.mil/5/index1.htm> on 22 December 2005.

²⁷ **DoD Handbook, Advanced Distributed Learning (ADL) Products and Systems**, MIL-HDBK-29612-5, section 5, page 20, retrieved August 2, 2005 from <http://dtswg.fedsun.navy.mil/Documents.htm>.

²⁸ **Defense Acquisition Guidebook**, Section 4.2.5.1. The Use of Standards versus Capability and Maturity Models, http://akss.dau.mil/dag/DoD5000.asp?view=document&rf=GuideBook\IG_c4.2.5.1.asp.

²⁹ Advanced Distributed Learning (ADL), Sharable Content Object Reference Model (SCORM®) Content Aggregation Model Version 1.3.1, 2004, Section 3.0, pp. 3-1—3-63, <http://www.adlnet.gov/scorm/index.cfm>.

³⁰ ADL Registry Portal, <https://adlregistry.dtic.mil> or www.adlregistry.org.

- Content Aggregation Package.

A Resource Package is a collection of learning resources (assets or SCOs) without any expressed interrelationship or learning context. An organization (a specification of the order in which the SCOs are presented) can not be specified in a Resource Package. One or more organizations are mandatory in Content Aggregation Packages. Multiple organizations could be used to express multiple SCO orderings, presumably for different instructional purposes.²⁹

4.2.3.2 Package Interchange Format (PIF)

The ADL team may want to decide whether or not the Content Package should be placed in a Package Interchange File (PIF). A PIF is the representation of the content package components within a single file using the PKZip software archive format. The only SCORM-conformant format recognized at this time is that of PKZip Version 2.04g. This is the underlying format of most ZIP-type compression programs used today. Although the PIF Zip format has become customary within the ADL community for delivering and transporting DL content, it is not required for SCORM conformance. This decision whether or not to require PIF packaging may depend upon the input requirements of the target DL system (both LMS and repository).

4.2.4 **SCORM Versions, Editions and Addendums**

SCORM 2004, the current version of SCORM, provides substantially expanded capabilities that were not present in previous versions. However, it is critical to ensure that the LMS platform to be used with SCORM 2004 content supports SCORM 2004, or the content may not function properly.

Editions occur due to changes to the underlying standards and specifications for an existing version of SCORM. These Editions are ADL's mechanism for managing the assimilation of new standards and specifications into SCORM. Addendums are published due to bug fixes, clarifications and resolved issues for an existing Edition release. They are ADL's mechanism for improving the interoperability of SCORM.

Editions and Addendums are expected to be published periodically in the near-term, with this activity slowing, as the underlying standards and specifications stabilize. Specifying the latest version of the SCORM 2004 Conformance Requirements is recommended while budgeting for Edition and Addendum changes to minimize program risk. The support activity should also watch for Edition and Addendum releases and assess for impacts to program. Information about the latest releases of SCORM and any known impacts can be found in the Support area of the Joint ADL Co-Lab website.

4.2.5 **Metadata**

The metadata specification describes a standard way of describing content artifacts for purposes of sharing and reuse. By structuring descriptive information in a common format, software can be designed to efficiently and effectively find these content artifacts. For this reason, the specification of metadata should be done in the context of an overall reuse plan or implemented in accordance with the specific metadata implementation of a target repository. Such plans or implementations could describe an enhanced vocabulary for completing each SCORM metadata element, and perhaps a classification taxonomy to facilitate storing and searching. Metadata is

not required to attain SCORM conformant content, but any metadata provided must be done according to specification. If metadata is deemed desirable outside of some enterprise-level plan, the procurement official should cite appropriate specifications in the acquisition package requirements. Arbitrary implementation of metadata outside of a reuse strategy or repository specification can be costly and quite possibly wasteful. Note that some metadata is required to comply with the requirements for registration of content packages in the ADL-R.³¹

A metadata specification, or a corresponding reuse plan if appropriate, is expected to describe where metadata applies to each of three resource types: Content Aggregation (or Content Package), Organization, Activity, Sharable Content Object (SCO) (or unit of instruction) and Asset (resource without instructional context). SCORM describes a metadata application profile for each one of these content types. SCORM application profiles describe which elements are mandatory, optional and reserved. Reserved elements are ones that do not currently have a recommended implementation, but for which a future need is foreseen. Once the metadata is created, it somehow needs to be associated or assigned to the SCORM components it describes, to become useful. The Content Package provides the way of associating the meta-data with the actual SCORM components.

SCORM provides a predefined set of metadata elements used to describe the different aspects of a component. In some cases, organizations may find that the core set of metadata elements is not adequate enough to describe SCORM components. The organization may wish to customize the metadata elements using what SCORM calls *extensions*. There are currently two types of extensions mechanism permitted in SCORM: element extensions and vocabulary extensions. Element extension involves defining and adding a custom element to the predefined set. Vocabulary extension involves redefining or tailoring the set of values and vocabulary used to fill the metadata elements. As with the application of metadata itself, the use of extensions is recommended only within the context of a reuse or repository strategy since its application compromises interoperability when combined with content from other programs.³²

4.2.6 Run-Time Environment (RTE)

The SCORM Application Programming Interface (API) and Data Model, collectively referred to as the Run-Time Environment (RTE), are the way to track a learner's progress in a course delivered via an LMS. One example of a data model element that may need to be tracked is the test score of the student. Instructional designers need to work with the programmers to determine what data needs to be tracked to ensure the instructional design is implemented effectively. Because data model elements and API interactions are part of the overall instructional design strategy, corresponding requirements are difficult to articulate in the RFP. Still, some DL instructional strategies may necessitate stipulating certain minimum tracking and data collection requirements that would be best included in the acquisition specification. These strategies may pertain to a particular DL project or program, or be part of an enterprise Service or organizational approach. The acquisition professional may want to refer to the *SCORM Run-*

³¹ ADL Registry Portal, <https://adlregistry.dtic.mil> or www.adlregistry.org.

³² Advanced Distributed Learning (ADL), **Sharable Content Object Reference Model (SCORM®) Content Aggregation Model**, Version 1.3.1, 2004, Section 3.0, pp. 4-1—4-110, <http://www.adlnet.gov/scorm/index.cfm>.

Time Environment document for a listing of data model elements that they may need to specify and their descriptions.³³

4.2.7 Sequencing

The SCORM Sequencing specification enables a learning experience to be tailored to the student by dynamically determining (or altering) the order in which SCOs are delivered. Sequencing functions need to be developed as described in the design documentation. For example, if the student's test score is tracked by the RTE, then the sequencing functions can read that data and customize the learning experience accordingly. The sequencing rules are specified in the manifest file of a content package, and evaluated by the LMS to determine the next SCO to be delivered. This functionality occurs outside of the SCO itself so that content can be sequenced in an interoperable manner. Because sequencing functions are so intricately tied to the design, related requirements are difficult to articulate in the RFP. The acquisition professional may want to simply address the need for sequencing at a high-level by specifying that the content shall adapt to the student in some way using sequencing mechanisms as much as possible. Methods have also been developed that capture instructional strategies in classes of "sequencing templates." While not required nor endorsed by ADL, these methods may be helpful in specifying sequencing behavior at the design level.³⁴

4.2.8 Navigation

The LMS has historically provided the capability and the means to move from one SCO to another in the course of a curriculum, but the recently added SCORM Navigation specification now allows the course developer to create a custom user interface for this purpose. Since navigation events are intricately tied to the design of the user interface, it is not realistic to specify them in an RFP. Instead, the acquisition professional may want to consider articulating requirements for the user interface, and specify that navigation events be employed as much as possible.

4.2.9 Tools, Utilities, and Authoring Environments

ADL does not test tools as SCORM conforming since it is impossible to prove that a tool will always produce conforming content, and because tools range in functionality from simple text editors up through full authoring systems. Also, many popular tools (e.g., Macromedia) are tools primarily designed for general web design but have some SCORM support built in. Such tools can produce both conforming and non-conforming content. *To determine a tool's efficacy, ADL recommends testing content produced by the tool as an indicator of compatibility with SCORM functionality.*³⁵ Tools can reduce cost, facilitate maintenance and upgrades, and give a consistent look and feel to the courseware; so the acquisition professional may want to consider a strategy where they are specified for use on a content development effort. Also, some Service or organization may require this as part of their enterprise or organizational content management strategy.

³³ Advanced Distributed Learning (ADL), **Sharable Content Object Reference Model (SCORM®) Run-Time Environment (RTE)**, Version 1.3.1, 2004, p. 4-15—4-16.

³⁴ **SCORM Best Practices Guide for Content Developers**, 1st Edition, Carnegie Mellon University (CMU) Learning Systems Architecture Lab (LSAL), 28 February 2003, pp. 35-66 retrieved from <http://lsal.org/lsal/expertise/projects/developersguide/>.

³⁵ Dodds, Philip, Notes on Acquisition Guidance and Private Communication, June 23, 2004.

4.2.10 Learning Management System (LMS) Planning

An LMS is generally defined as the software system that manages the instructional experience of the learner, tracks progress and mastery, and delivers the relevant content according to an instructional strategy that was pre-authored and imported into the LMS (in Content Packages). LMSs must be tested for SCORM conformance which confirms technical interoperability and indicates appropriate behavior at run-time. Conforming LMSs *should* run any SCORM conforming content. This is not utterly guaranteed due to the complexity of the underlying specifications, but it will be the case most of the time. Note that the web and browser technologies themselves occasionally yield errors. This means that a final acceptance of content from a contract developer should include a quality assurance step involving a human reviewer of representative content, and a commitment from the vendor to fix bugs/problems if they are found later for some reasonable period of time.³⁶

There are many factors to consider when purchasing a LMS, most of which are out of the scope of this document. However, one big factor affecting interoperability is the specifications and standards the LMS supports, such as SCORM. Per DoDI 1322.26, DoD systems designed to deliver, track, report on and manage distributed learning content, learner progress and learner interactions shall conform to the version of SCORM current as of their acquisition or development. The acquisition professional must ensure that the target host LMS supports the version of SCORM for which content is being developed to avoid potential incompatibility issues. Note: If new content is being developed for a system that is only conformant to a previous version of SCORM, then the developer cannot produce content that will be both conformant to the latest version of SCORM and execute in the target environment. This situation is not addressed by the Instruction or any other DoD policy.

4.2.10.1 LMS vs. LCMS

The terms *Learning Content Management System (LCMS)* and *Learning Management System (LMS)* have caused confusion due to overlapping functionality among some vendors. LCMS functionality is quite varied and so as a product category it is nearly impossible to define. Often, LCMSs are used during the authoring/development cycle of learning content to manage and maintain all of the digital assets used in creating deployable content, in addition to having the functionality of a LMS. Some are designed to maintain content over the lifecycle of the DL product. There is no applicable conformance test of the LCMS, but content produced by the system can and should be tested for conformance.

4.2.11 Applying MIL-PRF-29612B Specification for Training Data Products

Many of the instructional products recommended in this document are based on MIL-PRF-29612B Performance Specification for Training Data Products per the Instruction³⁷. While this and the MIL-HDBK-29612 handbook series³⁸ are excellent resources, they were written at a time when an earlier version of SCORM was in effect. Consequently, some of the terminology in these documents is obsolete and no longer exists in the current version of SCORM. Two of the most conspicuous cases of this are as follows:

³⁶ Dodds, Philip, Notes on Acquisition Guidance and Private Communication, June 23, 2004.

³⁷ MIL-PRF-29612B **Performance Specification Training Data Products**, 31 August 2001, <http://dtswg.fedsun.navy.mil/documents.htm>.

³⁸ MIL-HDBK-29612 Parts 1A-5A, 31 August 2001, <http://dtswg.fedsun.navy.mil/documents.htm>.

- **Course Structure Format (CSF)** – This term no longer exists in the current version of SCORM. The CSF was replaced by the *Organizations* component with the advent of content packaging.³⁹
- **Sharable Course (or Courseware) Object (SCO)** – This term was updated to Sharable Content Object (SCO) to better reflect the fact that the specifications contained in and referenced by the SCORM apply to various levels of courseware components (e.g. content) as well as entire courses.⁴⁰

The acquisition professional is cautioned against invoking the Data Item Descriptions (DIDs) for these products without addressing this outmoded language.

4.3 Acquisition Package Products

<i>General</i>
<ul style="list-style-type: none"> • Source Selection Plan (SSP) • Independent Government Cost Estimate (IGCE) • Contract Data Requirements Lists (CDRL) • Contract Schedule
<i>Conventional Contract Request for Proposal (RFP)</i>
<ul style="list-style-type: none"> • Statement of Work (SOW) • Specification
<i>Performance-based Contract Request for Proposal (RFP)</i>
<ul style="list-style-type: none"> • Statement of Objectives (SOO) • Requirements Document, Training Systems Requirement Document, Performance Specification

Table 3. Acquisition Package Products

4.3.1 Source Selection Plan

The Source Selection Plan evaluation factors list those aspects of a proposal that will be evaluated to give an integrated picture of how the proposal can meet the government’s need.⁴¹ Some evaluation factors to consider that pertain particularly to ADL developments include:

- **Cost** – The relative cost of the DL proposal should be a function of the content complexity cost factors discussed in Section 3.2.6. Each of these factors can be used to assess the value of a content development effort and to discriminate between differences in cost. Other factors that affect content development costs include the amount of testing and approach, and

³⁹ **Sharable Content Object Reference Model, Version 1.2, The SCORM Content Aggregation Model**, 1 October 2001, Advanced Distributed Learning Initiative, p. 2-101, <http://www.adlnet.gov/scorm/index.cfm>.

⁴⁰ **Sharable Content Object Reference Model, Version 1.2, The SCORM Overview**, 1 October 2001, Advanced Distributed Learning Initiative, p. 1-8, <http://www.adlnet.gov/scorm/index.cfm>.

⁴¹ **Systems Engineering Fundamentals**, January 2001, Defense Acquisition University, p. 198

licensing and intellectual property rights. Since DL system hardware and software components are usually commercial-off-the-shelf items, the same factors that affect the cost of any system development apply to a DL system.

- **Experience** – Since SCORM is a DL content development paradigm shift at the implementation level, contractor previous experience in developing SCORM conformant products is valuable.
- **Staffing** – Requirements for staffing a development team is similar to that for the acquisition team discussed in section 3.2.1. The contractor should have the right mix of individuals to successfully complete the development effort without unduly burdening the Government acquisition team.
- **Lifecycle Requirements** – DL content and systems must be maintained over their lifecycle. Refer to DoDI 1322.20 for more detailed requirements relating to life-cycle maintenance of ICW. Proprietary approaches and complex design may be economical in the short term, but costly over the lifecycle when the time comes to maintain either the content or the system.

4.3.2 Independent Government Cost Estimate (IGCE)

As more time passes since SCORM 2004 was released, there will be projects that can provide cost estimates for development of SCORM conformant products. These cost estimates can be used to estimate costs for a future project, taking into account any differences in the complexity of the products. Until that time, a SCORM educated workforce combined with experience in DL content development is the best way to attain accurate IGCEs. Sources of education for various audiences can be found in the Support area of the Joint ADL Co-Lab website.⁴²

4.3.3 Contract Data Requirements List (CDRL)

This document does not address all of the deliverables that might be required for a DL acquisition. For instance, most contracts include meeting minutes and monthly reports as deliverables. The acquisition professional should include these and other deliverables that experience and education say are needed to properly manage and track progress for the contract. The focus here is on those deliverables that are of particular value on a DL acquisition designed and developed according to ADL specifications. As discussed in the Introduction, the DL product is part instructional and part software product. The deliverables discussed in this document reflect this fact.

Deliverables that pertain specifically to a DL acquisition and recommended for inclusion in the CDRL are discussed in the next few sections under the phases that they would normally be delivered. Discussions include how ADL technology and SCORM implementation should be addressed, as applicable, with tailoring recommendations. As discussed in section 1.1 Document Overview, care is recommended invoking the Data Item Descriptions (DIDs) from MIL-PRF-29612B **Performance Specification for Training Data Products**.

⁴² <http://www.JointADLCoLab.org/>

4.3.4 Contract Schedule

Contract Schedule items should reflect that the DL content development project is both software and instructional material development. More discussion of recommended reviews, meetings and conferences in the following phases is provided in those sections. The Contract Schedule should allow time for SCORM Conformance Testing. If the products are required to be certified by a 3rd party, more time than in-house testing will be required.

4.3.5 Conventional Contracting Request for Proposal (RFP)

4.3.5.1 Statement of Work (SOW)

The Statement of Work (SOW) should specify in clear, understandable terms the work to be done in developing or producing the goods to be delivered or services to be performed by a contractor. Preparing an effective SOW requires both an understanding of the goods or services that are needed to satisfy a particular requirement and an ability to define what is required in specific, performance-based, quantitative terms. A properly written SOW forms the basis for successful performance by the contractor and effective administration of the contract by the government. A well-written SOW enhances the opportunity for all potential offerors to compete equally for Government contracts and serves as the standard for determining if the contractor meets the stated performance requirements.⁴³ On the downside, accuracy and responsibility for these requirements is placed on the Government, a contract specification usually must be developed along with the SOW, and the approach can stifle contractor design innovation.⁴⁴ The specific requirements are typically found in section 3.3 of the Statement of Work. The following are some examples of ADL requirements that should be considered:

- The contractor shall develop all web-based IMI to be SCORM conformant.
- The contractor shall develop SCORM conformant metadata.
- The contractor shall demonstrate that the developed courseware runs successfully on a sponsor-designated SCORM conformant LMS.
- The contractor shall store the content package in a designated repository.
- The contractor shall deliver the courseware copyright, with the government having the rights to modify and store the courseware for government use.
- The contractor shall deliver the courseware with no recurring software licensing fees.
- The contractor shall develop the aggregation architecture of the required training tasks and learning objectives, including what level the SCOs will be, and how the SCOs will be aggregated.
- The contractor shall develop scripts and storyboards which include the required SCORM functions to implement the instructional design.
- The contractor shall identify required resources, including staff needed to incorporate required SCORM functions in courseware.
- The contractor shall define the SCORM data model elements required to track student information about course completion and test scores.

⁴³ MIL-HDBK-245D **Handbook for Preparation of Statement of Work (SOW)**, 3 April 1996, p. 1, <http://www.ntsc.navy.mil/Resources/Library/Acqguide/documents.htm>.

⁴⁴ "RFP Document Scenarios," **Acquisition Guide**, NAVAIR Training Systems Division, retrieved on 29 December 2005 from <http://www.ntsc.navy.mil/Resources/Library/Acqguide/approach.htm>.

- The contractor shall describe the SCORM sequencing functions required to implement the course design.
- The contractor shall design the tests that evaluate student accomplishment of each critical learning objective. Tests shall be designed as a SCO separate from the courseware instruction⁴⁵.
- The contractor shall develop and deliver a sample/prototype lesson(s), representing the overall design strategy (performance standards, lesson content to include SCORM content packaging, interface design, SCORM run-time environment, etc).
- The contractor shall develop content package level metadata for the courseware based on the requirements found in DoDI 1322.26.
- The contractor shall develop courseware based on the Government accepted script/storyboards as SCORM conformant content packages. The contractor shall deliver developed packages as Package Interchange Files (PIFs) as required by the CDRL.
- The contractor shall deliver a test log that includes a statement stating the course has achieved a SCORM conformance label⁴⁶.

4.3.5.2 Specification

Specifications are used in conjunction with SOWs and describe essential technical requirements for DL products in a manner that encourages maximum competition. To the greatest extent possible, specification requirements are written so that commercial products or processes may be used to meet the requirements. Performance specifications prescribe a product's performance, operating requirements, operational environment, interfaces, and interoperability requirements; and should be used instead of detail specifications, whenever possible. Detail specifications specify materials, design or construction requirements, or "how to" requirements only to the extent necessary to ensure the adequacy, safety, and interchangeability of the product being acquired.⁴⁷ The following is sample ADL and SCORM language recommended for inclusion in a DL procurement specification (Requirements section):

"To ensure interoperability, Distributed Learning content shall conform to SCORM <current version>, <current edition> in accordance with SCORM <current version>, <current edition> Conformance Requirements <current document version>, <date of publication>."

"To ensure accessibility, Distributed Learning content shall be contained in SCORM-conformant content packages and described with metadata per ADL Registry specifications."⁴⁸

NOTE: The acquisition professional may also want to consider any program or Service-unique specifications that affect SCORM implementation such as that for SCO design, metadata, API tracking, and sequencing and navigation. Other specifications to consider that may affect SCORM implementation are those that affect content reuse and deployment. Industry best

⁴⁵ This test design as a separate SCO is a design decision, based on courseware requirements.

⁴⁶ Advanced Distributed Learning (ADL), **Sharable Content Object Reference Model (SCORM®) 2004 Conformance Requirements** Version 1.3, 2005, <http://www.adlnet.gov/scorm/index.cfm>.

⁴⁷ **DoD Standard Practice Defense and Program-Unique Specifications Format and Content**, MIL-STD-961E, 1 August 2003, Retrieved on 29 December 2005 from <http://www.nts.navy.mil/Resources/Library/Acqqguide/documents.htm>

⁴⁸ ADL Registry Portal, <https://adlregistry.dtic.mil> or www.adlregistry.org.

practices for SCO and curriculum design and tracking are available and can be included in a detailed specification.⁴⁹

4.3.6 Performance-based Contracting Request for Proposal (RFP)

4.3.6.1 Statement of Objectives (SOO)

The Statement of Objectives (SOO) is a Government prepared document incorporated into the RFP that states the overall solicitation objectives. It can be used in those solicitations where the intent is to provide the maximum flexibility to each offeror to propose an innovative development approach. Offerors use the RFP, product performance requirements, and SOO as a basis for preparing their proposals including a SOW and CDRL.⁵⁰ Example objectives for an ADL product acquisition are as follows:

An objective of this acquisition effort is to produce an on-line training solution for maintaining the engine of the M1A1 Abrams tank.

An objective of this acquisition effort is to conform to OSD requirements stated in DODI 1322.26.

4.3.6.2 Requirements Document

The purpose of the Requirements Document in a performance-based acquisition is to identify all known conditions and constraints of the product to be acquired. It is used in conjunction with the SOO document. While the SOO identifies objectives for the program, typically there are elements of most programs that are conditions or constraints that must be applied to the training system design solution. Typically, this information will have been determined in the products produced at the analysis phase. Depending on the volume of conditions and constraints applicable to a program, requirements can be expressed in a standalone document or identified separately within the SOO document.⁵¹ Standalone requirements documents are sometimes called: Systems Requirements Document (SRD) or Technical Requirements Document (TRD) among others; and should be developed with a focus on the outcome with measurements of how the performance will be achieved.⁵²

⁴⁹ **SCORM Best Practices Guide for Content Developers**, Carnegie Mellon University (CMU) Learning Systems Architecture Lab (LSAL), <http://lsal.org/lsal/expertise/projects/developersguide/>

⁵⁰ MIL-HDBK-245D **Handbook for Preparation of Statement of Work (SOW)**, 3 April 1996, p. 25, <http://www.ntsc.navy.mil/Resources/Library/Acqguide/documents.htm>.

⁵¹ "RFP Document Scenarios," **Acquisition Guide**, NAVAIR Training Systems Division, retrieved on 29 December 2005 from <http://www.ntsc.navy.mil/Resources/Library/Acqguide/approach.htm>.

⁵² **Statement of Objective (SOO) Information Guide**, 20 June 2003, Oklahoma Air Logistics Center/Acquisition Executive (OC-ALC/AE), Acquisition Center of Excellence (ACE), Retrieved on 30 December 2005 from <http://akss.dau.mil/jsp/StatementofObjectivesInformationGuide.doc>.

5.0 Analysis

During the analysis phase of the ADDIE process, the contract has typically been awarded, and the developer identifies requirements for the media and instructional delivery system to be applied. The analysis discussed in this section comes after and is different from the comprehensive needs assessment that should have been already completed, identifying a requirement for training. A comprehensive FEA has already been completed. During the analysis phase described below, a detailed job task analysis is performed.

5.1 Relevant Policy

From DoDI 1322.26:

6.1. Distributed learning content shall be developed using a front-end analysis (FEA) to identify costs, target audience(s), content, learning objectives, and optimal delivery method(s).

5.2 Points of Consideration

5.2.1 Task Analysis

At this point the FEA has been completed. High level learning objectives have already been identified. During task analysis, more details under each learning objective are clearly defined. Also learning objectives are typically mapped to SCOs. Performance requirements for each task are documented. A more detailed description of training audience skills and education backgrounds is documented. Training requirements are listed in terms of conditions, standards, and behaviors, and arranged in a logical sequence.

5.2.2 Media Selection

Media analysis is conducted to ensure the most effective media are used to efficiently meet the training requirements. During media selection the team will make such decisions on whether to incorporate simulation into the DL, what level of interactivity to incorporate, etc. At each step cost tradeoffs are performed, making it an iterative process.

5.3 Products

<i>Instructional</i>
<ul style="list-style-type: none">• Job Task Analysis (JTA), Instructional Performance Requirements Document• Media Selection, Instructional Media Requirements Document

Table 4. Analysis Products

NOTE: The following documents comprise analysis activities typically done as part of the normal ADDIE process for sound DL.

5.3.1 Instructional Performance Requirements Document

The Instructional Performance Requirements Document records the Job Task Analysis (JTA) and contains the data necessary to support the design of a training program. This document provides the mission, and collective and individual task information. This document also provides listings of knowledge, skills, attitudes, and learning objectives for the tasks that have been selected for training. Neither the Instruction nor ADL have specific guidance or impact on this product, but it is an important part of the FEA required by DODI 1322.26.⁵³

5.3.2 Instructional Media Requirements Document

The Instructional Media Requirements Document records the media selection analysis and serves as the baseline for instructional media performance specifications. The document includes media selection model specifications, media selection analysis data, instructional delivery system functional characteristics, and, if appropriate, training system modification data.⁵⁴ Any resources identified in the ADL-R that can be applied to this training requirement should be discussed in this document. The instructional delivery system should include a description of the target SCORM conformant Learning Management System (LMS).

⁵³ **Performance Specification Training Data Products**, MIL-PRF-29612B, Data Item Description, Instructional Performance Requirements Document, Number: DI-SESS-81518B, 31 August 2001, <http://dtswg.fedsun.navy.mil/documents.htm>.

⁵⁴ **Performance Specification Training Data Products**, MIL-PRF-29612B, Data Item Description, Instructional Media Requirements Document, Number: DI-SESS-81519B, 31 August 2001, <http://dtswg.fedsun.navy.mil/documents.htm>.

6.0 Design

In the design phase, the courseware designer develops learning objectives and testing strategies, and selects instructional methods and media. The metadata implementation strategy should also be defined in this phase. The software developer makes final plans for how the software will be developed including the process, technology and tools that will be employed. The software developer also works with the courseware designer to create a software design that will translate the instructional concept into a working product. This section discusses what to expect from an ADL perspective from the product deliverables and at the milestone events.

6.1 Relevant Policy

From DoDI 1322.26:

4.2. The DoD Components shall share training resources to the maximum extent possible. A joint architecture and common standards for training technology shall be developed.

6.2. All acquired or developed DoD systems shall conform to the SCORM (current version) to ensure accessibility, durability, reusability, maintainability and interoperability. This includes DoD systems designed to:

6.2.1. Deliver, track, report on and manage distributed learning content, learner progress and learner interactions.

6.2.2. Deliver, track, report on and manage content and systems.

6.3. All acquired or developed SCORM-conformant content packages shall:

6.3.1. Include metadata.

6.3.2. Be registered in the ADL-R according to enclosure 3.

6.3.3. Be maintained in DoD Components' repositories that are searchable and accessible, consistent with DoD information security and information technology policies according to DoD CIO Memorandum (Reference (e)).

6.3.3.1. These repositories shall be registered in the ADL-R according to Enclosure 3. Content with classified metadata is exempted from registering in the ADL-R under this subparagraph pending published guidance for alternative content management.

6.3.3.2. The ADL-R shall be searched prior to beginning any new distributed learning content development or acquisition to identify available

content suitable for sharing, reuse, or repurposing, through minor revisions, as part of the formal FEA process. The Defense Automated Visual Information System/Defense Instructional Technology Information System shall also be searched for learning content in other media.

6.7 Both the repositories and the learning content available through the repositories will be identified using the Corporation for National Research Initiatives (CNRI) Handle System. DTIC, in conjunction with CNRI and the respective DoD Components, will establish unique identifiers for each repository and its learning content.

E3.4.1. SCORM Content Packages (CPs) shall be stored in a content repository... The content repository shall be searchable via mechanisms provided by enterprise core services including the Enterprise Discovery Interface and specifications.

E3.4.2. The Repository Manager shall provide metadata describing each SCORM CP to the ADL-R. The ADL-R metadata requirements for CPs are maintained on the ADL-R web site. The metadata set includes tags (elements) such as a unique identifier, description, keywords, usage rights, access information, etc. The unique identifier is a Handle (based on the Handle System) that uses the NA assigned to the repository.

E.3.4.3 The Repository Manager shall submit the metadata to the ADL-R website.

6.2 Points to Consider

6.2.1 Metadata Strategy

In addition to meeting the requirements of the ADL-R and that stated in the RFP, the metadata strategy design should be critically examined for certain other qualities. Are certain SCOs targeted to be reused? Is the whole course to be reused? If the organization does not have a strategy, then what are the goals and strategies of the particular project? What repository will the courseware reside in? Should some of the assets be designed with the end goal of being reused by themselves?

SCORM does not itself require the use of metadata. However, the ADL-R requires that content packages be tagged with metadata. Also, if SCORM metadata is used, there are certain metadata elements that are mandatory, and some that are optional. The level of metadata can be at the content package, SCO, or asset level. Each organization, to some extent, will define what metadata is required. SCORM may have optional elements that an organization deems mandatory. In that case, the organization can either use these elements as is, or they can tailor the metadata. . Metadata can be adapted or tailored to specific project or program requirements, by replacing the best practices suggested in SCORM to ones more appropriate to organizational needs. Specifications can also be developed for free text formatted SCORM metadata elements. Tailored metadata elements can more effectively support discovery and reuse strategies.

Typically, cost goes up as the amount of metadata and tailoring increases, so it is important to agree upfront on how much and the type of metadata required for the particular project.

6.2.2 Sharable Content Object (SCO) Size

The design phase is the ideal time to consider SCO size (granularity). SCORM deliberately does not specify the size of SCOs so as not to constrain the design of content. Generally speaking, the size of SCOs should correspond to activity that the LMS is to track and evaluate mastery or progress, and thought should be put to recognizing content that might be reused or re-contextualized (often with the same course or sets of related courses). For example, a pretest is a logical SCO since it will report mastery that the LMS may use to determine what to deliver next. This needs to be resolved at the outset when the cost of modification is low (compared to when the SCOs are coded and implemented).

6.2.3 Content Reuse

The analysis phase may have uncovered opportunities for content reuse. Since it is assumed that the decision has been made to proceed with a DL content development project, the content that is likely to be applicable at the design phase are assets or SCOs that can be repurposed to meet the defined learning objectives. These resources and their impact on the program should be clearly articulated at the design phase. If the resources are not provided as Government Furnished Information (GFI) under the contract, then the identified resources should be obtained from the ADL-R.⁵⁵

6.2.4 Realizing the Instructional Strategy

The design documentation should include storyboards that describe not only the instructional strategy, but also the corresponding SCORM functions (i.e. SCORM sequencing [branching] and SCORM run-time data model elements used for tracking the student progress) that implement that design strategy. This behavior is typically expressed through a Content Structure diagram and an Activity Tree.⁵⁶ For example, if the instructional strategy calls for the student to have complete freedom in navigating through the course, the SCORM sequencing function would be choice equals true. And if the test scores need to be tracked, the data model element SCORE would need to be used and tracked. There are Best Practices Guidelines⁵⁷ available for use that can assist in describing the required SCORM behaviors that correspond to instructional design strategies. Below is a list of the current SCORM data model elements.⁵⁸

- Comments from Learner
- Comments from LMS
- Completion Status
- Credit

⁵⁵ ADL Registry Portal, <https://adlregistry.dtic.mil> or www.adlregistry.org.

⁵⁶ **Sharable Content Object Reference Model (SCORM), Sequencing and Navigation (SN), Version 1.3.1**, 22 July 2004, Advanced Distributed Learning Initiative, p. 2-1 – 2-13, <http://www.adlnet.gov/scorm/index.cfm>.

⁵⁷ **SCORM Best Practices Guide for Content Developers**, 1st Edition, Carnegie Mellon University (CMU) Learning Systems Architecture Lab (LSAL), 28 February 2003, pp. 35-66 retrieved on 28 December 2005 from <http://lsal.org/lsal/expertise/projects/developersguide/>

⁵⁸ Advanced Distributed Learning (ADL), **Sharable Content Object Reference Model (SCORM®) Run Time Environment Version 1.3.1**, 2004, <http://www.adlnet.gov/scorm/index.cfm>.

- Entry
- Exit
- Interactions
- Launch Data
- Learner ID
- Learner Name
- Learner Preference
- Location
- Maximum Time Allowed
- Mode
- Objectives
- Progress Measure
- Scaled Passing Score
- Score
- Session Time
- Success Status
- Suspend Data
- Time Limit Action
- Total Time

6.3 Reviews, Meetings and Conferences

<i>General</i>
<ul style="list-style-type: none"> • Kick-off Meeting, Post Award Conference (PAC)
<i>Instructional</i>
<ul style="list-style-type: none"> • Design Strategy IPR, Design Review
<i>Software/System</i>
<ul style="list-style-type: none"> • System Requirements Review • Software Specification Review • Preliminary Design Review (PDR) • Critical Design Review (CDR)

IPR – In-Process Review

Table 5. Design Reviews, Meetings and Conferences

6.3.1 Kick-off meeting

The kick-off meeting or Post Award Conference (PAC) is conducted to ensure all tasks and roles are understood by the IPT. The developers should have team members identified that are experienced in SCORM conformant content and systems.

6.3.2 Instructional Reviews, Meetings and Conferences

6.3.2.1 Design Strategy IPR

The purpose of the Design Strategy IPR is to review in detail the strategies for curriculum design. IPT participants typically include individuals from the contractor and procuring agency, as well as the Subject Matter Experts. The discussions and any decisions made are reflected in the design documents. Such details as the metadata strategy, SCO size, content reuse issues, content structure and activities will typically be discussed.

6.3.3 Software/System Reviews, Meetings and Conferences

6.3.3.1 System Requirements Review (SRR)

The System Requirements Review (SRR) is a multi-functional technical review to ensure that all system and performance requirements captured in the system specification are defined and consistent with cost (program budget), schedule (program schedule), risk, and other system constraints. The review ensures consistency between the system requirements, the preferred system solution and available technologies.⁵⁹ This event is most important when the effort involves acquisition of host system components including the LMS and repository, but may also include discussion of requirements for how content should work within the context of an identified host system. In some cases, the SRR may be conducted by the Government prior to RFP.⁶⁰ In terms of ADL, this typically means that job and task analyses have been completed.

6.3.3.2 Software Specification Review (SSR)

The Software Specification Review (SSR) is held to examine software requirements specifications, including interface requirements, for each software item. A SCO may typically be designated as a software item. Where appropriate, the Government may choose to combine the SSR for all software items into one meeting. When approved, the resulting document (see section 6.4.2.2) establishes the allocated baseline.⁶⁰ Requirements for learner progress tracking using the API and other interactions with the LMS should be discussed during the SSR as well as software requirements for complex resources, such as simulation components.

6.3.3.3 Preliminary Design Review (PDR)

Preliminary Design Review (PDR) is conducted after preliminary design efforts, but before start of detail design. This review is the first opportunity for the Government to closely observe the contractor's hardware and software design. The contractor is expected to describe all design changes made with respect to the original design disclosed in the technical proposal and to provide rationale for the changes. The contractor may also provide a hardware or hands-on demonstration of some of the preliminary designs to better illustrate important aspects.⁶¹ The PDR may assess the courseware design, analysis of the ADL "ilities,"⁶² trade studies, and any prototypes of the design. The design can be expressed in terms of storyboards for example.

⁵⁹ **Defense Acquisition Guidebook**, 4.3.3.4.2., System Requirements Review (SRR), http://akss.dau.mil/dag/DoD5000.asp?view=document&rf=GuideBook\IG_c4.3.3.4.2.asp.

⁶⁰ **Developing Software to Government Standards**, Prentice-Hall, Inc., 1991, pp. 187-189.

⁶¹ "Preliminary Design Review," **Acquisition Guide**, NAVAIR Training Systems Division, retrieved on 29 December 2005 from <http://www.ntsc.navy.mil/Resources/Library/Acguide/pdr.htm>.

⁶² The ADL "ilities" include reusability, maintainability, durability, interoperability, accessibility, and adaptability.

6.3.3.4 Critical Design Review (CDR)

Critical Design Review (CDR) examines the detailed design, performance, test characteristics and risk areas (technical, cost and schedule) of the design solution.⁶³ Approval of CDR normally establishes the "design freeze" date. This design freeze does not generally include software design in the sense that software is always flexible and being modified to reflect improvements. In another sense, software is frozen where changes to the software would modify the approved trainer performance requirements.⁶⁴ Generally this review assesses the system final design as captured in product specifications for each configuration item in the system (product baseline), and ensures that each product in the product baseline has been captured in the Detailed Design documentation.⁶⁵ For a content development effort, a single configuration item usually consists of a SCO. Storyboards would typically be examined before coding would begin. Test plans may also be reviewed.

6.4 Products

<i>Instructional</i>
<ul style="list-style-type: none">• Instructional Design Strategy (Instructional Media Design Package)• Flow Diagrams (Instructional Media Design Package)• Test Package
<i>Software/System</i>
<ul style="list-style-type: none">• System Architecture and Requirements Allocation Description, System Design Document• System Requirements Specification• Software Requirements Specification• Software Development Plan• Software Design Description• Software Test Plan• Test Procedures, Software Test Descriptions (Preliminary)

Table 6. Design Products

NOTE: The products suggested below enable the acquiring organization to assess adequacy and progress of the development effort from an ADL perspective. This is by no means a comprehensive list of deliverables necessary or available for every acquisition effort. The actual list of deliverables depends on the size and complexity of the effort, the acquisition approach and the PM's management style.

6.4.1 Instructional Products

6.4.1.1 Instructional Media Design Package

This training data product shall provide baseline requirements data necessary for the development and production of courseware. This data shall include a summary description of the

⁶³ **Developing Software to Government Standards**, Prentice-Hall, Inc., 1991, p. 189.

⁶⁴ "Critical Design Review," **Acquisition Guide**, NAVAIR Training Systems Division, retrieved on 29 December 2005 from <http://www.ntsc.navy.mil/Resources/Library/Acqguide/cdr.htm>.

⁶⁵ **Defense Acquisition Guidebook**, Section 4.3.3.4.5. Critical Design Review (CDR), http://akss.dau.mil/dag/DoD5000.asp?view=document&rf=GuideBook\IG_c4.3.3.4.5.asp.

training with such details as the major topics to be covered and the target audience; courseware design strategy including the user interface design and test design; lesson strategy including the organization, the learning objectives and test items; and courseware logic flow diagrams.⁶⁶ The media selections identified in the Instructional Media Requirements Document (analysis phase) should also be discussed. Since the project cost and schedule may have been based on the assumption that this existing material would be used in the current effort, the availability and application of this information should be confirmed, or the impact of its nonuse mitigated, in this document.

The design strategy should include a description of which SCORM sequencing rules will be used for interoperable branching, which SCORM data model elements will be used to track the student progress, and which SCORM metadata elements will be used for storage and discovery of the courseware in a repository.

6.4.1.2 Test Package

This training data product shall provide specific data necessary for examining an individual's or unit's knowledge, skills, attitudes, and achievement of learning objectives or performance standards. For example, the data shall include test items, test administration materials, and test item cross-reference chart.⁶⁷

6.4.2 **Software/System Products**

6.4.2.1 System Architecture and Requirements Allocation Description (SARAD)

The System Architecture and Requirements Allocation Description (SARAD) describes a high-level overview of the major product components, including both the hardware and software items, and their relationship to each other. This document also describes the system operations and concept of execution. Finally, the plan for fulfilling the system requirements through component implementation is documented.⁶⁸ The SARAD for a DL system might include the LMS, an LCMS and the repository system as well as the content.

6.4.2.2 System Requirements Specification (SRS)

The purpose of the System Requirements Specification (SRS) is to specify the requirements for a system or subsystem and the methods to be used to ensure that each requirement has been met.⁶⁸ If the project is primarily a content development effort, this document may be unnecessary with a SRS sufficing. A SRS can be useful for allocating and tracking requirements among system-level hardware components.

⁶⁶ Instructional Media Design Package Data Item Description, DI-SESS-81520B, 31 August 2001, Retrieved on 3 January 2006 from <http://dtswg.fedsun.navy.mil/PDF%20Files/81520B.pdf>.

⁶⁷ Test Package Data Item Description, DI-SESS-81525B, 31 August 2001, Retrieved on 3 January 2006 from <http://dtswg.fedsun.navy.mil/PDF%20Files/81525B.pdf>.

⁶⁸ **Industry Implementation of International Standard ISO/IEC 12207:1995 Standards for Information Technology-Software life cycle process-Life cycle data**, IEEE/EIA 12207.1-1997, pp. 21-27, <http://www.ieee.org/web/standards/home/index.html>.

6.4.2.3 Software Requirements Specification (SRS)

The purpose of the Software Requirements Specification (SRS) is to specify the requirements for a software item and the methods to be used to ensure that each requirement has been met.⁶⁸ This document also contains interface requirements specifications, or may be augmented with an Interface Requirements Specification (IRS) when there is sufficient number of specifications to justify a separate document. For DL, the SRS may describe the learning objectives for the courseware.

6.4.2.4 Software Development Plan (SDP)/Software Development Standards Description (SDSD)

The Software Development Plan (SDP) describes a developer's plans for conducting a software development effort including new development, modification, reuse, reengineering, maintenance, and all other activities resulting in software products. The SDP has been replaced by the Software Development Standards Description (SDSD). The SDSD provides the acquirer a tool for monitoring the processes that will be followed by the developer for software development, the methods to be used, the approach to be followed for each activity, and project schedules, organization, and resources.⁶⁹ Hopefully, most of the details regarding a contractor's software development processes will have been offered in the proposal as evidence of a well-established systems engineering process. If this is the case, then this documentation can be considered the SDSD. If not, the acquisition organization may want to consider asking for a SDSD that documents the methods, conventions and standards for this particular project.⁷¹

This SDSD should describe the approach for identifying and incorporating reusable software products. Any reusable content (assets, SCOs, or content packages) identified in the ADL-R that can be used in the project will have been found in the analysis phase and verified in the production of the Instructional Media Design Document. Also, the approach for developing reusable software products should be included. For example, conscientious use of SCORM metadata will potentially increase content reuse when that metadata is exposed to search engines.

The SDSD should describe the software engineering environment and any tools to be used. The plan may describe an activity network showing dependencies among activities. For example, it could describe the dependencies between the instructional design team and the software developers. Project resources could describe the types of staff required, for example, software engineering, instructional designers and management. Geographic locations could be listed if there is more than one.

6.4.2.5 Software Design Description (SDD)

The Software Design Description (SDD) documents the detailed design of the software product including a description of how the software satisfies the software requirements (described in the Software Requirements Specification) including algorithms and data structures, static relationships of software units, reusable elements, and database and interface design. The SDD may be augmented with a separate Interface Design Document (IDD) depending on the complexity of the interface.⁶⁸

⁶⁹ Industry Implementation of International Standard ISO/IEC 12207:1995 Standards for Information Technology-Software life cycle process-Life cycle data, IEEE/EIA 12207.1-1997, Section 6.17, p. 21, <http://www.ieee.org/web/standards/home/index.html>.

Furthermore, the acquisition organization may want to ask the developer to include the following in the SDD:

- Software technological approach (HTML, XML, Flash, ActiveX, Java, ASP, etc.) to development.
- Style guide or any templates for content development.
- Organization of content software modules and resources including the design and interface to any databases.
- Details concerning the implementation of sequencing and tracking (at the code level) that is not covered in the Instructional Media Design Package.
- Description, interface and relationship to any incorporated software (commercial, government-furnished or open source) reused or repurposed in the development.
- Project-specific metadata schema including tailored element values and extension categories.

6.4.2.6 Software Test Plan

The Software Test Plan (STP) describes testing activities for software items and software systems including the test environment, the kinds of tests to be performed and schedules of activities. The STP includes the test approach, conditions and coverage.⁶⁸ This document is separate from the Test Package discussed in section 6.4.1.2 because it focuses on technical interoperability and operation; however, the acquiring organization may choose to combine the documents into one. The STP discusses the organization that will perform the testing, and whether they will simply assess SCORM conformance or certify the content. Certification must be performed by an accredited 3rd party.⁷⁰

6.4.2.7 Software Test Description (Preliminary)

The Software Test Description (STD) describes the test preparations, test cases and test procedures to be used to perform testing of a software item or system.⁶⁸ Note that each Service may have business rules that dictate what percentage of SCOs are tested for each courseware. The STD may describe exactly which pieces of the content will be tested (i.e. a certain percentage of SCOs, the content package, the metadata, etc.). The content package as a whole should be tested for SCORM conformance and any discrepancies addressed.

⁷⁰ Refer to section 6.2.5 of this document for additional information on 3rd party testing.

7.0 Development

The primary outcome of the development phase is completed courseware that meets the training need. In an ADL environment, this courseware takes the form of SCORM conformant SCOs or content packages. Since SCOs are usually designed to be technically independent from one another, content development can proceed incrementally according to the Software Development Plan (SDP) with software coding, test and delivery stages for each SCO. The actual schedule of events for the development effort depends on the size and complexity of the effort, the acquisition approach and the PM's management style.

7.1 Relevant Policy

From DoDI 1322.26:

6.2. All acquired or developed DoD systems shall conform to the SCORM (current version) to ensure accessibility, durability, reusability, maintainability and interoperability. This includes DoD systems designed to:

6.2.1. Deliver, track, report on and manage distributed learning content, learner progress and learner interactions.

6.2.2. Deliver, track, report on and manage content and systems.

6.3. All acquired or developed SCORM-conformant content packages shall:

6.3.1. Include metadata.

6.3.2. Be registered in the ADL-R according to enclosure 3.

7.2 Points to Consider

7.2.1 Content Packages

The Content Package is the required delivery format for registration in the ADL-R.⁷¹

7.2.2 ADL Testing Terminology

7.2.2.1 Compliant

Compliance is the act of conforming to policy, guidelines, instructions, or law. In the context of this document, compliance is in accordance with DODI 1322.26.⁷²

⁷¹ ADL Registry Portal, <https://adlregistry.dtic.mil> or www.adlregistry.org.

⁷² Dodds, Philip, Notes on Acquisition Guidance and Private Communication, June 23, 2004.

7.2.2.2 Conformant

Conformance is acting in accordance with a specification, standard, or other specific direction (often technical) as specified by controlling documents. In the context of this document, a product is proven conformant with SCORM by producing a satisfactory test log from the official SCORM 2004 Conformance Test Suite.⁷³ The SCORM Conformance Test Suite (Self Test) contains the conformance testing software, procedures and supporting documents for organizations to perform self-testing on LMSs, SCOs, Metadata and Content Packages.⁷⁴ These same tests are also used to *certify* LMSs and content packages (see below).

7.2.2.3 Certification

Certification is a systematic evaluation performed by an accredited 3rd party to independently determine if one is conformant as defined above. Once certified, a product is deemed to be in compliance.⁷⁵

7.2.3 **Testing Content**

SCORM conformant content packages should interoperate with SCORM conformant LMSs, where both content packages and systems conform to the same SCORM edition. The Sample Run-Time Environment (SRTE) can be used to test SCORM content packages in a SCORM conformant LMS. SCORM ensures that content packages are interoperable between LMSs. However, graphical user interface elements such as the layout or style of buttons are not specified by SCORM. Such elements should therefore be tested on the LMS chosen for deployment to ensure the intended learner experience is achieved. The impact of this issue can be ameliorated by designing content using the SCORM navigation specification.

7.2.4 **SCORM Conformance Testing**

The SCORM 2004 Conformance Requirements describe the products that can be tested for SCORM conformance. It also describes the requirements each product must meet to be considered SCORM conformant. The SCORM Conformance Test Suite (Self Test) contains the conformance testing software, procedures and supporting documents for organizations to perform self-testing on LMSs, SCOs, Metadata and Content Packages.

Each has its own set of requirements, tests, and conformance labels. A conformance label is the label used by the SCORM 2004 Conformance Test Suite when the test subject is conformant to the conformance requirements.⁷⁶ The LMS SCORM 2004 Conformant label is used to describe LMSs that are conformant to the conformance requirements. The CP SCORM 2004 Conformant label is used to describe content packages (CP) that are conformant to the conformance requirements.

⁷³ Dodds, Philip, Notes on Acquisition Guidance And Private Communication, June 23, 2004.

⁷⁴ SCORM 2004 Conformance Test Suite, Available on 5 January 2006 from <http://www.ADLnet.gov/scorm/history/2004/scts.cfm>.

⁷⁵ Dodds, Philip. Notes on Acquisition Guidance. June 23, 2004.

⁷⁶ Advanced Distributed Learning (ADL), Sharable Content Object Reference Model (SCORM[®]) 2004 Conformance Requirements Version 1.3, 2005, <http://www.adlnet.gov/scorm/index.cfm>.

7.2.5 ADL Certification

Certification is an independent 3rd party testing, that provides consumers of DL content and systems with the assurance that products have successfully met conformance requirements. Certification is **not** an endorsement by the ADL Initiative, a guarantee that a product has been tested for defects in functionality, or a guarantee that the product’s content is instructionally sound.

Currently, there are two ADL Certification Testing Centers⁷⁷: 1) the Wisconsin Testing Organization located at the Academic ADL Co-Lab and 2) the Naval Undersea Warfare Center (NUWC) Division Keyport. The certification process and associated fees are determined by the individual ADL Certification Testing Centers.

7.2.6 ADL-R Required Metadata

The SCORM conformant content package should include content package level metadata and be registered in the ADL Registry (ADL-R), per DoDI 1322.26. Specific metadata requirements can be found at the ADL Registry Portal.⁷⁸

7.2.7 SCORM Conformance Test Suite

Self testing is the process of using the SCORM Conformance Test Suite software to test whether courseware is SCORM conformant. This is in contrast to *certification* which is testing by a 3rd party using the same test suite, but perhaps different procedures. Once the Test Suite software has completed analyzing the courseware, a “test log” will be generated. If the courseware is SCORM conformant, the test log will include a statement stating the course has achieved a conformance label.⁷⁹ The test log will also describe any SCORM defects (deviations from the SCORM specifications) that are found. The SCORM Conformance Test Suite can be downloaded free of charge from www.ADLnet.gov.

7.3 Reviews, Meetings and Conferences

<i>Instructional</i>
<ul style="list-style-type: none">• Script Storyboard IPR• On-Screen Lesson Review, Preliminary Integrated Courseware Review
<i>Software/System</i>
<ul style="list-style-type: none">• Test Readiness Review (TRR)

IPR – In-Process Review

Table 7. Development Reviews, Meetings and Conferences

⁷⁷ Support Area, <http://www.jointadlcolab.org/>

⁷⁸ ADL Registry Portal, <https://adlregistry.dtic.mil> or www.adlregistry.org.

⁷⁹ Advanced Distributed Learning (ADL), Sharable Content Object Reference Model (SCORM[®]) 2004 Conformance Requirements Version 1.3, 2005, <http://www.adlnet.gov/scorm/index.cfm>.

7.3.1 Instructional Reviews, Meetings and Conferences

7.3.1.1 Script Storyboard IPR

The purpose of the Script Storyboard IPR is to review a static mockup of a content module prior to development. Participants usually include Subject Matter Experts (SME) and instructional design professionals from the acquisition team and the contractor. Contractor software developers may also be present, but the goal is to achieve agreement on the instructional approach and content coverage in what is usually scoped to a SCO. This event can be informal or formal in nature and can occur incrementally until consensus is reached. Refer to Section 7.4.1.1 for discussion on what should be included in the Script Storyboards.

7.3.1.2 On-Screen Lesson Review

The purpose of the On-Screen Lesson Review is to review an early version of the content module under development. As with the Script Storyboard IPR, participants usually include Subject Matter Experts (SME) and instructional design professionals from the acquisition team and the contractor. In fact, these are often the same people. Contractor software developers may also be present to address discrepancies with content coding. The content module shall be reviewed for correct operation, including branching, navigation buttons, student interactivity, and technical accuracy. Each screen in a module is checked for accuracy against the final, Government-accepted, script storyboards. This event can be informal or formal in nature, and can occur incrementally until the final deliverable is produced. Refer to Section 7.4.1.2 for discussion on what should be included in the On-Screen Lessons.

7.3.2 Software/System Reviews, Meetings and Conferences

7.3.2.1 Test Readiness Review (TRR)

The Test Readiness Review (TRR) is a multi-disciplined technical review to ensure that the developmental product under review is ready to proceed into formal test. The TRR assesses test objectives, test methods and procedures, scope of tests, and safety and confirms that required test resources have been properly identified and coordinated to support planned tests. The TRR verifies the traceability of planned tests to program requirements and user needs, and determines the completeness of test procedures and their compliance with test plans and descriptions.⁸⁰ This event can be held one-time upon completion of the development, or incrementally as individual modules are completed. Incremental testing can sometime identify process and approach flaws early when they are more easily corrected.

⁸⁰ **Defense Acquisition Guidebook**, Section 4.3.3.9.1. Test Readiness Review (TRR), http://akss.dau.mil/dag/DoD5000.asp?view=document&rf=GuideBook\IG_c4.3.3.9.asp.

7.4 Products

<i>Instructional</i>
<ul style="list-style-type: none">• Script Storyboards• On-Screen Lessons, Incremental Courseware Delivery• Training Evaluation Plan
<i>Software/System</i>
<ul style="list-style-type: none">• Software Test Description• Software Test Report, Test Results Report

Table 8. Development Products

7.4.1 Instructional Products

7.4.1.1 Script Storyboards

Script Storyboards describe or define each training screen/frame that is accessible during the operation of the final product and are developed based upon the design strategy and flow diagrams approved by the acquisition organization. Script Storyboards contain a visual representation of all objects on each screen, written descriptions of all media (graphics, animations, photographs, video and audio), lists of source materials, references and programming instructions.^{81, 82} Included in the latter would be any requests to retrieve from (for adapting instruction) or store to (for student tracking) the LMS any data model elements through the SCORM API. The Script Storyboard may also include preliminary metadata according to standards set forth in the design phase.

7.4.1.2 On-Screen Lessons

On-Screen Lessons are incremental implementations of the on-line product under development based on the Script Storyboards. The On-Screen Lessons allow everyone involved to verify and comment on the developer's interpretation of the product designed and developed thus far before final delivery.⁸³ This is the acquisition organization's first opportunity to experience the content in the form of SCOs.

7.4.1.3 Training Evaluation Document

The Training Evaluation Document specifies the personnel, resources, organization, functions, procedures, and requirements for evaluating training and training equipment. The document is segmented into three parts: training evaluation planning data, training evaluation results data, and instructional delivery system test and evaluation data.⁸⁴ The document might discuss plans

⁸¹ **Statement of Work for Analysis, Design, and Development of Asynchronous Self-Paced Learning Content**, Navy Integrated Learning Environment, Retrieved on 5 January 2006 from https://www.npdc.navy.mil/ile/ile_content_mgmt10.pdf, p. 655.

⁸² **DoD Handbook, Development of Interactive Multimedia Instruction (IMI)**, MIL-HDBK-29612-3A, section 6.1.1.7.3 Storyboards, pp. 64-84, Retrieved 2 August 2005 from <http://dtswg.fedsun.navy.mil/Documents.htm>.

⁸³ **DoD Handbook, Development of Interactive Multimedia Instruction (IMI)**, MIL-HDBK-29612-3A, section 6.1.1.8 ICW Prototype Lessons, pp. 84-86, Retrieved 2 August 2005 from <http://dtswg.fedsun.navy.mil/Documents.htm>.

⁸⁴ Training Evaluation Document Data Item Description, DI-SESS-81524B, 31 August 2001, Retrieved on 3 January 2006 from <http://dtswg.fedsun.navy.mil/PDF%20Files/81524B.pdf>.

for testing the developed content in the operational environment on the target LMS. This early testing may reveal inconsistencies in interpretation, and subsequent implementation, of the SCORM specifications (on either the LMS or the content side) that may affect interoperability.

7.4.2 Software/System Products

7.4.2.1 Software Test Description

The Software Test Description developed in the design phase (section 6.4.2.7) may be revisited and updated to match any revision in testing of the courseware.

7.4.2.2 Software Test Report

The Software Test Report may be used to document the results of testing the software content or system; thus, enabling the acquisition organization to assess the testing and its results.⁸⁵ The test log from testing the content package with the SCORM Conformance Test Suite would typically be included. Also any test logs from testing separate SCOs or metadata may be included. If a 3rd party was used to certify the content or system, the proof of certification may also be included.

⁸⁵ **Industry Implementation of International Standard ISO/IEC 12207:1995 Standards for Information Technology-Software life cycle process-Life cycle data**, IEEE/EIA 12207.1-1997, Section 6.29, p. 27, <http://www.ieee.org/web/standards/home/index.html>.

8.0 Implementation

Implementing DL consists of delivery and acceptance of the final product, hosting the content on a LMS or other system for access by the target students, and registering the content metadata with the ADL Registry to facilitate discovery, reuse and repurposing by others in DoD.

8.1 Relevant Policy

From DoDI 1322.26:

6.3. All acquired or developed SCORM-conformant content packages (CPs) shall:

6.3.1. Include metadata.

6.3.2. Be registered in the ADL-R according to enclosure 3.

6.3.3. Be maintained in DoD Components' repositories that are searchable and accessible, consistent with DoD information security and information technology policies according to DoD CIO Memorandum (Reference (e)).

6.3.3.1. These repositories shall be registered in the ADL-R according to Enclosure 3. Content with classified metadata is exempted from registering in the ADL-R under this subparagraph pending published guidance for alternative content management.

6.5 Distributed learning content creation, sequencing, online display, and delivery software and licenses shall be acquired or procured on an upfront royalty basis. The Government shall not agree to pay royalties, recurring license or run-time fees, use tax, or similar additional payments for distributed learning content developed for and by the Department of Defense in other than unusual circumstances, such as intellectual property disputes.

6.7 Both the repositories and the learning content available through the repositories will be identified using the Corporation for National Research Initiatives (CNRI) Handle System. DTIC, in conjunction with CNRI and the respective DoD Components, will establish unique identifiers for each repository and its learning content.

E3.4.1. SCORM CPs shall be stored in a content repository... The content repository shall be searchable via mechanisms provided by enterprise core services including the Enterprise Discovery Interface (EDI) and specifications.

E3.4.2. The Repository Manager shall provide metadata describing each SCORM CP to the ADL-R. The ADL-R metadata requirements for CPs are maintained on the ADL-R web site. The metadata set includes tags (elements) such as a unique identifier,

description, keywords, usage rights, access information, etc. The unique identifier is a Handle (based on the Handle System) that uses the NA assigned to the repository.

E3.4.3. The Repository Manager shall submit the metadata to the ADL-R website.

8.2 Points to Consider

8.2.1 Content Repositories

A repository is any collection of content managed by a single activity or proponent. DoDI 1322.26 requires that all content be stored in an approved repository that is accessible for purposes of content search and retrieval. A DoD approved repository is one having a proponent sponsor that verifies that the repository maintains mission-relevant and SCORM conformant content. DoD Component's Proponent Offices authorize registration of DoD repositories for storing and maintaining Service component content, and as a reference source in the ADL-R. The Component Proponent Office also designates a Repository Manager for each approved repository who is responsible for registering, maintaining, and accessing content in the repository.⁸⁶

8.2.2 ADL Registry (ADL-R)

The designated Repository Manager is responsible for providing metadata to the ADL-R for content packages in their repository. Content metadata must be submitted in accordance with the **ADL-R Content Registration Metadata Model**. This model provides a detailed description of metadata schema, cardinality and examples.⁸⁷ More details regarding the registration process and registration metadata can be obtained in the Support area of the Joint ADL Co-Lab website.⁸⁸

⁸⁶ "Repositories," ADL Registry Portal, Retrieved on 6 January 2006 from https://adlregistry.dtic.mil/6/index1_2.htm.

⁸⁷ "How To Contribute," ADL Registry Portal, Retrieved on 6 January 2006 from <https://adlregistry.dtic.mil/4/index1.htm>.

⁸⁸ <http://www.jointadlcolab.org/>

8.3 Reviews, Meetings and Conferences

<i>Instructional</i>
<ul style="list-style-type: none">• Courseware Verification
<i>Software/System</i>
<ul style="list-style-type: none">• Functional Configuration Audit (FCA), System Verification Review (SVR)• Physical Configuration Audit (PCA)

Table 9. Implementation Reviews, Meetings and Conferences

8.3.1 Instructional Reviews, Meetings and Conferences

8.3.1.1 Courseware Verification

Courseware Verification confirms that the developed content meets the design specifications from the instructional perspective. It answers the question "Did they build it right?"⁸⁹ Verification tests should not only examine the presentation of the content, but also the underlying tracking and adaptation capabilities. Content verification activities can take place throughout the acquisition and development process.

8.3.2 Software/System Reviews, Meetings and Conferences

8.3.2.1 Functional Configuration Audit (FCA)

The Functional Configuration Audit (FCA) (also known as System Verification Review [SVR]) verifies that the final product meets the functional requirements established during the analysis phase. During FCA, the acquisition organization should verify that all developed content can be completely installed and executed from the content packages. They should also ensure that content designed to be an integrated package (course) runs as such and meets all tracking, interactivity and adaptability requirements. For developed and commercial systems, the FCA should include a review of all computer system tests, consisting of power-up sequencing, on-line readiness, and verification of commercial computer vendor documentation including the Computer Operator's Manual.⁹⁰

8.3.2.2 Physical Configuration Audit (PCA)

The Physical Configuration Audit (PCA) is the formal examination of the as-built product configuration against its design documentation. Following successful completion of the PCA and the establishment of the Product Baseline (PBL), all subsequent changes are processed by formal engineering change action. The PCA includes a detailed audit of engineering drawings, specifications, and logistics support and software documentation. The PCA should verify adequacy of the specified document discussed in section 8.4.⁹⁰

⁸⁹ **Defense Acquisition Guidebook**, Section 4.2.4.6. Verification, Retrieved on 6 January 2006 from http://akss.dau.mil/dag/DoD5000.asp?view=document&rf=GuideBook\IG_c4.2.4.6.asp.

⁹⁰ "Government Final Inspection," **Acquisition Guide**, NAVAIR Training Systems Division, retrieved on 29 December 2005 from <http://www.ntsc.navy.mil/Resources/Library/Acqguide/test-gfi.htm>.

8.4 Products

<i>Instructional</i>
<ul style="list-style-type: none">• Courseware Verification Document• Instructional Media Package<ul style="list-style-type: none">– Source Materials– Product• Training System Support Document
<i>Software/System</i>
<ul style="list-style-type: none">• Deficiency Report (DR), Discrepancy Report (DR)• Software Product Specification• Software User’s Manual• Source Code

Table 10. Implementation Products

NOTE: The products suggested below enable the acquiring organization to judge the adequacy of the delivery from an ADL perspective. This is by no means a comprehensive list of deliverables necessary or available for every acquisition effort. The actual list of deliverables depends on the size and complexity of the effort, the acquisition approach and the PM’s management style.

8.4.1 Instructional Products

8.4.1.1 Courseware Verification Document

The Courseware Verification Document may be used to record the results of the Courseware Verification event discussed in section 8.3.1.1.

8.4.1.2 Instructional Media Package

The Instructional Media Package contains visual, textual and audio information to be used in the development and presentation of the training content.⁹¹ This includes the source code discussed in section 8.4.2.4. For a SCORM DL delivery, the instructional media package can be entirely contained in one or more content packages.

8.4.1.3 Training System Support Document

The Training System Support Document provides complete procedures for utilization of all software utility programs, support software file generation, and system performance characteristics verification for life cycle maintenance. This document also contains information for user personnel to aid in operating and achieving full utilization of a training system during the presentation of the course of instruction, training exercises or missions.⁹² The Software User’s Manual (SUM) discussed in section 8.4.2.3 may be included as part of this document.

⁹¹ Instructional Media Package Data Item Description, DI-SESS-81526B, 31 August 2001, Retrieved on 3 January 2006 from <http://dtswg.fedsun.navy.mil/PDF%20Files/81526B.pdf>.

⁹² Training System Support Document, Data Item Description, DI-SESS-81527B, 31 August 2001, Retrieved on 3 January 2006 from <http://dtswg.fedsun.navy.mil/PDF%20Files/81527B.pdf>.

8.4.2 Software/System Products

8.4.2.1 Deficiency Report (DR)

Deficiency, Discrepancy, or Problem Reports provide a means for identifying and recording the resolution to software anomalous behavior, process noncompliance with plans and standards, and deficiencies in life cycle data.⁹³ In the case of ADL, the SCORM Conformance Test Suite test log may reveal and describe certain errors that occurred during testing. These errors will need to be addressed by the developer. Also, DRs are typically used to record and prioritize the maintenance of the content throughout its life.

8.4.2.2 Software Product Description (SPD)

The Software Product Description (SPD) identifies the critical software configuration items and their versions. The document establishes the software baseline, and provides the version references and other identification details.^{94,95} The baseline should identify the SCORM edition and addendum (see section 9.2.1). The SPD document should also include "as built" design information and compilation, build, and modification procedures for the software configuration items.

8.4.2.3 Software User's Manual (SUM)

The Software User's Manual (SUM) describes to a hands-on user of the software how to install and use the software system.⁹⁶ In this context of a DL content development effort, the user is the individual responsible for applying the content to a particular training need, like a courseware manager. The description would typically include how to install the content, launch the courseware from the LMS, and run the courseware.

8.4.2.4 Source Code

According to DoD Policy ...*content creation, sequencing, online display, and delivery software and licenses shall be acquired...* In the case of ADL, source code is a deliverable for the content, so that the government can modify the content as needed for future needs. The delivery of DL content in the form of SCORM conformant CPs is strongly recommended, because the ADL Registry identifies registered content as such. If the content is not delivered as a package, it must be made into one or more SCORM conformant packages for registration purposes.

⁹³ **Industry Implementation of International Standard ISO/IEC 12207:1995 Standards for Information Technology-Software life cycle process-Life cycle data**, IEEE/EIA 12207.1-1997, p. 18, <http://www.ieee.org/web/standards/home/index.html> .

⁹⁴ **Industry Implementation of International Standard ISO/IEC 12207:1995 Standards for Information Technology-Software life cycle process**, IEEE/EIA 12207.0-1997, p. 29, <http://www.ieee.org/web/standards/home/index.html> .

⁹⁵ **Industry Implementation of International Standard ISO/IEC 12207:1995 Standards for Information Technology-Software life cycle process-Life cycle data**, IEEE/EIA 12207.1-1997, p. 9, <http://www.ieee.org/web/standards/home/index.html> .

⁹⁶ **Industry Implementation of International Standard ISO/IEC 12207:1995 Standards for Information Technology-Software life cycle process-Life cycle data**, IEEE/EIA 12207.1-1997, p. 27, <http://www.ieee.org/web/standards/home/index.html> .

9.0 Lifecycle Support

Once DL content and systems are put into production, they must be maintained until such time they are deemed no longer useful or becomes otherwise irrelevant. This section discusses issues pertaining to lifecycle support after delivery.

9.1 Relevant Policy

From DoDI 1322.26:

6.6 Distributed learning content acquired or developed before the effective date of this Instruction (also referred to as legacy content) may be registered in the ADL-R at the discretion of the DoD Components. Specific procedures for registering non-SCORM conformant content will be published separately. Legacy content shall be made SCORM conformant and registered in the ADL-R whenever the owner of that content determines it is relevant, appropriate, and cost-effective. This includes browser-based visual information products developed according to DoD Instruction 5040.02 and DoD Instruction 5040.07.

E3.4.1. SCORM CPs shall be stored in a content repository. The access rights and means to the content shall be subject to all local policies with regard to authentication, security, and intellectual property rights. Access restriction and its enforcement shall be the responsibility of the Repository Manager. The content repository shall conform to DoD net-centric principles for allowing visibility and access to content within. This includes exposing repository content as web-accessible modules where applicable. Additionally, the content repository shall be searchable via mechanisms provided by enterprise core services including the Enterprise Discovery Interface (EDI) and specifications.

E3.4.2. The Repository Manager shall provide metadata describing each SCORM CP to the ADL-R. The ADL-R metadata requirements for CPs are maintained on the ADL-R web site. The metadata set includes tags (elements) such as a unique identifier, description, keywords, usage rights, access information, etc. The unique identifier is a Handle (based on the Handle System) that uses the naming authority (NA) assigned to the repository.

9.2 Points to Consider

9.2.1 SCORM updates

One factor that can affect life cycle cost is the release of a new SCORM edition or addendum. Editions occur due to changes to the underlying standards and specifications for an existing version of SCORM. Addendums are published due to bug fixes, clarifications and resolved issues for an existing Edition release. They are ADL's mechanism for improving the

interoperability of SCORM. Specifying the latest version of the SCORM 2004 Conformance Requirements document is recommended. Budgeting for SCORM migration to minimize program risk is advised. Ensure the target LMS conforms to the latest SCORM 2004 Conformance Requirements. Watch for Edition and Addendum releases and assess for impacts to program. The release of these editions and addendums is expected to slow down in the future.

9.2.2 Registration Update

According to DoDI 1322.26, the Defense Technical Information Center (DTIC) will maintain the DoD central registry for SCORM-based content repositories and Content Packages. The ADL Registry (ADL-R) will store metadata about SCORM Content Packages and the repositories in which they are stored. These metadata will be used to locate digital assets through a resolution process, providing the means to access both the content and its repositories. The DTIC will provide a service to enable searching of the registered metadata and shall return relevant identifiers that may be resolved to appropriate access points.

9.2.3 Repository Management

SCORM Content Packages need to be stored in a content repository. The cost of maintaining the content packages in repositories should be considered. Each Service will decide which repository the courseware will be stored in. No cost is expected for registering the content packages in the ADL-R.

9.3 Reviews, Meetings and Conferences

9.3.1 Operational Evaluation

Operational evaluation is a continuous process that assesses how well users of content or learning systems are meeting the established job performance requirements. It is part of a continuum of instructional systems design activities that occur throughout the life cycle of the system beginning with the analysis phase. While an expanded discussion of this topic is outside the scope of this document, operational evaluations are mentioned here because they can often serve as the basis for revising the content or system to correct identified training deficiencies.^{97,98}

9.4 Products

9.4.1 Configuration Management (CM) Plan

Configuration Management (CM) is a process for establishing and maintaining the consistency of a product's physical and functional attributes with its design and operational information throughout its life. Program managers are required to base configuration management decisions on factors that best support implementing performance-based strategies throughout the product life cycle. Integral to successful CM is developing a CM Plan. The following are attributes of the Configuration Management Process:

⁹⁷ **Instructional Systems Development/Systems Approach to Training and Educations (Part 2 of 5 parts)**, MIL-HDBK-29612-2A, pp. 179-197, <http://dtswg.fedsun.navy.mil/Documents.htm>.

⁹⁸ Dr. David Daly, personal communication, 8 November 2005.

- **Configuration Identification** – uniquely identifying the functional and physical characteristics of an item;
- **Configuration Change Management** – controlling changes to a product using a systemic change process;
- **Configuration Status Accounting** – capturing and maintaining the configuration of an item throughout the lifecycle;
- **Configuration Verification and Audit** – ensuring product design is accurately documented and achieves agreed upon performance requirements.⁹⁹

The configuration item (CI) is an important concept in the CM plan. Each CI is chosen because it has been designated for separate configuration management. A particular organization's reuse strategy should drive these decisions. The curricular design of the content will also drive the decision for a particular DL content project since this is where the information is allocated to SCOs. In programs where integrity of the product is critical and tightly controlled, the CM plan is best initiated early on in the acquisition process to better facilitate this requirement.¹⁰⁰

⁹⁹ **Defense Acquisition Guidebook**, Section 5.2.1.4. Configuration Management, http://akss.dau.mil/dag/DoD5000.asp?view=document&rf=GuideBook\IG_c5.2.1.4.asp.

¹⁰⁰ **Industry Implementation of International Standard ISO/IEC 12207:1995 Standards for Information Technology-Software life cycle process-Implementation considerations**, IEEE/EIA 12207.2-1997, p. 46, <http://www.ieee.org/web/standards/home/index.html>.

Service-Specific Guidelines

The focus of this document is general in nature; however, some Services have produced or are in the process of producing acquisition guidance and rules for their Service only. Information about these efforts can be found in the Support area of the Joint ADL Co-Lab website (www.JointADLCoLab.org).

10.0 Terms and Definitions

Accessibility- The ability to locate and access content from multiple locations and deliver that content to other locations.

Acquisition Professionals- In our context, Department of Defense (DoD) personnel responsible for acquiring DL courseware and systems that store, manage and run DL courseware,

ADL Network – A network of organizations designed to foster the collaborative research, development and assessment of the common tools, standards, content and guidelines for advanced distributed learning.

Advanced Distributed Learning (ADL) - An evolution of distributed learning that emphasizes networks, standards-based versions of reusable objects, learning management systems, and performance support systems. It may be delivered synchronously or asynchronously and may include legacy methods and media.

Advanced Distributed Learning Initiative (ADLI) – A DoD-initiated collaborative effort to harness the power of information technologies to enhance structured learning and performance support.

ADL Registry (ADL-R) – A DoD service, managed by DTIC, for registering the existence, location, description, and other relevant properties of distributed learning content developed or acquired by the DoD to enable the discovery and reuse of that content regardless of its location and/or origin. The registry and associated procedures provide a centrally searchable set of records representing the distributed content objects. The registration process results in each content object being identified by a unique and persistent identifier that may be used as a constant reference to the object over changes in its location and other access details. The identifier system used will be an implementation of the Corporation for National Research Initiatives (CNRI) Handle System.

Assets - Assets are electronic representations of media, such as text, images, sound, web pages or other pieces of data that can be delivered using web technologies.

Content Organization – A standardized way to describe the structure and behavior of content.

Content Model – A standardized set of definitions used to define content components and their relationships.

Content Packaging - A standardized way to identify and exchange digital resources between different systems or tools. Content packaging can also define content organizations.

Data Model - A standard set of data elements used to define information.

Distance Learning – Structured learning that takes place without requiring the physical presence of an instructor.

Distributed Learning – Structured learning mediated with technology that takes place without requiring the physical presence of an instructor.

Durability – The ability to withstand technology evolution and/or changes without costly redesign, reconfiguration, or recoding.

Embedded Training – Capabilities built into, strapped onto, or plugged into operational materiel systems to train, sustain, and enhance individual and crew skill proficiencies necessary to operate and maintain the equipment.

Front-End Analysis (FEA) – A structured process used to examine training requirements and identify alternative approaches to training job tasks. The process identifies job tasks to be performed, analyzes the skills and knowledge needed to perform them, assesses the technologies available for training the skills and knowledge, performs a media analysis to recommend the best mix of delivery media, and provides cost and lead-time comparisons for the feasible alternatives.

Interactive Multimedia Instruction (IMI) – Applies to predominantly interactive, electronically delivered training, education, and instructional support products. IMI products include instructional software and software management tools used to support instructional programs.

Interoperability – The ability to take instructional components developed in one system and use them in another system.

Learning - The acquisition of knowledge, skills, and attitudes.

Learning Management System (LMS) - Software that automates training event administration through a set of services that launches learning content, keeps track of learner progress, sequences learning objects, and reports student mastery.

Legacy Content – Content developed and managed using DITIS, and non-SCORM-conformant content.

Metadata – information about content that includes descriptions of characteristics and relationships among category items

There are five types of SCORM metadata:

- **Content Aggregation Metadata**
Content Aggregation Metadata describes the content aggregation (i.e., the content package) as a whole. The purpose of applying Content Aggregation Metadata is to enable discoverability of the Content Aggregation and to provide descriptive information about the Content Aggregation as a whole. The requirements for any metadata built for a

Content Aggregation shall match those requirements set forth in the Content Aggregation Metadata Application Profile.

- **Content Organization Metadata**

Content Organization Metadata describes the Content Organization. The purpose of applying Content Organization Metadata is to enable discoverability within, for example, a content repository and to provide descriptive information about the content structure, as a whole, defined by the Content Organization. The requirements for any metadata built for a Content Organization shall match those requirements set forth in the Content Organization Metadata Application Profile.

- **Activity Metadata**

Activity Metadata describes an individual Activity. The purpose of applying Activity Metadata is to make the Activity accessible (enabling discovery) within a content repository. The metadata should describe the Activity as a whole. The requirements for any metadata built for an Activity shall match those requirements set forth in the Activity Metadata Application Profile.

- **SCO Metadata**

Metadata can be applied to SCOs to provide descriptive information about the content in the SCO independent of use. This metadata is used to facilitate reuse and discoverability of content. The requirements for any metadata built for a SCO shall match those requirements set forth in the SCO Metadata Application Profile.

- **Asset Metadata**

Metadata can be applied to Assets to provide descriptive information about the Assets independent of any usage or potential usage within courseware content. This metadata is used to facilitate reuse and discoverability, within, for example, a content repository during content creation. The requirements for any metadata built for an Asset shall match those requirements set forth in the Asset Metadata Application Profile.

Repository – A storage and retrieval mechanism for digital media that may or may not be searchable.

Reusability – The flexibility to incorporate instructional components in multiple applications and contexts.

Sample Run-Time Environment (SRTE) - A "mini-LMS" that adheres to the SCORM requirements for managing the runtime environment responsible for launching content, tracking the learner, providing the SCORM API and supporting the data model used for passing information relevant to the learner's experience with the content.

SCORM Application Program Interface (API) - The communication mechanism for informing the LMS of the state of a content object (e.g., initialized, finished, in an error condition). The API is used for getting and setting data (e.g., score, time limits, etc.) between the LMS and the Sharable Content Object (SCO).

SCORM Content Aggregation Model (CAM) – A common method to describe the components used in a learning experience, how to package those components for exchange from system to system, how to describe those components to enable search and discovery, and how to define sequencing rules for the components.

SCORM Run-Time Environment (RTE) – The RTE describes the LMS requirements for managing the run-time environment (i.e., content launch process, standardized communication between content and LMSs, and standardized data model elements used for passing information relevant to the learner's experience with the content.

SCORM Sequencing and Navigation (SN) – Information and behaviors that an LMS must apply in order to present a designed learning experience. The information is expressed within Content Structure and encoded in the *organization* section of Content Packaging.

Sharable Content Object (SCO) - A collection of one or more assets that represents a single launchable resource that can communicate with an LMS using the SCORM RTE. A SCO represents the lowest level of granularity of learning resources that can communicate with an LMS using the SCORM RTE.

Sharable Content Object Reference Model (SCORM®) - A collection and harmonization of specifications and standards that defines the interrelationship of content objects, data models, and protocols such that objects are sharable across systems that conform to the same model.

Sharable -- Content that is accessible, interoperable, durable, and reusable.

Structured Learning – An intentional, purposely designed instructional experience typically characterized by explicitly stated instructional objectives and/or goals and leading to discrete measures of effectiveness. Structured learning is commonly associated with job/task competency instruction, and is equivalently supportive of other domains of procedural knowledge. The term structured learning is used in contrast to incidental, informal, discovery or recreational learning.

11.0 Product Checklist

The following is provided as both a quick reference and a checklist of products that may need to be produced or acquired through the course of one's program. The list may not be entirely definitive, nor should all the products be considered required. It may be possible to combine some documents into others or delete them entirely depending on the nature of the specific program. The program manager's education and experience, and that of the acquisition team members should serve as the final determiner of required products.

ADL Acquisition Product Checklist

Product:	Phase	Section of Document (for reference)
Training Situation Document	Front-End Analysis	2.3.1
Training Program Structure Document	Program Management	3.3.1.1
Systems Engineering Plan	Program Management	3.3.2.1
Source Selection Plan	Procurement Planning	4.3.1
Independent Government Cost Estimate	Procurement Planning	4.3.2
Contract Data Requirements Lists (CDRLs)	Procurement Planning	4.3.3
Contract Schedule	Procurement Planning	4.3.4
Statement of Work (SOW)	Procurement Planning	4.3.5.1
Specification	Procurement Planning	4.3.5.2
Statement of Objectives (SOO)	Procurement Planning	4.3.6.1
Requirements Document	Procurement Planning	4.3.6.2
Instructional Performance Requirements Document	Analysis	5.3.1
Instructional Media Requirements Document	Analysis	5.3.2
Instructional Media Design Package	Design	6.4.1.1
Test Package	Design	6.4.1.2
System Architecture and Requirements Allocation Description	Design	6.4.2.1
System Requirements Specification	Design	6.4.2.2
Software Requirements Specification	Design	6.4.2.3
Software Development Plan	Design	6.4.2.4
Software Design Description	Design	6.4.2.5
Software Test Plan	Design	6.4.2.6
Software Test Description	Design, Development	6.4.2.7
Script Storyboards	Development	7.4.1.1
On-Screen Lessons	Development	7.4.1.2
Training Evaluation Document	Development	7.4.1.3
Software Test Report	Development	7.4.2.2
Courseware Verification Document	Implementation	8.4.1.1
Instructional Media Package	Implementation	8.4.1.2
Training System Support Document	Implementation	8.4.1.3
Deficiency Report	Implementation	8.4.2.1
Software Product Description	Implementation	8.4.2.2
Software User's Manual	Implementation	8.4.2.3
Source Code	Implementation	8.4.2.4
Configuration Management Plan	Lifecycle Support	9.4.1

12.0 Reviews, Meetings and Conferences Checklist

The following is provided as both a quick reference and a checklist of conferences, meetings and reviews that might be needed on one's ADL program. The list may not be entirely definitive, nor should all the events be considered required. It may be possible to combine some events with others or delete some entirely depending on the nature of the specific program. The program manager's education and experience, and that of the acquisition team members should serve as the final determiner of required events.

ADL Acquisition Reviews, Meetings and Conferences Checklist

Conference/Review	Phase	Section of Document (for reference)
Kick-off meeting	Design	6.3.1
Design Strategy IPR	Design	6.3.2.1
System Requirements Review	Design	6.3.3.1
Software Specification Review	Design	6.3.3.2
Preliminary Design Review	Design	6.3.3.3
Critical Design Review	Design	6.3.3.4
Script Storyboard IPR	Development	7.3.1.1
On-Screen Lesson Review	Development	7.3.1.2
Test Readiness Review	Development	7.3.2.1
Courseware Verification	Implementation	8.3.1.1
Functional Configuration Audit	Implementation	8.3.2.1
Physical Configuration Audit	Implementation	8.3.2.2
Operational Evaluation	Lifecycle Support	9.3.1