

DOCUMENT NO. ELS001

# Digital Electronic Library System

## An AICC White Paper

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AICC DELS Subcommittee

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## ABSTRACT

This document gives information and recommendation for a Digital Electronic Library System(DELS) for aircraft operation and training. Today computerized training and electronic documentation are different programs, based on different set of data, with different interfaces. But the trend, is to integrate training programs in electronic documentation. A DELS is a system for storage and interactive access to any technical data, including multimedia and training; this data includes all of the digital information delivered to an airline and related to an aircraft. Implementing DELS requires harmonization in the fields of data structures and formats, information access protocols, and standard communication (e.g. query, answer) .

## KEY WORDS

DELS	Training
Digital Electronic Library	Maintenance
System	User interface
PSS	Query
Performance Support	Operations
System	

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## REVISION HISTORY

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DRAFT 1                      June 1996

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DRAFT 2                      September 1996

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Incorporation of modifications worded at the Ottawa meeting:

Title:        ELS User Interface is replaced by DELS.

Abstract:    rewording of the whole paragraph corresponding to a shift of the scope from mainly user interface to mainly standards and formats

1."Introduction": same as above.

2."DELS main functions and user categories": deletion of § "purpose" and creation of § "definition", "functions", and "user categories"

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DRAFT 3                      June 1997

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Incorporation of modifications following the review of Spec 2100, Chapter 4.

Chapter 1 "Introduction":

reference is made to Spec 2100

Chapter 2 "DELS main functions and user categories":

reference is made to Spec 2100 in all chapter,

section "CBT" is updated,

section "just in time training" is developed

section "line maintenance technician is deleted

new section "instructors"

Chapter 3 "CBT/Digital Data systems functional requirements comparison

Change of title

Rewriting of sections 3.1 "CMI" and 3.2 "CBT"

New section: "Digital Data"

Chapter 4 "New requirements for introducing Training into DELS"

Change of title and rewriting to reflect change of scope.

Chapter 5 "Standards and Engines":

Rewriting to list Spec 2100 and AICC standards

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DRAFT 4                      May 1998

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Major changes throughout the document, to reflect the perception that AICC influence is focused on training matters.

Abstract:

rewriting.

Chapter 1 “Introduction”:

updating of the paragraphs “background”, “purpose” and “scope”, deletion of the paragraph “the need for a white paper” and addition of a paragraph “references”.

Chapter 2:

- modification of the title
- addition of the “summary table”
- various modifications in the paragraph “functions”
- various modifications and additions in the paragraph “users”
- addition of the paragraph “issues”

Chapter 3:

- modification of the title
- otherwise chapter mostly reformatted, with little wording changes.

Ex-chapter 4: deleted

Ex-chapter 5: becomes chapter 4

- modification of the title

Appendix: unchanged

Glossary of terms: updated and made consistent with other AICC glossary.

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DRAFT 5

May 1999

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Spelling mistakes on pages V, 1, 11, 16, 24, 26.

P5, 13, 14, 15, 24 : cancellation of SDS.

P10 : cancellation of SDS and additional information.

P13, 16 : additional information.

P16 : new paragraph 2.5 concerning Santa Fe 98 and Toulouse 98.

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DRAFT 6

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September 2001

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New paragraph 2.6 giving issues from AICC meetings in 1999, 2000  
and 2001 including a first example of metadata for aviation industry

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DRAFT 7

June 2002

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New paragraph 2.7 giving a mapping between metadata for aviation  
industry and the IEEE LOM document

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## 1. Introduction

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### Background

Today airlines receive their operational documentation and their training packages under a variety of formats. Many airlines still use operational documentation under paper or microfilm format. But a growing number uses the CDs provided by aircraft manufacturers and by engine/systems vendors; these CDs are used *directly* on stand alone workstations, or *on network*. On the other hand training packages are mostly CBT. They are still mostly used on networked workstations; but with new storage capacity and speed of CDs there is a trend towards running CBT with CD on stand alone stations.

Today an airline personnel with a PC can run the CDs from different sources which gives him/her all kind of information needed for the job: system or spare part information, procedures, training, etc...The fact that data formats and runtime applications may be different is no inconvenience for running applications separately.

The foreseen next step is to integrate all technical data, including multimedia and training, for a given aircraft. This integrated approach will result in a Digital Electronic Library System (DELS).

### Purpose

The Aviation Industry CBT Committee (AICC), in relation with the ATA-Technical Information and Communication Committee (TICC), is willing to provide a standard for Digital. Electronic Library Systems (DELS). The AICC has the objective to define the right standardization level for this initiative. This standardization should bring enough commonality so that users can easily access data from different manufacturers. This is most important for maintenance technicians, who are supporting several types of aircraft simultaneously. This is also important for some airline training centers, who want to reuse/modify data provided by manufacturers with their own tools.

### References

Consistency is ensured between this document, other AICC documents, and the ATA Spec 2100,chapter 4.

**Scope**

This document:

- Lists DELS functions , users and related issues.
- Compares CBT/Digital Data navigations.
- Compares CBT/Digital Data standards.
- Will gives requirements for an integrated system.

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## 2. DELS functions, users and issues

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**Definition**

DELS is a system for storage and interactive access to any technical data, including multimedia and training. This data includes all of the digital information delivered to an airline and related to an aircraft.

**Functions**

Functions provided by a DELS have been regrouped in four blocks:

- delivery system for the hangar
- delivery system for the training center
- authoring system for the manufacturer
- authoring system for the airline

**Users**

Users of a DELS system include airline and manufacturer personnel

- servicing personnel
- maintenance and engineering personnel
- flight crew
- flight operation personnel
- training personnel (instructors and authors)

**Issues**

Issues raised during the sessions of the DELS subcommittee have been compiled and regrouped in four domains:

- new generation user interface
  - training library
  - common library training – tech. pub.
  - tech. Pub. library
-

2.1

**Functions/users/issues Summary Table**

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See next page

FUNCTIONS / USERS	ISSUES (regrouped per domain)			
	New generation user interface	Training library	Common library Training – tech pub	Tech pub library
DELS is a delivery system for the hangar (airline)	1) Software agents for linking and retrieval issues (ETC) 2) Wearable computers for maintenance tasks 3) Contribute to define user interface for new Tech. Pub. 4) Next generation electronic documentation (Hyperman, annotations, bookmarks, groupware) 5) Improved search engine		13) JITT : user selected training sequences in addition to a job task (see M2047)	25) ATIS (Airbus)  26) PMA (Boeing)
DELS is a delivery system for the training center (airline and manufacturer)	6) Instructor notes 1), 2), 3), 4), 5)		14) LATTE (Boeing instructor tool)	25) ATIS (Airbus)  26) PMA (Boeing)
DELS is an authoring system for the manufacturer		7) Metadata (link with CMI, with AU)	16) Take into account Spec 2100 formats/structures (different from CBT due to different approach to information presentation) 17) Current format issue for Tech. Pub.( SFQL, XML, HTML, Java, etc) 18) Metadata (is there anything comparable in Spec 2100 ?) 19) Restructure CBT (smaller elementary units) 20) Updating and effectivity for CBT (and influence on CMI) 21) Reuse Tech. Pub. Data for CBT  23) CBT material for Tech. Pub. Use 24) Cooperate with ATA-TICC	27) Developing technical data in a context independent manner.
DELS is an authoring system for the airline		8) Avoid use of dedicated proprietary tools 9) Secure automatic conversion from one tool to the other 10) Smart Graphics 11) Develop an interchange format for DELS database 12) Guidelines for interchange		

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**2.2****Functions**

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**Purpose**

This sub-chapter develops the training functions of DELS and gives references for non-training functions.

**List of functions**

Functions provided by a DELS system include:

- transition and recurrent training
- just in time training
- training authoring
- operational access to technical information
- performance support

**Transition and recurrent training: CBT**

In this paper the scope of CBT is limited to technical training for civil aviation industry, applied to qualification or recurrent training programs. This part of CBT uses data that will be present on DELS system. The other part of existing CBT is for ab-initio programs; but it is based on generic data, which will not likely be present in the DELS database.

CBT for qualification or recurrent training programs makes assumptions on the entry level of students, and presents them information that is complete and structured.

Information is complete in that sense that all sub-systems, controls, warnings, etc. are covered in the lesson on a given system; there is no selection.

Information is structured because an instructional philosophy has been chosen when designing the lesson, and consequently comparable element are always presented in the same order (e.g. a system lesson will comprise, in that order, a statement of objectives, a system description, a section on controls and alarms, a sub-system description for each sub-system, a quizz, etc.).

CBT material is very interactive, it may even include simulation. It is also very rich in that sense that it includes multimedia data (sound, video, animations, pictures).

Progression in CBT is mostly directed (this goes with the structured information described above), and a simple progression system is enough to ensure that the student will access easily to training elements, and never feel lost during the course.

CBT for transition and recurrent training currently exists under the two forms of Student Paced CBT and Instructor Led CBT. Often it is the same computer program, used differently (e.g. turn off the audio messages when using a program in Instructor Led mode).

**Transition and recurrent training: other DELS data**

tbd

**Just-in-time training**

“Just in time training is a short training session taken little time before performing the actual task. The training objective may be to review rapidly the whole task, to memorize the global process. It may also be to practice an elementary procedure which, for any reason, the person in charge of the task does not know.”

Just in time training can be taken only at maintenance site; it is not applicable to training centers. It is more needed at line locations than at base. Because at line locations there is often a single person who must know everything, when more expertise and support is available at base.

Just in time training is easy to achieve before scheduled maintenance, because it can be planned. It is more difficult before trouble shooting. It requires the fault to be declared enough in advance of aircraft arrival, which can be done with the ACARS.

Because the user requirements have not yet been studied for Just In Time Training the best amount of information (complete or partial) and the best way to present it (more structured, linear, instructor driven, or more random, reader driven) are not yet defined.

**Training authoring**

tbd

**Operational access to technical information**

The ATA-TICC organization includes functional teams. It is the objective of these teams to define the categories of users and their functional requirements.

**Performance support**

See glossary

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**2.3****Users**

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**Purpose**

This sub-chapter lists the main categories of users of a DELS system and gives additional information for two of them: instructors and CBT authors

**List of user categories**

The categories of users considered in this chapter are:

- servicing personnel (ATA 104 level 2)
- line maintenance technicians (level 3)
- base maintenance technicians (level 3)
- shop maintenance technicians (level 4)
- structural repair technician (level 4)
- technical services (level 4)
- engineering specialists (level 4)
- pilots
- dispatchers
- instructors
- CBT authors
- Tech. Pub. authors

Note: this list will be harmonized with the one defined by TICC functional teams, when available. Tentatively only the instructors and CBT authors categories will be described by AICC. It is also possible that the requirements will be defined for all categories by the TICC functional teams.

<b>Instructors</b>	<p>Instructors give qualification and recurrent training to airline personnel.</p> <p>They perform systems presentation and operationally oriented training.</p> <p>Training is given in manufacturers training centers, but also at airline base.</p> <p>Training aids and means used by instructors comprise:</p> <ul style="list-style-type: none"> <li>-CBT lessons</li> <li>-Training manuals</li> <li>-Extracts from the operational documentation</li> <li>-Full set of operational documentation (electronic or not)</li> <li>-Part Task Simulators</li> <li>-Simulators</li> <li>-Aircraft</li> <li>-instructor guide</li> <li>-instructor notes</li> </ul>
<b>CBT authors</b>	<p>CBT authors create the CBT programs presented to the trainees. These programs may be designed for Student Paced CBT, Instructor Led CBT or both.</p> <p>CBT authors produce:</p> <ul style="list-style-type: none"> <li>-AUs (lessons), using various authoring systems and following, or not AICC existing recommendations.</li> <li>-AU elements such as Smart Graphics or Templates, which are used in libraries.</li> <li>-course structures (routers), when using a CMI system.</li> <li>-training manuals, when applicable.</li> </ul> <p>Note: the only currently existing AICC recommendation giving a high level of details for CBT authors is the CMI recommendation. It deals with CBT data for interfacing with the CMI system when creating an AU, and with CMI data when creating a course structure. There is not such detailed recommendation neither on CBT structure nor on CBT elements (such as text, graphics, etc).</p> <p>Sources of information for CBT authors typically are:</p> <ul style="list-style-type: none"> <li>-operational documentation (published and/or drafts)</li> <li>-design office documents or drafts</li> <li>-modifications dossiers</li> <li>-direct contact with design office and system manufacturers</li> </ul>

## 2.4

**Issues****Domain:  
New generation  
user interface**

This has been the first domain of investigation of AICC DELS subcommittee, at a time where user interface was estimated to be a primary field of concern for this subcommittee. Information has been collected and reviewed, but no action has been identified yet in this field.

**1) Software agents**


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“Software agents for linking and retrieval issues”

This is an early vision from the Emerging Technology Committee. Agents were implemented years ago in HP NewWave software. This product has since been discontinued. Status of this technology in software industry is to be inquired.

**2) Wearable  
computers**

“Wearable computers for maintenance task”

Prototypes have existed for years. American made a presentation at AICC of the use of first generation laptop computers for documentation consultation aboard the a/c. Recently Boeing made a presentation at AICC of state of the art wearable computers. The Si-Fi glasses of Mach 2047 also belong to this category of equipment. Cost of equipment probably explains that this technology is not yet widespread in the maintenance community.

**3) New Tech. Pub.  
user interface**

“Contribute to define user interface for new Tech. Pub.”

This issue has been raised but has not been pursued because the work with Tech. Pub. has been limited to exchange of information.

**4) Next generation  
electronic  
documentation**

“Next generation electronic documentation (Hyperman, annotations, bookmarks, groupware)”

Most information on this matter came from the two presentations made at AICC of the NASA Hyperman project. This was very informative, with many new features for Tech. Pub., but less direct implication for training. These new features are not present in today's Spec 2100. Status of Tech. Pub. future features is to be inquired.

**5) Search engine**

“Improved search engines”

Information came mostly from the study of NMSU (New Mexico State University) work on the subject, which was presented at AICC. No implication had been identified for CBT. Status of such technology improvement for Tech. Pub. is to be inquired.

- 6) Instructor notes** “Instructor notes”  
Notes capability is already a feature of current electronic documentation. In future electronic documentation they will have sophisticated feature, such as intelligent following of updates. An instructor note capability could be implemented in CBT system for ILCBT. This would have an influence on AUs and on CMI.
- Training library** All the issues listed in the “training library” domain are pure CBT concern and could be addressed independently of the DELS, but at the risk of developing non compatible solutions.
- 7) Metadata** “Metadata (link with CMI and with AUs)”  
There are common parameters in CMI guidelines and in what is known of Metadata (e.g. title, author, training objective). Exchange of information with the goal to harmonize standards is in progress (is that fully true?).
- 8) Avoid proprietary tools** “Avoid use of dedicated proprietary tools”  
Historically AICC standardization has been going bottom up from hardware to operating system to CMI and now to common access with Tech. Pub. digital data (all related to delivery, not to authoring). Some standardization on authoring had been discussed since long (see AGR 007), but could never be really started. In the framework of DELS the Smart Graphics could be a step toward this goal.
- 9) Automatic conversion** “Secure automatic conversion from one tool to the other”  
This is an airline concern, expressed at AICC first by UAL, and now by Braathens. No adequate technology has been identified yet.
- 10) Smart graphics** “Smart Graphics (SMG)”  
They are called smart graphics because it sounds better than dumb simulation (this is an authentic AICC member statement).  
This issue is related to 8) “avoid use of dedicated proprietary tools”. SMG standardization will allow to satisfy airline need for authoring without multiple developments by manufacturers.
- 11) Interchange format for DELS** “Develop an interchange format for DELS database”  
This is a high level goal, set up at the beginning of the DELS work. SMGs contribute to this objective.
- 12) Guidelines for interchange** “Guidelines for interchange”  
Another wording for 11)

<b>Domain: Common library Training – Tech. Pub.</b>	This is the core of DELS effort, as per the DELS definition “a system for storage and interactive access to any technical data, including multimedia and training...”.
<b>13) JITT</b>	<p>“JITT: user selected training sequences in addition to a job task (see M2047)”</p> <p>JITT was first presented at AICC by NASA, which had developed a program for Space Shuttle operators, using Web technology. It was later presented at AICC by Boeing, in its Si-Fi video on the next 50 years of training technology. A concern to develop the concept of JITT is that it is not applicable to training centers; so the instructors are less interested in this concept; still instructors performing OJT (On the Job Training) will be impacted and could contribute to develop this concept.</p>
<b>14) LATTE</b>	<p>“LATTE (Boeing instructor tool)</p> <p>This is the first example presented at AICC of application of the common library concept. From Boeing presentation it appeared that their instructors can put together a set of CBT and Tech. Pub. extracts, easily accessible from menus, for ILCBT.</p>
<b>16) Spec 2100 formats</b>	<p>“Take into account Spec 2100 formats/structures (different from CBT due to different approach to information presentation)</p> <p>This issue is documented in chapter 4 “CBT / Digital Data standards comparison”. AICC has not concluded yet on this issue.</p>
<b>17) Format issue for Tech. Pub.</b>	<p>“Current format issue for Tech. Pub. (SFQL, XML, HTML, Java, etc)</p> <p>See chapter 4 “CBT / Digital Data standards comparison” for some information. Status of Tech. Pub. for digital data future standards is to be inquired.</p>
<b>18) Metadata and Spec 2100</b>	<p>“Metadata (is there anything comparable in Spec 2100)</p> <p>Status to be inquired.</p>
<b>19) Restructure CBT</b>	<p>“Restructure CBT (smaller elementary units)</p> <p>This is a long time concern for DELS subcommittee, since the first assessment of Tech. Pub. digital data structure (which goes down to the paragraph). A rough equivalent to paragraph in CBT is the Topic (see glossary). Another approach could be the source graphics, the jpg video...</p>

- 20) Updating and effectivity** “Updating and effectivity for CBT (and influence on CMI)  
At least some CBT, maybe most (to be inquired), has updating and effectivity management of a kind. These feature are needed to store CBT data and Tech. Pub. data in a common repository. But the need for AICC standardization is not obvious and should be inquired.
- 21) Reuse Tech. Pub. data** “Reuse Tech. Pub. data for CBT”  
Tech. Pub. data have always been a major source of information for CBT authoring. Historically text was not adapted for training purposes, and graphics had to be redone for many reasons (format, excessive complexity, lack of color or highlights, etc).
- 21) ctd 1** Why use operational doc in training?  
1) to provide customized information  
2) to provide real life looking information  
3) as a support for exercises
- 21) ctd 2** 1) to provide customized information  
It is a demand from trainees. They want training on their aircraft. But instructors may not want or be able to do so.  
They may not want because training is more and more on acquiring right comportment (e.g. read ECAM) and less on memorizing values or schematics. In this respect customized information is not at the training level, it is at the operation level.  
They may not be able because it would be too time consuming for instructors to get updated on a course which is permanently, automatically updated. And instructors do not want to be surprised by the content of the CBT they are showing!

**21) ctd 3****2) to provide real life looking information**

It is of course desirable that training schematics are consistent with what the trainee will see later in operational documentation. But operational documentation graphics are typically information rich, not synthetic. For training purpose they are simplified, highlighted, colored, and often animated. They have always been and there is no reason to think that it will change. Now can the training modifications be introduced in an operational graphic at the creation stage? Probably yes, technically. But is it worth to design all operational graphics with training in mind? Only a portion of them will be used for training. So they should be training adapted afterward, when training has made its selection. Then there would be a training graphic automatically updated. The instructor would have to check that the updates of the graphic do not make the training simplification, highlights, etc, irrelevant. The difference in effort with creating and maintaining a pure training schematic maybe minimal or negative in the end. Still the quality improvement would be great: it would be impossible to have a training graphic becoming totally disconnected from reality.

**23) CBT for Tech. Pub.**

“CBT material for Tech. Pub. use”

This is an issue for Tech. Pub.

**24) Cooperate with TICC**

“Cooperate with ATA-TICC”

Initial effort has been made early by AICC. There is still exchange of information and some projects of mutual standards recognition between members of both groups.

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<b>Domain:</b>	All the issues pertaining to this domain are issues for Tech. Pub. solely.
<b>Tech. Pub. library</b>	
<b>25) ATIS</b>	<b>“ATIS (Airbus)” ( Airbus Technical Information System)</b> This is the new generation Airbus electronic documentation system, with integrated Tech. Pub. data, managed CBT references and some training documentations.
<b>26) PMA</b>	<b>“PMA (Boeing)” (Portable Maintenance Aid)</b> This is Boeing current delivery system for maintenance information.
<b>27) Developing technical data</b>	<b>“Developping technical data in a context independent manner”</b> When this issue was raised, at the beginning of the DELS work, it was understood as developing data which could be used also for training. Current developments by some Tech. Pub. are context independent to a certain extent: technical data can be used for all maintenance manuals. Their usability for training is still an issue.

## 2.5 Issues (santa Fe and Toulouse 98)

A first general point which appears is that the elaboration of an AGR for DELS (training part) is not a short term item.

Another one is that the AICC approach should be more practical than theoretical.

Rather than starting with a general data model, we start by the concrete side. As a consequence , it was decided to create a particular subcommittee for the smart graphics.

By the way, there may be some redundancies or common objectives with the Courseware Technology and Emerging Technology subcommittees.

Concerning the granularity, some levels are identified :

-elements (graphics, smart graphics, video...)

-scripts (templates...)

-modules (AU, doc files...)

-courses (routers, menus...)

Concerning the user interface, the configuration management is a major item.

## 2.6 Issues 1999, 2000 and 2001

### 2-6-1 Possible scenarios to use a DELS

#### SCENARIO 1

An airline wants to be delivered with a courseware from the a/c manufacturer.

The user should give the following information and select some items :

name entry; password

dedicated menu

click a delivery

type of course

adapted router; envelope course

The basic point is the access to the information, in particular to the correct version of the technical information which supposes a precise configuration management of the information. A possible input from the user could be the MSN (Manufacturer Serial Number)

#### SCENARIO 2

Somebody wants to review a procedure.

User inputs and selections :

access, menus... towards :

courseware routers

classified lists of procedure (ATA systems,...,normal, abnormal,...,deactivation, removal/installation...)

play the AU

The requested procedure may not exist in the courseware but the training purpose is to teach methods, not to cover all the procedures.

So, training procedures could be presented by type ; e.g. 11 types of T/S on A320 depending of ECAM messages types, MMEL or not...

To be taken into account is the evolution of operational documentation (colour, animations, videos...) which implies multimedia means.

### SCENARIO 3

Somebody is looking for information concerning a component

User inputs and selections :

- component name (key words)
- FIN number
- click on a schematic....
- get text, photos, location, cut off graphics, safety recommendations...

The following points should be considered :

- granularity : a component is a topic inside an AU
- configuration management becomes a more important concern.
- evolution of maintenance manual (easy on such a descriptive item)

### SCENARIO 4

The a/c manufacturer updates a course or the airline customizes the a/c manufacturer course

The following choices and jobs should be performed

- target choice
- modification analysis
- corrections, improvements
- development

With the following aspects, some of them needing a well organized DELS :

- access to modification dossiers
- contacts with the design office...
- configuration management at AU level
- (configuration ) management for graphics, video, smart graphics
- data bases

### SOME CONCLUSIONS

- configuration identification is a major item
- be careful about the balance between granularity, level of management and the quantity of parameters associated to the elements

- all the above scenarios implies that the information/learning objects are well classified and identified through an efficient metadata system
- merging/complementarity between the operational documentation world and the training world

### **2-6-2 Courseware structure**

There are various types of developpers :

- A/c manufacturers
- System manufacturers
- Course development firms
- Airlines

Here are some axis for action :

- Show the experience and results
- Advise
- Items may partly be linked to DELS, partly to “methods and processes” subcommittee
- Suggest guidelines for future presentations

Some points which can be addressed :

- Naming of files
- Issue management
- Configuration management
- Graphics/video banks
- Questionnaires
- Options management
- Difference courses
- Router generation
- Documentation
- Development method
- Quality control

About the naming of the files :

- Segregation between various domains (flight, cabin, maintenance...)
- Part of the information in the name
- Part of the information elsewhere (data base, ...)
- Legacy/new programs
- Issue management

Some aspects about questionnaires :

- Quiz in/out of assignable units
- Quiz answer recording
- Conditional quiz
- Question categories
- Automatic test
- Links with AU or routers
- Options management

When possible it is better to isolate, in specific assignable units, the coverage of the options in order to deal with the various possible cases by letting or removing these specific AU from the router.

A way to build a difference course between/from an aircraft A and/to an aircraft B consists of selecting the necessary AUs from an existing envelope course of the targeted B aircraft; a better but more expensive way is to develop specific modules corresponding to this difference course; the problem with this last solution is that the number of specific AUs increases exponentially with the number of aircraft versions or types. And each updating is heavier and heavier.

There are several types of routers in particular for the maintenance courses where there are several types of trainees (mechanics, avionics...).

Once the envelope router is produced, one can have systems generating automatically the subrouters, corresponding to the various speciality.

One can also have systems which customize automatically a router by removing from it the assignable units covering options that the considered customer does not have on his aircraft.

The structure of the associated documentation may be equivalent to the structure of the courseware (cf ATA 104 for the maintenance documentation).

By the way, with the evolution of the technology the difference between a documentation file and a CBT course is decreasing.

### **2-6-3 Metadata : general**

Metadata are parameters giving information about a file.

They enable to manage and indentify the files.

Then searching functions can use metadata as criteria.

If we consider the example given in 2-6-4 there are several kinds of metadata.

- general metadata : filename, software, title, size, language, author, duration
- metadata linked to the production method : standard, training objective, issue, links tab, stamp
- metadata linked to the management of the files : modifications, TSAR, links tab again
- among them metadata linked to the aviation subject : profile, a/c family, ATA, engine, units, zone, flight phase
- metadata linked to the questions : number of answers, correct answer number

Some metadata could belong to several categories depending of the use we make of them. An objective is to reach a set of metadata for the aviation industry which is compliant with existing specifications (IMS/LOM).

### 2-6-4 Example of aviation metadata

This example corresponds to the metadata used by Airbus. It is just given as a possible starting point for discussions.

Here are first the types and subtypes of files to which metadata will be associated:

#### TYPE

- Documentation
- Drawing
- Module : the official word is assignable unit; the basic piece of a CBT course, generally using graphic, text, audio and video, and covering one or several training objectives.
- Movie
- Router : the list of assignable units corresponding to a complete course
- Script
- Smart graphic : a graphical object which contains all the graphical possibilities of the corresponding physical object.
- Sound
- Still picture
- Video table : a file used in the context of video disks, giving the correspondance between a “logical address” used in an assignable unit and the physical address on the video disk.

Remark : suggestion to add “text”.

#### SUBTYPE

- Documentation
  - Courseware
  - Other
- Drawing
  - 3D images
  - Chart : an organigram
  - Graph : a graphical representation of numbers or mathematical functions.
  - Image
  - Miscellaneous
  - Schematic
  - Table
  - Wiring diagram
- Module
  - Abnormal operation
  - Briefing/debriefing : an instructor led piece of training
  - Check list
  - Component
  - Description/operation
  - Ecam

- General: not dedicated to a particular system of the aircraft
- In service event
- Indicating and control
- Interface
- Introduction
- Maintenance practice
- MCDU specific pages
- Normal operation
- Other
- Presentation
- Quiz : questions for trainee self evaluation.
- Summary
- Test : the official final trainee test.
- Warning
- Movie
  - Animation : artificial film.
  - Film : real film.
- Router
  - Courseware
  - Documentation : a router dedicated to the production of a documentation
  - Menu : a list of courseware routers.
- Script
  - Draft
  - Procedure
  - Sound
- Still picture
  - Aircraft general
  - Component/system
  - Miscellaneous
  - Panel

An now the list of the possible metadata; Not all the listed metadata apply to all types of files but only when relevant.

#### FILENAME

- Definition :  
The computer name of the training element. It integrates an extension written after a dot.

#### SOFTWARE

- Definition  
The name and version of the software

## STANDARD

- Definition : the name of the preprogrammed or template file used to produce the assignable unit.

## TITLE

- Definition : The name of the training element expressed in plain language.

## TRAINING OBJECTIVE

- Reference
- Description : free text

## PROFILE

- Cabin crew
- Flight crew
- Maintenance
- Performance
- Structure
- Other

## SIZE

- definition : the size of the training element given in Kbyte.

## AIRCRAFT FAMILY

- Wide body
- A300
- A310
- Single aisle
- A319
- A320
- A321
- Long range
- A330
- A340
- Other

## ATA

The ATA reference given till the 6<sup>th</sup> digit.

## MODIFICATIONS

- The list of aircraft modifications attached to the training element. This information is used for the configuration management.

## ENGINE

- CFM56
- CF680
- CF680(FADEC)
- JT9
- PW4000
- PW6000
- TRENT 500
- TRENT 700
- V 2500
- Not relevant

## UNITS

- Metric
- US
- Not relevant

## LANGUAGE

- English
- French
- Chinese

## ISSUE

- Definition : this number is incremented each time a correction or an improvement is applied. (The file name does not change).

## AUTHOR

- Definition : the name of the person who created the training element.

## TSAR

- Definition : Training System Action Request. All remarks from users about training products are given a reference identification (the TSAR number). There are two cases :
  - the TSAR implies a technical modification; a new file is created.
  - the TSAR implies a correction or an improvement; a new issue of the file is created.

## STAMP

- Name of the person who validates the training element
- Date of this validation

#### LINKS TAB

- Linked : the name of the files necessary for the considered file to run correctly.
  - Associated : e.g. associated training documentation file, to be used for delivery purposes
  - Source : source filename
  - Remediation : used for test files; name of the assignable unit where the subject is covered.
- Remark : if we want to have the opposite direction, that is from the assignable unit towards the test question, the “associated” metadata can be used.

#### VIEW

- Access : view or zoom of the door behind which a component is.
- Close-up : the component fills the picture.
- General : the component is shown with its environment.

#### ZONE

- ext engines
- ext fuselage
- ext main LDG
- ext nose
- ext nose LDG
- ext tail
- ext whole A/C
- ext wings
- int APU bay
- int avionics bay
- int belly fairing
- int cabin
- int cargo
- int cockpit or flight deck
- int PFD
- int ND
- int SD
- int MCDU
- int EWD
- Other

#### FLIGHT PHASE

- flight preparation
- exterior inspection
- cockpit preparation

- cabin preflight checks
- boarding
- safety demonstration
- before pushback or start
- engine start
- taxi
- before takeoff
- takeoff
- after takeoff
- climb
- cruise
- descent
- approach
- landing
- go around
- after landing
- parking
- securing the aircraft
- deboarding
- not relevant

Remarks : suggestion to add “rotation” and “flare”.

#### DURATION

- Definition : animation/movie/sound duration

#### TEST

- Number of answers
- Correct answer number

COMMENTS which is a field for any kind of comments.

Airbus stores all the metadata of a given file (learning object) in an associated text file called the MIF (Main Identification File).

Airbus has developed a tool which is a user interface to fill the MIF called the “miffer”.

When a learning object, with its MIF, is stored in the Training Central Library :

- the storage process can be forbidden if some mandatory metadata are missing
- the information contained in the MIF is loaded in the data base of the library.

Some of the metadata need external specific tools to be used.

An example is the “modifications” which correspond to the technical aircraft modifications which are part of the content of the learning object.

These metadata are just the references of these modifications and the configuration management requires an external tool containing in particular the list of modifications defining all the aircraft of a given family as well as programs able to calculate modifications combinations

corresponding to a given MSN (Manufacturer Serial Number) aircraft and thus generating the technical definition of a learning object.

Another example is the TSAR which is just a reference number. The complete information about a TSAR (issuer, date, purpose of the TSAR...) is found in an external data base.

## 2.7 Issues 2002 (Orlando 2002)

During a working session, a mapping was done between the metadata presented in the last chapter and the LOM IEEE.

### 0. INTRODUCTION

The mapping is made between/from the present metadata system used in Airbus and/to the IEEE LOM document Draft Standard for Learning Object Metadata IEEE P1484.12/D6 18 April 2001. The ~ sign means “about.

### 1. GENERAL TAB

FIELD	ENTRY	VALUES	IEEE REF
NAME	Automatic	15 alphanumeric digits	1.1 Identifier
TITLE	Manual		1.2 Title
STAMP	Manual	Green : OK Yellow : OK but not linked files Red : no stamp	2 Life cycle ~ 2.2 Status
TYPE	Automatic or manual	Documentation Drawing Module Movie Router Script Smart graphic Sound Still picture Video table	~ 5.2 Learning resource type
SUBTYPE	Automatic or combo box	Depends of type Refer to chap 2.6.4	~5.2 Learning resource type
PROFILE	Automatic	Cabin crew Flight crew Maintenance Performance Structure Other	~5.5 Intended end user role ~5.6 Context
LANGUAGE	Combo box	English French Chinese	1.4 Language

FIELD	ENTRY	VALUES	IEEE REF
FAMILY	Automatic or Combo box	Wide body A300 A310 Single aisle A319 A320 A321 Long range A330 A340 Other	9.2.2 Taxon
UNIT	Combo box	Metric US Not relevant	9.2.2 Taxon
ATA	Automatic and manual		9.2.2 Taxon
Engine	Combo box	CFM 56 CF6 80 CF6 80 (FADEC) JT9 PW4000 PW6000 TRENT 500 TRENT 700 V 2500 NOT RELEVANT	9.2.2 Taxon
SOFTWARE	Automatic or combo box		4.1 Format
STANDARD	Combo box		7. Relation 7.1 Kind 7.2.1 Identifier
SIZE	Automatic		4.2 Size
AUTHOR	Manual		~ 2.3.1 Role

## 2. HISTORY TAB

FIELD	ENTRY	VALUES	IEEE REF
REFERENCE	Manual	TSAR ref	~ 2. Life cycle ~ 7. Relation
TYPE	Automatic	Creation TSAR STAMP	~ 2. Life cycle
DATE	Automatic		2.3.3 Date
DESCRIPTION	Manual	Free text	~ 2. Life cycle
AUTHOR	Automatic		~ 2.3.1 Role
ISSUE	Automatic	An incremented nbr	~ 1.1 Identifier 2.2. Version

## 3. MODIFS TAB

FIELD	ENTRY	VALUES	IEEE REF
REFERENCE	Manual	Modification ref	~ 7. Relation
OPTION	Manual	Isolatability : Y if yes	~ 8. Annotation ~ 9. Classification
DESCRIPTION	Manual	Free text	7.2.2 Description

## 4. LINKS TAB

FIELD	ENTRY	VALUES	IEEE REF
REFERENCE	Manual or automatic	A filename	7.2.1 Identifier
TYPE	Manual or automatic	Linked Associated Source Remediation	~ 7.1 Kind
DATE	Automatic		~ 7.2.1 Identifier
DESCRIPTION	Manual	Free text	7.2.2 Description

## 5. SPECIFIC DATA TAB

FIELD	ENTRY	VALUES	IEEE REF
<b>TEST</b>			
NB	Combo box	Number of answers	??
GOOD	Combo box	Ref of the correct answer	??
<b>PICTURE</b>			
VIEW	Combo box	Access Close-up General	~ 9. Classification
ZONE	Combo box	Engines Fuselage Main LDG Nose Nose LDG Tail Whole A/C Wings APU bay Avionics bay Belly fairing Cabin Cargo Cockpit PFD ND SD MCDU EWD Other	~ 9. Classification

FLIGHT PHASE	Combo box	Flight preparation Exterior inspection Cockpit preparation Cabin preflight checks Boarding Safety demonstration Before pushback/start Engine start Taxi Before take off Take off After take off Climb Cruise Descent Approach Landing Go around After landing Parking Securing the A/C Deboarding Not relevant	~ 9. Classification
FIELD	ENTRY	VALUES	IEEE REF
AUDIO -ANIMATION			
DURATION	Automatic	H/mn/s	4.7 Duration
MODULE TRAINING OBJECTIVES			
REFERENCE	Manual	Ref of trng obj	~ 7. Relation
TYPE	Combo box	Objective Event	~ 7.2.2 Description
DESCRIPTION	Manual	Free text	~ 7.2.2 Description

## 6.COMMENTS TAB

FIELD	ENTRY	VALUES	IEEE REF
COMMENTS	Manual	Free text	1.5 Description 1.6 Keywords 1.7 Coverage 4.5 Installation remarks 5.10 Description 1.3 Description 8 Annotation 8.3 Description

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### 3. **CBT / Digital Data navigations comparison**

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**Purpose**

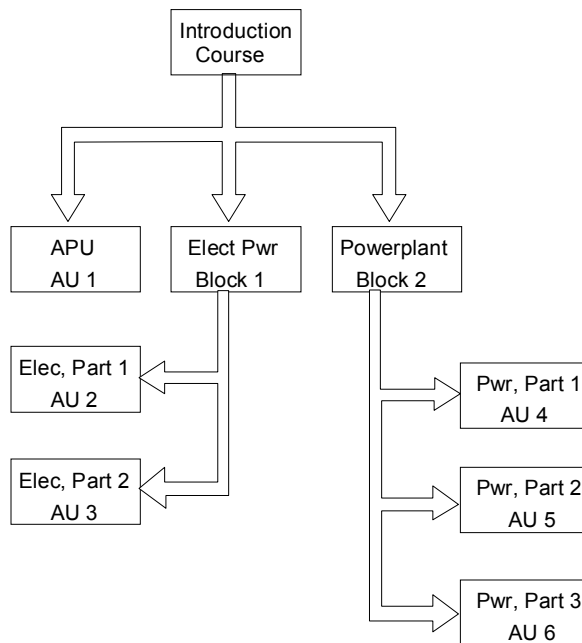
This chapter gives information on the navigation functions for CBT applications and for Digital Data. For Digital Data only titles and ATA Spec 2100 references are given.

**CBT applications**

For CBT there are two levels (two layers of software) to access to training information and navigate through it: these are the CMI and the CBT lesson.

3.1 CMI navigation

CMI course structure, example

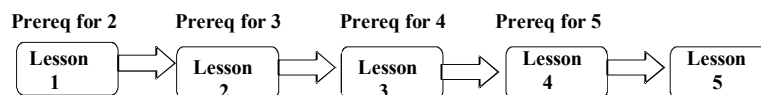


**CMI progression logic**

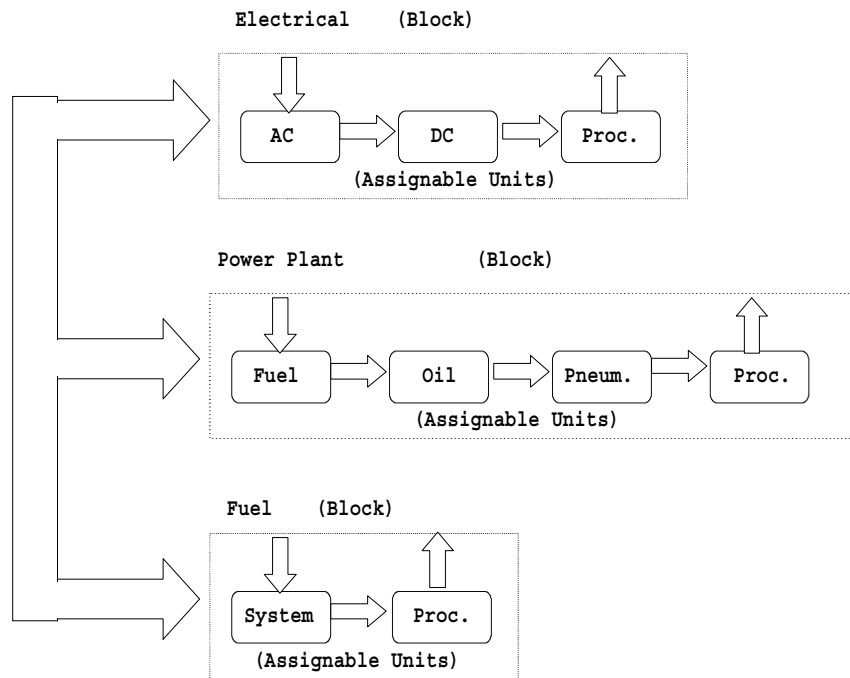
CMI supports prerequisites, objectives and lesson completion. Prerequisites are logical expressions linking the student progression to the objective met and/or the lessons completed.

Document CMI001 details the possible logic expressions, the lesson statuses (completion) and the objectives categories.

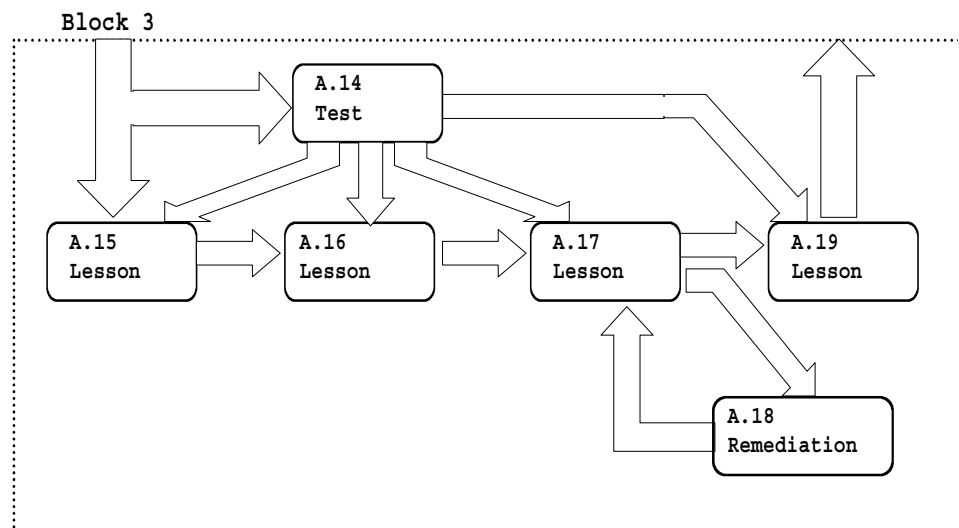
CMI progression logic, example 1



CMI progression logic, example 2



CMI progression logic, example 3



## 3.2

**CBT lessons navigation**

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**CBT lessons structure**

From a retrieval system point of view CBT lessons can only be entered by one entry point. Their internal structure is not standardized and no point other than the entry point can be accessed directly. For this reason lessons are also called assignable units (A.U) by AICC.

Note on the entry point: it is usually the first screen presented when accessing the lesson for the first time. But it can also be any screen when using the review mode: in that mode the student re-enter the lesson directly where he left it.

**CBT lessons progression logic**

CBT lessons can be entered in several modes, corresponding to different progression logic. These modes are detailed in document CMI001. At version 1.8 of this document they are:

- Sequential
- Choice-Fast
- Test
- X-test

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### 3.3 **Digital Data navigation**

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**Foreword** Functional requirements for digital data are given in ATA Spec 2100, chapter 4.2.1, paragraphs 3.2 to 3.4.

<b>Functional requirements</b>	Browse/Traversal (Navigation)	ATA ref: 3.2
	Manual Front Matter Data	3.2.1
	TOC (table of content)	3.2.2
	Illustrations	3.2.3
	Backtracking	3.2.4
	Bookmark	3.2.5
	Cross References Links	3.3
	Search	3.4
	Word Search	3.4.1
	Scope of Search	3.4.2
Search Results	3.4.3	

**Note** ATA 100 has standardized the structure of some maintenance manuals, such as the AMM (Aircraft Maintenance Manual), bringing to airline users a common “paper interface”, which also transcribes in today’s electronic interface. But other maintenance manuals, such as the TSM (Trouble Shooting Manual) or FRM/FIM (Fault Reporting/ Fault Isolation Manual) do not have this ATA standardization.

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## 4. CBT/Digital Data Standards comparison

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**Purpose** This chapter lists standards presently used in the world of aviation industry for CBT and electronic documentation.

**Spec 2100 standards** Limited to the study of chapter 4 of Spec 2100:

- \* TCP/IP (ref 4.4.1§1.3.3 and 4.4.3§1.2)
- \* FTP (ref 4.4.1§1.3.3)
- \* SFQL (ref 4.2.2§3.1.1)
- \* HTML tables/forms/frames (ref 4.4.3§1.2)
- \* SSL (ref 4.4.3§1.2)

Out of chapter 4, with exact reference to be found:

- \* SGML
- \* ATA CGM
- \* CCITT group 4 TIFF

**AICC standards** The following formats are listed in AGR007 on courseware interchange formats:

- \* CGM
- \* TIFF
- \* MPEG
- \* Quick Time
- \* PICT
- \* WMF
- \* DIB/BMP
- \* AVI
- \* FLIC/FLI
- \* PICS
- \* WAVE
- \* AIFF

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## Appendix: extracts from preliminary AICC survey

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### Scope

This survey was conducted among AICC members in August 1995. It comprised 15 questions. Some of the questions / answers were not relevant to user interface, some were loosely related, some were more specific. So a selection has been made for this white paper.

### On “balance & limits between the ATA & AICC efforts”

“We can declare that Interactive Training involves unique packaging and presentation of data which is largely common to a number of aircraft development and maintenance processes, and therefore we need to determine how to best make use of the (loosely organized) technical data repository defined in the ATA-2100 specifications. In this case, it is the AICC’s role to advise the ATA on how to address the needs of courseware developers in defining extensions to the existing ATA specifications. Rather than incurring the repetitive costs of translating/reformatting/restructuring ATAT-2100 data every time a courseware developer wants to make use of it, we would also encourage tool developers looking for AICC approval to deal directly with the ATA-2100 formats, as tailored for CBT purposes through our recommendations.”

### On “reuse and repurposing of ELS data / use of ELS data for performance support”

“It would appear that most of the repurposing of data would be a one way process, that is, while courseware developers can make use of technical data available through the ELS, there are relatively few types of applications which can make use of data or processes developed specifically to support training. Performance Support Systems (PSSs) are the chief exception to that rule. The existing ATA specifications define relatively rudimentary performance support documents, which provide few opportunities for reuse of Courseware-originated objects. However, more sophisticated PSSs would naturally want to incorporate elements of the CBT which prepares technicians to perform the tasks a PSS supports. There is anecdotal evidence that integrated CBT/PSS systems of this sort improve technician performance. If we are going to try and influence the ATA to address our CBT related issues in the ATA-2100 specs. we ought to be willing to address the needs of PSS developers in our ELS spec.”

**On “one copy of information in one place used for tech. Manuals and CBT”**

“There are obviously a lot of CBT developers who think this is not only impossible, but an intrinsically bad idea. There is a conceptualization problem here, insofar as CBT developers think of the “one place” in which this “one copy” of information would reside, as being a data base representation of the tech manual. The real idea, of course, is that the tech manual is NOT the repository, any more than the CBT is. The tech manual extracts tech data from the repository and applies it to its own, boring, ghastly, incomprehensible uses. The CBT extracts tech data from the repository, and applies it to its own brilliant, scintillating, intuitively appropriate uses. What is hard for people to imagine is developing the technical data in a context independent manner. Having structured specifications like ATA-2100 gets you part way there. But in order to fully implement this concept, the processes by which we develop the original technical data will have to evolve to develop such context-independent data. In the mean time, the “one copy in one place” is just an ideal to be implemented when feasible and worked toward when it is demonstrably beneficial.”

**On “the issues for the AICC-ELS project to consider”**

“..., I would suggest that the major issues we can consider are the ones dealing with guidelines for interfaces and interchange, independent of any particular use.”

“We should contribute to define user interface for new electronic documentation”.

“...specially interested in linking and retrieval issues, and see a role for [software] agents in implementing some of these capabilities...”

## Glossary of Terms

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<b>AICC</b>	Aviation Industry CBT Committee. An international organization regrouping aircraft manufacturers, vendors, airlines and authorities. Its purpose is to provide and promote cost effective implementation of computer based solutions to the training needs of the Commercial Aviation Industry.
<hr/>	
<b>ATA</b>	Air Transport Association. To be expanded.
<hr/>	
<b>CBT</b>	Computer-Based Training. The use of computers to provide an interactive instructional experience. Also referred to as CAI (Computer Assisted Instruction), CAL (Computer-aided Learning), CBE (Computer Based Education), CBI (Computer-based Instruction), etc.  CBT includes SPCBT (Student Paced CBT), ILCBT (Instructor Lead CBT), and JITCBT (Just In Time Computer Based Training)
<hr/>	
<b>CMI</b>	Computer Managed Instruction. A system which manages both courseware and students in a training environment.
<hr/>	
<b>DELS</b>	Digital Electronic Library System. A system which manages storage and interactive access to any technical data, including multimedia. This data includes all of the digital information delivered to an airline and related to an aircraft.
<hr/>	
<b>Effectivity</b>	Identification of airplane to which content is applicable.
<hr/>	
<b>ILCBT</b>	Instructor Lead Computer Based Training. IL Training utilizing CBT.
<hr/>	
<b>IL Training</b>	Instructor-Lead Training: Classroom instruction. One instructor with multiple students.
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<b>Instructor guides</b>	Information useful to an instructor before becoming responsible for IL training, tutoring, or SP training.
<hr/>	
<b>Instructor notes</b>	Information useful to an instructor during IL Training.
<hr/>	
<b>JITT</b>	Just In Time Training: Knowledge transfer or learning about a task that takes place shortly before working on that task.
<hr/>	
<b>Lesson</b>	<p>A meaningful division of learning that is accomplished by a student in a continuous effort -- that is at one sitting. That part of the learning that is between designed breaks. Frequently requires approximately 20 minutes to an hour.</p> <p>OR</p> <p>A grouping of instruction that is controlled by a single executable computer program.</p> <p>Or</p> <p>A unit of training that is a logical division of a subchapter, chapter, or course.</p>
<hr/>	
<b>Maintenance Manual</b>	Document created by the hardware manufacturer that provides information relevant to servicing and repairing that hardware.
<hr/>	
<b>PSS</b>	<p>Performance Support System.</p> <p>“An Electronic Performance support system is an integrated electronic environment that is available to and easily accesible by each employee and is structured to provide immediate, individualized on-line access to the full range of information, software, guidance, advice and assistance, data , images, tools, and assessment and monitoring systems to permit the employee to perform his or her job with a minimum of support and intervention by others.” (Gloria Gery, June 1989)</p>
<hr/>	

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<b>Smart graphic</b>	<p>(Also known as SMG) A graphical object (Typically a cockpit panel or a system page display ) which contains all the display capability of the corresponding physical object.</p> <p>A smart graphic should be controlled by CBT applications. Controls should include visible/invisible state, scale, location on the screen, configuration any dynamic components ( i.e. switch up/down position, push button on/off/fault state, rotary selector position, ...).</p> <p>A smart graphic should send event to external applications ( i.e. mouse click event on push buttons ).</p> <p>A smart graphic should remain unique within courseware data.</p> <p>Smart graphics could be used for multipurpose and by a variety of applications ( CBT, presentations, simulation, ..).</p>
<b>SMG</b>	See Smart graphic.
<b>SPCBT</b>	Student Paced Computer-Based Training. SP Training utilizing CBT.
<b>SP Training</b>	Student-Paced Training: Any form of instruction that a learner can experience at his preferred speed.
<b>Topic</b>	Training unit in a multimedia database. The logic and multimedia elements necessary to transfer a meaningful unit of knowledge, skill, or attitude. Smallest instructionally coherent piece.
<b>TICC</b>	Technical Information and Communications Committee. To be expanded.

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