

Training/Interactive Electronic Technical Manual Interface Guide



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How To Use This Guide

Welcome!

Welcome to the Training/Interactive Electronic Technical Manual (IETM) Interface Guide (TIIG). No matter who you are or how you are using the guide, we hope that it will prove easy for you to follow with the help of the icons introduced below.



This icon indicates that a text section deals with information that is familiar to members of the training community. If you're a Navy trainer, you might want to skim these paragraphs or skip them altogether.



This icon indicates that a text section deals with information that is familiar to members of the IETM development community. If you fall into that category, you might want to skim these paragraphs or skip them altogether.

Other icons that help to guide you through the text are introduced below.



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**Caution!**  
Pay particularly close attention to this text.



Here's a quotation.  
This is a text excerpt, taken verbatim from another source.



Keep this text in mind.  
It's especially important.



Here's a helpful hint.



Here's the answer to something you might be wondering about.

## ***Navigating the Guide***

The icons are used throughout the four main parts of the guide:

- ✓ Part 1: Introduction
- ✓ Part 2: Training Issues
- ✓ Part 3: Business Case Analysis – Training/IETM Interface Functionality
- ✓ Part 4: Training/IETM Acquisition Planning Checklist

Part 1 provides a brief history of IETMs and introduces the concept of concurrent engineering. Part 2 presents four key issues that need to be addressed in the coordinated development, implementation, and support of IETMs and training materials; and Part 3 walks you through the process of performing a business case analysis.

Part 4 presents a checklist to assist acquisition managers in determining the scope of requirements for training/IETM interfaces.

The guide also has 12 appendixes that complement or augment information provided in the four main parts of the guide.

Appendix A provides an Overview of Navy Automated Training Development and Delivery, and Appendix B provides Requirements and Methods for Interface Between IETMs and Training Development/Delivery Tools.

Appendix C contains Interface Examples, and Appendixes D, E, and F list Acronyms, Definitions, and References, respectively.

The remaining appendixes present:

- ✓ Navy IETM Information (Appendix G)
- ✓ Common IETM Standards (Appendix H)
- ✓ Classes of IETMs (Appendix I)
- ✓ IETM Development and Viewing Software (Appendix J)
- ✓ Future Directions for IETMs (Appendix K)
- ✓ Sample SGML Files (Appendix L)

# Executive Summary

## Part 1 – Introduction

This Training/Interactive Electronic Technical Manual Interface Guide (TIIG) is designed to:

- ✓ Support the general IETM acquisition guidelines in the IETM Process Plan with more specific requirements for interfaces between IETMs and training development and delivery tools.
- ✓ Present a business case structure for an interface between IETMs and training tools.
- ✓ Supply business case analysis tools for Acquisition/Logistics Managers to assess the feasibility of expanding IETM functionality to support interfaces with training tools.
- ✓ Provide a checklist for those managers to define development and implementation of IETM functionality required to support the training interface.

Part 1 summarizes recent developments in electronic documentation and hyper-media, which have created many exciting opportunities to revolutionize information access, presentation, storage, and development in the U.S. Navy. Program, Acquisition, and Logistics Managers need to recognize that future Navy infrastructure must support concurrent IETM/training development.

This part also discusses the Tri-Service IETM Interoperability Working Group formed by the Joint Commanders Group for Communication and Electronics (JCG-CE) to develop guidance and policy on:

- ✓ Devising a uniform approach for electronically communicating and accessing technical data throughout the Department of Defense
- ✓ Whenever possible, taking advantage of Commercial, Off-the-Shelf (COTS) technology in the process
- ✓ Creating a common user information interface for field delivery systems

The working group is composed of Service representatives with responsibility for IETM policy, and contractors with extensive experience in IETM development. The committee conducted a DoD study to develop a high-level Joint IETM Architecture (JIA) to guide and standardize IETM acquisition, management, and display. The JIA will maximize accessibility in the use of technical information to meet the needs of the Defense Logistics Community. Both current and future IETM/training tool interfaces must account for the standards and technologies recommended by this working group. The output of the group's efforts is a draft JIA Handbook, which will be endorsed by all the services with the recommendation that it be implemented as formal DoD IETM acquisition policy.

## Part 2 – Training Issues

Part 2 focuses on four basic issues involved in the *coordinated* development, implementation, and support of IETMs and training materials:

- ✓ **Issue 1:** Basic relationship of technical manual data (hard copy or electronic) as the “text book” for development, update, and delivery of training materials
- ✓ **Issue 2:** Models for interaction of technical manual organizations and training organizations
- ✓ **Issue 3:** Concurrent engineering as an agent of organizational change to improve the coordination between technical manual and training development/ update
- ✓ **Issue 4:** Near-term methods for permitting efficient interface of IETMs and training materials, given the reality of separate technical manual and training organizations.

Appendix A and B supplement Part 2 by providing detailed discussion of automated tools for development and delivery of Navy training and on specific methods and requirements for implementing automated interfaces between IETMs and training tools. Appendix C adds examples of current IETM/training tool interfaces.

## Part 3 – Business Case Analysis

Part 3 discusses a methodology for determining and analyzing the resource expenditures necessary to provide the IETM functionalities for interfaces with training development and delivery tools. This part defines formulas for computing a Savings/Investment Ratio (SIR) to assess adding IETM functionality to support interfacing with training tools, as well as data elements which must be provided to support those formulas.

## Part 4 – Training/IETM Acquisition Planning Checklist

Part 4 provides a checklist designed to assist acquisition managers in making several basic but critical decisions affecting the scope of requirements for training/IETM interfaces. It is structured to query acquisition managers and record their inputs to the process for developing and implementing an effective IETM/training tool interface.

### Supporting Material

Several additional appendixes are included to provide the reader convenient reference material relevant to IETM/training tool interfaces:

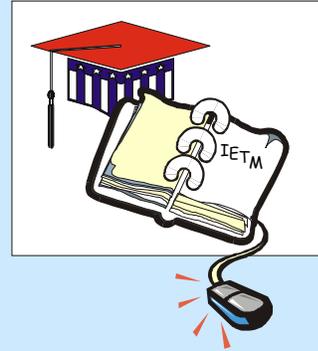
- ✓ Appendix D: Acronyms
- ✓ Appendix E: Definitions
- ✓ Appendix F: References
- ✓ Appendix G: Navy IETM Information
- ✓ Appendix H: Common IETM Standards
- ✓ Appendix I: Classes of IETMs
- ✓ Appendix J: IETM Development and Viewing Software
- ✓ Appendix K: Sample SGML Files Optimized for IETM/Training Interface

# Part 1: Introduction

## About the TIIG ..

This Training/Interactive Electronic Technical Manual Interface Guide (TIIG) is designed:

- To support the general IETM acquisition guidelines in the IETM Process Plan with more specific requirements for interfaces between IETMs and training development and delivery tools.
- To present a business case structure for an interface between IETMs and training tools.
- To supply business case analysis tools for Acquisition/Logistics Managers to assess the feasibility of expanding IETM functionality to support interfaces with training tools.
- To provide a checklist for training managers to define development and implementation of IETM functionality required to support an interface with training tools.



It specifies the requirements for IETM/training interfaces in Navy training acquisition and life cycle support programs.

Activities that have TIIG-related responsibilities are listed below.

- ✓ NAWCTSD: Develop and maintain the TIIG
- ✓ NAVSEA, NAVAIR, SPAWAR: Perform in-process reviews; invoke the approved TIIG as policy guidance on IETM/training development and revision projects
- ✓ CNO (N7): Serve as project sponsor and promulgating authority for the TIIG

## IETMs and Multimedia Training: A Short-Short History

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Acquiring, developing, deploying, and sustaining electronic technical documentation and associated multimedia elements are an emerging area of technology that has rapidly gained acceptance throughout the armed services.

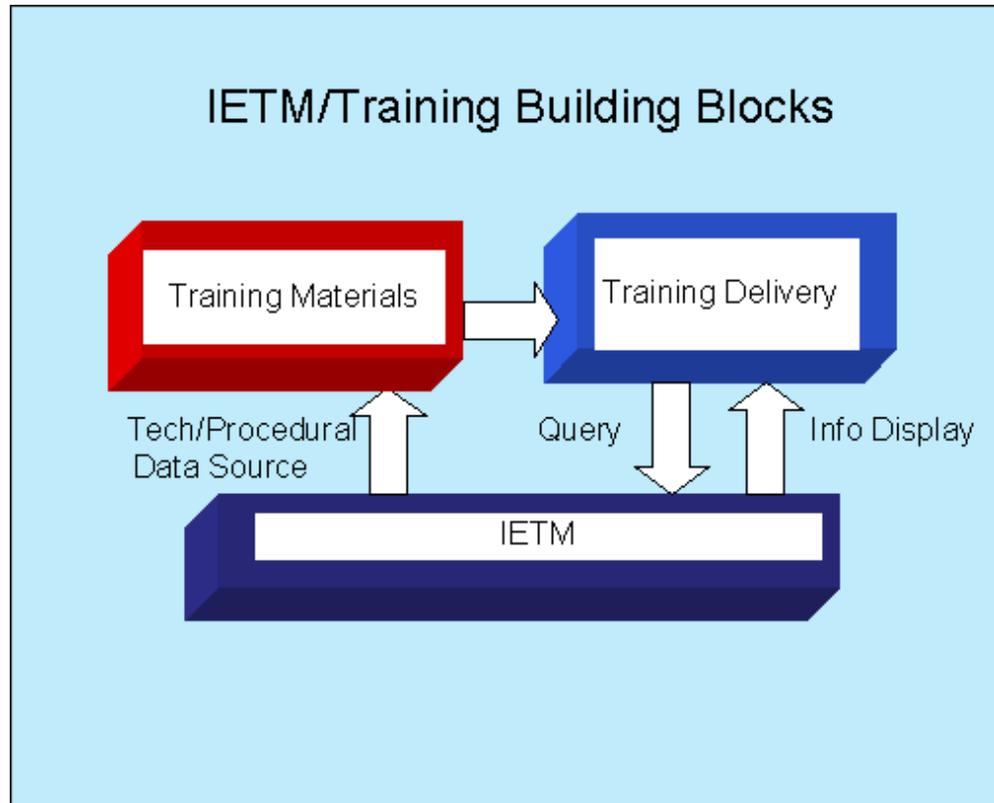
The Internet's explosive popularity has produced an insatiable appetite for near real-time information, which in turn has spurred the demand for electronic media.

At the same time, weapon system managers faced with shrinking defense budgets have turned to a small corner of the information spectrum to meet their technology needs: the IETM, which was conceptualized in the 1980s and became a reality in the early 1990s.

Concurrently, advances in computing power, increased functionality in IETM delivery software, and portability of computers paved the way for a successful electronic documentation delivery and sustainment program. By the mid to late 1990s, pilot programs that coupled IETMs with multimedia training elements emerged, and the armed forces began to see that electronic documentation, combined with a multimedia editing and delivery system to develop more effective classroom instruction, could be extended into the field and reused.

Today, CD-ROMs that contain entire technical manuals and selected interactive training materials can provide users with Just-in-Time (JIT) refresher training when they return to their duty stations. Such electronic performance support systems (IETM technology integrated with training programs) promise both to improve individual performance and to streamline the training pipeline.

Electronic documentation and hyper-media have created many exciting opportunities to revolutionize information access, presentation, storage, and development in the U.S. Navy. The Carderock Division Naval Surface Warfare Center (CDNSWC) has led the effort by supplying guidance, definitions, and specifications. Many contractors have developed and fielded products in support of these initiatives and thereby enhanced information access, training, and on-the-job performance in the Navy.



Program, Acquisition, and Logistics Managers need to recognize that future Navy infrastructure must support concurrent IETM/training development.

## What Is an IETM?



MIL-PRF-87268 defines an IETM as a:

Technical Manual, prepared (authored) by a contractor and delivered to the Government or prepared by a Government activity, in a digital form on a suitable medium, by means of an automated authoring system; designed for electronic screen-display to an end user, and possessing three characteristics [paraphrased below].

- ✓ In an IETM, the format and style of the information are designed for viewing on a computer screen; they are not page oriented. That means that electronic display is quite different from traditional page formats. There are, however, numerous legacy as well as new development

IETMs in the field that are interactive yet maintain certain page format attributes.

- ✓ Related topics are electronically linked as much as possible to give users easy access to the information they need.
- ✓ The presentation medium (display device) is interactive. That means that it responds to user commands and queries and provides user guidance. IETMs may contain expert systems, interactive simulations, and modules to aid end users in understanding, navigating, and problem solving.

## Concurrent Engineering and the IETM

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Concurrent engineering has revolutionized the way that logistics organizations do business. Organizations that integrate logistics disciplines with the design, engineering, and manufacturing of a system have influenced design to improve supportability (which includes operations, logistics support analysis, maintainability, reliability and training) while reducing the cost of support documentation.

Concurrent engineering may be applied to virtually any development effort. IETM development should combine or closely tie all efforts that may provide mutual benefits. This may mean that design influence spills over from one area into a previously separate area. For example, capturing actual bit streams for use in display simulation is more efficient and more effective than taking a photo of the same display and trying to convert it to a crisp, usable format. The direct capture not only provides higher quality results; it also reduces development time.

## What Lies Ahead?



In recent years, logistics technologies have been evolving rapidly. The following table lists some of the advancements that are now just over the horizon.



- ✓ New acquisitions will be able to take advantage of object-oriented database technology as it continues to mature.
- ✓ Use of operational software in the creation and display of tactical information may also become part of support documentation.
- ✓ Interlinking of diagnostic systems, on-board training systems and support documentation, and concurrent development and display of support information with tactical information at a system workstation are practical, near-term goals. (In some of the most recent Naval programs, the combination of on-line IETMs with on-board operation and maintenance training is already being required in order to provide users on tactical platforms with the most comprehensive and accessible support information possible.)
- ✓ New, more cost-effective methods for legacy conversion will be developed.
- ✓ Faster computers and better monitors will permit a wider range of multimedia use, and users will demand real-time access to data.
- ✓ As the Services field more and more information systems, users will gain access to a completely integrated operation that includes training, parts ordering, and expert diagnostic systems.
- ✓ Any time, anywhere delivery of IETMs and training materials via the Internet and intranets in HTML format.

Because future military operations are increasingly likely to consist of joint missions in which one Service might be required to repair another Service's equipment, the JCG-CE has formed Tri-Service IETM Technology Working Group (TSWG) to develop guidance and policy on:

- ✓ Devising a uniform approach for electronically communicating and accessing technical data throughout the Department of Defense

- ✓ Whenever possible, taking advantage of COTS technology in the process
- ✓ Creating a common user information interface (COTS Web browsers) for field delivery systems

The working group is composed of Service representatives with responsibility for IETM policy, and contractors with extensive experience in IETM development. The TSWG in turn formed a task force to conduct a DoD study to develop a high-level JIA to guide and standardize IETM acquisition, management, and display.



The JIA will maximize accessibility in the use of technical information to meet the needs of the Defense Logistics Community

To reduce implementation risks and demonstrate the utility of the working group's approach, the policy recommendations are based on a series of FY99 pilot demonstration programs that showed the applicability of the JIA to support IETMs for the full range of military systems.

The primary goal for the JIA is to establish a technical framework for acquiring and deploying the whole spectrum of IETMs. When completed, users will be able to view and utilize technical information distributed to work locations through a common user interface, no matter what authoring source or data format is employed. DoD will thus be able to establish a unified approach to the acquisition, management, and use of existing and newly procured IETMs.

To meet this goal, the overall approach will be based on maximum use of existing COTS and Non-Developmental Item (NDI) equipment, the Internet and World Wide Web technology.



A secondary goal is to achieve end-user-level accessibility of the IETMs delivered to and used by the entire DoD operational community. In this context, an IETM has end-user accessibility when it can enable a user with one common, commercially available display device (such as a portable personal computer) to:

- ✓ View and interact with technical information from any source and in any internal format.
- ✓ Automatically access and view, by means of an electronic-link reference in the displayed technical information, additional information in any other IETM.

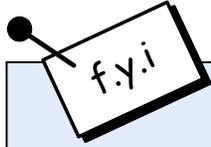
### note:

To learn more about this important new development in IETM acquisition, see <http://navycals.dt.navy.mil/ietm/ietm.html>.

## Part 2: Training Issues

Part 2 focuses on four basic issues involved in the *coordinated* development, implementation, and support of IETMs and training materials:

- ✓ **Issue 1:** Basic relationship of technical manual data (hard copy or electronic) as the “text book” for development, update, and delivery of training materials
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A fundamental tenet of Navy training is that course content is driven by the documented information and procedures sailors use as fleet operators and maintainers. This is just as true with IETMs as it has been with hard-copy technical manuals. The better the coordination between technical manual and training developers:

- ✓ the more usable technical manuals will be as “text books” for training development and delivery
- ✓ the more technical manuals will benefit from the usability inputs of the training developers.

### Issue 1: Tech Manual as the Bible for Training

Electronic training and training environments have been a natural spin-off of IETMs. Interactive Courseware (ICW) was the first effort to take advantage of this new medium. Already, electronic training systems, in conjunction with IETMs, have demonstrated their ability to reduce

**note:**

A detailed discussion of electronic training development and delivery tools is provided in Appendix A.

training development and instruction times. Advanced systems that provide IETM capabilities integrated with a tactical system also lend themselves to computer-based training. This can be accomplished by providing an IETM with a tactical system simulation.

Knowledge of and data for the learning environment must be separate from the software used in its implementation. By separating knowledge and software, the knowledge data can be updated more easily and managed as a data set.



This feature of training development is especially important in the development of multimedia training for the end user. If the ICW is delivered in the same environment as the IETM, it can be presented in the IETM for onboard use, and the IETM can be used in the classroom in parallel with the curriculum. For example, interface between an HTML-based IETM and HTML-based ICW is easier to implement than if the ICW is delivered with a proprietary viewer.

The approach does, however, present problems to Navy training maintenance activities if the curriculum is not separable from the IETM. Much of the Navy support infrastructure does not currently provide for concurrent IETM/Training document management, although there are significant exceptions; e.g., ARCI, Virginia Class SSN, and LPD 17 programs.



Development and presentation of electronic examinations are a natural extension of the electronic instructional environment. Exams are given on-line to help the student and instructor gain an understanding of:

- ✓ How well the student understands the subject matter, and
- ✓ How effective the material and environment are in conveying the subject matter.

An electronic exam system should be able to accomplish both development and assessment tasks.

Exam development allows Subject Matter Experts (SMEs) to tie questions directly to individual Learning Objectives (LOs) and provide the number of questions required for each LO. Ideally, this is an on-line, iterative process. Student record administration, test item analysis, and exam bank administration are also significant features to be considered in the acquisition or development of an electronic testing system.

With electronic exam functionality completely integrated:

- ✓ An exam can be developed, generated, administered, graded and recorded
- ✓ A remediation plan can be produced and tracked
- ✓ Individual and group performances can be analyzed and evaluated — all automatically

The electronic instructional environment should use a variety of system presentation methods and instructional techniques to promote students' comprehension. In the electronic instructional environment, the IETM has shown its ability to far exceed the capabilities of paper manuals. All front matter, text, and graphic references can be hyperlinked to provide instant data access. This is especially useful if the references include Trainee Guide/IETM or Lesson Plan/IETM links. Full text search, annotation, and bookmark functionality have improved data access and note-taking capabilities for both students and instructors.



Given the current Navy infrastructure and the way that support documentation is maintained, it is important for IETM developers to provide a means for separate technical manual and training documentation deliverables, if both are developed concurrently. If they are delivered separately, it is important for developers to provide a means for updating them that ensures that they will remain consistent with each other.

**note:**

Today's military budgets demand the cost-effective development of IETM products that serve both maintenance and training requirements. IETMs are a key source of data to implement the electronic classroom and on-the-job training. Training benefits from IETMs have already been demonstrated through practical applications in several programs, such as BSY-2 and LM-2500 systems.

Training development for a system is a long and complex Integrated Logistics Support (ILS) process that begins early in system acquisition. Clearly, there is a major interface between development of training and the development of IETMs. When appropriate, a Training Plan (or equivalent) should address those IETM items needed for familiarization, formal classroom, and on-the-job training for system operation, maintenance, and other special forms of logistics support.

Identifying and understanding requirements and interfaces requires close coordination between the maintenance planning, technical manual, and training disciplines for an IETM.

In order to determine the IETM functionality needed to economically support training, input is required on training infrastructure requirements and training objectives to:

- ✓ Develop, reduce, or eliminate formal course training
- ✓ Develop on-site training
- ✓ Define and develop a shared IETM and training database

Once the equipment and user training requirements are determined, all disciplines must identify the issues and resources they require to implement the IETM within their communities. The Training Plan, which documents these requirements, as prescribed in the IETM Process Plan (Section 3), is needed before award of the IETM development contract. This definition of IETM features that are necessary to support the training requirements (whether in a formal classroom or on-site) can be part of the functional baseline for IETM development and maintenance.

## Issue 2: Integrated/Interfacing Training Strategies and Issues

A number of issues are involved in the integration of electronic versions of technical manual data (the source of technical data for training materials) and automated electronic training development and delivery systems.



The following paragraphs address the selection of an interface strategy and other issues that Program Managers must resolve in developing logistics support for a system or equipment. Due to the rapid advancement and employment of automated tools to create and present technical data, failure to address these issues may lead to early problems in implementing even conventional systems.

The IETM Process Plan defines four strategies for approaching the interface between training and the IETM development process:

### Four Interface Strategies

**Coordinated (exchanging files, interfacing software):** Independent IETM and training product development with planned and coordinated exchange of IETM files, software, etc. for interface with automated curriculum development programs.

**Concurrent (developing some shared data, sharing/interfacing software):** Simultaneous, planned, and coordinated development of IETM and training support products; development and use of shared data and software; initial joint planning and requirements determination which enable data integration into the training curriculum.

**Integrated (developing a shared database; sharing software):** Structured, concurrent, and shared development of all maintenance, operations, and training materials into a single, fully integrated database that uses multiple tailored view packages to present material to various users.

**Embedded:** Combining all requirements and materials into an integrated database with a single view package so that training materials are indistinguishable from maintenance, operations, and other materials; enable operations, maintenance, and training personnel to use a single product.

During initial planning, the Program Manager must decide which approach will provide the most benefit, including acquisition and support of both IETM and training requirements throughout the life cycle. Because training will have a significant impact on both acquisition and life cycle costs, these decisions may affect the choice of IETM that will most appropriately support the system and the fleet.

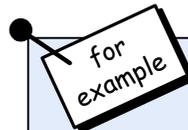
## Issue 3: Concurrent Engineering Must Drive Logistics Organization Changes

The electronic training and IETM interface has organizational implications for both the Government and contractors/developers. Traditional logistics organizations are divided into product-oriented groups (such as provisioning, training, technical manuals) that support specific logistics functions (such as supply support, training and maintenance). Differing requirements, goals, timing, and funding have kept tech manual and training products and the development processes distinct.

The development of an IETM offers a fresh opportunity to integrate separate engineering and logistics functions into a single process team that focuses the leadership and work force on the entire logistics spectrum. This confluence also offers an opportunity to improve the quality and consistency of all logistics products, while reducing both initial and life cycle resource requirements.

Under the accelerated and integrated acquisition processes for new ships, aircraft, and weapon systems, training and technical manual data needed to teach a course may be jointly

and concurrently developed. Occasionally, the training schedule may even require that training begin before the system or its technical manual is complete.

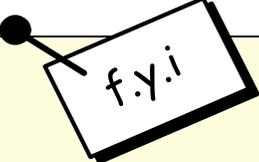


For example, the technician who repairs and the instructor who teaches the equipment can pool their knowledge and develop a single set of data that satisfies multiple requirements and enhances work performance and quality at any maintenance level. The writer can be either an SME or a third party skilled in preparing technical data. This would ensure that data is sufficiently granular, or properly subdivided, to satisfy multiple requirements while enhancing work performance at the organizational or intermediate level.

Traditionally, the basic outline of the technical manual is developed from an approved book plan that contains all paragraph elements, tables, and figures needed to support a basic curriculum plan.

Because the more advanced types of IETMs will at least have all of the required data, but will not have the traditional publishing organization, the equivalent of a book plan must be developed to provide the definitions and relationships that satisfy the need for understandable and mutually agreeable “hooks.” This navigation tool is then populated with cross-references between traditional organizational elements and an object identifier (ID) for each element. The cross-reference IDs are stored and managed in a database and provide the links in the final product.

As more detailed information is developed by tech manual authors, the IDs can be expanded under this structure. The new IDs are made available to curriculum authors, who use them to improve the accuracy of the curriculum references. It is easier to integrate a static or completed data set with a developing data set. But in the case of parallel development, integration is part of the overall process during creation of both data sets.



### Training Impact On CONOPS Development

Whether to produce an IETM, what kind of IETM, and how to connect the IETM with other requirements (e.g., training) to improve logistics support, are lengthy, complex, and interrelated. Conveying the breadth of background, knowledge, and understanding needed to derive the product desired is made more difficult by adding training factors and considerations. This further supports the concept of documenting factors and decisions and establishing the conditions within and under which the IETM and training products will function.

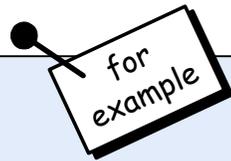
Preparing the Concept of Operations (CONOPS) Document, as prescribed in the IETM Process Plan, and expanding it to include these additional considerations is still the most effective approach to clarify issues and establish parameters to help a manager select optimal IETM functionality levels consistent with program, IETM, and training requirements. The Program Manager can then develop performance statements, mapped to conditions in the CONOPS, to use in the Technical Manual Contract Requirement (TMCR) and any other requirements document that deals with the interface of IETMs and training products.

Additionally, as training and IETMs become more intertwined, the existence of an organized and structured way of monitoring, acknowledging, and addressing the total impact of change can provide insight and understanding and obviate the need for hasty or ad hoc changes. By highlighting and monitoring factors that are critical to IETM and training success, decision processes can be periodically or specifically revisited and parameters adjusted, if necessary, to ensure that change is accommodated and continued success is assured.

## Interface vs. Integration of Training and IETMs

The design of the database is one of the more sophisticated and technical decisions that need to be made. There are essentially two choices. The first choice is to divide and manage the tech manual data as objects that are some variant of their original form (raster-scanned page, tagged paragraph, warning, title, etc). For text files already in digital form (Class II/III), data are generally tagged in accordance with MIL-PRF-28001 with little or no significant reauthoring. The files may remain in a linear format, particularly where hard-copy versions of the tech manuals are also required.

This orientation toward hard-copy product formats is well suited to existing training processes, where traditional linking ties data (e.g., paragraphs, tables, figures, videos) to specific learning objectives. The data extracted from the IETM, however, must often be processed to glean only a specific portion needed to meet a Learning Objective (LO).



An IETM paragraph often contains a level of detail that can obscure the point of the learning objective or confuse the student.

Legacy data conversions that attempt to fully accommodate such training requirements may find that additional data handling, authoring, and processing increase conversion costs enough to change the initial decisions on the selection of IETM or conversion type.

The second choice is to build the data as an object (Class IV/V) database, where information is broken down into small units (steps) that are connected by the inherent logical hierarchical structure of the database (as discussed in MIL-PRF-87269). Typically, this process will evolve from a new acquisition or major modernization for which the documentation is already being substantially redone. A big advantage is that an integrated team of training and tech manual authors can ensure that these steps:

- ✓ Are at the smallest logical unit that accommodates both tech manual and training team members
- ✓ Are phrased with language that can be used by both with no additional processing

Curriculum connections are made at points in the hierarchical structure that provide access to sets of data that may include graphics, animations, and audio. For the maintainer, these data sets can vary in response to the actual conditions found at each decision point. That is, the IETM can propose alternative courses of action based on input from the technician, equipment historical files, diagnostic data, maintenance schedules, and a variety of other factors.

Because of specific training objectives, the trainee's use is more constrained. This mandates a more active training role in concurrent development of electronic training and IETM requirements and products to maximize the benefits. Significant effort must be invested in initial planning and coordination, but many benefits can accrue through the elimination of redundancies in authoring, reviews, formatting, storage, and data. The reduction in life-cycle costs is also significant but difficult to fully measure in the absence of practical experience with a sufficient number of mature, fielded systems.



Early program decisions on the most beneficial approach to IETM/training interface enable coordinated planning for support of both sets of requirements throughout the life cycle.

## Life Cycle Configuration Management and Update Considerations

Budgeting, funding sources and priorities, update cycles, and distribution vary widely between the hardware and required logistics products. On one hand, an interfaced or integrated logistics system can substantially reduce life cycle costs and improve user performance.

On the other hand, failure of any portion of the system to effect changes on a timely or synchronized basis can rapidly lead to disconnects in the existing manual system. In comparing electronic databases with their manual counterparts, the difference is that manual systems generally allow users to “make do” with available data; the computer may simply provide a “file not found” message, which may frustrate users and actually have a negative impact on readiness. Thus, proper planning and process modification are needed to ensure that a single engineering update is sufficient to satisfy all logistics needs and appropriate modifications are made to the logistics infrastructure.

Traditionally, training lags behind other equipment and logistics changes by weeks or months. But synchronization of the electronic training and IETM products demands that changes occur simultaneously. Currently, there is no formal mechanism to ensure this happens. Failure to synchronize electronic training and IETM products may:

- ✓ Cause electronic products to simply stop working (e.g., the training system is unable to find expected data and “crashes”) or
- ✓ Force all joint users to use the last common revision, even though it does not reflect current installations.

Where the IETM is embedded within the operational software of the actual hardware system, this problem can become even more complex, and life cycle planning must account for it in overall system deployment and operational plans.

Reducing the costs for life cycle support is a key objective for both automated training and IETM development. Both consider automated processes for reducing development and update costs and for improving the delivery of the data to the user. For training, fewer classroom hours may be a key measure of success. It may reduce the number of instructors and students in the training pipeline.

The IETM may similarly enable personnel with less skill or little training to perform functions at an acceptable level of performance. In both cases, the net result is that training costs can be reduced and maintainers who are able to perform increasingly sophisticated and demanding work are available sooner.

Adding training developers, instructors, students, and other related users into the IETM requirements increases the complexity but does not change the decision-making process for functionality determination.

Three elements are involved:

- ✓ Function
- ✓ Functionality
- ✓ Feature

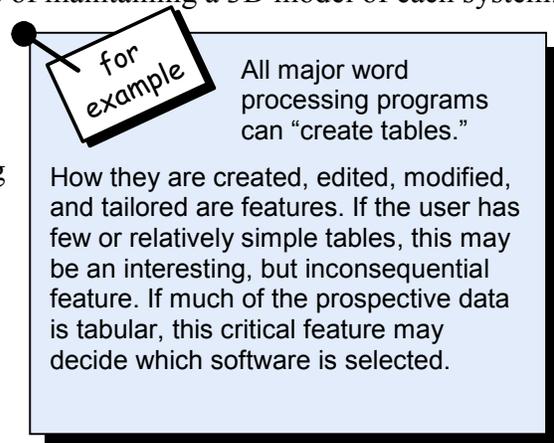
Function is the customer task that must be satisfied (e.g., manage and update drawings).

Functionality is the capability to perform that function. For example, the function “update drawings” may be satisfied by:

- ✓ “edit 3D CAD,”
- ✓ “edit 2D CAD,”
- ✓ “edit with vector over raster,”
- ✓ “edit raster,” or
- ✓ “input new drawing.”

The products derived from each are clearly different. There is also a substantial difference in the infrastructure investment, training and life cycle costs required for each. Thus, while giving the user the ability to “walk around” a 3D version of the system is desirable, the benefits may not justify the life cycle costs of maintaining a 3D model of each system.

The choice of functionality, therefore, depends upon potential cost, priority, expected uses of the resulting product, projected benefit, and other related factors. Once selected, various software packages are examined for features (i.e., how the functionality is provided).



for example

All major word processing programs can “create tables.”

How they are created, edited, modified, and tailored are features. If the user has few or relatively simple tables, this may be an interesting, but inconsequential feature. If much of the prospective data is tabular, this critical feature may decide which software is selected.

Training may increase the functionality requirements and probably will change the priority and importance of specific functionality.

- ✓ Specific features may be critical to training but not to developers or maintainers and vice versa, thus complicating software selection.
- ✓ Because most programs also provide a range of functionality, decisions may involve some duplication or sub-optimization of functionalities to obtain the most cost-effective or productive mix.
- ✓ The addition of training requirements and functionality may also impact the selection of the database management system and associated presentation software and hardware.

Thus, training input must be an integral part of this decision-making process in order to ensure an optimal mix of software that works together and provides at least adequate functionality for all potential users.

Using standard formats, selecting mainstream software and hardware, documenting processes, purifying and managing data are all critical to having a system that is able to continuously satisfy the functional requirements of users. (Note: It is essential to migrate source data to compatible formats to support effective interface between training and IETM programs.)

Planning for orderly progress is challenging when migration is unilateral (tech manuals), but it becomes significantly more complex when migration is multilateral (e.g., tech manuals, training, supply support). This is particularly true when programs have followed the “rules” and are using COTS resources. A prime benefit of COTS products is that they are constantly upgraded at modest or no cost to the Government. However, COTS products sometimes require application tailoring or selection of application options. Moreover, when multiple COTS packages are used, the specific interface and integration tailoring are left to the using activity. Thus, any COTS upgrade may upset the balance between packages, leading to significant programming, re-tailoring, or worse. The problem can be significant when the original developer is still engaged, but it can be severe when the system has been turned over to a Government maintenance activity that is not familiar with, or prepared to update, the integration software.

With multiple migration paths to consider, a key part of strategic planning is to determine where interfaces and integration occur and how they are impacted. For example, if multiple presentation systems feed off of the same database, each can be independently upgraded without direct impact, so long as the interface with the database is constant. Modifying the database may, however, impact all application programs. Although such problems cannot be solved by strategic planning, they can be addressed with management attention focused on key decisions to mitigate impact.

## Issue 4: IETM Interface Decisions



The program decision to use an IETM and interface it with training involves a commitment of resources to accomplish one or more objectives that will reduce costs and improve operational availability, worker productivity, and quality. Whether acquiring new data or converting existing data for use in an IETM, three key decisions must be made:

- ✓ **Functionality:** What capabilities and features are desired?
- ✓ **Standards:** Which Government, commercial, performance (or other) standards will be required?
- ✓ **Data Structure:** What tools will be used to create, assemble, or manage the IETM data?

Each decision is an enabler, facilitator, or constraint for other decisions. For simplicity, decisions on data structure, standards, and functionality will be collectively referred to as “functionality” unless otherwise noted. Clearly, the functionality selected has critical impact on:

- ✓ Cost of and time needed for conversion
- ✓ Users’ ability to gather and use data
- ✓ Costs and ability to maintain and update the data
- ✓ Ability to interface, interact, and share data with other logistics processes (such as training) and data files
- ✓ Ability, cost, and effort to migrate in the future to newer technology

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note

### Further Reading . . .

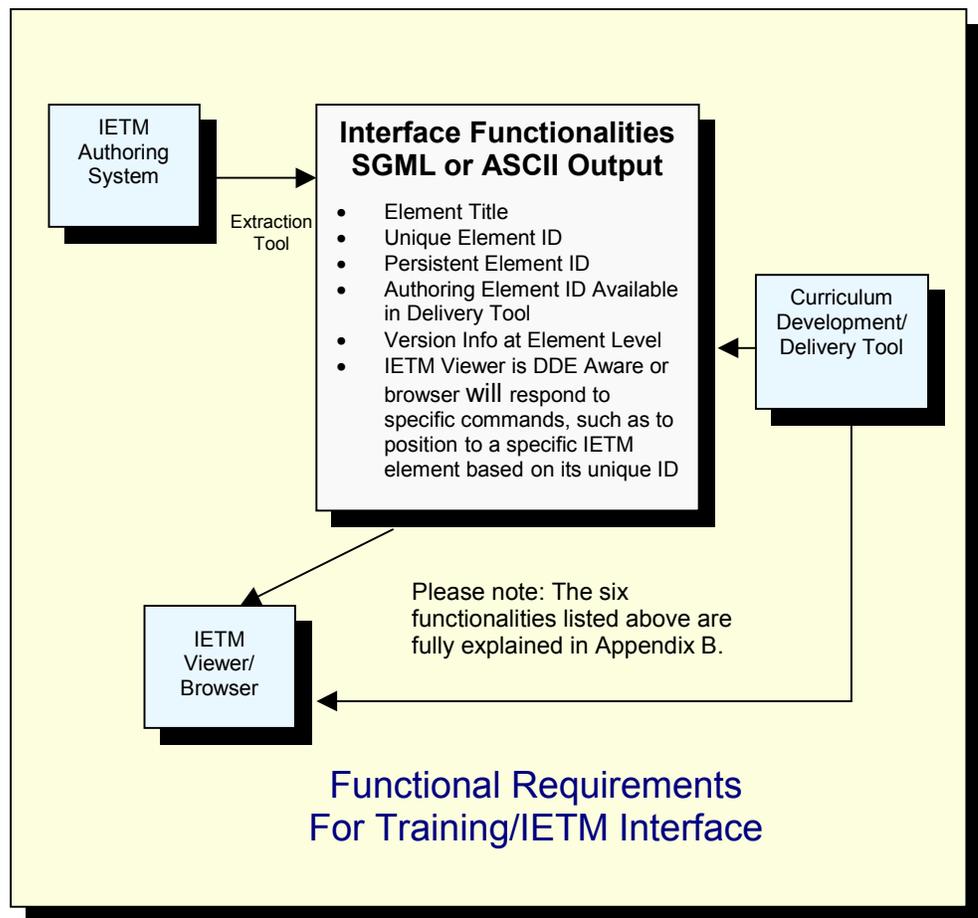
Appendix B presents scenarios for both manual and automated interfaces between IETMs and training development and delivery tools. This discussion assumes the current predominance of separate tech manual and training development organizations. The interface mechanisms presented bridge those gaps, based on minor additional functionality included in the IETMs. Appendix B describes currently operational IETM/training interfaces as well as prototypes for additional interfaces, reusing most components of the current interfaces with minor changes.

Appendix C details specific examples of the currently operational interfaces.

# Part 3: Business Case Analysis

Reduced budgets require cost-effective development of IETM products that serve both maintenance and training requirements. IETMs are the key source of data for implementing the electronic classroom and conducting on-the-job training.

The following paragraphs discuss a methodology for determining the resource expenditures necessary to provide the six IETM functionalities required for all training/IETM interfaces supporting development and delivery tools.



Business case analysis has become the technique of choice within the Information Technology (IT) arena. Moreover, it has been accepted by the Office of Management and Budget, as well as System Decision Paper (SDP) and Milestone Review authorities for major acquisitions.

## What Is a Business Case Analysis?



Business case analysis is a systematic approach to evaluating the relative worth of a proposed project. The technique is based on the premise that there are alternative ways of reaching an objective and each alternative requires certain resources and produces certain results.

**for example**

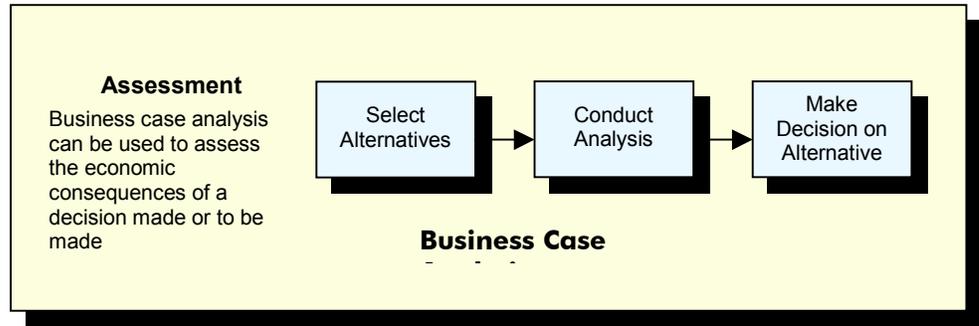
**Alternative A:**  
Continue manual technical inputs to training materials (development, maintenance, and surveillance, etc.)

**Alternative B:**  
Using IETMs, provide the needed six functionalities, automating the Training Material/IETM interface.

**Requirement to Achieve Alternative B:**  
Funding to implement the six functionalities (**initial costs**) and costs resulting from process changes necessary to provide data in the authoring system (**recurring costs**)

The alternatives identified above incorporate the following basic principles:

- ✓ The analysis investigates one or more reasonable alternative methods of satisfying a given objective (providing an effective [technical and cost] transfer of technical material into the training development and delivery tools). To be reasonable, an alternative must be both technologically and operationally feasible.
- ✓ The analysis must consider both current and future expenditure patterns of the alternatives being considered (e.g., current manual method and the proposed training/IETM interface functionalities).



The assessment assumes:

- ✓ A given decision or set of decisions have been made or will be made.
- ✓ It is desirable to assess the economic consequences of the actions.

The assessment considers how long it will take to recoup the investment cost through cost avoidance in training material life-cycle support.

## Limitations

A business case analysis has three major limitations:



- ✓ A business case analysis is not a method for choosing the preferred means of meeting an objective; it is only an input to the decision-making process. The decision-maker must weigh the results of the analysis against other factors such as response, product quality, accuracy, user environment, and tools needed.
- ✓ A business case analysis does not normally establish priorities among various goals and objectives. It merely determines the most cost-effective means of satisfying the stated objective.
- ✓ A business case analysis cannot provide results that are more valid than the input data. Judicious formulation of assumptions and careful estimation of costs and benefits are therefore critical to the process.

## The Savings/Investment Ratio

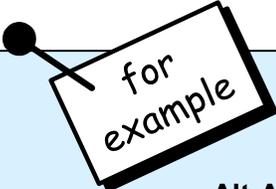
Many business case analyses are performed when a potentially less costly alternative is proposed to a given requirement that is already being met. To measure the degree of financial benefit that can be attained from investing in that alternative, an SIR is computed.

An SIR shows the relationship between future cost savings (and avoidance) and the investment cost necessary to effect those savings. An SIR of 1 indicates that the value of savings is equal to the value of the investment. Thus, for an investment to be economically sound, the SIR must be greater than 1. When computing an SIR, the analyst is not interested in total operations costs – only the difference between life-cycle operating costs for the two alternatives; that is, the effect the investment has on the operation.

If:

- ✓ A = the current manual method,
- ✓ B = the automated training/IETM interface, and
- ✓ I = the investment (the sum of initial costs and recurring costs),

the following rules apply:

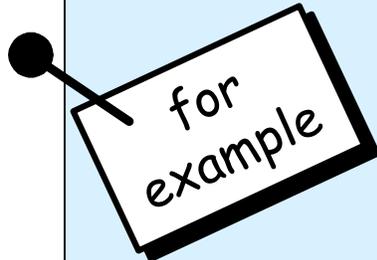


|                                                      |              |
|------------------------------------------------------|--------------|
| <b>Alt A</b>                                         | <b>Alt B</b> |
| <b>(Manual cost – (automated cost + Investment))</b> |              |
| <hr style="width: 80%; margin: 0 auto;"/>            |              |
| <b>Investment</b>                                    |              |

**Notes:** (1) All data is presented in current FY dollars.  
 (2) The SIR formula is further defined under "Data Elements (page 3-6).



The crucial question is the following: Is the cost avoidance of B relative to A sufficient to warrant the investment cost that would be necessary to implement Alternative B?



A course of 20 weeks in length is being maintained manually at a cost of \$10,000 per year and life cycle is projected for 5 years. All dollars are in FY 00 and are not discounted. The technical materials are being developed as an IETM. A proposal has been made to provide six functionalities to effect an interface to connect training materials to the IETM automatically.

The following costs are used to demonstrate the SIR formula:

- Alternative A = \$50,000
- Alternative B = \$20,000
- Investment = \$5,000 (Initial cost)  
+ \$1,000/year (recurring cost for 5 years = \$5,000)

$$\text{SIR} = \frac{50,000 - (20,000 + 5,000 + 5,000)}{10,000} = 2$$

An SIR of 2 means that an avoidance or savings equal to two times the investment will result from the example above. Three points should be noted:

- ✓ Initial investment is stated in current FY funds and is a one-time entry.
- ✓ Recurring costs are stated as costs per year times the number of years in the life cycle.
- ✓ Alternatives A and B consist of the same data elements of different values and cover the same fiscal years for life cycle.

## Data Elements

The SIR calculation is the final step in the business case analysis process. The SIR uses dollars (funding) to perform the calculation. The dollars represent three primary parts of the computation; that is, Alternatives A and B and the Investment required for the interface. Before listing the data elements, a review of the SIR formula is provided below to ensure there is a clear understanding of what parts of the formula constitute which elements.

### Data Elements for Alternatives A and B

The elements required for computing cost data for a business case analysis are listed below. The elements are the same, except for Links per Week (L/W), which is reduced substantially by IETM interface.



#### Data Elements for Alternatives A & B

- ✓ TCW Total Course Weeks of training material or course(s)
- ✓ L/W Links per Week\*
- ✓ R/Y Revisions per Year
- ✓ M/L Minutes per Link to perform function (estimated or assumed)
- ✓ C/SM Cost per Surveillance Minute
- ✓ LCY Life Cycle (5 or 10 years)

\* For Alternative B (Automated), Element L/W is the percentage (%) of change only. This is a result of functionality 5 (Version Information at Element Level), which allows for efficient maintenance of curricula when a later version of the IETM is selected for use in the curricula. The best estimate at this time is 25% change and is identified specifically by functionality 5.

### Data Element for Investment

Investment costs are composed of two elements:

- ✓ Labor and software cost for initial implementation of the six required IETM functionalities to implement and maintain the IETM/training interface. These implementation costs will vary for each program depending on the IETM developer's expertise in the authoring system and on the functionality built into the authoring system. (initial costs [IC])

- ✓ Labor cost to provide manual updates to versioning information (if required) for the automated interface (recurring costs [(RC)]).

The value for Investment is also expressed in current FY dollars. It is used in the formula in two ways:

- ✓ as a divisor
- ✓ as an addition to Alternative B.

In the example that follows, the data elements appear in parentheses.

for  
example

A 10-week course (**TCW**) has been developed and is being taught in a Navy school. A decision has been made to develop an IETM for the technical manuals. The Training Manager has proposed automating the training/IETM interface. The estimated cost to include the six functionalities is \$5,000. There are 100 links per week (**L/W**) and each link requires 5 minutes to conduct surveillance (**M/L**). The cost for training support is \$50 per hour. There will be one revision of 25% of the links to the IETM each year (**R/Y**), and the life cycle is 5 years (**LCY**).

| Element | Alt A      | Alt B                 |
|---------|------------|-----------------------|
| TCW     | 10         | 10                    |
| L/W *   | 100        | 25 Note: only changes |
| R/Y     | 1          | 1                     |
| M/L     | 5 = .08/hr | 5 = .08/hr            |
| C/SM    | \$50/hr    | \$50/hr               |
| LCY     | 5 years    | 5 years               |

\* % of links changed at revision is 25% for Alt B (25 each)

# Formulas

The first portion of this section identifies all data elements that are necessary to conduct the training/IETM interface business case analysis.

The collection of the required data to make the calculations will include inputs from both IETM and training personnel. Some data elements may require the use of assumptions or estimates. They will be clearly identified, and the reason will be explained.

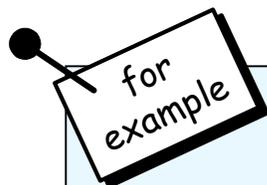


The ultimate comparison formula, SIR, is a characteristic of **costs only**. In the current Navy training process, the business case analysis evolves from a situation in which a given requirement is already being met, but a less costly scenario is perceived or proposed.

The second portion of this section provides the formulas necessary to conduct the business case analysis. The formulas are explained in detail, and examples are included that clearly demonstrate the process.



Again, a business case analysis cannot provide results, which are more valid than the input data. Judicious formulation of assumptions and careful estimation of cost data are critical to the business case analysis process. The business case analysis process does not establish priorities; it merely seeks to determine the most cost-effective means of satisfying a given objective; that is, reduction in price to develop, maintain, and conduct surveillance of training materials.



**Alternative A**  
 $10 \times 100 \times 1 \times .08/\text{hr} \times \$50/\text{hr} = \$4,000/\text{year} \times 5 \text{ yr} = 20,000$

**Alternative B**  
 $10 \times 25 \times 1 \times .08/\text{hr} \times \$50/\text{hr} = \$1,000/\text{year} \times 5 \text{ years} = \$5,000$

**SIR =**

$$\frac{(A) (\$20,000 - ((B) \$5,000 + \$5,000))}{5,000} = \frac{\$20,000 - \$10,000}{5,000} = 2$$

Thus, SIR = 2 The investment of \$5,000 for this example is economically sound.

Note: If the life cycle is longer, the SIR increases.

## Business Case Analysis Tools

In conducting a business case analysis, two formulas are required. One is used two times with differences in the data elements (quantities). This will be a result of changes in data element L/W in the calculation of the costs of alternatives A and B.

- ✓ Cost of Alternative A (Manual Cost)

$$\text{TCW} \times \text{L/W} \times \text{R/Y} \times \text{M/L} \times \text{C/SM} \times \text{LCY} = \text{Cost of Alt A}$$

- ✓ Cost of Alternative B (Automated Link Cost)

$$\text{TCW} \times \text{L/W} \times \text{R/Y} \times \text{M/L} \times \text{C/SM} \times \text{LCY} = \text{Cost of Alt B}$$

L/W: changed links only  
(25%)

- ✓ Investment (I)

$$\text{IC} + \text{RC} \times \text{LCY} = \text{I}$$

- ✓ Savings/Investment Ratio (SIR)

$$\frac{(\text{Cost of Alt A} - (\text{Cost of Alt B} + \text{Investment}))}{\text{Investment}} = \text{SIR}$$

Note: An SIR of more than 1 indicates a sound investment. The higher the SIR, the more sound the investment.



The material data elements and formulas in Part 3 will be used extensively in completing the checklist in Part 4.

## Part 4: Training/IETM Acquisition Planning Checklist

This checklist is designed to assist acquisition managers in making several basic but critical decisions affecting the scope of requirements for training/IETM interfaces. It is set up to query acquisition managers and record their inputs to the process for developing and implementing an effective training/IETM interface.

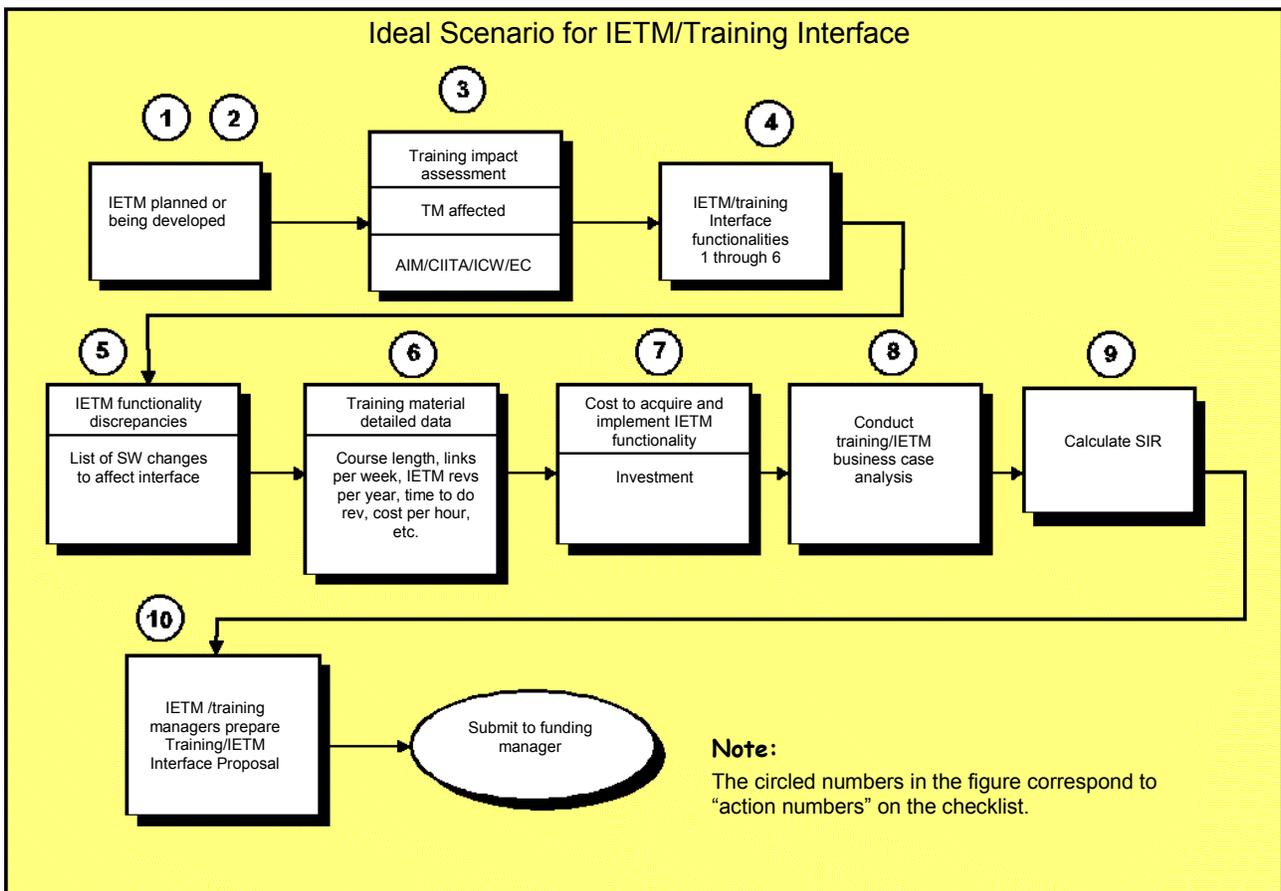
The checklist:

- ✓ Begins with technical manual/IETM data (completed, underway, or planned),
- ✓ Proceeds through functionality queries for training interface,
- ✓ Requests funding data,
- ✓ Requests information for training development and delivery tools, and
- ✓ Provides a set of business case analysis formulas with blanks to be filled in.

The figure that appears on the following page shows the ideal scenario for IETM/training interface planning process.

The following acronyms and abbreviations are used in the flow chart shown below:

- ✓ AIM      Authoring Instructional Materials
- ✓ CIITA     Computer Improved Instructor Training Aid
- ✓ EC        Electronic Classroom
- ✓ ICW       Interactive Courseware
- ✓ IETM     Interactive Electronic Technical Manual
- ✓ SIR        Savings/Investment Ratio
- ✓ SW        Software
- ✓ TM        Training Material



## Checklist For Training/IETM Interface Planning Checklist

Note: The lead for each action is identified in the left column by “IETM MGR” for IETM Manager or “TRNG MGR” for Training Manager. Some actions — especially those concerning funding resources — may require input from a more senior level manager (for example, modifications to IETM or training acquisition plans and subsequent funding).

| Lead                  | Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| IETM MGR              | <p><b>1. Identify the IETM:</b></p> <p>Title:</p> <p>Tech Manual Identification Numbering System (TMINS) Number:</p> <p>Other ID:</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| IETM MGR              | <p><b>2. Describe the IETM:</b></p> <p>Authoring tool:</p> <p>Document Type Definition (DTD) used (if applicable):</p> <p>Runtime/delivery tool:</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| TRNG MGR/<br>IETM MGR | <p><b>3. Assess training impact.</b></p> <p>Course Identification Number(s) (CIN(s))</p> <p>Course title(s):</p> <p>Authoring tool(s):</p> <p>ICW:</p> <p>Electronic Classroom Integration Software (ECIS):</p> <p>Note: a database or report showing IETMs to CINs would be beneficial to identification.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| IETM MGR              | <p><b>4. Review IETM for the six functionalities needed to effect a successful training/IETM interface:</b></p> <ul style="list-style-type: none"> <li>• Element Title <span style="float: right;">Yes ___ No ___</span></li> <li>• Unique Element ID: <span style="float: right;">Yes ___ No ___</span></li> <li>• Persistent Element: <span style="float: right;">Yes ___ No ___</span></li> <li>• Authoring Element ID available in Delivery Tool: <span style="float: right;">Yes ___ No ___</span><br/>(ID carried over to commercial SGML viewer file, OR<br/>ID carried over to HTML file in anchor tag or ID attribute)</li> <li>• Version information at Element Level <span style="float: right;">Yes ___ No ___</span></li> <li>• IETM Viewer Allows Positioning to Individual Elements <span style="float: right;">Yes ___ No ___</span><br/>(Proprietary viewer is DDE Aware, or ID anchor tag or</li> </ul> |

| Lead | Action |
|------|--------|
|------|--------|

attribute methodology is supported by HTML browser)

[Note: If this is a new design development effort (i.e., if there is no functional IETM yet), this information (Y/N) will come from input from the design team. If it is an existing IETM, information can be obtained from NAWCTSD via the registration process.]

**IETM MGR**      **5. List the “No” activities from Action 4.**

**TRNG MGR**      **6. Define/develop training material surveillance data.**

- Course title and CIN:
- Total course weeks covered in proposed IETM:
- Number of links to IETM per week:
- Revisions per year to course or IETM:
- Minutes per link to perform surveillance:  
(Express in a decimal of one hour. For example, 5 minutes = .08/hour)
- Actual or estimated cost per hour (in current \$):
- Estimated life cycle of tech manual:

**IETM MGR**      **7. Estimate the initial and recurring costs to implement training/IETM functionalities identified in Action 5.** Enter in current year \$. The sum of the initial and recurring costs becomes the investment cost for the business case analysis.

\$ \_\_\_\_\_ Investment

**TRNG MGR/**  
**IETM MGR**      **8. Conduct training/IETM business case analysis.**

[Note: For business case analysis descriptive material, refer to Part 3 of the TIIG. The object of this business case analysis is to develop two cost elements: (a) the cost to manually support the TM identified in Actions 3 and 6 (Alt A) and (b) the cost to support the TM with training/IETM interface and the linkage automated (Alt B).]

Cost of Alt A:

Cost of Alt B:

| Lead                                         | Action                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>TRNG<br/>MGR/<br/>IETM<br/>MGR</b></p> | <p><b>9. Calculate the savings to investment ratio (SIR) for the proposed training/IETM interface.</b> Use the funding from Action 8 for Alt A, Alt B, and from Action 7 for Investment. Refer to Part 3 of the TIIG for a description of the process.</p> $\frac{(\text{cost Alt A} - (\text{cost Alt B} + \text{Investment}))}{\text{Investment}}$ <p>[Note: If the SIR exceeds 1, the proposal for the investment is economically sound.]<br/>SIR:</p> |
| <p><b>IETM<br/>MGR/<br/>TRNG<br/>MGR</b></p> | <p><b>10. Prepare a Training/IETM Interface Development Proposal.</b></p> <p>Upon completion of the business case analysis and SIR and agreement between the Training Manager and IETM Manager that the interface would be beneficial, a proposal for the interface will be prepared and submitted to the funding manager (ILS manager, etc.).</p>                                                                                                        |

## Appendix A

# Overview of Navy Automated Training Development & Delivery Tools

- ✓ Authoring Instructional Materials (AIM)
- ✓ Word Processing Programs
- ✓ Interactive Courseware (ICW) Authoring Tools
- ✓ Computer Improved Instructor Training Aid (CIITA) II
- ✓ Electronic Classroom Integration Software (ECIS)

## Appendix A

# Overview of Navy Automated Training Development & Delivery Tools

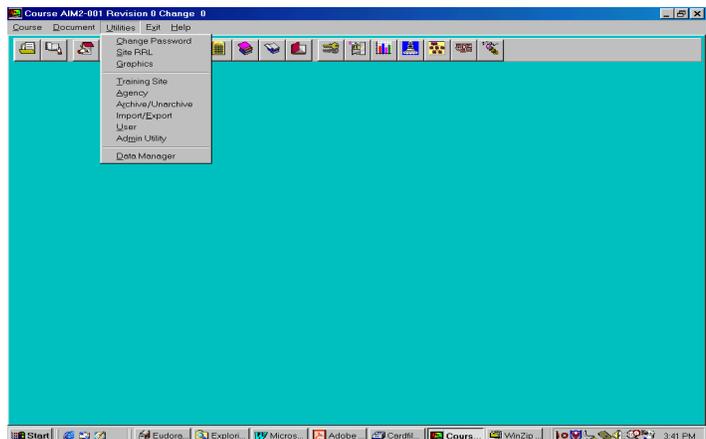
This appendix describes the primary automated tools now in use by the Navy training community for development, surveillance, maintenance, and delivery of training materials in electronic format. This material provides Navy Acquisition and Logistics Managers with a basic knowledge of the various automated tools with which their IETMs may need to interface. By general functional categories, these tools are used for:

- ✓ Lesson Plan (LP) and Training Guide (TG) development and maintenance
- ✓ ICW authoring and presentation
- ✓ CIITA II presentation of LP
- ✓ ECIS presentation of LP/TG

## Authoring Instructional Materials (AIM)

AIM is a software program implemented in FY94 by CNO N75 to streamline the development, maintenance, and management of Navy technical training materials. These training materials draw heavily on and refer extensively to technical data provided by hard-copy TMs, Electronic Technical Manuals (ETMs), or IETMs. As the AIM System Support Office (SSO), NAWCTSD manages the program for CNO.

AIM automates many elements of the Instructional Systems Development (ISD) process and ensures uniform formatting and specification compliance of all required output products. AIM provides efficient design, development, surveillance, maintenance, and production of training materials.



Sample AIM Screen

AIM optimizes the process of training development and standardizes training products by:

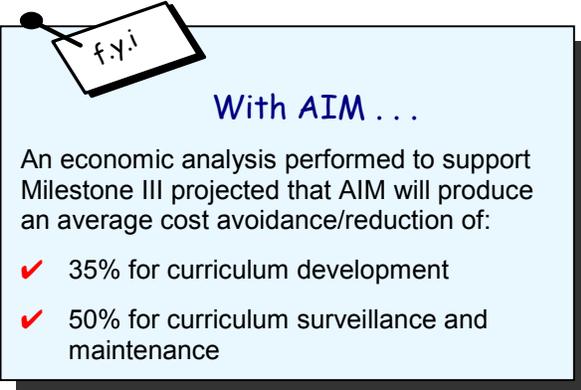
- ✓ Automating the format of NAVEDTRA 130/131
- ✓ Providing specialized software for design, development, and maintenance of training materials, including the conversion of existing training materials to properly formatted relational database products
- ✓ Supporting configuration management of graphics and their integration with text.
- ✓ Exchanging AIM data with other logistics and training databases, such as Logistics Support Analysis Record (LSAR), test/test item banks, training administrative data, and technical data

The most important benefit of AIM is its reduction in time and cost to develop and maintain training materials throughout their life-cycle.

Two versions of AIM make up the overall AIM System: AIM I and AIM II.

AIM I supports the development of Personnel Performance Profile (PPP) based training materials, which are used for most undersea warfare training. PPP-based training materials rely heavily on references to technical manual data. These structural references are inserted in the curriculum in the LP at the Discussion Point/Related Instructor Activity (DP/RIA) level. The TG typically uses technical data references on Instruction Sheets as well. NAVEDTRA 131: PPP-Based Curriculum Development Manual, provides detailed guidance on this method.

AIM II supports the development of task-based curricula. The task-based ISD process was designed for developing training programs that teach the performance of a job or function in which the operation or maintenance of hardware is usually incidental or secondary to actual performance of the job. Task-based curriculum uses information from TMs even more extensively than PPP-based training.



**f.y.i.**

**With AIM ...**

An economic analysis performed to support Milestone III projected that AIM will produce an average cost avoidance/reduction of:

- ✓ 35% for curriculum development
- ✓ 50% for curriculum surveillance and maintenance

In task-based materials, structural references are used in RIAs and TG Sheets, but going one step further, these materials frequently incorporate portions of the technical data (blocks of text or graphics) directly into the training materials. NAVEDTRA 130: Task-Based Curriculum Development Manual provides details on this methodology.

AIM provides a menu-based interface to SMEs and training material developers. The menu request information for the background and support of training materials, as well as prompting for the training material itself. This interactive, menu-driven approach helps the user enter data to develop and maintain training materials much faster and more consistently than manual methods. By guiding the user through menus, the AIM system allows the user to develop, convert, maintain, and manage training materials.

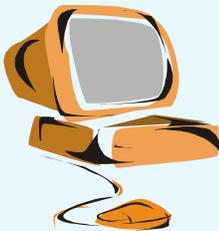


AIM is built on a Relational Database Management System (RDBMS). This design offers power and flexibility in the organization of the data and complex relationships between each element stored. It also eases the task of locating the reusable units and cross-referencing data across several training material products. Life-cycle surveillance and maintenance is accomplished through a menu-driven user interface and by automated links among the various AIM modules. The user is notified of all potential impacts of maintenance actions to all other related training materials, thus ensuring that each related item affected by a change is kept up-to-date with minimal manual effort.

The following paragraphs summarize AIM's functions and output products.

AIM I transitions the previous PPP-based Unix version of AIM into a Graphical User Interface (GUI) environment. Because AIM I is an MS-Windows product, it has a look and feel that is familiar to nearly all computer users. Output products of AIM I are shown below.

### Output Products of AIM I



- ✓ Training Project Plan (TPP)
- ✓ Resource Requirements List (RRL)
- ✓ PPP Table
- ✓ Curriculum Outline of Instruction (COI)
- ✓ Course Master Schedule (CMS)
- ✓ Training Course Control Document (TCCD)
- ✓ LP
- ✓ TG

AIM II uses the same GUI interface as AIM I and provides the Navy with a state-of-the-art tool for automating the development and maintenance of task-based training materials in accordance with NAVEDTRA 130. Output products of AIM II are shown below.

### Output products of AIM II



- ✓ TPP
- ✓ RRL
- ✓ Course Task Training List (CTTL)
- ✓ LOs
- ✓ COI
- ✓ CMS
- ✓ TCCD
- ✓ LP
- ✓ TG
- ✓ Test Items/Tests

### AIM Implementation Considerations

Analysis and needs determination of the individual Navy or contractor end user site is normally required as a key element of AIM implementation.

Existing equipment (hardware and software) and anticipated equipment, personnel, training, and administration support requirements are considered. To initiate this process, the Program Manager:

#### note:

**Submarine training is required to use AIM I, as determined by Resource Sponsor policy**

- ✓ Decides to implement AIM for his/her program based on the benefits analysis process and return on investment computations
- ✓ Coordinates funding with the appropriate resource sponsor
- ✓ Contacts the AIM Program Manager to develop outfitting, training, and support plans

To determine each site's system requirements, the AIM SSO has the site fill out an on-site survey form. The answers to the questions in the survey form are used to determine:

- ✓ The number, size (processing speed, amount RAM, and hard disk storage space), and location of AIM fileserver(s) needed

- ✓ The maximum number of workstations that may need to be connected to the AIM fileserver
- ✓ The most appropriate and cost-effective method for connecting these workstations to the AIM fileserver
- ✓ The facility changes (including cabling and telecommunications) required to support the AIM system, its fileservers, workstations, and peripherals such as laser printers and modems

One major decision is whether the curriculum development/maintenance personnel will perform their AIM tasks at a central location or in various locations around the base. If AIM users are to be widely dispersed, it may be more functional and cost-effective to install several small AIM systems serving one or more buildings than to connect them all to one centrally located AIM fileserver. The locations within buildings, the distance between buildings, and the existing networking facilities determine how AIM users are connected to the AIM fileserver. Contractors using AIM are provided access to Government-owned AIM equipment (or procure their own equipment) and are provided the software as Government-Furnished Information (GFI).

### **Hardware Requirements**

AIM I and AIM II client software require workstations that are 486/66 or higher PCs with 8 mb of RAM and 20 megabytes (Mb) of free disk space. The AIM I and AIM II database can be located on the local workstation if AIM is run stand-alone or on a Novell, Banyan, or Windows NT file server if AIM is run on an existing LAN.

### **Software Requirements**

AIM I and AIM II are MS Windows applications developed using Microsoft Visual Basic. Both programs use an embedded MS Access-compatible database and require MS Windows version 3.1, Windows 95, Windows 98, or Windows NT. Network configurations of AIM I and AIM II require IPX/SPX (for Novell installations) or Win9X/WinNT to interact with the database and fileserver. The interface between AIM and IETMs is integrated into AIM and requires no additional software.

### **SSO Support Services**

Life-cycle management of AIM requires a variety of support services for configuration management, software maintenance, and user site support. NAWCTSD has been designated as the AIM SSO.

## Classified Processing

AIM systems at all sites must comply with the requirements of local Automated Data Processing (ADP) Security Plans. Security regulations apply to personnel, training development materials, and space being used for the training program. With the proper system configuration and procedural precautions, AIM can be used to process classified information. Whether the AIM software is used for classified or unclassified information, however, all processing is governed by appropriate Navy and local command ADP regulations. Classified system size and complexity requirements are determined through the same process as unclassified systems with the additional requirement that their design must be approved by the site's ADP security personnel.

AIM software has three control points that require specific safeguards: input, processing, and output. There are three types of security safeguards, as shown below.



### Security Safeguards

- ✓ Administrative: focus on assignment of user IDs and passwords assigned and managed by the AIM Administrator
- ✓ Physical: include location of AIM workstations in controlled access spaces.
- ✓ Technical. Technical safeguards emphasize audit trails of who accessed and changed files.

## Redevelopment of Legacy Training Materials

Legacy training materials remaining in word processing or hard-copy format should be considered for redevelopment into AIM I or AIM II. In addition to streamlining the normal update process for these training materials, redevelopment in AIM I or AIM II will also offer the benefits of automated linking of IETMs and training data as described in this document.

## Word Processing Programs

### **Automated Curriculum Authoring Program (ACAP)**

NATTC Pensacola uses a word processing macro-based authoring tool named ACAP for development and update of NAVEDTRA 130-compliant training materials, including:

- ✓ TPP
- ✓ CTTL
- ✓ LOs
- ✓ COI
- ✓ TCCD
- ✓ CMS
- ✓ RRL
- ✓ LP
- ✓ Test Items, Test Plans, and Tests
- ✓ TG

ACAP was developed and is supported in-house at NATTC. The system is based on WordPerfect 6.1 for MS Windows.

ACAP provides the user with macros to accomplish the rapid creation and formatting of the major training materials products, with SMEs then filling in the correct content based on the pre-formatted files. This tool streamlines development of training materials by reducing the level of user expertise required in complex word processor formatting and editing functions. For surveillance and maintenance of LPs and TGs, the word processor's Find and Search-and-Replace functions reduce the manual review time and improve the consistency and comprehensiveness of changes and revisions.

## NAMTRAGRU Word Processing Macro-Based Authoring Tool

NAMTRAGRU has also used a word processing macro-based authoring tool for development and update of training materials products for more than 5 years. This tool, which was developed in house, is now supported at NAMTRAGRU headquarters and used at all NAMTRAGRU detachments. The system was originally based on WordPerfect 5.0 for MS-DOS and has recently been migrated to MS Word 97. The NAMTRAGRU tool produces the same training materials products as ACAP and provides the same type of surveillance and maintenance support. For more information about the NAMTRAGRU tool, see:

<http://namtra.cnet.navy.mil/Curriculuml.htm>

## Interactive Courseware (ICW) Authoring Tools

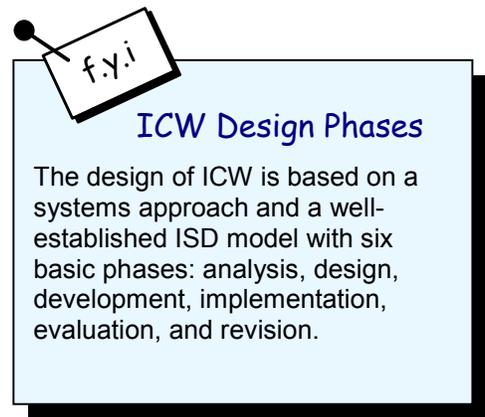
Interactive courseware has evolved from different forms of instruction delivered via computer. In an optimally designed course, the learner's decisions and inputs determine the level, order, pace of instructional delivery, and forms of individualized visual or aural outputs. Interactivity ranges from simple button-pushing to complex inputs, and content-specific feedback and remediation.

ICW is used in a variety of education and training environments, such as elementary and secondary school classrooms and computer labs, universities, technical and business schools, corporate training programs, government agencies, and military training programs.

ICW is primarily used to:

- ✓ Present information textually, graphically, and aurally
- ✓ Elicit learner responses through various prompted and unprompted strategies
- ✓ Provide feedback, remediation, and testing
- ✓ Provide practice in simulated tasks and decision-making scenarios

User control varies from limited navigational control to complete control, such as freeplay.





MIL-HDBK- 1379-4 defines interactive courseware as:

Computer-controlled courseware that relies on trainee input to determine the pace, sequence, and content of training delivery using more than one type computer sequence, and content of training delivery using more than one type medium to convey the content of instruction. ICW can link a combination of media, to include text, graphics, digital audio, animation, and up to full motion video, to enhance the learning process.

ICW consists of text, graphics, and computer programming and/or scripting instructions assembled into a logical structure designed to convey facts, concepts, procedures, and to provide instruction and practice in problem solving. Assembling the various elements of ICW is commonly called **authoring**. Authoring software packages are available for a variety of computer platforms including MS Windows and Macintosh-based systems. Most authoring programs provide the capability to access, or call external programs (shell out) from within the instructional program that is running.

ICW may be produced on various configurations of computer hardware. The current trend is to produce ICW on Pentium (or better) multimedia PCs or Macintoshes, which have video and sound cards, VGA monitors, and built-in CD-ROM players. The PCs may be stand-alone or part of a computer network

Ideally, the hardware used to produce ICW is the same as the hardware on

which it will be made available to the end user. A run-time version (limited to display functions only) of the authoring software is normally used as the display/presentation software. Because of their small size and portability, laptop computers are becoming increasingly popular as ICW delivery hardware. Deployed military units have critical space limitations, so having all necessary technical information (when combined with IETMs) on a compact medium is advantageous.

f.y.i

### Authoring Tools . . .

Among the COTS authoring tools currently in use for undersea warfare training programs are:

- ✓ Toolbook II by Asymetrix Learning Corp.
- ✓ Quest by Allen Communication
- ✓ AuthorWare by Macromedia, Inc.

In addition to COTS products, custom authoring tools, such as the Lockheed Martin Undersea Systems (LMUSS) system developed for the Acoustic Rapid COTS Insertion (ARCI) program, are used for ICW development and maintenance.

## Computer Improved Instructor Training Aid (CIITA) II

CIITA II is a computer-based display system developed to replace traditional instructor classroom training aids, such as slides, 2-D transparencies, 3-D models, and panel trainers. CIITA II can combine audio/video, animation, hypermedia, and graphic materials in one package. The hardware consists of one PC for the instructor's use and an interactive video projector for displaying information on a large screen. The instructor is provided with the capability to dynamically freeplay the course materials to facilitate classroom communication. Although CIITA II does not have the extensive capabilities of an electronic classroom system, it is a highly cost-effective approach to preparing and presenting computer-based training aids.

NAWCTSD is responsible for the development of the CIITA II system and for preparing CIITA II course material for schoolhouse use.

CIITA II is a combination of hardware and software elements that, together, support a multimedia environment. CIITA II uses a relational database of multimedia files that operate under an MS Windows GUI. CIITA II is not an authoring system *per se*, but it is used to structure a previously approved training course.



NAWCTSD and the Naval Submarine School conducted a Training Effectiveness Evaluation (TEE) of CIITA II when it was used for the Basic Enlisted Submarine School (BESS) program. This report is called the *Computer Improved Instructor's Training Aid (CIITA II) Effectiveness Evaluation*.

The CIITA II operational prototype was validated using this TEE under actual field use. In cooperation with end users and experts in the field of TEE of instructional environments, the evaluation criteria and procedures were developed, carried out, and a final TEE report published. No direction or constraint was given to instructors on how to conduct the training, although they did receive CIITA II familiarization. They were free to use the technologies, as they deemed appropriate, consistent with Navy school teaching requirements.



## Evaluation Findings . . .

A clear advantage for training with CIITA II technology was found with respect to the time it took to teach a course. Instructors, using conventional technology, required at least 20% more classroom time, on average, to prepare students to an equivalent level of proficiency. This is a significant and meaningful difference.

Students trained with CIITA II, vice the conventional training aids, showed firm support for the technology. They cited its strength as the use of animation and visual imagery to present difficult and complex information consequently assisting student understanding. The cost of CIITA II media was found to be substantially less than the cost of the conventional media (slides, 2-D transparencies, 3-D models, panel trainers, etc.) that it is intended to replace.

A cost avoidance of as much as 66% reduction may be realized. CIITA II is particularly cost-efficient for those training contexts in which an instructor addresses a large group of students, thus increasing the student-hours of media exposure.

The TEE also evaluated and presented detailed results as to what worked or did not work and likely reasons why. It cited, for example, that more difficult topics may benefit more from this type of media. The findings provide information that may be helpful in future training technology development.

A summary of the analysis concluded that CIITA II:

- ✓ Provides effective training
- ✓ Reduces time to teach material
- ✓ Helps teach difficult and complex topics
- ✓ Costs significantly less than preparing traditional training materials

The CIITA II hardware is Multimedia PC (MPC) II compatible. The minimum CIITA II system requirements are shown on the following page.

## CIITA II: Minimum System Requirements

- ✓ Pentium 100 MHz CPU
- ✓ 16 Mb RAM
- ✓ 2 Mb Video RAM Graphics Card -  
640 x 480 @ 32K colors
- ✓ 1 Gb Hard Drive
- ✓ 4X CD ROM
- ✓ 3.5" Floppy Disk Drive
- ✓ 8 Bit Sound Card
- ✓ MS Windows 95, 98 or NT



## Electronic Classroom Integration Software (ECIS)

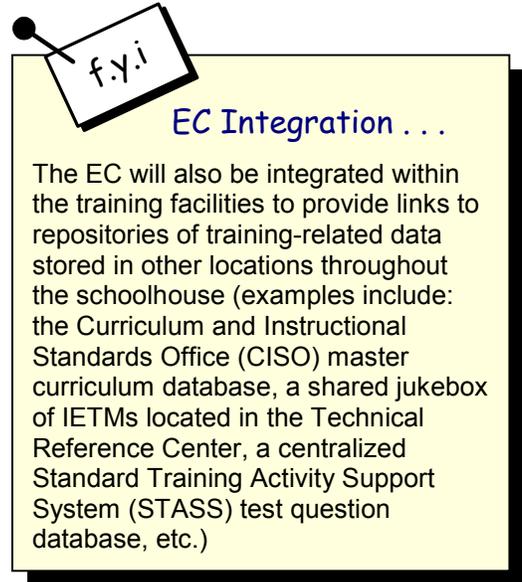
The Navy ECIS is an IT-21 compliant software program that enables users to integrate media into instructional or presentation materials electronically and to present these materials in an electronic classroom environment. It is a subsystem of the Navy's Electronic Classroom Operating Environment (ECO). The ECIS will be used in both introductory and advanced level ECs and in the instructor preparation stations.

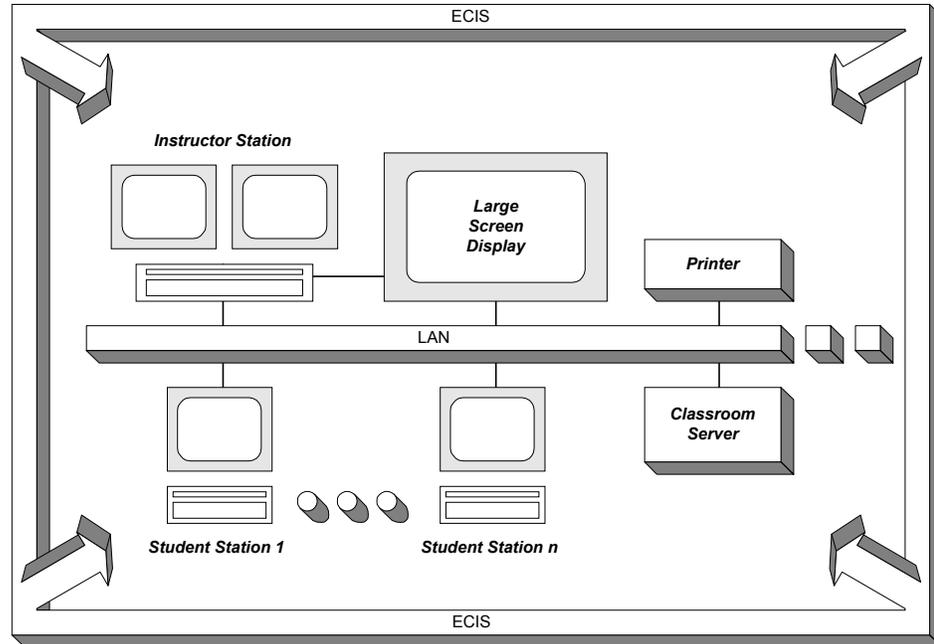
The ECOE establishes the functions, performance characteristics, and interfaces required to implement electronic classrooms to support training in shore facilities. EC systems support formal instructor-led training sessions; they also provide an interactive environment supporting independent preparation, study, and self-paced learning to maximize the use of electronic training materials available at-sea and ashore.

The EC provides an enhanced training environment to support the use, and, more importantly, the integration of electronic media such as IETMs, AIM I- and AIM II-based curricula, and ICW lessons. The EC leverages the technology required to support IETM implementation to improve on the capabilities of the traditional classroom.

EC is defined as a total classroom environment, encompassing the facility, computer hardware, software, and furniture. The system supports and provides a capability to effectively conduct formal instructor-led courses as well as a variety of self-paced instructional activities. In the EC, the instructor and students have PC workstations that are connected to each other electronically within a single classroom. The system also allows the connection of individual classrooms to each other and to other areas outside of the classroom, but within the training facility, such as instructors' offices.

The system requirements are implemented by a suite of student stations that are connected to each other and to an Instructor Station by a LAN. Since the majority of training material is implemented in software accessed by the EC, ECIS is an important component of the system. The figure on page A-14 provides a basic system diagram for the core components of the EC.





**EC System Concept**

An EC supports group-paced and self-paced instruction. It consists of several subsystems: the formal training materials; IETMs; Computer Based Training (CBT) products; media such as audio clips, video clips, PowerPoint slides, or other graphics; audio/video (A/V) and other presentation systems such as large screen displays, projectors, and speakers; and ECIS.

ECIS gives the instructor the ability to manage and control presentation of the training information and other data needed to conduct training by managing the necessary electronic links among the subsystems. ECIS enables the instructor to launch other applications (such as video clips, graphics slides, or the IETM) for display on the large-screen presentation systems or on the student consoles. It allows the instructor to give designated control to each student so that he/she can run a CBT lesson or perform an exercise. The system also allows the instructor to personalize the LP by creating additional electronic links to other media, reference files, etc. and notes to the baseline LP.

## ECIS Modes

ECIS supports the Navy's EC Presentation and Independent Study modes through five sub-modes: curriculum integration, instructor preparation, course presentation, student personalization, and independent study.

### ECIS Sub-Modes

#### Presentation Mode

- ✓ **Curriculum Integration.** This sub-mode enables Curriculum Managers to import the promulgated curriculum into the ECIS and integrate various media with promulgated LPs and TGs. This integrated curriculum becomes the "baseline" course that all instructors will use in the EC.
- ✓ **Instructor Personalization.** This sub-mode allows instructors to add Personalization to the baseline course. It enables them to create additional links and to add personal notes to the baseline course created during integration.
- ✓ **Course Presentation.** This sub-mode provides the capability to present the course in the EC and allows the instructor to control the presentation of the material.

#### Independent Study Mode

- ✓ **Student Personalization.** This sub-mode allows students to add personalized information to the TG. It enables students to create additional links and to add notes without affecting the baseline course as personalized by an instructor.
- ✓ **Independent Study.** In this sub-mode, the EC is used as a learning resource center where students may complete independent study and review instructional materials such as their personalized TG, complete assignments, and otherwise prepare for later class work or upcoming tests.

## Operating Environment

**Classroom Configurations.** The operating environment supports two different classroom configurations: introductory and advanced. The instructor stations have the same configuration for both.

- ✓ **Introductory.** This environment consists of an instructor podium with one multimedia computer, monitor(s), and an A/V display system. The system can simultaneously display the instructor's LP with its links to other media and preview and/or present multimedia or other instructional objects used during lesson presentation.
- ✓ **Advanced.** This environment consists of an instructor podium with one multimedia computer, monitor(s), and an A/V display system; in addition, students have workstations (e.g., individual multimedia computers) that are networked to the instructor's computer. Instructors may send any media on their monitor to the students' workstations. The students can also run any CBT modules at their workstations.

## Human-System Interface

Human-System Interface (HSI) and ease of use issues are major considerations in the design of ECIS. ECIS displays are ergonomically designed. ECIS is user-friendly, operating within standard design guidelines for MS Windows environments as specified in "The Windows Interface Guidelines for Software Designs." Accordingly, it has easy to use, understandable, direct, and informative graphical displays. The GUI functions as users would expect a Windows interface convention to look and behave, including icons, toolbars, arrow keys, pull-down menus, drag and drop editing, and mouse buttons. The instructor interface for the Presentation Mode is an interactive LP with hotlinks to referenced materials.

## File Management

File management is necessary to realize a centralized file management system. Through the use of file management, like file types can be stored in pre-designated locations, thereby allowing training personnel the ability to manage their electronic training materials. This functionality adds to the intuitiveness of the ECIS.

**Training Support Materials (TSMs).** TSMs consist of, but are not limited to, the following:

- ✓ Graphics
- ✓ Images (photos, videos, drawings, etc.)
- ✓ IETMs
- ✓ ICW/CBT
- ✓ Personalization

**Curricula.** Curricula consist of LPs, TGs and Course Management documentation, which are generally found in one of, but not limited to, the following formats:

- ✓ AIM I
- ✓ AIM II
- ✓ Rich Text File (RTF)
- ✓ WordPerfect

**External Applications.** External applications refer to applications that may be used to support development, maintenance, or delivery of training materials.

**Pre-Defined Electronic Links.** Pre-defined electronic links/paths contained within electronic materials, including but not limited to AIM-created materials and IETMs are used to the maximum extent possible. The ECIS does not affect these links, but can make use of them.

**Hotlinks.** Electronic hotlinks are established by identifying and linking references/location within the various subsystems and their databases and document references. The primary purpose of the hotlinks is to provide an interactive link between the LP's RIA and the media being referenced. The links can also be used for instructor/student references.

Selecting the hotlink during instructor presentation results in the reference material being displayed on the Instructor monitor and the Large Screen Display. The reference is also displayable on the student stations if applicable to the instruction.

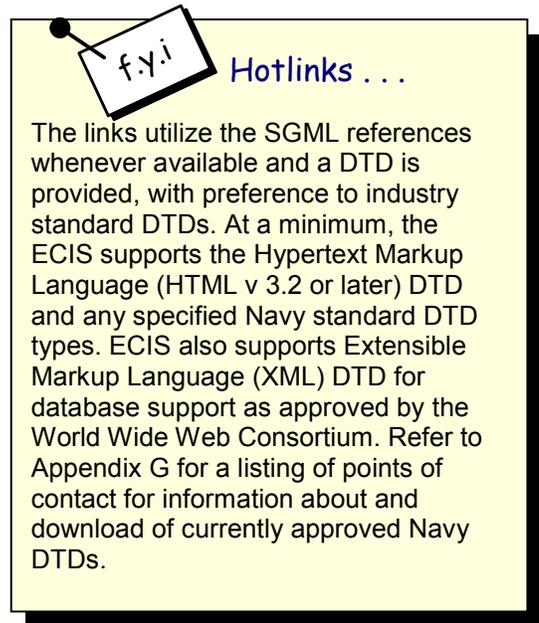
### Windowing

The windowing arrangement can be configured so that any particular window or multiple open windows may be displayed on the instructor monitor or the display device, as designated by the instructor.

### Testing

The ECIS software accommodates the electronic presentation of tests. This capability provides for on-line delivery, execution, review, and scoring of formal examinations. It interfaces with:

- ✓ STASS
- ✓ Test and Evaluation delivery and control application software



## Distance Learning

The ECIS software accommodates distance learning through the use of Wide Area Networks, Video TeleTraining (VTT), and Video TeleConferencing (VTC) as well as web-based training. It provides:

- ✓ Delivery of remote instruction with bi-directional transmission of audio, video, and data information
- ✓ Interoperability and connectivity with remote stations (such as in a Learning Resource Center or instructor preparation space)
- ✓ Capability to interface with a secure real-time, two-way audio, two-way video, multi-point, fully interactive Video Teletraining Network

It also interfaces with Internet and World Wide Web browsers.

## Interfaces

**Software.** The integration software is capable of recognizing, displaying, playing, and/or running the following file formats, including but not limited to: .bmp, .dxf, .eps, .gif, .jpg, .pcx, .pic, .tga, .tif, .wmf, .ds4, .aas, .avi, .flc, .fli, .mov, mpg, .wav, and .asf. Other application/object files including but not limited to .htm, .rtf, and .sgm, MS Office Pro Suite, Corel Suite, and Micrografx files, and AIM I files are also supported.

ECIS initiates and runs other software such as executable software and Object Linking and Embedding (OLE) linkable software in the MS Windows environment. At a minimum, it can initiate and run MS Office Pro Suite, Corel Suite, and Micrografx Designer 4 and Designer 3 applications.

**Hardware.** At a minimum, ECIS can be hosted on and interface with IT-21 compliant systems. ECIS interfaces with the following hardware:

- ✓ Instructor Console
- ✓ Student Stations
- ✓ Large Screen Display
- ✓ Windows standard Laser printers (output to)
- ✓ Remote Control Device (input from)
- ✓ VTT/VTC systems
- ✓ LAN (such as remote media library server)
- ✓ VCR, CD-ROM, DVD (access and accept input from)
- ✓ Document Camera, Scanners (access and accept input from)

### **Modes and Sub-Modes**

**Presentation Mode.** This mode supports the creation of the electronic version of the curriculum and its presentation as a group-paced, instructor-led course.

Curriculum Integration Sub-Mode: In the Curriculum Integration Sub-mode, ECIS:

- ✓ Supports the following user actions:
  - Import LPs/TGs into the EC.
  - Create hotlinks within course materials (e.g., LP, TG) or a displayed object and between that and other resource materials and their locations, such as video clips, animations, audio files, graphics, other documents, and IETMs. The links generated by the Curriculum Managers and instructors/developers are supported by the ECIS with a two-part link.

The first part comprises the logical location of the reference item (e.g., IETM, AIM database). This part of the link is the physical/logical location of the material, such as f:\IETM1. This is a common link generated for the entire reference material and is easily modified to a different location at the sites, such as \\server2\ietms\IETM1\.

The second part is a fixed reference within the object. An example is a reference to figure 2 of a document. This portion within the database is a fixed reference at the site, only modifiable by the Curriculum Managers and instructors.

The instructors and students can add to the list of hotlinks, but cannot remove the previous links from the baseline course.

ECIS prompts the user to identify the path/pathways to the information that is to be displayed. This is done using standard Windows conventions.

ECIS prompts the user to identify the hotlink's description, and file type of the extension required for linking. TSMs are stored through the use of a centralized file management system

ECIS provides a media preview window so that when creating a hotlink, the user has the option to display the media selected in the preview window. The instructor then confirms that this is the media to be linked. A dialogue box is also provided to allow the user to select the media player to be used.

ECIS alerts users if they attempt to create a hotlink on a previously linked location. If the users choose to continue, the new hotlink overrides the previous link.

ECIS provides a description of the item to be displayed. The hotlink text is modified from surrounding text to indicate the presence of the hotlink. For example, the hotlink indicator could be standard blue text, such as "HYPERLINK \\\Figure 1-2: Hatch A removal," with underlining.

- Save the integrated course materials with all pre-defined links and all hotlinks.
  - Print, with links (icons and short English titles) and bookmarks, whole baseline course materials (e.g., LP and TG), a range of pages, or an individual page.
  - Make bookmarks. A bookmark enables users to mark (paper clip) a place so that they may return to it, as needed. For example, users might create a bookmark to mark the spot in the document where they quit working so that they may return to it easily when they resume work.
- ✓ Integrates with IETMs as follows:
- Interface with and allow creation of specific (data-driven, directed) links to IETMs.
  - Allow application of a non-destructive layer on the IETM that supports development of a different path for instructional purposes. The ECIS does not affect the IETM's embedded links.
  - Accept existing links as defined in AIM-based LPs and TGs or other TSM.

- ✓ Provides the following options:
  - On/off indicator showing locations of hot spots (e.g., highlighted, cross hairs, boxes) and a description of the hot spot.
  - Pull down menus that list hot spots by name (i.e., as the user scrolls through the hot spots, each would be highlighted on the screen).
  - Tool-tip like function with associated field that describes the link when the cursor is placed over it.
  - A history file for the open session in order for the user to return to preceding hot links.
- ✓ When a media (link-end) within a source document is revised, the ECIS software recognizes that a change has occurred and flag changes to the user.
- ✓ Provides on-line context sensitive help. The help function is organized into content, search by topic, and index segments, at a minimum. It is accessible from any point in the software and includes descriptive definitions, instructions, and examples.
- ✓ Conducts real-time, context-sensitive search within instructional materials.

Instructor Personalization Sub-Mode: In the Instructor Personalization sub-mode, the ECIS has the same capabilities as the Integration Sub-mode. In addition, it has the following capabilities:

- ✓ Create Personalization, notes, and links. This feature allows the user to record blocks of text, thereby “tailoring” the source document. This feature does not modify the baseline document.
- ✓ Save Personalization to a designated resource without modifying the baseline document.
- ✓ Edit and copy/paste text within the document and external to the document without impact on the source database or file. The editing feature include the capability to format text using colors, bold, italics, underlining, and font sizes and styles.
- ✓ Print, with links (short title and icon), the entire baseline document with or without Personalization.
- ✓ Display Instructor Personalizations simultaneous with, but distinctive from, the baseline document.
- ✓ The Personalization shall be protected so that only the individual who creates the Personalization can make changes. All others shall have read-only access.

Course Presentation Sub-Mode: In the Course Presentation Sub-mode, the ECIS has the same capabilities as those assigned to the Instructor Personalization Sub-mode. Additionally, the presentation mode has the following capabilities:

- ✓ ECIS presents the LP with links on the designated instructor window. The Discussion Point, RIA, and associated instructor Personalization, as applicable, are displayed and easily viewable from a minimum distance of six feet from the instructor station. The instructor can navigate through the document using standard input devices such as a keyboard (page up/page down, home/end), mouse, and/or remote control.
- ✓ When a hotlink is activated, the linked material is automatically displayed. Additionally, the instructor can display this linked material to either the student stations, to the large display, or both. The instructor may also select not to display this information at all.
- ✓ ECIS provides the capability for instructors to control the classroom environment as follows:
  - Send contents of any station to A/V presentation systems.
  - Send contents of any station to any other station.
  - Freeze all student station displays and input devices.
  - Provide synchronized navigation of instructor and student station displays.
  - Give control of student workstations to the students so they may do such activities as take ICW lessons, personalize TGs, or review materials.
  - ECIS has the capability to save, print, and restore data recorded on an intelligent white board, including integrated overlays, when available.
- ✓ ECIS supports navigation and control via keyboard and mouse, remote control (e.g., infrared mouse), and electronic whiteboard, when available.
- ✓ ECIS supports on-line formal and informal question and examination. It supports entering, editing, saving, recall, broadcasting, and receipt of messages, queries, and formal/informal comprehension checks between instructor and student stations. Comprehension check results are visually coded (e.g., color) so instructors can instantly assess student responses.

**Independent Study Mode.** This mode supports individual, self-paced student activities.

- ✓ **Student Personalization Sub-Mode:** In the Student Personalization Sub-mode, the ECIS provides all the capability provided in the Instructor Personalization Sub-mode. Additionally, it has the capability to present the TG with links on the student monitor. The student can move around the document using standard MS Windows features such as the scroll bars, page up and page down, end, home keys, and mouse controls.
- ✓ **Independent Study Sub-Mode:** In the Independent Study Sub-mode, the EC is used as a learning resource center. In this sub-mode, the ECIS provides all the capabilities provided in the Student Personalization Sub-mode. Additionally, it has the following capabilities:
  - Assists the student in selecting and launching IETMs, ICW, and other instructional materials.
  - Provides access and navigation interfaces identical to the interfaces used in the Student Personalization Sub-mode.

## Utilities

ECIS has the following utilities. Access to the various utilities is determined by the privilege level of the user.

### **Import Utility**

This utility allows users to bring into ECIS instructional materials or presentation outlines such as LPs and TGs. Links stored in the original materials are preserved.

### **Media Library**

The media library contains the paths to each individual media integrated into the course. Media to be used in a lesson must first be added through the media library utility or automatically input from AIM RRL data during import. This utility:

- ✓ Allows users to call up, based on their privilege level, only that media which relates to a specific lesson topic or TGs for which they have permission to access based on their privileges.
- ✓ Have a search capability that allows search by course identification number, course title, unit/topic title, and developer.

### **Change Password**

This utility allows users to change their passwords in ECIS. The System Administrator's privilege level has the ability to reset passwords.

### **Pack and Transport**

The ability to pack and transport TSMs and Curriculum is needed with the majority of classrooms being utilized for more than one purpose. The method of delivery may vary with the associated hardware requirements at individual sites. The resulting functionality, however, remains constant and meets the following criteria at a minimum:

- ✓ Appropriate storage for all TSMs
- ✓ Appropriate storage for Curricula
- ✓ Appropriate storage for personalization
- ✓ Ability to manage and/or control path/location of TSMs
- ✓ Maintain security standards (based on classification of materials)

### **Daily Operational Readiness Test**

ECIS provides a utility that verifies the operational status of the system and provides a status message upon system/equipment initialization. This test is run from the instructor station.

### **System Management Utility**

This utility provides the following capabilities at the instructor station:

- ✓ Controlled Access to External Applications
- ✓ Configuration Log with Printable Reports
- ✓ Installation of Updates to Any System Software or Training Materials

### **Update Utility**

ECIS provides a utility that allows the user to check all links for accuracy between an instructional material and its associated links. This utility provides an intelligent search capability based on specific characteristics (e.g., key words). If a database is used, a repair function (e.g., key indices, pointers, compacting) is provided.

## **Security**

ECIS provides a utility to allow multi-layered security. Privileges are inherited through the levels. Access to documents and utilities is a function of the user's access level as developed via the operating system.

Security levels are:

- ✓ System Administrator
- ✓ Curriculum Manager
- ✓ Instructor
- ✓ Student

ECIS provides system administrators the capability to add, delete, or change the privilege level of users and reset their passwords.

## Appendix B

# IETM/Training Development/Delivery Tool Interface: Requirements and Methods

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### Manual Linking

- ✓ Lesson Plan (LP) and Trainee Guide (TG)  
Development and Update
  - Authoring Instructional Materials (AIM)
  - Automated Curriculum Authoring Program (ACAP)
  - NAMTRAGRU Tool
- ✓ Interactive Courseware (ICW)
- ✓ Computer Improved Instructor Training Aid (CIITA) II
- ✓ Electronic Classroom Integration Software (ECIS)

### Automated Linking

- ✓ AIM
- ✓ ICW
- ✓ CIITA II
- ✓ ECIS

## Appendix B

# IETM/Training Development/Delivery Tool Interface: Requirements and Methods

This appendix discusses various ways to create hot links between IETMs and training products:

- ✓ For development and update of LPs and TGs via AIM, ACAP, and NAMTRAGRU Tool
- ✓ For development, update, and delivery of ICW
- ✓ For delivery of approved LPs, TGs, and ICW via CIITA II and ECIS

There are two sections in this appendix: one addresses manual methods and the other addresses automated methods of creating and updating such links. The section on automated linking also provides the technical and functional data required to do a business case analysis (presented in Part 3 of the TIIG) of the resources required to implement the various linking methods.

## Manual Linking

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### LP and TG Development and Update

#### AIM

There is currently no manual method implemented to create and maintain hot links between IETMs and AIM-based training materials. Please see page B-6 for a description of the automated IETM/AIM interface process that is now in place.

#### ACAP

ACAP authors can create manual hyperlinks from within an LP or a TG to any external document via standard word processor tools. These links function effectively from within the word processor-based document; however, they are not carried forward with the document into the electronic classroom for presentation. When either the word processing document or the IETM to which the document is linked is changed, the links can be broken without notification to the author. There is currently no automated method implemented to create and maintain hot links between IETMs and ACAP-based training materials.

## NAMTRAGRU Tool

Authors working in the NAMTRAGRU word processing tool (Word 97 files) can also create manual hyperlinks from within an LP or a TG to any external document via standard word processor tools. These links function effectively from within the word processor-based document; however, they are not carried forward with the document into the electronic classroom for presentation. When either the word processing document or the IETM to which the document is linked are changed, the links can be broken without notification to the author of the change. There is currently no automated method implemented to create and maintain hot links between IETMs and the NAMTRAGRU tool-based training materials.

## Interactive Courseware (ICW)

Both the Virginia (SSN 774) class submarine and U.S. Coast Guard's WLM Buoy Tender programs are developing ICW, which will be linked manually from the ICW lessons to pertinent sections of the IETM.

General Dynamics Electric Boat Company (GD/EB) is in the process of developing IETMs and familiarization ICW for the Virginia (SSN 774) class submarine. The Ship Systems Manual (SSM) is being developed in SGML using Arbortext. It will be displayed in the HTML environment. The Familiarization ICW is being developed in HTML. While there is no operational ICW with links to the SSM as of this writing, there is a plan to link the two. There will also be links between the classroom-based curriculum and the ICW and IETM.

GD/EB is attempting to design all three products (ICW, IETM, and classroom curriculum) efficiently by developing an integration strategy that defines the optimal use (and reuse) of materials such as graphics and instructional content.

GD/EB plans to use the traditional design approach to design the ICW. Specifically, the content of the ICW will be based on the information contained in the IETM and will be supplemented, but not entirely replaced, by the link to the information in the IETM. The ICW will consist of a series of frames that present, test, or reinforce instructional concepts. These frames will have links to the IETMs. The ICW will utilize a bitmap form of graphics, while the IETM will use vector-based graphics. The bitmap graphics will also be used in the classroom instruction. The different graphic formats are used because CAD graphics used in the IETM are not suitable for the training environment.

To facilitate the development of the ICW, GD/EB is creating templates that will serve as a front end for developing frames of instruction. A template will be developed for each type of instructional activity (e.g., one for presenting instruction with simple navigation capability, one for presenting a multiple-choice question, etc.). These templates will have fields in which the ICW developer will enter instructional content (text and graphics).

Some links between the ICW and the IETM will be at the chapter level and others will link to specific paragraphs. These links will be accomplished using simple HTML link tags. There are also links from the classroom instruction to specific frames of the ICW. More specifically, Related Instructor Activities may require the instructor to launch some component of an ICW lesson (e.g., a specific frame of ICW). This poses a challenge since the navigation controls associated with the ICW are defined when the ICW is activated from the front end. If a specific frame of the ICW is activated without going through the front end, the ICW controls are never activated. GD/EB and the government are currently in the process of determining the best way to work around this.

As another example, Jardon and Howard Technologies, Inc. (JHT, Inc.) developed ICW for the United States Coast Guard's Primary Crew Assembly for use on a new class of 175' WLM Buoy Tender. The ICW provides standardized indoctrination training to new WLM crewmembers. The ICW was developed using Authorware 5 Attain and included links to five existing government-furnished IETMs. Four of the IETMs were Microsoft Word 97 documents and one was an Adobe Acrobat file. Students can access the IETMs directly from the ICW through a menu of the document titles. Additionally, specific frames of the ICW contain links to specific chapters, and in some instances, specific paragraphs within an IETM. All IETMs were externally linked so that future document changes should not affect the ICW programming.

From the ICW, the Microsoft Word documents are opened via a third party ActiveX program called TextControl 6.0. The TextControl program is activated via Authorware code. The TextControl program opens up the document file within the Authorware code. The Authorware code controls the document formatting so that it can be sized within the ICW's interface. In addition to the IETM file name, a specific phrase (or string) can also be passed to the TextControl program so that the document can be opened to a specific location within the document. Once an IETM has been opened, the ICW interface allows the user to move within the document. JHT, Inc. used strings of text associated with paragraph header (the text string itself and the format). In this way, as long as the paragraph headers do not change, modifications to the document will not affect the ICW.

The Adobe Acrobat document is segmented into many small files, each one corresponding to a chapter of the IETM. This was done to allow the user to “jump” directly to only those sections of the document in which they are interested. Each Adobe file is opened within the ICW via an Adobe Acrobat Reader 4.0 ActiveX program (called within Authorware). Code within Authorware again controls the formatting of the document so that it is sized within the ICW’s interface. Authorware code also controls which IETM is opened. Once opened, a scroll down menu allows the user to select other sections to view. Moreover, since the files are being opened using Adobe Acrobat reader, all of the viewing controls, such as zooming in and out, viewing multiple pages at a time, etc., are available to the user.

In some instances, the ICW was “scaled down” since the required instructional content was contained in the IETM. In these cases the student is linked to the specific paragraph. For example, some complicated procedures were not detailed in the ICW; instead, there was a link to the procedure in the IETM.

There are many advantages to interfacing ICW with IETMs. From an IETM perspective, the user can access content-specific instructional text, graphics (static or dynamic/animated), and/or video to enhance or augment technical concepts or procedures.

From an ICW perspective, having an interactive electronic technical database available during an ICW lesson makes possible the access of realistic technical information, extensive in depth and scope. All of the necessary learning elements (such as menus, objectives, and embedded questions) can be resident in the ICW, while specific technical data (text, graphics, and video) reside in an underlying IETM database. Tying ICW to IETMs also provides instructors with an on-line reference.

See page B-34 for a description of a prototype of an automated interface process, based on the IETM/AIM interface already in place.

## CIITA II

There are two manual methods for using the CIITA II system to present an IETM or IETM data:

- ✓ CIITA II Hardware Only
- ✓ CIITA II Hardware and Software

The first interface method consists of using the CIITA II hardware as a large screen, overhead projection system for simply displaying the IETM program in a classroom situation. This method is used if the IETM contains embedded data files; or, if an actual presentation of the IETM is desired. The CIITA II training course-structuring capabilities are not used with this method. When this method is used, the IETM is installed on the computer as a normal Windows program, generating an icon that is selected from a group in the Windows Program Manager. The CIITA II software component is not used with this method.

The second interface method consists of providing externally maintained, stand-alone animation, graphic, and sound files from the IETM to be used in CIITA II course development. This method implies that these files can be integrated with other instructor training materials and presented in a different manner than was originally designed for the IETM. A copy of these external files can also be kept with other CIITA II course files in a CIITA II-oriented library to be used for preparation of many different CIITA II courses. CIITA II-built training courses can then use files from several different IETMs.

Whether method 1 or method 2 is used, the IETM and/or data files must be delivered on CD-ROM or 3 1/2" diskettes. For using an IETM with CIITA II, all necessary files are provided to NAWCTSD for installation into CIITA II.

- ✓ **For Method 1 (CIITA II Hardware Only):** All supporting files and the executable file of the IETM must be provided. They must be capable of working in an MS Windows environment.
- ✓ **For Method 2 (CIITA II Hardware and Software):** Stand-alone IETM data files must be provided on separate media - CD-ROM or 3 1/2" diskettes including file names and descriptions. This data must be Multimedia Personal Computer II (MPC II) compatible in order to run within CIITA II. CIITA II supports the Autodesk Animator Pro™ animation file formats (.flc) and software playback of audio video interleave (.avi) files (e.g., Microsoft Video for Windows or Intel Indeo) and Motion Picture Experts Group (.mpg) files. If stand-alone IETM animation and graphic files are to be delivered to NAWCTSD, they must be in one of these file formats; or, be capable of being

converted to these file formats. If user demand warrants, CIITA may be modified to support additional formats in future releases.

Life cycle support depends on which interface method is being used. It primarily consists of providing current revisions of supporting files to NAWCTSD when updates are required to CIITA II.

- ✓ **For Method 1 (CIITA II Hardware Only):** Whenever changes are made to the IETM, a new installation or executable file (including updated animation/graphic files) must be included in the delivery update support.
- ✓ **For Method 2 (CIITA II Hardware and Software):** Any data file changes or updates must be provided as new stand-alone files in the update support.

For the Government procurement agency specifically contracting for an IETM to interface with CIITA II, depending on which of the two interface methods is desired, the Government would include one of the following requirements in the specification or statement of work:

**For Method 1 (CIITA II Hardware Only):** The contractor should provide the IETM on CD-ROM or 3 1/2" floppy diskette. The IETM software should include all executable and supporting files. These files must be MPC II compatible and capable of running in the Microsoft Windows environment.

**For Method 2 (CIITA II Hardware and Software):** The contractor should provide the IETM on CD-ROM or 3 1/2" floppy diskette. The IETM software should include all executable and supporting files. These files must be MPC II compatible and capable of running in the Microsoft Windows environment. All distribution licenses should be in order. In addition, the contractor should provide the separate animation and graphic files of the IETM data on CD-ROM or 3 1/2" floppy diskette. These files must be in .avi or .flc format and run in the Microsoft Windows multimedia environment.

**note:**

If an IETM is being specifically developed to interface with CIITA II, it is recommended that the IETM developer contact NAWCTSD Code 11U7, 407-380-4214, to discuss their approach.

Please see page B-36 for a description of a prototype of an automated IETM/CIITA II interface process, based on the IETM/AIM interface already in place.

## ECIS

The TechSight ECIS currently supports a manual linking process for defining both baseline IETM links and Instructor Personalization links. This process is mechanized by the ECIS user navigating to the point in the curriculum to which he/she wants to make an IETM link. Using the TechSight Link Manager, he/she then opens the appropriate IETM and manually navigates to the correct position. He/she can then implement a link, which is displayed to the instructor in the classroom as a functional hot link, enabling him/her to jump directly from the DP/RIA in question to the linked element of the correct IETM. This procedure is the same both for baseline curricula links and for individual instructor personalization links. The resulting links work well once manually authored, until either the IETM or the curriculum changes, at which time all IETM links must be manually revalidated.

The major limitation of this approach is that TechSight does not offer any automated functions for identifying invalid links when the IETM to which the curriculum is linked changes. If the IETM changes and the ECIS-based curriculum is not updated:

- ✓ The previous baseline and personalization links may appear to work correctly but point to different information than the link author intended, or
- ✓ The link may simply return an error message when the instructor activates it. In addition, all baseline links, which must be defined as an inherent part of the curriculum development and maintenance process, must be regenerated in the ECIS-based curriculum prior to its use in the Electronic Classroom.

This creates a significant duplicate workload, both for new curricula and for updates to current curricula.

Please see page B-38 for a description of a prototype of an automated IETM/ECIS interface process, based on the IETM/AIM interface already in place.

## Automated Linking

This section describes the functional capabilities required in an IETM to support automated interface with four training development and delivery tools described in this TIIG: AIM, ICW, CIITA II, and ECIS.

### Authoring Instructional Materials (AIM)

#### LP Benefits and Examples of Interfacing AIM and IETMs

There are a number of benefits to implementing an automated link between AIM and an IETM, including:

- ✓ Automatic creation of the detailed list of IETM structural elements in the AIM RRL to support development of references in the LP (in RIAs) and the TG (in Instruction Sheets) as opposed to the laborious and error-prone manual entry that would otherwise be required.
- ✓ Cutting and pasting of technical data from an IETM into various elements of the LP and TG.
- ✓ (Once the technical data references from an IETM have been linked to the LP and TG via the AIM RRL) The ability of AIM to generate LP and TG output with links already established to the pertinent sections of an IETM, viewable via ECIS with hot links automatically established.
- ✓ Significantly faster and less resource-intensive life-cycle maintenance of the AIM-based LP and TG. Import of change data from an IETM can automatically focus the curriculum maintainer on only those specific areas of the LP and TG that must be reviewed in detail.

#### note:

Please refer to Part 3 for a business case analysis process to quantify the potential cost avoidance of the functional capabilities outlined in this section. This cost avoidance could offset both initial and life-cycle costs of implementing changes in the IETM development and maintenance process to support an automated interface with AIM.

All these functional enhancements have been designed, developed, and tested with current Navy IETM projects, including:

- ✓ NAVSEA/LMFS – ARCI sonar system
- ✓ NAVSEA/Naval Underwater Warfare Center (NUWC) Keyport – Attack Console, Mk 92, Mods 3-6, SW282-C3-MN10-010
- ✓ NAVSEA/Newport News Shipbuilding – Ship System Manuals for Los Angeles and Sea Wolf Class SSNs
- ✓ NAVSEA/Lockheed Martin Syracuse – SQQ-89 Sonar
- ✓ Strategic System Programs (SSP)/General Dynamics Defense Systems (GDDS) – SWS Fire Control System Manual [OD 62687]

### **Program and Logistics Management**

This section discusses IETM-AIM interface programmatic and logistical concerns from the Program Manager's perspective.

**Functional Requirements for an Automated AIM-IETM Interface.** An automated interface between AIM-based training materials and the IETMs on which those materials rely for technical and procedural references offers several functional benefits:

- ✓ Streamlining the development and update of training materials
- ✓ Reducing instructor workload in preparing to teach those materials in an electronic training environment
- ✓ Improving configuration management of IETM-based curricula

As a result, the automated interface also promises reduced costs in acquisition and life-cycle support of these curricula. For these functional and economic benefits to be realized, however, the IETMs with which AIM curricula are interfaced must provide the six functional capabilities as defined in Table B-1 (for delivery via proprietary viewers) and in Table B-2 (for delivery via HTML-based browsers).

**Table B-1. Functional Capabilities  
Required for Automated IETM Interface with AIM --  
(DATABASE/SGML AUTHORIZING – PROPRIETARY VIEWER)**



|                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Element Title</b>                                   | English language descriptive name for each individual node in the IETM. These are the names displayed for each element in the table of contents of the IETM.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Unique Element ID</b>                               | Alphanumeric value used by the IETM to assign a distinct identifier for a specific element. <sup>1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Persistent Element ID</b>                           | Unique element ID is maintained the same over multiple versions of the IETM.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Authoring Element ID Available in Delivery Tool</b> | The unique element ID assigned in the IETM authoring tool is also carried over to the delivery tool. (Note: in most cases, the element ID is carried over from the authoring tool to the delivery tool; e.g., ID attribute of the element in the SGML file). In some cases, however, the document compiled from the authoring tool for delivery in a different tool does not contain the element ID from the authoring tool (e.g., in a Guide Reader document, the SGML ID attribute of the element is not always automatically carried over to the object name in the compiled document and is not, therefore, available for use in the delivery tool). |
| <b>Version Information at Element Level</b>            | Alphanumeric value used by an individual IETM element to identify the change level for that particular element (when the element was added or modified). Version information at the element ID level allows for efficient maintenance of curricula when a later version of the IETM is selected for use in the curricula. <sup>2</sup>                                                                                                                                                                                                                                                                                                                   |
| <b>IETM Viewer Is DDE Aware</b>                        | The IETM viewer software includes DDE capability to communicate with external programs; i.e., the IETM viewer will respond to specific commands, such as to position to a specific IETM element based on its unique ID. <sup>3</sup>                                                                                                                                                                                                                                                                                                                                                                                                                     |

<sup>1</sup> The level to which IDs are assigned – the granularity of the IDs – must be coordinated between the IETM development and training development staffs as the IETM is designed. This will ensure that training developers and instructors have hotlink access to an adequate level of detail within the IETM for training purposes while minimizing the number of unique IDs the IETM developer must create and manage.

<sup>2</sup>There are a variety of ways this version information can be maintained and provided to the training tools. If some type of version data is not maintained and provided, however, much of the potential benefits for training material surveillance and update will be lost.

<sup>3</sup>DDE awareness is a function built into the IETM viewer by the viewer software vendor. Given the choice between two viewers, the IETM developer should opt for a viewer whose vendor has made it DDE aware. The following IETM viewers have been tested successfully for DDE awareness in conjunction with automated IETM/AIM interface projects: Dynatext, Guide Publisher, User Access System (UAS) – used by SWS IETMs for the TRIDENT program, AIMSS, and ARCI.

**Table B-2. Functional Capabilities  
Required for Automated IETM Interface with AIM --  
(DATABASE/SGML AUTHORIZING – HTML BROWSER)**



|                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Element Title</b>                                   | English language descriptive name for each individual node in the IETM. These are the names displayed for each element in the table of contents of the IETM.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Unique Element ID</b>                               | Alphanumeric value used by the IETM to assign a distinct identifier for a specific element. <sup>1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Persistent Element ID</b>                           | Unique element ID is maintained the same over multiple versions of the IETM.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Authoring Element ID Available in Delivery Tool</b> | <p>The unique element ID assigned in the IETM authoring tool is also carried over to the HTML files. This can be accomplished by either 1) including the ID as an anchor tag or 2) including it as an ID attribute. The anchor-tagging concept should work with Internet Explorer 4.0 and 5.0 as well as with Netscape Communicator. However, the ID attribute concept is only supported by IE 5.0 or greater, and is not supported by Netscape. (See the <a href="http://www.w3c.org">www.w3c.org</a> web page for additional information.)</p> <p>Example of anchor tagging:</p> <pre>&lt;a name="Z0001S0001"&gt;...&lt;b&gt;&lt;u&gt;General Information and Safety Precautions&lt;/u&gt;&lt;/b&gt;</pre> <p>"Z0001S0001" is the ID specified for the element in the authoring tool.</p> |
| <b>Version Information at Element Level</b>            | Alphanumeric value used by an individual IETM element to identify the change level for that particular element (when the element was added or modified). Version information at the element ID level allows for efficient maintenance of curricula when a later version of the IETM is selected for use in the curricula. <sup>2</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>IETM Viewer Is HTML-based Browser</b>               | The browser will respond to specific commands, such as to position to a specific IETM element based on its unique ID. This will be accomplished via a call to the browser in the following format:<br><b>HTML filename#ID.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

<sup>1</sup> The level to which IDs are assigned – the granularity of the IDs – must be coordinated between the IETM development and training development staffs as the IETM is designed. This will ensure that training developers and instructors have hotlink access to an adequate level of detail within the IETM for training purposes while minimizing the number of unique IDs the IETM developer must create and manage.

<sup>2</sup>There are a variety of ways this version information can be maintained and provided to the training tools. If some type of version data is not maintained and provided, however, much of the potential benefits for training material surveillance and update will be lost.

The data transferred automatically from an IETM into AIM is limited to structural information (i.e., Element Titles and Unique Element IDs for new development efforts; Version input from the IETM to AIM is added for IETM updates) for use in the LP and TG via the AIM RRL. This transfer is accomplished via an SGML-based or an ASCII output file from the IETM authoring system.

For SGML-based exports, if the DTD of an IETM to be interfaced with AIM is based on or matches a DTD that has already been analyzed for AIM applicability and is supported by the data extraction routines developed as part of the AIM-IETM interface project, AIM can directly import this data into the AIM database for use by AIM training materials developers. These data extraction routines are provided to the IETM developer by the AIM SSO as part of the ongoing AIM life-cycle support process. The IETM acquisition manager should coordinate with the AIM SSO to obtain initial versions of extraction software. The same principle holds true for the ASCII output file -- if existing database extract routines developed for a currently supported IETM work with a different type of IETM, no additional effort is required.

Figure B-1 shows the processes and data flow between an IETM and AIM as described in this section for a newly developed course.

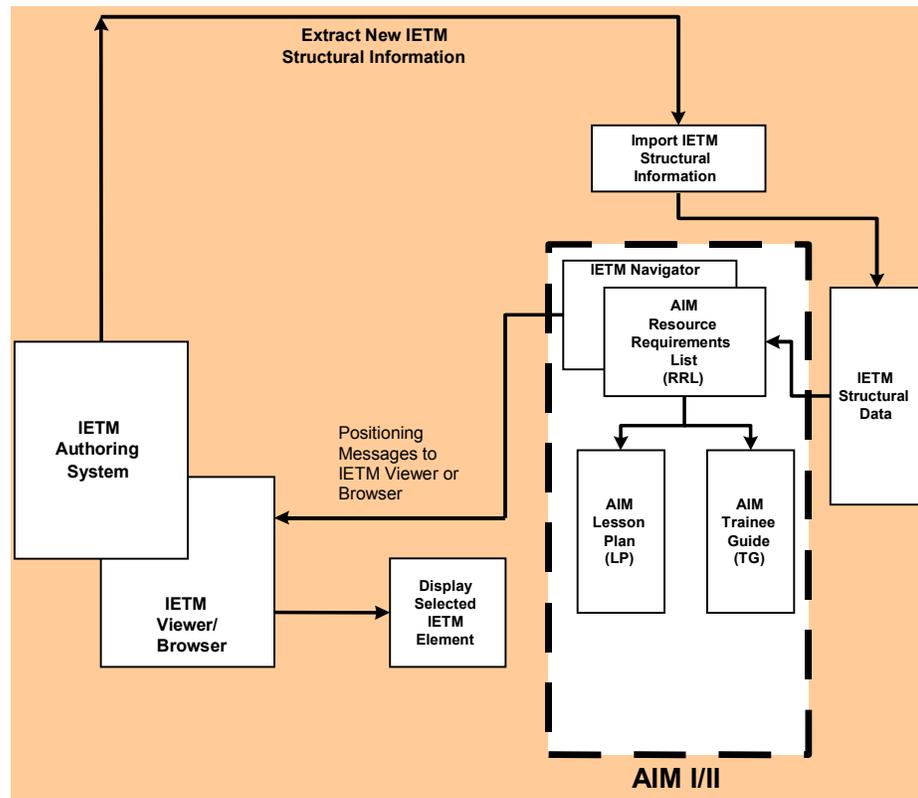


Figure B-1. AIM/IETM Interface for New Development

“Registration” is the initial analysis of the IETM DTD or ASCII file output for an IETM not currently supported by the AIM/IETM interface project (tailoring of the IETM data extraction software to support that DTD). If the IETM’s DTD does not match a DTD currently registered with AIM, an analysis of the DTD and tailoring of the data extraction software will be required before the IETM can interface with AIM. Likewise, the database query that produces the ASCII output from the IETM database may need to be modified to work successfully with that particular database structure. This registration process should be coordinated by the IETM acquisition manager with the AIM SSO at NAWCTSD.

IETM acquisition planning must ensure that the functional requirements for the IETM include the capability to provide an output of the IETM element titles, element identifiers, and version information:

- ✓ In a file with SGML information which matches a currently registered DTD or can be easily converted to match that DTD for SGML-based IETMs, or
- ✓ In a tab-delimited ASCII file (for RDBMS-based IETMs)

Care must be taken to ensure that the structural export from an IETM includes all of the data that AIM requires. Project Managers for SGML-based IETMs should obtain the latest list of registered DTDs from the AIM Project Manager to ensure that all of these requirements are correctly specified in the IETM CONOPS, Functional Description, or similar functional requirements document. For RDBMS-based IETMs, the IETM Project Manager should provide a copy of the RDBMS structure to the AIM Program Manager for review to determine whether modifications will be required to the current database extraction routines used to produce ASCII outputs from the IETM database.

To move textual information from an IETM to the training materials developed with the AIM system, the IETM viewer/browser must allow for text to be copied to the MS Windows clipboard. AIM I and AIM II will allow any text in the MS Windows clipboard to be pasted into the pertinent sections of training materials under development or modification.

For an IETM system to be interfaced with AIM-produced curriculum with minimal manual intervention, the structural export of the IETM system must include all of the elements that AIM requires. (See the functional capabilities described in Tables B-1 and B-2 of this appendix.)

**f.y.i**

Of the several SGML-based IETMs reviewed by the AIM SSO thus far during the interface project, all those based on the MIL-PRF-87269 DTD or similar DTDs do have the ID structure required to implement the initial interface with AIM. In the case of the ARCI IETM, the only RDBMS-based product reviewed thus far, the element ID data is also available at a detailed level, permitting reproduction within AIM of the basic IETM structure for curriculum developer browsing and selection of IETM elements for use in training materials.

The most basic requirement for an IETM is that each structural element to which training developers may want to link (e.g., paragraph of text, figure, or table) must have its own element ID. This ID must be unique within a particular IETM file. These IDs, along with their English language descriptive titles, form the basis of the IETM

structure that is extracted and used by AIM to allow the curriculum developer to identify portions of the IETM to be linked to the LP or TG to support presentation of the subject matter. The level at which IDs are assigned should be coordinated between IETM and training developers to ensure adequate links are available for training while imposing the minimum necessary ID overhead for the IETM developer.

Figure B-2 graphically depicts the processes and data flow between an IETM and AIM as described in this section for surveillance and maintenance of a previously developed course. The primary additional functionality for surveillance and maintenance is the capability to extract updated IETM structural information when Version 2 of an IETM is issued and compare the structural information with that from Version 1.

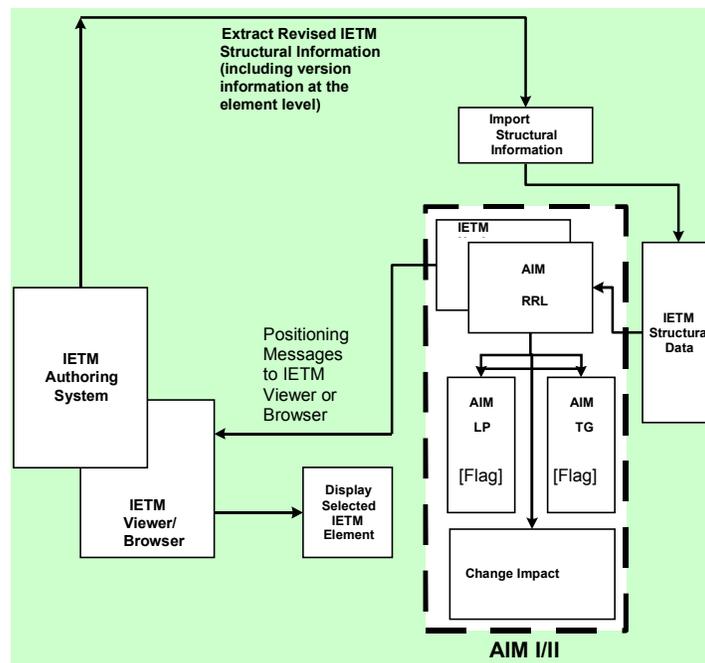


Figure B-2. AIM/IETM Interface for Surveillance and Maintenance

The updated extract of IETM structural information contains the same Element Title and Unique Element ID data as for the initial interface and adds Version information to specify what elements remain at Version 1 and what elements have been added or modified in Version 2 of the IETM.

The output product -- the Change Impact report -- tells the curriculum surveillance staff:



- ✓ Which courses in the AIM database have links to Version 1 of the IETM
- ✓ Within each of those courses, which DP/RIAs in the LP and Instruction Sheets in the TG have links to elements in Version 1 of the IETM that have been changed or deleted in Version 2

Based on the Change Impact Report, the curriculum surveillance staff determines that a change needs to be made to the curriculum. AIM then creates the change and automatically generates flags identifying all DP/RIAs and TG sheets with links to IETM elements that were changed or deleted in Version 2 of the IETM.

This capability greatly streamlines the curriculum surveillance process. Automatic flagging reduces the number of links to be checked manually from 1000 in the whole course to only those 50-100 linked to IETM elements that actually changed or were deleted in Version 2 of the IETM.



This reduction of time required for manual confirmation of the IETM links will drastically reduce the cost and time to conduct surveillance of curricula linked to IETMs. This streamlining of the surveillance process is the basis for the business case analysis for adding required functional capabilities to an IETM (presented in Part 3).

Most of the IETM DTDs the AIM SSO has reviewed to date provide for version control at the ID level. It is simply a question of whether the developer is tasked and funded to implement and maintain this granular level of version information.

Of equal importance to the availability of Version information at the IETM element level is the continuity or “persistence” of the IETM element IDs. In other words, it is crucial to the current design of the IETM/AIM interface that the technical material (e.g., text paragraph, figure, or table) associated with a given ID in Version 1 of the IETM retain that association in Version 2, 3, etc. If the material associated with the given ID is deleted, AIM can readily identify that deletion by determining that the ID in question is missing from Version 2.

If, however, the IETM IDs are redefined or resequenced in Version 2, all links made in AIM during development of training materials based on Version 1 of the IETM become worthless when Version 2 is issued. If IDs are resequenced from one IETM version to the next, every link between an IETM element and a DP/RIA entry in AIM — and there are usually 75-100 links per week of curriculum — will have to be manually revalidated.

This revalidation requires an SME to review each link each time the IETM is reissued, whether or not there are actually any training impacts. Instead of streamlining the curriculum life-cycle maintenance process, the IETM/AIM linkage then greatly increases the workload for curriculum surveillance staff, both at contractor and at Navy training facilities.

#### **Output from AIM to IETM.**

The only output from AIM to an IETM will be a positioning message sent from AIM to the IETM to start its viewer/browser and display a specific IETM element. The key requirement for the IETM is that 1) the viewer is able to respond to the DDE message sent from AIM in starting the viewer and displaying the appropriate IETM element as identified in the DDE message or 2) the browser responds to specific commands to position to a specific IETM element based on its unique ID.



f.y.i.

This issue of IETM ID persistence across IETM versions appears to be a more difficult issue than the availability of the IDs themselves. Several IETM developers have indicated that their normal process is to resequence all IETM IDs when a new version of the IETM is issued.

Use the business case analysis in Part 3 of the TIIG to determine return on investment for the proposed changes in IETM development and/or maintenance processes to support an automated interface.

If implementation of all IETM process changes cannot be justified based on the Savings/Investment Ratio from the business case analysis, consider an intermediate step. SSP, with a large investment in current IETM processes and data, developed a software utility program to compare IETM versions and produce the required output data to enable full use of automated AIM curriculum surveillance functions at a fraction of the cost of re-engineering their IETM process.

#### **IETM Technical Management and Engineering**

This section discusses IETM-AIM interface technical and engineering concerns required to implement the IETM/AIM functional capabilities specified by the Program Manager.

**Input from the IETM to AIM.** AIM extracts IETM structural information from either SGML-tagged IETM authoring files or from the IETM RDBMS (output in ASCII file format with tab-delimited field structure). This structural information includes element titles, related element IDs, version information, and external communication information.

In order for AIM to determine those items that have been modified within an IETM, unique element IDs must:

- ✓ Be assigned to each IETM element
- ✓ Persist over the life cycle of the IETM
- ✓ Include version information that is created and maintained at the element ID level.

**SGML Input to AIM from IETM.** AIM extracts IETM structural information from SGML-tagged authoring files that correspond to registered DTDs.

If an IETM system is to be interfaced with AIM-produced curricula with minimal manual intervention, the SGML extract from the IETM system must include all of the elements that AIM requires. To represent IETM data within the AIM database (i.e., to facilitate linking of training materials to IETM data), the SGML export from the IETM must contain:

- ✓ Unique Element IDs
- ✓ Element Titles
- ✓ Version information for each IETM element

AIM I and AIM II also allow the user to paste text or graphics from the MS Windows clipboard into the training materials being developed. To use this method to transfer data from the IETM to AIM, the IETM viewer/browser software must be able to support copying text or graphics to the clipboard from the IETM. This is not as much a function of the programming of the IETM as it is a function of the interface that the IETM maintains with the MS Windows environment.

**ASCII Output File Input to AIM from IETM.** Data output for the tab-delimited ASCII file is as follows:

- ✓ Node ID (integer)
- ✓ Parent Node ID (numeric)
- ✓ Node Name (240 character alpha numeric)

- ✓ IETM ID (50 character alpha numeric)
- ✓ Node Level (numeric)
- ✓ Node Sequence Number (integer)
- ✓ Revision Indicator (50 character alphanumeric)
- ✓ Node Type (numeric) [0=undefined; 1=text; 2=graphics; 3=table]
- ✓ Viewer Info (240 characters alphanumeric)

A sample format of the ASCII extract file information required is provided below.

for  
example

**[DDE Message Information]**

*DDE Service Name*

*DDE Topic Name*

*IETM viewer location*

*IETM viewer configuration location (copy of viewer location if no special configuration)*

*Text required in DDE command preceding the IETM ID*

*Text required in DDE command following the IETM ID*

*DDE Command Type (1=EXECUTE; 2=POKE; 3=Dynatext; 4=GuideReader; 5=AIMSS)*

*IETM Window Name (name is specified if static; otherwise, this is left blank)*

*(blank line)*

*IETM Name*

*IETM Version specified in database or SGML file*

*IETM Version to be displayed*

**[DB DATA]**

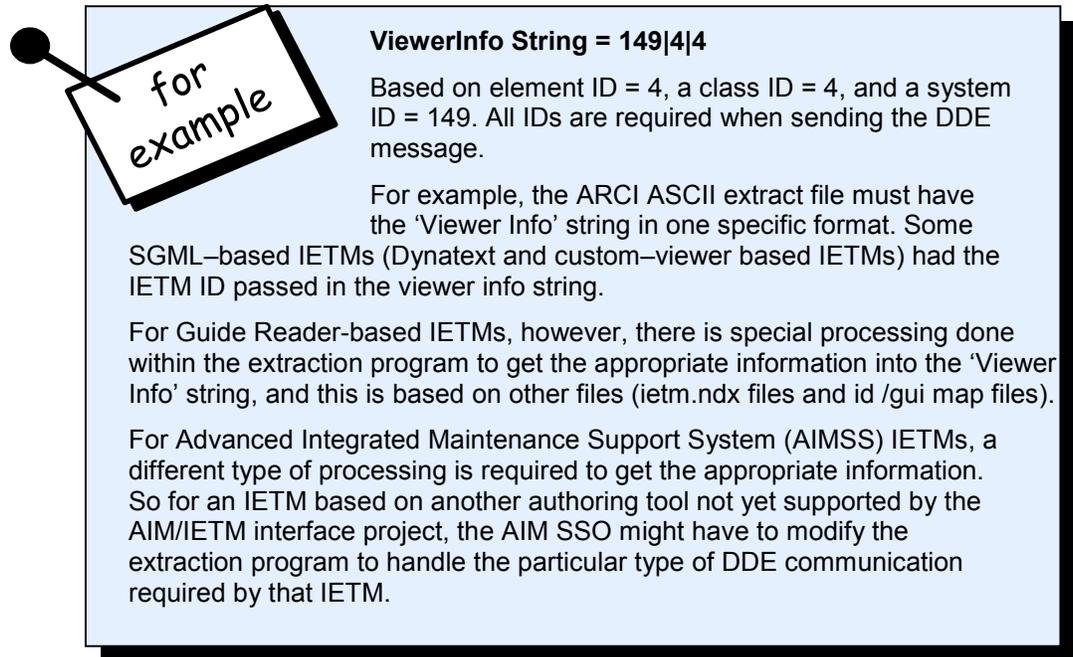
*DOC\_NODE\_ID(tab)DOC\_PARENT\_NODE\_ID(tab)DOC\_TEXT(tab)IETM\_ID(tab)LEVEL(tab)SEQUENCE(tab)VIEWER\_VERSION(tab)DOC\_NODE\_TYPE(tab)VIEWER\_INFO*

*Node id(tab)Parent node id(tab)Element title(tab)Element ID (0 if none available)(tab)TOC level(tab)Element sequence on appropriate TOC level(tab)Element version(tab)type of node(tab)DDE viewer information string*

**Output from AIM to IETM.** The DDE message issued by AIM passes information from the 'Viewer Info' string in order to position the viewer to an individual IETM element. This string may be unique for each different

type of IETM viewer. The standard case is for this string to contain a copy of the IETM ID. However, in some cases, additional information is required when sending the DDE message. The IETM developer, therefore, is responsible for providing the AIM SSO with the appropriate information on the IETM viewer DDE call necessary for AIM to call a specific IETM element.

An example of the 'Viewer Info' data item, therefore, is shown below.



**ViewerInfo String = 149|4|4**

Based on element ID = 4, a class ID = 4, and a system ID = 149. All IDs are required when sending the DDE message.

For example, the ARCI ASCII extract file must have the 'Viewer Info' string in one specific format. Some SGML-based IETMs (Dynatext and custom-viewer based IETMs) had the IETM ID passed in the viewer info string.

For Guide Reader-based IETMs, however, there is special processing done within the extraction program to get the appropriate information into the 'Viewer Info' string, and this is based on other files (ietm.ndx files and id /gui map files).

For Advanced Integrated Maintenance Support System (AIMSS) IETMs, a different type of processing is required to get the appropriate information. So for an IETM based on another authoring tool not yet supported by the AIM/IETM interface project, the AIM SSO might have to modify the extraction program to handle the particular type of DDE communication required by that IETM.

## Interactive Courseware (ICW)



There are also many advantages to interfacing ICW with IETMs:

- ✓ From an IETM perspective, the user can access content-specific instructional text, graphics (static or dynamic/animated), and/or video to enhance or augment technical concepts or procedures.
- ✓ From an ICW perspective, having an interactive electronic technical database available during an ICW lesson enables access to realistic technical information, extensive in depth and scope. All of the necessary learning elements, such as menus, objectives, embedded questions, etc., can be resident in the ICW, while specific technical data (text, graphics, video) would reside in an underlying IETM database. Tying ICW to IETMs also provides instructors with an on-line reference.



Navy guidelines state specifically that “An IETM display system must present technical information to the user in a manner that facilitates high-quality user performance or learning, within the technical job environment, through an effective man-machine interface.” (CDNSWC/TM-18-95/02 Electronic Display System Hardware Guidelines for IETMs, January 1995).

They also state that an IETM “...must be capable of employing, and providing user control of optimal electronic display features (e.g., text-graphics modules, animation, zoom, scroll, windowing) which support job performance and the transfer of technical information to the user.” ICW specifications and guides support the development of highly realistic, efficient training with the end-user considered the primary focus of courseware design and information presentation. Within financial and logistical constraints, and without compromising training effectiveness, ICW is expected to provide:

- ✓ A user-friendly trainee interface and lesson structure
- ✓ Accurate, up-to-date technical information and procedures
- ✓ Instruction segmented to provide meaningful training
- ✓ Extensive use of help routines and remediation
- ✓ Individualized, tailored instruction
- ✓ Confirmation of learning by immediate and/or delayed lesson- and content-specific feedback
- ✓ IETMs and ICW have both been categorized in terms of their interactivity and branching capabilities, and these designations will be used in this discussion as a preliminary point of comparison. The

IETM classifications are defined in detail in Appendix I of this document.

Interactive Courseware has been grouped according to four general categories of interactivity (MIL-HDBK-1379-4):

- ✓ **Category 1: Low Grade Presentation.** This is the lowest (baseline) category of interactive courseware development. It is normally a knowledge or familiarization lesson, provided in a linear format (one idea after another). Category 1 is primarily used for introducing events of the lesson material. Minimal interactivity is provided by selective screen icons and inserted into the lesson through typical input/output peripherals and programming protocols. This category may include simple developed graphics and/or clip art, customer-provided video and audio clips.
- ✓ **Category 2: Medium Grade Presentation.** This category involves the recall of more information than a Category 1 presentation and allows the trainee more control over the lesson's scenario through screen icons and other peripherals, such as light pens or touch screens. Typically, Category 2 is used for non-complex operations and maintenance lessons. Simple emulations or simulations are presented to the user. As an example, the user is requested to rotate switches, turn dials, make adjustments, or identify and replace a faulted component as part of a procedure.

This category also may include simple to standard developed graphics, and/or clip art, and customer- provided video and audio clips.

- ✓ **Category 3: High Simulation Presentation.** This category involves the recall of more complex information (compared to Categories 1 and 2) and allows the user an increased level of control over the lesson scenario through peripherals such as light pen, touch screen, track ball, or mouse. Video, graphics, or both are presented to simulate the operation of a system, subsystem, or equipment. The lesson scenario training material typically is complex and involves more frequent use of peripherals to effect a transfer of learning. Operation and maintenance procedures are normally practiced with Category 3 scenarios, and students may be required to alternate between multiple screens to keep pace with the lesson material. Multiple software branches (two to three levels) and rapid response are provided to support remediation. Emulations and simulations are an integral part of this presentation. This category may also include complex developed graphics, and/or clip art, and customer-provided video and audio clips.

- ✓ **Category 4: Real-Time Simulation Presentation.** This category involves more in-depth recall of a larger amount of information (compared to Categories 1, 2, and 3) and gives the user an increased level of control over the lesson. Every possible subtask is analyzed and presented with full, on-screen interaction, similar to the approach used in aircraft simulator technology. The lesson material is extremely complex and involves more frequent use of peripherals to effect the transfer of learning. This category normally supports certification, recertification, or qualification requirements.

**note:**

The potential for significant similarity between Class 3, 4, and 5 IETMs and Category 3 and 4 ICW is notable and will be important “common ground” between the two methods of information presentation.

Complicated operation and maintenance procedures are normally practiced with Category 4 and involve all of the elements of Categories 1, 2, and 3 presentations plus:

- A high degree of inter-activity
- An extensive branching (four or more levels)
- Levels of sophistication short of artificial intelligence

There are other important differences in the underlying foundations and design of IETMs and ICW:

- ✓ Traditionally, the purpose of **technical manuals** has been to provide information such as procedures, troubleshooting, parts, and theory of operations. Manuals are used in classroom-based courses as resources to provide detailed data that supplements lecture material. Manuals are also used as on-the-job references.
- ✓ **ICW**, as stated previously, is based on clearly specified learning and performance objectives. The amount of detail contained in the ICW varies according to the needs of the learner. For example, ICW for novices would contain more detailed information than ICW designed to refresh the skills of experienced individuals. Thus, although the learner controls the lesson through navigational features, the content of the lesson is specifically customized to the learner for whom the ICW was designed.

Higher category IETMs are designed to provide information access through a variety of paths, as determined by end user requirements. ICW more discretely defines a target audience than do IETMs. Information may be accessed through textual and graphical hierarchical menus, word/topic

searches, or discrete linear sequences. Speed and ease of access to detailed technical information (textual and graphical) are significant factors influencing the design of IETMs.

ICW is designed to allow different methods for accessing instructional information. Some information is presented linearly, and some information has embedded questions that trigger branching sequences depending on the learners' response to the questions. Also, some information is presented through elicited (prompted) response, while other ICW is designed to provide unprompted practice (freeplay).



The learning or performance objectives are the primary factors influencing the design of ICW. Therefore, ICW can be custom-designed for various learning/performance levels, ranging from entry-level to advanced. These design differences determine:

- ✓ How the IETMs or ICW lessons are programmed
- ✓ What type of navigation and access capabilities are needed for the two information presentation systems

Combining ICW and IETMs is a natural evolution. The goal of professional courseware developers and tech manual developers alike should be to synthesize the best of both methods of information delivery. The result will be a computer-based learning and performance support system that is easily updated and readily adaptable to different environments. The courseware can function in the dual role of:

- ✓ Presenting training as preparation for a particular task
- ✓ Providing on-demand verbal and graphical information and review of procedures during the actual task performance.

In an IETM, text, graphics, video, and sound elements are stored in a common database, and the information is accessed as needed by the user. All of the necessary learning elements, such as menus, objectives, embedded questions, etc. can reside in the ICW while specific technical data (text, graphics, video) resides in the underlying IETM database.

**Graphics.** Graphics for IETMs or ICW may be in a variety of forms, as long as they can be displayed by a .cgm (computer graphics metafile) viewer. Since the IETM-ICW should have the ability to call external programs, any graphic format can be used. Below are common formats:

- ✓ **Static ICW graphics:** .pcx or .bmp
- ✓ **Animated ICW graphics:** .flc or .avi

- ✓ **Text:** .txt, .doc, or .wmf
- ✓ **Video:** .avi

In most cases, video should be digitized for use in IETMs and in ICW. Digital cameras are extensively used to take pictures and store the images as raster files. These full-color images can then be treated as figures in the IETM-ICW. Sound for IETMs or ICW should be in standard file form, such as .wav.

Two primary IETM-ICW delivery environments are (1) Classroom, and (2) On-the-job.

- ✓ **Classroom (Formal Training).** This delivery environment consists of a lecture classroom and associated computer labs that may be available for self-study or practice. In the lecture classroom, the IETM probably takes the form of a viewpackage.
- ✓ **On-the-Job (Just-In-Time) Training.** This delivery environment varies according to the location of the actual task performance. The IETM-ICW is meant to be a resource, or job aid, which provides a description and/or demonstration of a particular procedure. It also provides detailed facts and specifications about a particular task or piece of equipment. It is not meant to replace formal training in the schoolhouse.

### **IETM - ICW Interface Scenarios**

Three major scenarios for interfacing IETMs and ICW are presented below to demonstrate procedural similarities and differences for different acquisition and/or production needs:

- ✓ Procedures for Developing IETMs Given Existing ICW
- ✓ Procedures for Developing ICW Given an Existing IETM
- ✓ Procedures for Developing ICW and IETM in Parallel

#### **Scenario 1: Procedures for Developing IETMs Given Existing ICW.**

IETMs must be 100% technically accurate and complete. ICW provides content relevant to specific objectives — the information for a specific piece of equipment is not all-inclusive; rather, it is a subset of the total technical information that would reside in an electronic technical manual information system. ICW cannot be used as a sole source of technical information. A well-built ICW segment can provide graphic scenarios and the background interface (computer-managed instruction routines, branching, etc.) to accept and complement a complete IETM that was developed after the ICW. The TRIDENT Strategic Weapon System

(SWS) program is an example of this development scenario in which existing ICW lessons provided media inputs to evolving IETMs.

### **Scenario 2: Procedures for Developing ICW Given an Existing IETM.**

This scenario is expected to be the most prevalent type of development in the near future. The following subsections constitute a sample procedure for developing ICW given an existing IETM. The procedure involves five major task areas:

- ✓ Analysis
- ✓ Planning
- ✓ Authoring
- ✓ Testing and quality assurance
- ✓ Final production.

### **Scenario 2, Task Area 1: Analysis**

There are six steps in analysis, as shown below.

#### **Six Steps in Analysis**

**Step 1:** Gather all data used in the development of the IETM, including pertinent manufacturer data.

**Step 2:** Break existing IETM into basic components. Generically, all technical publications will support the following:

- a. Principles/Theories of Operation
- b. System/Component, Description, Function, Location
- c. Maintenance
- d. Normal/Abnormal Operation
- e. Fault Isolation/Troubleshooting
- f. Repair
- g. Parts Breakdown (Illustrated)

**Step 3:** Determine system commonalties (avoid redundancy). Ideally, the IETM will provide all supporting text. The ICW needs to provide sound training practices at various levels:

- a. Entry level
- b. Journeyman equivalent
- c. Master equivalent

**Step 4:** Gather Logistics Support Analyses (LSAs) to provide:

- a. Singular job task lists
- b. Occupational specialty and level required
- c. Real time estimates for task accomplishment
- d. Expected results

**Step 5:** Gather maintenance requirement conditions

**Step 6:** Create the equivalent of a Design Strategy

## Scenario 2, Task Areas 2: Planning

ICW Flow Diagrams and Storyboards can be combined, and the existing IETM can provide a beginning outline.

### Graphics

**Static Graphics:** Special care should be taken when using graphics. For instance, if an exploded model of a component is required for an Illustrated Parts Breakdown, the model and its parts can be referenced repeatedly throughout the IETM or ICW where needed. This is recommended in order to reduce redundant development and conserve disk space.

**Animation:** Animation is especially helpful in explaining Principles/Theories of Operation. Once again, this requires special consideration. In theory, any jet engine, turbine engine, electrical solenoid, internal combustion engine, or hydraulic pump works like any other. Consequently, a generic model can be used to illustrate operating theory. If an animated model is required, it will be expensive to maintain and support a component that is prone to constant change. In Fault Isolation and Troubleshooting and Systems Operation (Normal and Abnormal), animation (including modeling) may be especially helpful but costly. For example, one power source may provide power (electrical, hydraulic or pneumatic) to several systems and components. If these were animated, correct power was supplied, correct switches were applied, and flow was simulated, a technician could easily determine the correct flow path (as compared to a black and white schematic). From this, the technician could formulate a point-to-point troubleshooting table, locate components sharing common power, and eliminate unnecessary branches. These models would require updating every time a component or system was modified.

**Two-Dimensional Still Images:** Two-dimensional still images have little or no perceived depth; they are typically presented as a single visual view to introduce an idea or concept.

## Two-Dimensional Still Images

- ✓ **Simple.** Artwork that may contain clip art, scanned images, charts or text composed in a simplistic layout that requires very little original creative development. Typically, a single view of an object with little detail, basic color, and simple composition (i.e. forms, charts, caution tags, block diagrams, or clip art with text).
- ✓ **Standard.** Artwork that may contain scanned images, charts, text, or illustrations composed in a more detailed layout that requires some original creative development. Typically, a single view of one or more objects with some detail, color shading and average composition (i.e., panel with various buttons, switches and dials, or a flat view of a device with several components).
- ✓ **Complex.** Artwork that may contain original illustrations or diagrams composed in an intricate layout that requires detailed and accurate original creative development. Typically, a single view of one of more objects with much detail, color shading, and detailed composition (i.e., panel with gauges, meters, digital readouts, and multiple switch types, or a flat view of a device with many components).

**Two-Dimensional Animation:** Two dimensional animation has little or no perceived depth. Images are assembled and animated to depict a process or procedure through applied, single-plane motion.

## Two-Dimensional Animation

- ✓ **Simple.** Motion sequence that may contain clip art, scanned images, graphic representations, or text assembled and electronically stored for presentation support and configuration management requirements. Typically, a simplistic layout that requires little, if any, original creative development and minimal motion (i.e., pop-ons of objects and textual callouts, a single flow path of animated lines between two components, or a change in object position such as a lever or switch).
- ✓ **Standard.** Motion sequence that may contain scanned images, graphic representations, or text assembled and electronically stored for presentation support and configuration management requirements. Typically a more detailed layout which requires some original creative development and multiple motion paths (i.e. a series of steps to illustrate a process or flow between multiple components with color cycling or animated lines, changing positions of buttons, switches, dials, or animated readings in gauges and meters).
- ✓ **Complex.** Motion sequence that may contain clip art, still photography, graphic representations, or text assembled and electronically stored for presentation support and configuration management requirements. Typically, an intricate layout which requires detailed and accurate original creative development and multiple motion paths (i.e., a series of steps to illustrate a complex process or flow through a detailed series of interrelated components, flows which depict property changes such as fluids to gasses or vapor, operational display of interrelated components on an instrument panel such as radar, or a combination of gauges, meters, switches or dials).

**Three-Dimensional Still Images:** Images that have perceived three-dimensional depth, which are typically presented as a single, realistic view to introduce an idea or concept.

### Three-Dimensional Still Images

- ✓ **Simple.** Artwork that is the result of the creation of a three-dimensional model which requires minimal original creative development and is simplistic in nature with a limited number of surfaces, textures, and properties. Typically a single visual view of a simple object (i.e., an individual part, such as a gear or switch, tool, lever, or valve).
- ✓ **Standard.** Artwork that is the result of the creation of a three-dimensional model which requires some original creative development and multiple interrelated surfaces, shapes, textures, and properties. Typically, a single visual view of several interrelated objects (i.e., a panel with buttons, switches, gauges and meters, or an assembly of several parts).
- ✓ **Complex.** Artwork that is the result of the creation of a three-dimensional model or environment which requires detailed and accurate original creative development and many interrelated surfaces, shapes, textures, and properties. Typically, a single visual view of several detailed, interrelated objects (i.e., an opened, cut away or glassing view to reveal internal components of a piece of hardware, a vehicle or aircraft, or an assembly of many detailed parts).

**Three-Dimensional Animation:** Three-dimensional images have perceived three-dimensional depth. Images are assembled and animated to depict a process or procedure through applied, three-plane motion.

### Three-Dimensional Animation

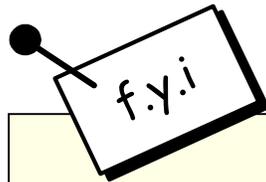
- ✓ **Simple.** Motion sequence that is the result of the creation and motion scripting of a three dimensional model or environment which is simplistic in nature and requires some original creative development. Typically, a single object in motion (i.e., the rotation of an individual part such as a gear or switch, tool, lever, or valve).
- ✓ **Standard.** Motion sequence which is the result of the creation and motion scripting of a three dimensional model which is more detailed and requires more original creative development than simple 3D animations. Typically, an object composed of several interrelated components in motion (i.e., a panel with buttons, switches, gauges and meters changing positions and readings, or an assembly of several parts in motion).
- ✓ **Complex.** Motion sequence that is the result of the creation and motion scripting of a three-dimensional model or environment which requires detailed and accurate original creative development. Typically, one or more objects composed of many interrelated components in motion (i.e., an opened, cut away or glassing view to reveal working internal components of a piece of hardware, a vehicle or aircraft in motion, or an assembly of many detailed parts in motion).

**High Fidelity Simulation:** High fidelity simulation consists of images that have perceived three-dimensional depth. The images are assembled and animated to simulate a complex real world situation or occurrence through applied, three-plane motion. Typically, an animated process requiring complex modeling of multiple objects and environments, complex mapping, motion scripting, timing, and camera controls.

**Video:** In many instances, video is a relatively inexpensive method for demonstrating location of components, compared to computer-generated graphics. Video has been used successfully to demonstrate simple and complex remove and replace procedures as well as routine and preventative maintenance. Video can be used to illustrate types of problems (e.g., types of corrosion, unacceptable wear patterns, and failed components).

**Sound:** Sound may be incorporated to augment animation, but narrated sequences should be avoided. Many systems have audio enhanced capabilities that can be incorporated. Aircraft have audio warnings and cues. In some instances, ships have alarm cues and voice. Some ground vehicles have the same capabilities. Narrated sequences require updates, and until voice can be digitally generated, narrators can be expensive, with the same ones not always available.

**Scenario 2, Task Area 3: Authoring:** At this point, authoring takes the form of back-fitting the planned sequences into the appropriate points throughout the existing IETM.



### An Example . . .

An aircraft is usually broken down into 7 or 8 primary sub-systems: Avionics, Electrical, Hydraulics, Armament, Power Plants, Egress, Environmentals, and Airframes. Each sub-system is logistically supported individually, but they are all interrelated.

The components of the sub-systems are further broken down into 3 major categories of maintenance:

- ✓ **Organizational:** routine/preventative measures, simple repairs and troubleshooting and component removal and replacement
- ✓ **Intermediate:** the on-site troubleshooting and repair of the components
- ✓ **Depot:** designated site or manufacturer repair only capabilities. The scope of this concept is immense

For example, the design of the AV8B Instructor Graphics Training Device is based on manuals more than existing curriculum. Only 4 of the above-mentioned areas have been modeled, and it requires 2 gigabytes of storage space. Furthermore, it focused on areas that were not easily taught, so it is far from all encompassing — it does not incorporate sound or text. To adequately cover an entire weapons platform may require 50 or 60 gigabytes. Paper publications currently require entire rooms for storage, and cost considerations may be negligible once a process is established. To store 60 gigabytes of weapons platform data, approximately 1,000 CD-ROMs would be needed (640 megabytes per CD-ROM). Thus, storage space and weight are reduced tremendously.

Advantages and disadvantages must be considered. Advantages include anywhere/anytime use and learning at the student's speed. Disadvantages include the learning curve, updating, cross-linking information on the CD-ROMs, and associated costs during the changeover from paper to CD-ROM.

**Scenario 2, Task Area 4: Testing and QA:** Testing and quality assurance may require on-site visits with groups of SMEs, as defined in an approved Quality Assurance (QA) Plan. The QA procedures and management processes established to assure all work tasks are performed correctly, and deliverables meet established criteria, should be provided by the contractor.

**Scenario 2, Task Area 5: Final Production:** The planning and production team should establish “logical chunks” of courseware and test them at each point.

### **Scenario 3: Procedures for Developing ICW and IETM in Parallel**

This scenario describes the optimal method of development; it is expected to be used more in the future. The same process used for general instructional systems development and ICW can be modified and applied to IETM development, and vice versa. It is recommended that the same SMEs be used for IETM and ICW development on a particular topic.

IETM-ICW interface development requires merging the best processes and procedures from ICW development experts and from IETM development experts. Since IETM-ICW interface specifications are not currently available, it is suggested that ICW specifications (developed according to) be merged with an IETM specification developed using considerations provided in this TIIG.

**note:**

MIL-HDBK-1379-3 provides detailed guidance for requirements pertaining to ICW Front-End Analysis (FEA), and ICW design, development, and implementation.

MIL-HDBK-1379-3 provides detailed guidance for requirements pertaining to ICW life cycle support. The information and guidance contained in MIL-HDBK-1379-3 is intended to assist acquisition and program managers in defining contract requirements for inclusion in an ICW ILS — ICW maintenance — acquisition package statement of work. The appendix provides suggestions for tailoring MIL-PRF-29612 requirements and associated Data Item Descriptions (DIDs) to acquire courseware maintenance without an excessive amount of deliverable data. MIL-PRF-29612 data product descriptions applicable to ICW ILS acquisition are presented and described in their recommended Statement Of Work (SOW)/contract performance sequence. The work effort resulting from these SOW task descriptions should define the training program deficiencies and changes necessary to correct them.

Contractor requirements are usually defined by the SOW and associated Contract Data Requirements Lists (CDRLs) and DIDs.

## QA Plan

The QA procedures and management processes established to make certain that all tasks are performed correctly and all deliverables meet established criteria; QA procedures and management processes should be provided by the contractor. It is important to ensure that the QA Plan specifically addresses each and every work task in the SOW and all deliverable data identified in the CDRL.

The contractor's QA Plan should provide ample opportunity for Government review, of developmental products, such as design strategy documents, flowcharts, storyboards, and perhaps a prototype of the IETM-ICW interface for a particular project.

## Design Team Considerations

IETM-ICW projects require a broader range of skills than traditional ICW projects. Project Managers need to oversee IETM production in addition to ICW production. Instructional designers need to transfer their ICW/IETM design skills, such as writing storyboards, to the design of IETMs. IETM designers may need training as instructional specialists. ICW storyboards usually specify a mix of linear and non-linear (ranging from simple to complex branching) frame sequences. The degree of frame sequence linearity in an IETM depends on the type of data. Tasks or procedures tend to be linear sequences; troubleshooting tends to be non-linear.

## Production Considerations

### Production Considerations

- ✓ ICW Authoring Tool Requirements
- ✓ IETM Media Requirements
  - Complexity of Graphics
  - Animation Capabilities
  - Level of Detail (Simple Line Drawings, Shaded Realistic Illustrations)
  - Text - Frame-Based (Rather than Page-Based) Breakdown
- ✓ Video Requirements
  - Sound (Realistic Environment, Music, Narration) Requirements
- ✓ Existing Electronic Text and Graphics
  - Industrial/Manufacturers' Technical Resources (CAD-CAM)

## Prototype of Automated ICW/IETM Interface

This section describes a conceptual prototype for an automated interface between ICW authoring tools and IETMs.

This prototype design is based insofar as possible on reuse of the software components already developed and tested for the AIM/IETM interface with the minimum necessary new software development and no changes to the existing ICW authoring software.

Virtually all the modules implemented for AIM can be applied to this effort:

- ✓ IETM extraction routines
- ✓ Import of extracted data to an IETM structural database
- ✓ The IETM structural database itself
- ✓ The IETM Navigator developed for the AIM interface
- ✓ DDE messaging routines for calling the IETM viewer from the IETM Navigator
- ✓ Change Impact Report

The only significant new software development required to implement the approach described in this section and depicted in Figures B-3 and B-4 is a stand-alone database of ICW structural elements for each ICW lesson to be linked with IETMs. The structure of this database is similar to that created for CIITA II — a relatively simple list of ICW lessons with a breakdown of the internal structure (e.g., topics and sub-topics) of the lessons as well as database fields for storing IETM linking information for these structural elements. The initial linking to the ICW lesson must still be done manually by the ICW developer, much as is done within AIM for assigning baseline IETM links during development.

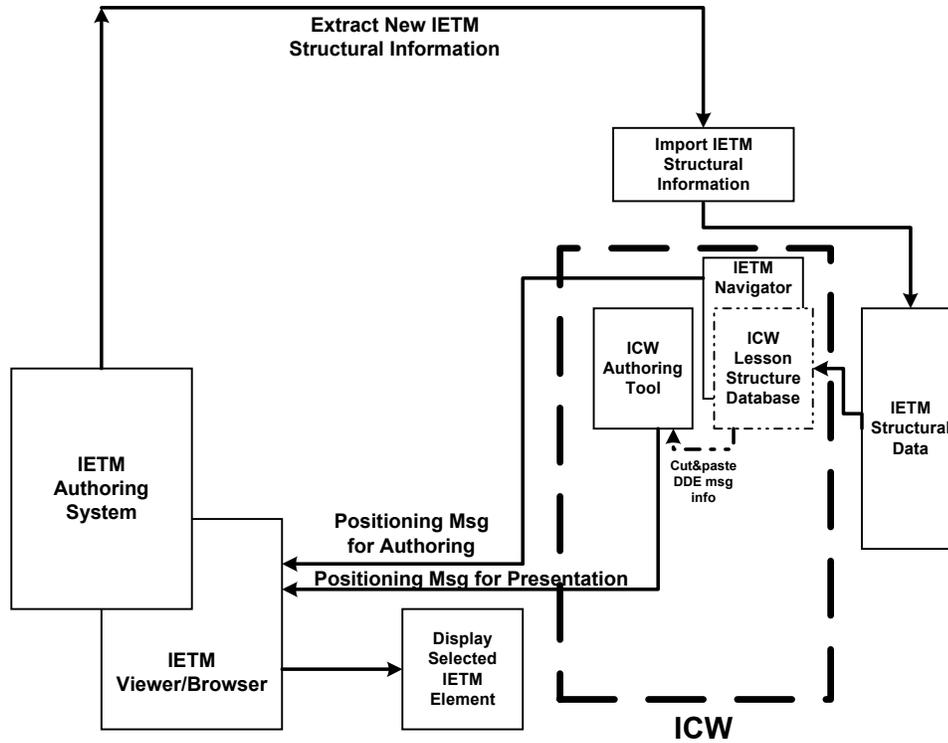


Figure B.3. ICW/IETM Interface for New Development

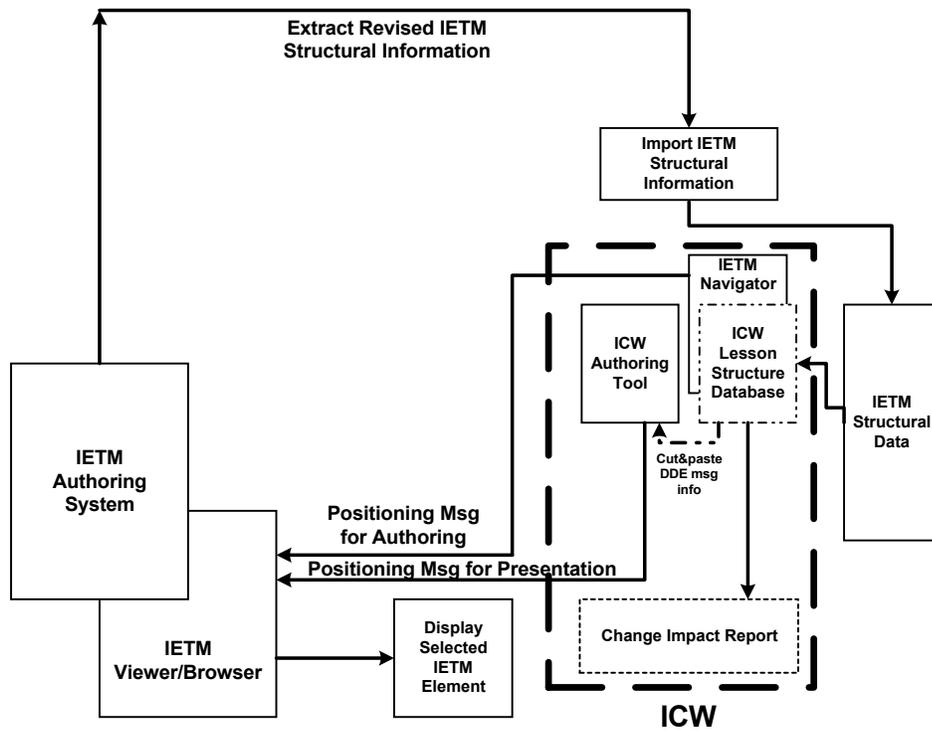


Figure B-4. ICW/IETM Interface for Surveillance/Maintenance

The ICW developer initially defines and stores the link in the new ICW structure database. This linking information is the DDE-related data defining the IETM file name and the specific IETM element to which the topic/sub-topic is to be linked. This DDE-related information is then presented to the ICW developer in a format that can be copied and pasted directly into the ICW scripting language file at the appropriate point in the code. This two-step process will:

- ✓ Retain the IETM link information in the new ICW structure database for later use in generating Change Impact Reports when the IETM is revised
- ✓ Embed the IETM linking information directly in the ICW lesson file as the basis for a fully functional hot link to the IETM.

Once the links are defined, any revision to the IETM will generate a Change Impact Report from the ICW structural database, telling the ICW surveillance staff which lessons and internal lesson topics must be revalidated and possibly re-linked because of the change to the IETM. This will save significant manpower and calendar time in updating ICW lessons to the current IETM version, compared to having to revalidate manually every link to that IETM in every ICW lesson.

## CIITA II

This section describes a conceptual prototype for an automated interface between CIITA II and IETMs. The prototype design is based insofar as possible on reuse of the software components already developed and tested for the AIM/IETM interface with minimal software modifications to CIITA II and no new software development.

Virtually all the modules implemented for AIM can be applied to this effort:

- ✓ IETM extraction routines
- ✓ Import of extracted data to an IETM structural database
- ✓ The IETM structural database itself
- ✓ The IETM Navigator developed for the AIM interface
- ✓ DDE messaging routines for calling the IETM viewer from the IETM Navigator
- ✓ Change Impact Report

The only significant software modification required to implement the approach described in this section is an addition to the CIITA II database to store the information on IETMs to be linked to CIITA II courses. The initial linking to the CIITA II course must still be done manually by the CIITA II developer, much as is done within AIM for assigning baseline IETM links during development.

Once the links are defined, however, any revision to the IETM will generate a Change Impact Report from the modified CIITA II database, telling the CIITA II surveillance staff which courses, topics, and DP/RIAs must be revalidated and possibly re-linked because of the change to the IETM. This will save significant manpower and calendar time in updating CIITA II courses to the current IETM version (compared to having to revalidate manually every IETM link in every CIITA II course that uses that IETM every time the IETM changes).

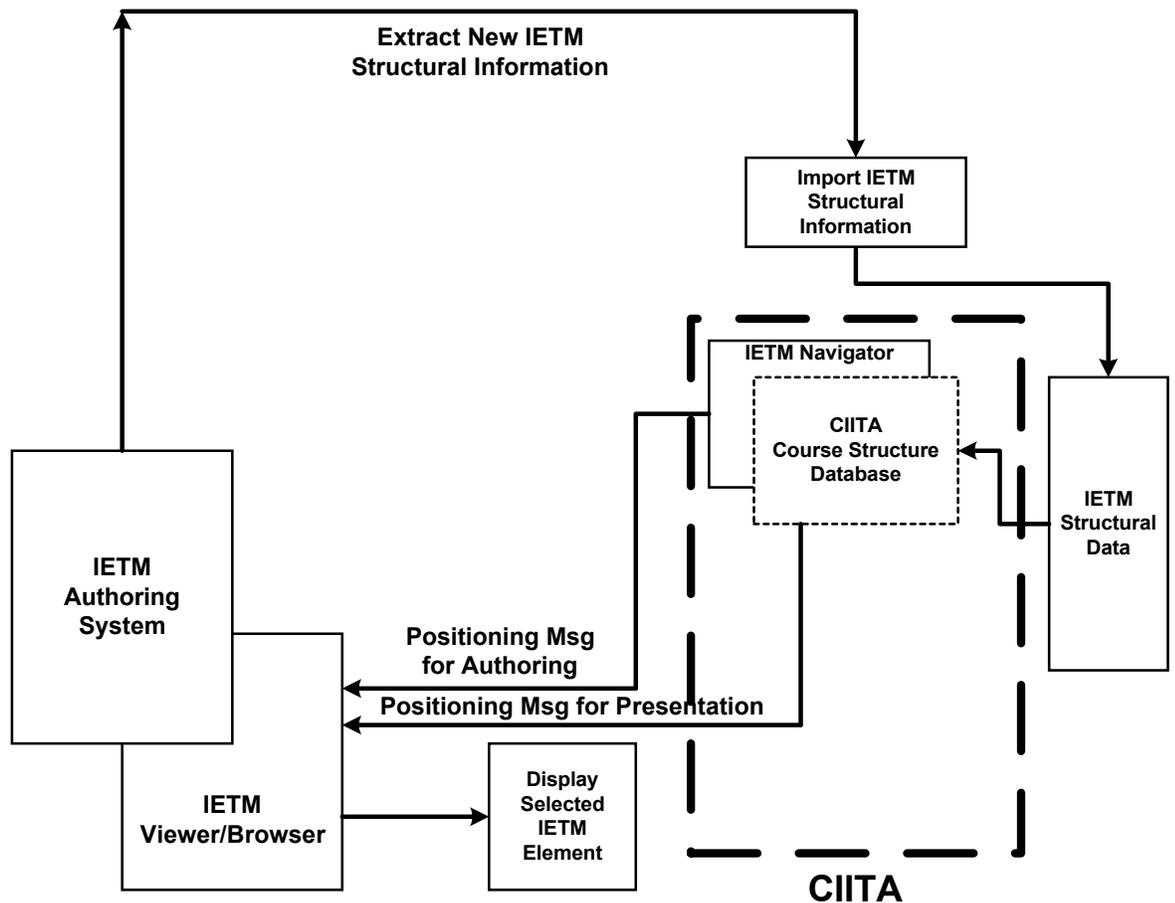


Figure B-5. CIITA II/IETM Interface for Development

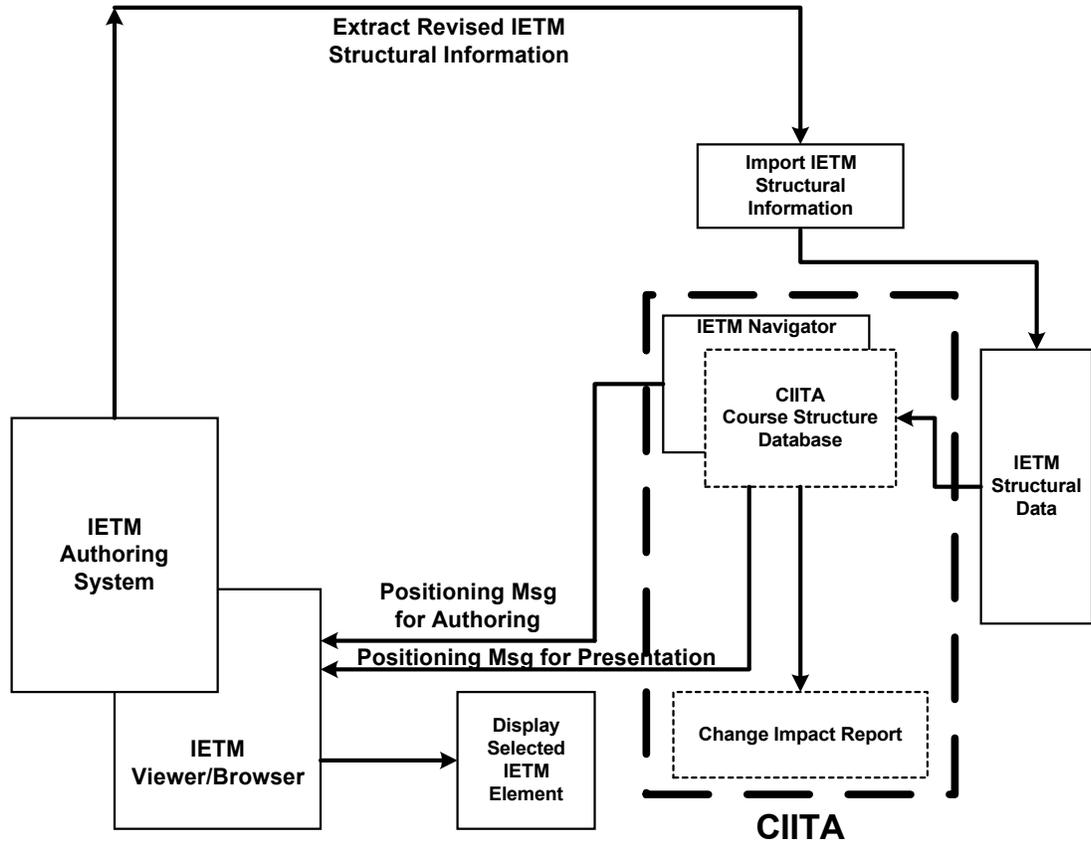


Figure B-6. CIITA II/IETM Interface for Surveillance/Maintenance

## Electronic Classroom Integration Software

This section discusses a currently operational automated interface between the TechSight ECIS and IETMs via AIM. It also describes conceptual prototypes for automated interfaces between ECIS and IETMs with non-AIM training materials and for instructor personalization.

### Automated ECIS/IETM Interface for AIM-Based Courses

For AIM I or AIM II LPs and TGs with automated links to IETMs established as part of training material development, the TechSight ECIS supports automated linking to the IETMs supporting the courses presented in the EC. TechSight reads the LP and TG structure from the AIM database, including the IETM links already defined. This enables either the instructor or the CISO staff at the training facility to avoid manually creating the baseline LP/TG links to IETMs after the course is imported into the TechSight ECIS. There is, therefore, no additional effort to include baseline LP/TG links to IETMs for AIM-based courses used in the

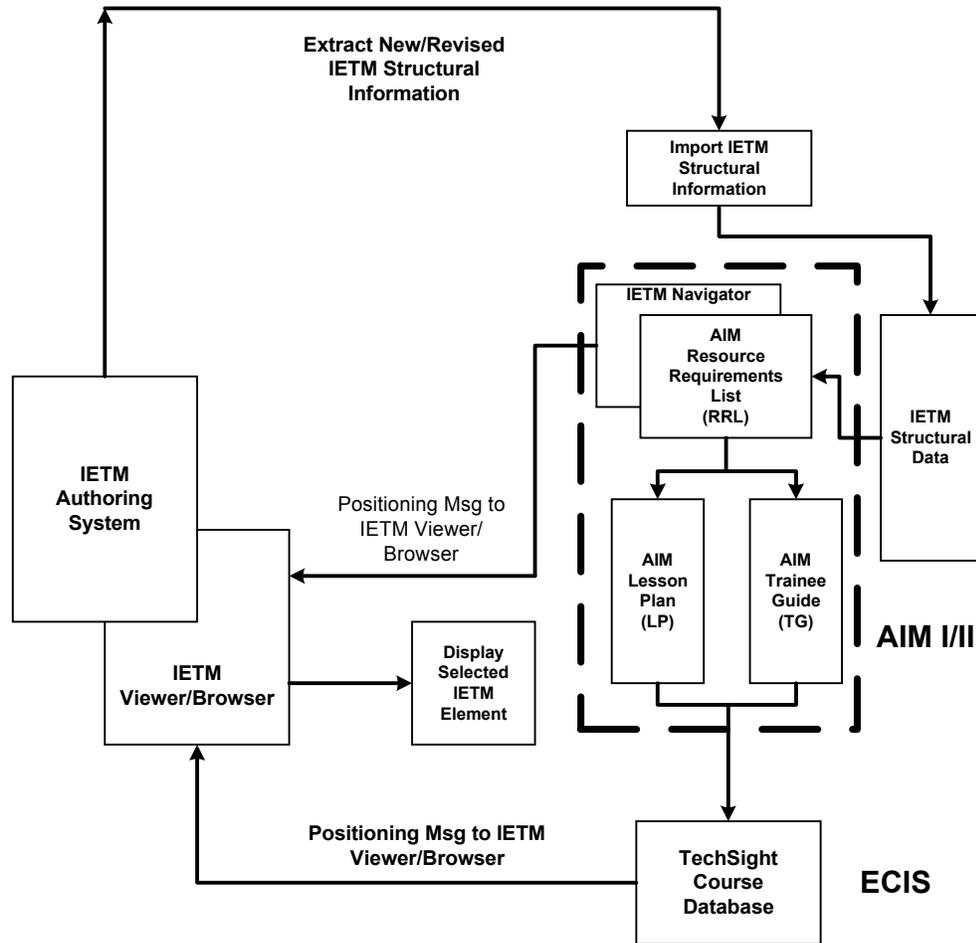
EC. Likewise, when the course is revised or changed in AIM, the modifications to the IETM linking done as part of that normal curriculum maintenance process will be automatically carried forward into the ECIS.

At an estimated 5 minutes per link for CISO or instructor staff to implement these links manually as part of preparation to teach an approved course, this automated functionality of AIM/TechSight offers major time savings to end users of the curriculum in the EC. No additional changes to the IETM development or update process are required for this AIM/ECIS integration beyond those required for the initial AIM/IETM interface as defined earlier in this Appendix.

In addition to quantifiable time savings, other benefits include:

- ✓ Reduced calendar time from receipt of the course to presentation to students
- ✓ Improved accuracy of the baseline IETM links since they are done, reviewed, and approved as part of the integrated curriculum during development or maintenance

Figure B-7 depicts the process for import and use of an AIM-based course in a TechSight-equipped EC.



**Figure B-7. Import/Use of AIM-Based Course with IETM Links In Electronic Classroom**

**Automated ECIS/IETM Interface for Non-AIM-based Courses**

The following paragraphs discuss a conceptual prototype automated interface between ECIS and IETMs for baseline LP/TG links in non-AIM-based courses. This prototype design is based insofar as possible on reuse of the software components already developed and tested for the AIM/IETM interface with minimal revision to the existing ECIS software.

Virtually all the modules implemented for AIM can be applied to this effort:

- ✓ IETM extraction routines
- ✓ Import of extracted data to an IETM structural database
- ✓ The IETM structural database itself
- ✓ The IETM Navigator developed for the AIM interface

- ✓ DDE messaging routines for calling the IETM viewer from the IETM Navigator
- ✓ Change Impact Report

The only significant modifications required to implement the approach described in this section and depicted in Figures B-8 and B-9 are updates to the current manual IETM linking functions of the ECIS. They require replacing the current interface with the IETM Navigator from AIM and modifying the ECIS database to accept the DDE links to the IETM defined from the Navigator. The initial linking to the ECIS-registered course will still have to be done manually by the CISO or instructor staff before the course is taught.

Once the links are defined, however, any revision to the IETM will generate a Change Impact Report very similar to that in AIM, telling the school staff which DPs/RIAs and/or TG sheets must be re-linked because of the change to the IETM.

This will save significant manpower and calendar time in updating EC-based courses to the current IETM version, compared to having to revalidate every IETM link manually every time the IETM changes.

**note:**

Please refer to Part 3 for the business case analysis tools to support quantitative assessment of the benefits of such an automated interface for ECIS for non-AIM-based courses.

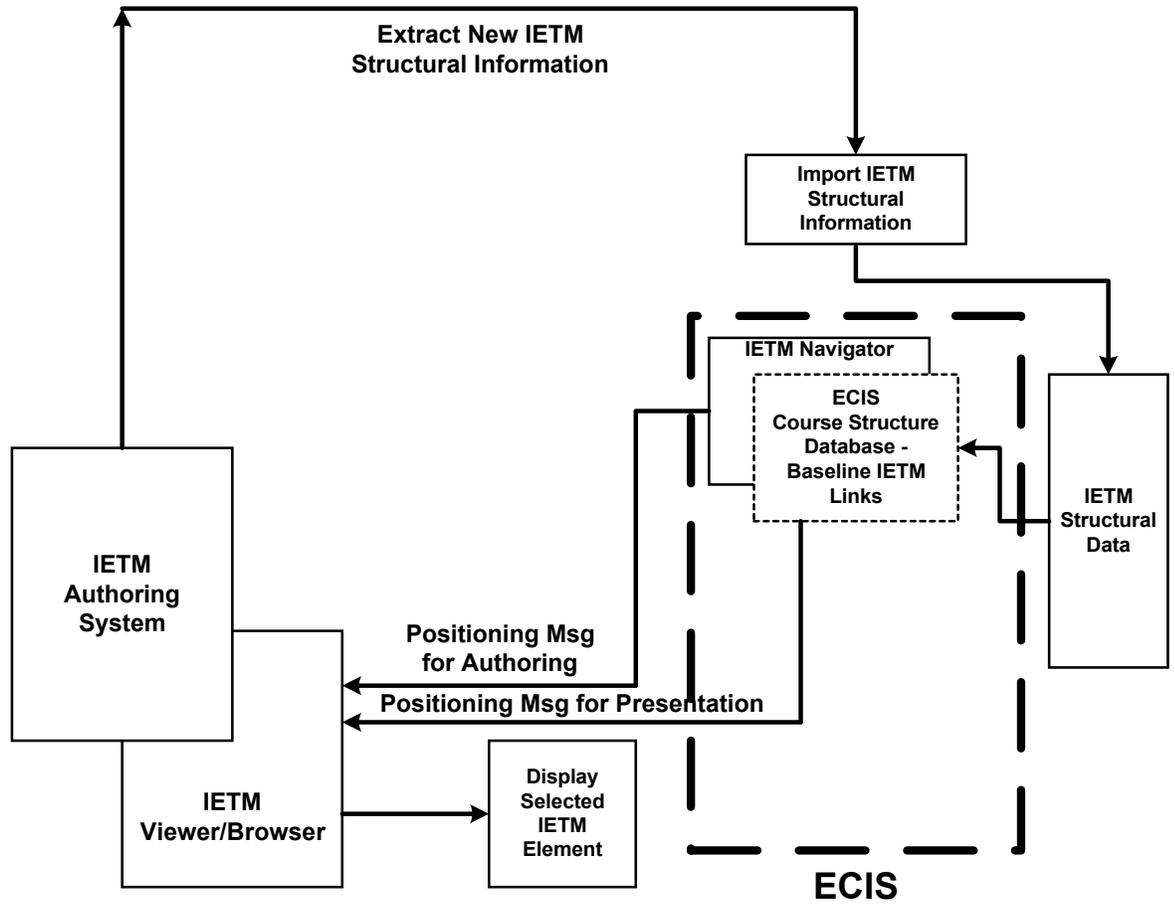
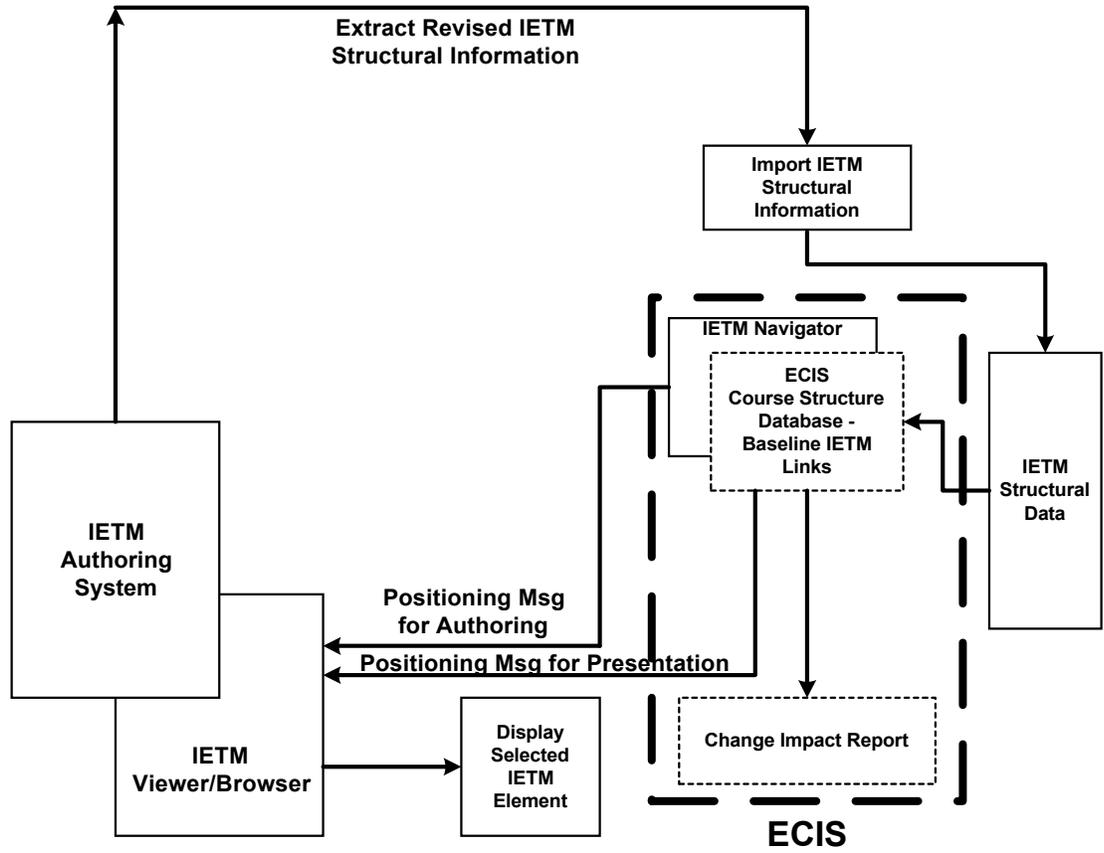


Figure B-8. ECIS/IETM Interface for Development for Non-AIM Courses



**Figure B-9. ECIS/IETM Interface for Surveillance/Maintenance for Non-AIM Courses**

**Automated ECIS/IETM Interface for Instructor Personalization**

The following paragraphs discuss a conceptual prototype automated interface between ECIS and IETMs for instructor personalization of both AIM- and non-AIM-based courses. This prototype design is also based on re-use of the software components already developed and tested for the AIM/IETM interface with the minimum necessary revision to the existing ECIS software.

As with the prototype interface for baseline course links discussed in the previous paragraph, virtually all the modules implemented for AIM can be applied to this effort:

- ✓ IETM extraction routines
- ✓ Import of extracted data to an IETM structural database
- ✓ The IETM structural database itself
- ✓ The IETM Navigator developed for the AIM interface
- ✓ DDE messaging routines for calling the IETM viewer from the IETM Navigator
- ✓ Change Impact Report

The only significant modifications required to implement the approach described in this section and depicted in Figures B-10 and B-11 are updates to the current manual IETM linking functions for instructor personalization in the ECIS. They require replacing the current personalization linking interface with the IETM Navigator from AIM and modifying the ECIS database to accept the DDE links to the IETM defined from the Navigator. The initial linking to the ECIS-registered course still has to be done manually by the instructor prior to teaching the course.

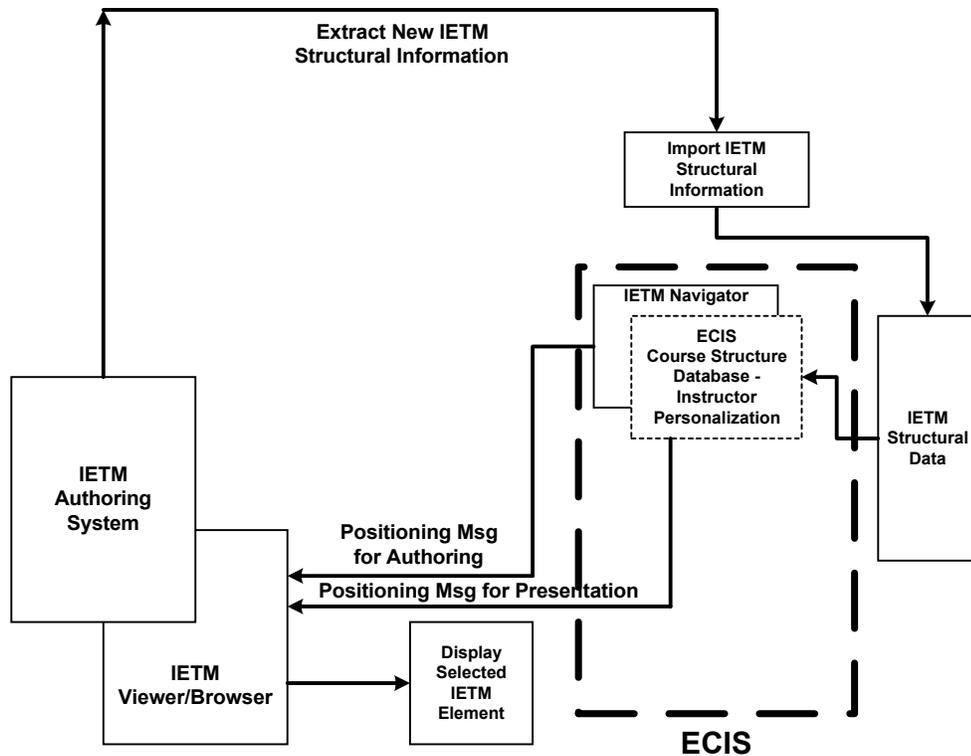
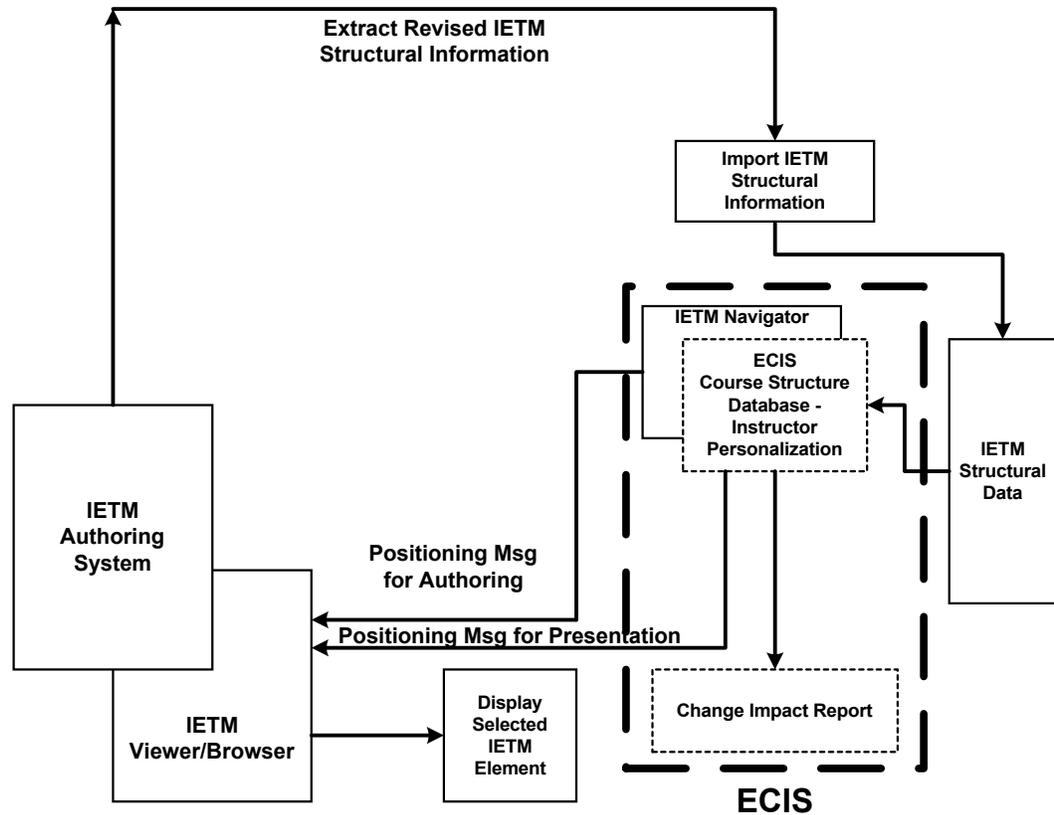


Figure B-10. ECIS/IETM Interface for Initial Personalization



**Figure B-11. ECIS/IETM Interface for Surveillance/Maintenance of Personalization**

Once the links are defined, however, any revision to the IETM will generate a Change Impact Report very similar to that in AIM, telling the school staff what DPs/RIAs and/or TG sheets must be re-personalized because of the change to the IETM. This will save significant manpower and calendar time in updating EC-based courses to the current IETM version, compared to having to revalidate every personalized IETM link manually every time the IETM changes.

## Appendix C

# Interface Examples

- ✓ IETM/AIM Interface Examples
- ✓ IETM/ICW Examples
- ✓ IETM/CIITA Examples
- ✓ IETM/CIITA Examples

## Appendix C

# Interface Examples

### IETM/AIM Interface Examples

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- ✓ NAVSEA/LMUSS – Acoustic Rapid COTS Insertion (ARCI) Program
- ✓ NAVSEA/NUWC Keyport – Attack Console, Mk 92, Mods 3-6, SW282-C3-MN10-010 – **Data unavailable on course structure and business case**

### IETM/ICW Examples

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- ✓ NAVSEA/NUWC Keyport – **Data unavailable**
- ✓ ARCI – **Development of ICW not planned until FY00**

### IETM/CIITA Examples

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**None currently in place**

### IETM/ECIS Examples

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- ✓ SSP/GDDS – TRIDENT Fire Control System Manual in SPACE Electronic Classroom – **Data unavailable**
- ✓ NAVSEA/GDDS – ARCI Manual in TechSight Electronic Classroom – **ARCI courses won't be presented in EC until FY00**
- ✓ NAVSEA/LM Syracuse – BSY-2 Manual in NAVSUBSCOL Electronic Classroom – **Integrated vs. interface model; pending coordination between NAWCTSD and NAVSEA**

## ARCI IETM/AIM Interface

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### Title of System, Subsystem, or Equipment Covered by IETM

**ARCI Program****NAVSEA/Lockheed Martin Undersea Systems (LMUSS), Manassas, VA  
Contract N00024-95-C-6535**

- ✓ **IETM Document ID Number:** To be assigned
- ✓ **IETM Volume ID Number [if assigned]:** To be assigned

### Description of IETM

- ✓ **Authoring Tool:** Custom Tool, developed by LMUSS
- ✓ **DTD Used (if applicable):** Not applicable (RDBMS-based IETM)
- ✓ **Publishing/Delivery Tool:** Custom Viewer, developed by LMUSS

### Support for Training Interface Functions in Original IETM Design

- ✓ **Element Title:** Yes
- ✓ **Unique Element ID:** Yes
- ✓ **Persistent Element ID:** Yes
- ✓ **Authoring Element ID Available in Delivery Tool:** Yes
- ✓ **Version Information at Element Level:** Yes
- ✓ **IETM Viewer DDE Aware:** Yes

## Changes Required in IETM and Level of Effort Expended to Provide All 6 Functions Required for Effective Automated Interface with AIM:

No significant changes were required in the ARCI IETM authoring or delivery system to support the automated interface with AIM.

All 6 functions were implemented in the original design of the IETM.

NAVSEA allocated approximately \$4K to support LMUSS efforts in design and testing of the interface with AIM.

## IETM Development and Production

✓ **How often was IETM re-issued during development?**

**Phase 1:** 7 releases issued to NAVSEA

**Phase 2:** To be determined (begins Jun 00 for Virginia class)

✓ **How long was development cycle?**

**Phase 1:** Aug 97 – Apr 99

**Phase 2:** To be determined

✓ **How often will IETM be revised during life-cycle support?**

**FY00 – FY01:** two revisions per year

**FY02 – FY04:** one revision per year

✓ **How long will life-cycle support continue?**

For the business case analysis in this example, the life cycle is arbitrarily defined as 5 years.

## Training Materials Supported by This IETM

- ✓ Total number of course weeks in all courses based on this IETM:  
Two courses with a total of 20 weeks (A-130-0009 – AN/BQQ-10 Combined Maintenance Conversion and A-130-0010 AN/BQQ-10 Maintenance Pipeline)
- ✓ Average number of links to the IETM per course week  
35 links per instructional day = 175 links per week
- ✓ Average time to check each IETM link manually  
5 minutes per link = .08 hrs per link
- ✓ Average manhour cost to do surveillance and maintenance of curricula  
\$50 per hour loaded cost (assumed for purposes of business case analysis)

## Benefits Resulting from IETM Interface with AIM

- ✓ **Subjective:**  
Reduced calendar time and manhours to conduct surveillance and prepare changes to AIM I-based training materials when a change or revision is issued to the IETM, based on the availability of automated interface capabilities between the IETM and AIM I.
- ✓ **Quantifiable Benefits:** (per business case analysis process in Part 3 TIIG)  
The following data elements are provided per Part 3 of the TIIG. Two tables are required to display the specific data values for this example because of the different frequency and magnitude of revisions during the first two years of the life-cycle period (FY00 and FY01) and for the last three years (FY02 – FY04). Manual development and maintenance of the IETM/AIM I links is defined as Alternative A. Automated development and maintenance is defined as Alternative B.

**Data Elements for Alternatives A & B**

|             |                                                             |
|-------------|-------------------------------------------------------------|
| <b>TCW</b>  | Total Course Weeks of training material or course(s)        |
| <b>L/W</b>  | Links per Week*                                             |
| <b>R/Y</b>  | Revisions per Year                                          |
| <b>M/L</b>  | Minutes per Link to perform function (estimated or assumed) |
| <b>C/SM</b> | Cost per Surveillance Minute                                |
| <b>LCY</b>  | Life Cycle (5 or 10 years)                                  |

\* For Alternative B (Automated), Element L/W is the percentage (%) of change only. This is a result of functionality 5 (Version Information at Element Level), which allows for efficient maintenance of curricula when a later version of the IETM is selected for use in the curricula.

**FY00 and FY01**

| Data Element | Alternative A | Alternative B | Notes       |
|--------------|---------------|---------------|-------------|
| <b>TCW</b>   | 20            | 20            |             |
| <b>L/W</b>   | 175           | 43.75         | 25% chg/rev |
| <b>R/Y</b>   | 2             | 2             |             |
| <b>M/L</b>   | 5 min/.08 hrs | 5 min/.08 hrs |             |
| <b>C/SM</b>  | \$50/hr       | \$50/hr       |             |
| <b>LCY</b>   | 2 yrs         | 2 yrs         |             |

**FY02 through FY04**

| Data Element | Alternative A | Alternative B | Notes       |
|--------------|---------------|---------------|-------------|
| <b>TCW</b>   | 20            | 20            |             |
| <b>L/W</b>   | 175           | 17.5          | 10% chg/rev |
| <b>R/Y</b>   | 1             | 1             |             |
| <b>M/L</b>   | 5 min/.08 hrs | 5 min/.08 hrs |             |
| <b>C/SM</b>  | \$50/hr       | \$50/hr       |             |
| <b>LCY</b>   | 3 yrs         | 3 yrs         |             |

The following formulas provide the specific ARCI business case analysis using the data elements from the previous tables:

**Formula for Alternative A (Manual Cost):**

**TCW x L/W x R/Y x M/L x C/SM x LCY**

**FY00 and FY01**

**20 x 175 x 2 x .08 x \$50 x 2 = \$56,000**

**FY02 through FY04**

**20 x 175 x 1 x .08 x \$50 x 3 = \$42,000**

***Total Cost for Alternative A for 5 years = \$98,000***

**Formula for Alternative B (Automated Link Cost):**

**TCW x L/W x R/Y x M/L x C/SM x LCY**

**FY00 and FY01**

**20 x 43.75 x 2 x .08 x \$50 x 2 = \$14,000**

**FY02 through FY04**

**20 x 17.5 x 1 x .08 x \$50 x 3 = \$4,200**

***Total Cost for Alternative B for 5 years = \$18,200***

Savings/Investment Ratio for ARCI Example:

- ✓ Cost of Alternative A: \$98,000
- ✓ Cost of Alternative B: \$18,200
- ✓ Total Investment: \$4,000

Formula for Savings/Investment Ratio (SIR):

$$\frac{(\text{Cost of Alt A} - (\text{Cost of Alt B} + \text{Investment}))}{\text{Investment}}$$

$$\frac{(\$98,000 - (\$18,200 + \$4,000))}{\$4,000}$$

$$\frac{\$75,800}{\$4,000}$$

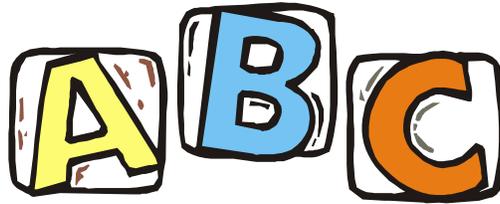
**SIR = 18.95**

**Note:** Additional cost avoidance can be expected from the ARCI program as more courses are implemented and as those courses are presented in Electronic Classrooms. For the EC, the automated interface will eliminate the requirement for CISO or instructor staff to implement and maintain links from the EC Lesson Plan to the IETM. All those functions will be performed in AIM and automatically carried forward into the EC via the ECIS.



**Appendix D**  
**Acronyms**

## Appendix D Acronyms




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|               |                                                    |               |                                                 |
|---------------|----------------------------------------------------|---------------|-------------------------------------------------|
| <b>2D CAD</b> | Two-dimensional CAD                                | <b>CAI</b>    | Computer-Assisted Instruction                   |
| <b>3D CAD</b> | Three-dimensional CAD                              | <b>CALS</b>   | Continuous Acquisition and Life Cycle Support   |
| <b>ACAP</b>   | Automated Curriculum Authoring Program             | <b>CAM</b>    | Computer Aided Manufacturing                    |
| <b>ACL</b>    | ADEPT Command Language                             | <b>CBT</b>    | Computer Based Training                         |
| <b>ACN</b>    | Advance Change Notice                              | <b>CD</b>     | Compact Disc                                    |
| <b>ADP</b>    | Automated Data Processing                          | <b>CD-ROM</b> | Compact Disc-Read Only Memory                   |
| <b>AIM</b>    | Authoring Instructional Materials                  | <b>CDRL</b>   | Contract Data Requirements List                 |
| <b>AIMSS</b>  | Advanced Integrated Maintenance Support System     | <b>CDNSWC</b> | Carderock Division Naval Surface Warfare Center |
| <b>AME</b>    | Advanced Maintenance Environment                   | <b>CGI</b>    | Common Gateway Interface                        |
| <b>ARCI</b>   | Acoustic Rapid COTS Insertion                      | <b>CGM</b>    | Computer Graphics Metafile                      |
| <b>ASCII</b>  | American Standard Code for Information Interchange | <b>CIITA</b>  | Computer Improved Instructor Training Aid       |
| <b>ASOM</b>   | AIM SGML Output Module                             | <b>CIN</b>    | Course Identification Number                    |
| <b>ASP</b>    | Active Server Page                                 | <b>CISO</b>   | Curriculum Instructional Standards Office       |
| <b>ATA</b>    | Air Transport Association                          | <b>CLO</b>    | Course Learning Objective                       |
| <b>ATIS</b>   | Advanced Technical Information Support             | <b>CMI</b>    | Computer Managed Instruction                    |
| <b>A/V</b>    | Audio Visual                                       | <b>CMS</b>    | Course Master Schedule                          |
| <b>.avi</b>   | Audio Video Interleave                             | <b>CNO</b>    | Chief of Naval Operations                       |
| <b>BESS</b>   | Basic Enlisted Submarine School                    | <b>COI</b>    | Curriculum Outline of Instruction               |
| <b>BMP</b>    | Bitmap                                             | <b>CONOPS</b> | Concept of Operations                           |
| <b>CAD</b>    | Computer Aided Design                              |               |                                                 |

|                |                                                                 |                |                                                   |
|----------------|-----------------------------------------------------------------|----------------|---------------------------------------------------|
| <b>COTS</b>    | Commercial Off-the-Shelf                                        | <b>GDSS</b>    | General Dynamics Defense Systems                  |
| <b>CPU</b>     | Central Processing Unit                                         | <b>GD/EB</b>   | General Dynamics Electric Boat Company            |
| <b>C/SM</b>    | Cost per Surveillance Minute                                    | <b>GFI</b>     | Government-Furnished Information                  |
| <b>CTTL</b>    | Course Task Training List                                       | <b>GIF</b>     | Graphics Interchange Format                       |
| <b>DAP</b>     | Document Application Profile                                    | <b>GUI</b>     | Graphical User Interface                          |
| <b>DCOM</b>    | Distributed Common Object Model                                 | <b>HML</b>     | InfoAccess' proprietary Hypertext Markup Language |
| <b>DDE</b>     | Dynamic Data Exchange                                           | <b>HP</b>      | Hewlett Packard                                   |
| <b>DHTML</b>   | Dynamic Hypertext Markup Language                               | <b>HPGL</b>    | Hewlett Packard Graphic Language                  |
| <b>DID</b>     | Data Item Description                                           | <b>HSI</b>     | Human System Interface                            |
| <b>DII-COE</b> | Defense Information Infrastructure-Common Operating Environment | <b>HTML</b>    | Hypertext Markup Language                         |
| <b>DNS</b>     | Domain Name Services                                            | <b>HTTP</b>    | Hypertext Transfer Protocol                       |
| <b>DoD</b>     | Department of Defense                                           | <b>I</b>       | Investment                                        |
| <b>DoN</b>     | Department of the Navy                                          | <b>IADS</b>    | Interactive Authoring and Display System          |
| <b>DP</b>      | Discussion Point                                                | <b>IC</b>      | Initial Cost                                      |
| <b>DTD</b>     | Document Type Definition                                        | <b>ICW</b>     | Interactive Courseware                            |
| <b>DVD</b>     | Digital Video Disk                                              | <b>ID</b>      | Identifier (IETM element)                         |
| <b>EC</b>      | Electronic Classroom                                            | <b>IETM</b>    | Interactive Electronic Technical Manual           |
| <b>ECIS</b>    | Electronic Classroom Integration Software                       | <b>IETMDB</b>  | IETM Database                                     |
| <b>ECOE</b>    | Electronic Classroom Operating Environment                      | <b>IETM PP</b> | IETM Process Plan                                 |
| <b>ETM</b>     | Electronic Technical Manual                                     | <b>IG</b>      | Instructor Guide                                  |
| <b>FEA</b>     | Front-End Analysis                                              | <b>IGES</b>    | Initial Graphics Exchange Specification           |
| <b>FLC/FLI</b> | Adobe animation file formats                                    | <b>ILS</b>     | Integrated Logistics Support                      |
| <b>FOSI</b>    | Formatting Output Specification Instance                        | <b>IM</b>      | Information Manager                               |
| <b>FPSI</b>    | Formatting Presentation Specification Instance                  | <b>IMM</b>     | Instructional Media Materials                     |
| <b>FTP</b>     | File Transfer Protocol                                          | <b>INFOSEC</b> | Information Security                              |
| <b>Gb</b>      | Gigabyte                                                        | <b>IP</b>      | Internet Protocol                                 |
| <b>GCSFUI</b>  | general content, style, format, and user interaction            | <b>IPDF</b>    | Indexed Portable Document Format                  |
| <b>GCSS</b>    | Global Combat Support System                                    | <b>ISD</b>     | Instructional Systems Development or Design       |
|                |                                                                 | <b>IT</b>      | Information Technology                            |

|                 |                                                                  |                  |                                                                |
|-----------------|------------------------------------------------------------------|------------------|----------------------------------------------------------------|
| <b>HyTime</b>   | Hypermedia/Time-based Structuring Language                       | <b>MPC II</b>    | Multimedia PC Compatible                                       |
| <b>JCG-CE</b>   | Joint Commanders Group for Communication and Electronics         | <b>.mpg</b>      | MPEG file extension                                            |
| <b>JEDMICS</b>  | Joint Engineering Data Management Information and Control System | <b>MS</b>        | Microsoft                                                      |
| <b>JHT</b>      | Jardon and Howard Technologies                                   | <b>MS-DOS</b>    | Microsoft Disk Operating System                                |
| <b>JIA</b>      | Joint IETM Architecture                                          | <b>MTBF</b>      | Mean Time Before Failure                                       |
| <b>JIMIS</b>    | Joint Integrated Maintenance Information System                  | <b>MTTR</b>      | Mean Time to Repair                                            |
| <b>JIT</b>      | Just in Time                                                     | <b>M/L</b>       | Minutes per Link (to perform a function)                       |
| <b>JPEG/JPG</b> | Joint Photographic Experts Group                                 | <b>NAMTRAGRU</b> | Naval Aviation Maintenance Training Group                      |
| <b>JSTARS</b>   | Joint Surveillance Target Attack Radar System                    | <b>NATEC</b>     | NAVAIR Technical Data and Engineering Service Command          |
| <b>JTA</b>      | Joint Technical Architecture                                     | <b>NATTC</b>     | Naval Aviation Technical Training Center                       |
| <b>K</b>        | Kilo (1000)                                                      | <b>NAVAIR</b>    | Naval Air Systems Command                                      |
| <b>LAN</b>      | Local Area Network                                               | <b>NAVEDTRA</b>  | Naval Education and Training Command                           |
| <b>LCY</b>      | Life Cycle                                                       | <b>NAVSEA</b>    | Naval Sea Systems Command                                      |
| <b>LMOS</b>     | Lockheed Martin Ocean Systems                                    | <b>NAWCTSD</b>   | Naval Air Warfare Center Training Systems Division             |
| <b>LMUSS</b>    | Lockheed Martin Undersea Systems                                 | <b>NDI</b>       | Non-Developmental Item                                         |
| <b>LO</b>       | Learning Objective                                               | <b>NIRS/NIFF</b> | Navy Implementation of Raster Scanning/Naval Image File Format |
| <b>LP</b>       | Lesson Plan                                                      | <b>NSSN</b>      | New Attack Submarine (Virginia Class)                          |
| <b>LSAR</b>     | Logistics Support Analysis Record                                | <b>NSWC</b>      | Naval Surface Warfare Center                                   |
| <b>L/W</b>      | Links per week                                                   | <b>NT</b>        | New Technology                                                 |
| <b>Mb</b>       | Megabyte                                                         | <b>NTCSS</b>     | Naval Tactical Command Support System                          |
| <b>Mhz</b>      | Megahertz                                                        | <b>NUWC</b>      | Naval Undersea Warfare Center                                  |
| <b>MIME</b>     | Multipurpose Internet Multimedia Extension                       | <b>OCR</b>       | Optical Character Recognition                                  |
| <b>MMI</b>      | Man-Machine Interface                                            | <b>ODA</b>       | Office Document Architecture                                   |
| <b>MML</b>      | Master Material List                                             |                  |                                                                |
| <b>MPEG</b>     | Motion Picture Experts Group                                     |                  |                                                                |
| <b>MPC</b>      | Multimedia Personal Computer                                     |                  |                                                                |

|                |                                               |               |                                                        |
|----------------|-----------------------------------------------|---------------|--------------------------------------------------------|
| <b>ODBC</b>    | Other Database Connection                     | <b>SOW</b>    | Statement of Work                                      |
| <b>OE</b>      | Operating Environment                         | <b>SPAM</b>   | SP Added Markup                                        |
| <b>OEM</b>     | Original Equipment<br>Manufacturer            | <b>SPAWAR</b> | Space and Naval Warfare<br>Systems Command             |
| <b>OLE</b>     | Object Linking and<br>Embedding               | <b>SSO</b>    | System Support Office                                  |
| <b>O-Level</b> | Organizational Level                          | <b>SSM</b>    | Ship System Manual                                     |
| <b>OODBMS</b>  | Object Oriented Database<br>Management System | <b>SSP</b>    | Strategic Systems Programs                             |
| <b>OS</b>      | Operating System                              | <b>STASS</b>  | Standard Training Activity<br>Support System           |
| <b>PC</b>      | Personal Computer                             | <b>SW</b>     | Software                                               |
| <b>PDF</b>     | Portable Document Format                      | <b>SWS</b>    | Strategic Weapon System                                |
| <b>PEDD</b>    | Portable Electronic Display<br>Device         | <b>TAM</b>    | Table Assignment Matrix                                |
| <b>PFE</b>     | Program File Editor                           | <b>TCCD</b>   | Training Course Control<br>Document                    |
| <b>PPP</b>     | Personnel Performance<br>Profile              | <b>TCP/IP</b> | Transmission Control<br>Protocol/Internet Protocol     |
| <b>PURL</b>    | Persistent Universal Resource<br>Locator      | <b>TCW</b>    | Total Course Weeks (of<br>training)                    |
| <b>QA</b>      | Quality Assurance                             | <b>TEE</b>    | Training Effectiveness<br>Evaluation                   |
| <b>RAM</b>     | Random Access Memory                          | <b>TG</b>     | Trainee Guide                                          |
| <b>RC</b>      | Recurring Cost                                | <b>TIFF</b>   | Tagged Image File Format                               |
| <b>RCS</b>     | Revision Control System                       | <b>TIIG</b>   | Training/IETM Interface<br>Guide                       |
| <b>RDBMS</b>   | Relational Database<br>Management System      | <b>TLA</b>    | Training Level Assignment                              |
| <b>RFP</b>     | Request for Proposals                         | <b>TLO</b>    | Topic Learning Objective                               |
| <b>RIA</b>     | Related Instructor Activity                   | <b>TM</b>     | Technical Manual                                       |
| <b>RRL</b>     | Resource Requirements List                    | <b>TMCR</b>   | Technical Manual Contract<br>Requirement               |
| <b>RTF</b>     | Rich Text Format                              | <b>TMINS</b>  | Technical Manual<br>Identification Numbering<br>System |
| <b>R/Y</b>     | Revisions per Year                            | <b>TMPODS</b> | Technical Manual Publish<br>On-Demand System           |
| <b>SCO</b>     | Santa Cruz Operation                          | <b>TO</b>     | Topical Outline                                        |
| <b>SDP</b>     | System Decision Paper                         | <b>TOC</b>    | Table of Contents                                      |
| <b>SEADDSA</b> | NAVSEA Automated Data<br>Systems Activity     | <b>TOS</b>    | Training Objective Statement                           |
| <b>SGML</b>    | Standard Generalized<br>Markup Language       | <b>TPC</b>    | Training Path Chart                                    |
| <b>SIR</b>     | Savings/Investment Ratio                      | <b>TPP</b>    | Training Project Plan                                  |
| <b>SME</b>     | Subject Matter Expert                         | <b>TPS</b>    | Training Path System                                   |
| <b>SNAP</b>    | Shipboard Non-tactical ADP<br>Program         |               |                                                        |

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|                |                                              |
|----------------|----------------------------------------------|
| <b>TQM</b>     | Total Quality Management                     |
| <b>TSM</b>     | Training Support Materials                   |
| <b>TSWG</b>    | Tri-Service IETM<br>Technology Working Group |
| <b>UPS</b>     | Uninterruptible Power<br>Supply              |
| <b>URL</b>     | Universal Resource Locator                   |
| <b>USA</b>     | United States Army                           |
| <b>USAF</b>    | United States Air Force                      |
| <b>USMC</b>    | United States Marine Corps                   |
| <b>USN</b>     | United States Navy                           |
| <b>USPRO</b>   | United States Product Data<br>Association    |
| <b>VCR</b>     | Video Cassette Recorder                      |
| <b>VGA</b>     | Video Graphics Array                         |
| <b>VP</b>      | Viewpackage                                  |
| <b>VRAM</b>    | Video Random Access<br>Memory                |
| <b>VTC</b>     | Video Teleconferencing                       |
| <b>VTT</b>     | Video Teletraining                           |
| <b>vURL</b>    | Virtual Universal Resource<br>Locator        |
| <b>WYSIWYG</b> | What You See Is What You<br>Get              |
| <b>WWW</b>     | World Wide Web                               |
| <b>W3C</b>     | World Wide Web<br>Consortium                 |
| <b>XLL</b>     | Extensible Linking Language                  |
| <b>XML</b>     | Extensible Markup Language                   |
| <b>XREF</b>    | Cross Reference                              |
| <b>XREF ID</b> | Cross-Reference Identifier                   |
| <b>XSL</b>     | Extensible Stylesheet<br>Language            |

Appendix E

## Definitions

## Appendix E

# Definitions



**Acquisition Streamlining.** Common sense approach that results in more efficient and effective use of resources to develop or produce quality products. This includes ensuring that only necessary and cost-effective requirements are included, at the most appropriate time in the acquisition cycle, in Requests for Proposals (RFPs) and resulting contracts for the design, development, and delivery of new products or modifications to existing products.

**AIM SGML Output Module (ASOM).** A program which provides an Instructor Guide (or Lesson Plan) and a Trainee Guide in an SGML (compliant with the AIM Export DTD) formatted file (typically used for display of training materials in an Electronic Classroom environment).

**Animation.** Animation is a method of visually presenting information or demonstrating a procedure. The objects that perform the action are called actors. For example, to show how two parts fit together, an animation sequence could be created that shows the two parts separated and then slowly moving together so that the user can clearly see the fit. Animations are usually used to clarify procedures or information that are difficult to express in words.

**Annotation.** Information the student can add to his/her instructor-supplied materials for personal Trainee Guide. Annotations are not configuration controlled and are not intended to be used by another student. Student annotations do not alter the course materials but are linked to specific points within those materials. This information is user-specific and will be saved in a user-specific directory. Annotation capabilities are equivalent to the personalization functions used by instructors in the electronic classroom.

**Authoring Element ID Available in Publishing/Delivery Tool.** The unique element ID assigned in the IETM authoring tool is also carried over to the delivery tool. (Note: in most cases, the element ID is carried over from the authoring tool to the delivery tool (e.g., ID attribute of the element in the SGML file)). In some cases, however, the document compiled from the authoring tool for delivery in a different tool does not contain the element ID from the authoring tool (e.g., in a Guide Reader document, the SGML ID attribute of the element is not always automatically carried over to the object name in the compiled document and is not, therefore, available for use in the delivery tool).



**Baseline Course.** A promulgated curriculum that has been imported into the ECIS and integrated with the media that all instructors must present during conduct of the course. The baseline course configuration is not affected by any instructor personalization or student annotation.

**Bookmark.** Also called Annotation. Bookmarking is a feature by which the end user may mark a certain portion of the electronic text of the IETM and associate a key word with it. The user can then scroll through a list of bookmarks to quickly locate a certain part. It can be thought of as a way for the end user to take notes as he reads, and to build his own custom index.

**Browse Mode.** IETM mode in which the user is simply scrolling through or hyperlinking through text and graphics.

**Build.** The build process is the process of taking all the discrete files, which are to be a part of the IETM, and compiling them into an actual IETM. Often if a project is very large, builds are done incrementally so that portions of the IETM may be checked without waiting for the entire IETM to be completed.



**Computer Assisted Instruction (CAI).** The use of computers to aid in the delivery of instruction.

**Computer Based Training (CBT).** Instruction delivered by a computer which includes CAI, CMI, as well as computer simulation and part-task training.

**Computer Managed Instruction (CMI).** The use of computers to manage the instructional process, generally including registration, pre-testing, diagnostic counseling, prescription of learning experiences, progress testing, post-testing, determination of student mastery of objectives, and disenrollment.

**Cost Effective.** Economical in terms of goods or services received for money spent.

**Course Learning Objective (CLO).** A description of the overall knowledge and/or skills to be attained upon completion of a course.

**Course Materials.** Include all information and materials associated with the conduct of a course. Course materials can also be called curricula materials, and consist of the Lesson Plan, Trainee Guide, and Training Support Materials.

**Courseware.** Paper-based, audiovisual, and electronically stored instructional material necessary to deliver a lesson, instructional module, or course. Courseware also includes the special applications programs and other software necessary to present instruction.

**Curriculum Outline of Instruction (COI).** Description of the overall course outline and objectives; includes CLOs and Topic Learning Objectives (TLOs).

**Course Task Training List (CTTL).** A list of duties and tasks to be trained in a course.



**Database.** A way of organizing and storing data. For an IETM, however, particularly a Class 4 or 5 IETM, the database becomes highly complex. Such a database may be required to store not only text and graphics but also audio, video, animations, engineering information, parts list data, and so on; assign and track IDs for each element; retrieve elements by ID, by class, etc.; incorporate changes by updating affected items automatically; record and track changes made to data, including when and by whom; and so on. The higher the level of IETM, the more sophisticated the database that will be required to support it.

**Dynamic Data Exchange (DDE).** A form of interprocess communication that uses shared memory to exchange data between applications. With two or more applications that are DDE-compatible, the applications can carry out DDE between applications running on the same computer or on different computers in a network.



**Edit.** For ECIS, the minimum functions assumed as part of edit are copy, cut, and paste.

**Element Title.** English language descriptive name for each individual node in the IETM. These are the names displayed for each element in the table of contents of the IETM.

**ETM (Electronic Technical Manual).** Least interactive form of IETM. Essentially nothing more than electronic storage of page images with a basic page-turning capability. (Compare IETM.)

**Expert System.** A tool for incorporating expert knowledge into an IETM such that it benefits the end user. Expert systems are usually in a question-and-answer format; the system asks a series of questions answered by the user; then, using the expert knowledge built into it by its authors, produces a solution for the end user. The end user thus benefits from expert knowledge that he/she may not personally possess.

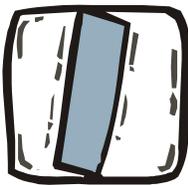
**Extraction.** The process of analyzing the IETM SGML authoring file or RDBMS (as appropriate to the specific IETM) to derive the structural information required for development and maintenance of automated links between the IETM and training tools, such as AIM. This process is supported by software routines developed, distributed, and maintained by NAWCTSD as the ETE SSO.



**Hot Links.** Provide an interactive link between the Lesson Plan and the referenced media. A hot link enables the instructor to display Training Support Material or launch an application by activating the hot link within the ECIS.

**Human System Interface (HSI).** Also called Man-Machine Interface (MMI). HCI refers to the method or methods by which a human and a computer interact, and encompasses such items as keyboard, mouse, trackball, and display screen.

**Hyperlinks.** Also called hot links, hot spots. An area in the IETM, usually set off by being in reverse video or a separate color, that when clicked on takes the user to another location in the IETM or launches another process such as a video or animation segment.



**IETM (Interactive Electronic Technical Manual).** An IETM is the workstation, or other display device. The lowest form of IETM is an ETM, or Electronic Technical Manual, which has no interactivity at all and is nothing more than electronic storage of page images with a basic page-turning capability. An IETM adds progressively more interactive electronic features such as indexing, searching, and hyperlinking, all the way up to multimedia features such as audio, video, and animations.

**IETM Viewer Is Dynamic Data Exchange (DDE) Aware.** The IETM viewer software includes DDE capability to communicate with external programs; i.e., the IETM viewer will respond to specific commands, such as to position to a specific IETM element based on its unique ID.

**Instructional Delivery System.** Training devices, training equipment, training aids, and/or a combination of interactive courseware selected during the training media analysis.

**Instructional Materials.** All items of material prepared, procured, and used in a course or program as part of the teaching or general learning process.

**Instructional Media Materials (IMM).** Used to introduce, reinforce, or supplement training provided in the formal environment; includes Transparencies, Video Tapes, Interactive Courseware/Computer Based Training exercises, Slides, Wall Charts, etc.

**Instructor Guide (IG).** Provides specific definition and direction to the Instructor on training objectives, equipment and support material requirements, and course conduct; includes a Master Materials List (MML).

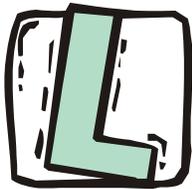
**Interactive Courseware (ICW).** Computer-controlled courseware that relies on trainee input to determine the pace, sequence, and content of training delivery using more than one type of medium to convey the content of instruction. ICW can link to a combination of media, to include but not be limited to: programmed instruction, video tapes, slides, film, television, text, graphics, digital audio, animation, and up to full motion video, to enhance the learning process. Consists of text, graphics, and computer programming and/or scripting instructions assembled into a logical structure designed to convey facts, concepts, procedures, and to provide instruction and practice in problem solving.

**Interactive Density.** Interactive Density is a measure of the amount and complexity of the interactive features in an IETM. For example, an IETM with expert systems, video, audio, etc., would have high interactive density; an ETM would have extremely low interactive density.

**Interface.** The device or circuit that provides the communicating transition between different systems. The hardware and/or software for connecting a device to a system or one system to another. A physical or functional connection between two or more devices or systems.



**Knowledge.** Information required to develop the skills and attitudes for effective accomplishment of jobs, duties, and tasks.



**Learning Objective (LO).** A statement of behavior or performance expected of a trainee as a result of a learning experience, expressed in terms of the behavior, the conditions under which it is to be exhibited, and the standards to which it will be performed or demonstrated. Sometimes call a “training objective.”

**Legacy Development IETM.** A legacy development IETM is one in which most if not all of the data to be used already exists, either in paper or electronic format, or a combination. Thus, the greatest benefit of this type of project is that data entry or creation costs are very low. The primary concern with a legacy development project is the conversion of the existing data. Conversion can be simple or highly complex, depending on the format of the legacy data, and the end format it must be converted to. (Compare to New Data Development IETM.)

**Lesson.** A segment of instruction that contains an objective, information (to be imparted to the trainee), and an evaluation instrument (test).

**Lesson Plan (LP).** Provides specific definition and direction to the Instructor on training objectives, equipment and support material requirements, and course conduct; includes a Resource Requirements List.

**Life-Cycle Maintenance Capability.** The ability to update, modify, and otherwise change training materials and/or equipment after initial delivery.



**Man-Machine Interface (MMI).** Also called Human System Interface. Describes the way the user and computer interact, and encompasses such items as keyboard, mouse, trackball, and display screen.

**Master Materials List (MML).** A list of everything required to conduct the course (equivalent to RRL).

**Media Selection.** The process of selecting the most effective means of delivering instruction.



**New Data Development IETM.** A new data development IETM is one in which the data is being created/developed specifically for the IETM, or concurrently with it. The greatest benefit of this type of project is that data can be authored directly in the desired format rather than being converted from some other, possibly incompatible, format. (Compare Legacy Development IETM.)



**Object Linking and Embedding (OLE).** With object linking, a developer can create a drawing, sound file, or other object by using an application, and then insert (embed) it in another document. The embedded information can then be edited from within the document.

With object linking, the same information (the object) can be used in several documents. An object can be any kind of information, including text, a drawing, or a sound file. The object can be created and then connected (linked) to as many documents as needed. When the object is edited in any of the documents, the changes are reflected in all the other documents that contain the same linked information.



**Performance Specification.** A statement of requirements, in terms of the required results with criteria for verifying compliance, without stating the methods for achieving the required results. A performance specification defines the functional requirements for the item, the environment in which it must operate, and interface and interchangeability characteristics.

**Persistent Element ID.** Unique element ID is maintained the same over multiple versions of the IETM.

**Personalization.** Information the instructor can add to his/her copy of the Lesson Plan. Instructor personalization is not configuration controlled, is not intended to be used by another instructor, and is generally authored by the instructor for his/her use only. This information is user-specific and will be saved in a user-specific directory accessible only by the instructor who authored the personalization. Personalization can include text-based data, illustrations, overlays, or links to other Training Support Material (e.g., IETMs, PowerPoint files, ICWs). Addition of personalization does not alter the configuration of the baseline course materials.

**Personnel Performance Profile (PPP).** A minimum listing of knowledge and skills required to operate and maintain a system, subsystem, or equipment, or to perform a task or function.

**Personal User Notes.** The capability within the ECIS to access a word processor to create, edit, and save information, the same as the student would do with a notepad in a non-electronic environment. Information is user specific and will be saved in a user-specific directory.

**Pre-Defined Electronic Links.** Links contained within an electronic document or file such as an IETM. These links shall not be affected by the ECIS, and they shall be maintained during integration or import.



**Registration.** The term used by NAWCTSD for the process of testing currently available IETM extraction and DDE messaging interface routines against a new type of IETM. This process yields one of two results:

- ✓ Determines that available extraction and DDE messaging will work without modification for the new IETM in question, or
- ✓ Define what changes will need to be made either to the SSO-provided extraction and DDE messaging software or to the IETM development, delivery, and maintenance processes, or to both

The registration process is conducted by the IETM acquisition manager and NAWCTSD as the ETE SSO, supported by the IETM developer and the ETE software support contractor. This procedure provides the IETM acquisition manager all the data required to perform the business case analysis outlined in Part 3 of the TIIG. This analysis will define the justification for devoting additional resources and time to the IETM development and maintenance process to support an automated interface with AIM and other automated training tools.

**Resource Requirements List (RRL).** A list of everything required to conduct the course (equivalent to MML).

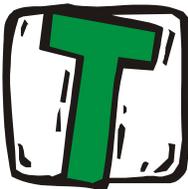


**Savings/Investment Ratio.** The relationship between the projected cost avoidance/savings of the recommended alternative and the investment necessary to realize those savings. Investment is defined as the implementation costs to implement certain functionalities plus the life-cycle costs to support those functionalities throughout the life of the product or system in question. A Savings/Investment Ratio of greater than 1 is required for the proposed course of action to be economically feasible.

**Shell Out.** The action of an external program being called from within a program that is currently running.

**Skill.** The ability to perform a job-related activity that contributes to the effective performance of a task.

**Subject Matter Expert (SME).** An individual who has a thorough knowledge of a job, duties/tasks, or a particular topic, which qualifies him to assist in the training development process (for example, consultation, review, analysis, advice, critique).



**Tailoring of Requirements.** The deletion of requirements (from DIDs and specifications) that are not required to meet the needs of a specific contract, or the addition of (for specifications only) requirements that may be needed under certain conditions.

**Task.** A single unit of specific work behavior with clear beginning and ending points that are directly observable or otherwise measurable. A task is performed for its own sake; that is, it is not dependent upon other tasks, although it may fall in a sequence with other tasks in a duty or job.

**Trainee Guide (TG).** The primary trainee material; may be used to provide supplementary information needed to successfully complete a course or information that is not readily available in reference publications at a level required for instructional purposes. Also provides problems to complete or steps to perform to apply what the trainee has learned.

**Training Course Control Document (TCCD).** The primary management tools of higher authority to approve course scope and outline, and both overall and specific objectives of the course, including resources and the personnel for which the course is being designed to train.

**Training Data Product.** Contains information related to the analysis, design, development, presentation, evaluation, or the life-cycle maintenance of training, regardless of its form or physical characteristics.

**Training Support Materials (TSM).** Any information or materials not included in either the Lesson Plan or Trainee Guide but required for the course. They may include the material listed on the first page or topic page of each paper-based Lesson Plan topic. They may include documentation, instructional media, training aids, equipment, and electronic files (text, graphic, video, multimedia, etc.). In cases of electronic media, Training Support Materials are considered data content and not software application that displays the data content. For example, a Training Support Material would be an IETM (IETM database) but not the software that must be installed to display the IETM (IETM viewer). The viewer software is considered an external software application.

**Training System.** An integrated combination of all elements (e.g., training material and equipment, personnel, support) necessary to conduct training.

**Topic Learning Objectives (TLOs).** Support the CLOs and describe the topic-specific skills and knowledge to be attained by the trainee during the topic.

**Training Path System (TPS).** A management tool, which designates the training requirements for Navy personnel, involved in a particular training program(s). A TPS includes Training Objective Statements (TOS), Training Level Assignments (TLAs), Table Assignment Matrix (TAM), and Training Path Charts (TPCs).

**Training Project Plan (TPP).** The output product of the training planning phase; presents a plan for curriculum development and training material modification which contains course data, justifications for the course revision or new course development, impact statements, milestones, and resource requirements.



**Unique Element ID.** Alphanumeric value used by the IETM to assign a distinct identifier for a specific element.

**User.** A person belonging to any one of the four categories of ECIS users: System Administrator, Curriculum Manager, Instructor, and Student.

**User Files.** Electronic files belonging to an individual user for his/her personal use that may include text and graphic files.



**Version Information at Element Level.** Alphanumeric value used by an individual IETM element to identify the change level for that particular element (when the element was added or modified). Version information at the element ID level allows for efficient maintenance of curricula when a later version of the IETM is selected for use in the curricula.

**Video.** Video refers to actual video segments, which can be played by the user of an IETM. For example, video can be taken of personnel performing procedures on actual equipment. The video can be edited; titles, arrows to show flow or motion, or voice-overs for additional clarification can be added. Video is best used for demonstrating difficult or error-prone procedures.

**Viewpackages (VP).** Viewpackages come in two types: Static or Dynamic. A static viewpackage is a sequential presentation of procedural steps. Each step may be a piece of text, a graphic, etc. A dynamic viewpackage is made up of steps, which may each incorporate several different media; the user chooses which particular piece he/she wishes to see.

**Viewpackage Mode.** IETM mode in which the user is accessing and moving through viewpackages.



**Word Processing.** The capability to create, edit, delete, save, or print a document using a keyboard and/or a pointing device, such as a mouse. Minimum word processing capabilities include formatting text using the following:

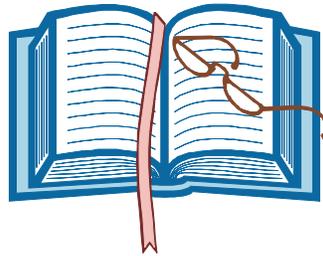
- ✓ Bold, italic, underline, and color
- ✓ Font type and size
- ✓ Cut, copy, and paste
- ✓ Bullet lists



**XREFs, XREF IDs.** Shorthand for cross-reference, cross-reference IDs. An XREF is a cross-reference item; the computer must have some way of finding the target object (paragraph, figure, etc.). This is accomplished by assigning each object — whether paragraph, figure, table, step, video segment, or whatever — an XREF ID, sometimes also called an Object ID. Thus, when the user clicks on a link, the system checks for the XREF ID, finds the object with that ID, and brings up that element on the display screen.

**Appendix F**  
**References**

## Appendix F References



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|                      |                                                                                                                                        |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------------|
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| CNETINST 1550.10B    | Production, Approval, Implementation, and Cancellation of Training Programs and Materials.                                             |
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|                 |                                                                                                                                                     |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| ISO 10744       | Hypermedia/Time-based Structuring Language (Hytime), 1997                                                                                           |
| MIL-HDBK-1379-1 | Department of Defense Handbook: Guidance for Acquisition of Training Data Products and Services, 9 June 1997.                                       |
| MIL-HDBK-1379-3 | Department of Defense Handbook: Development of Interactive Multimedia Instruction (IMI), 9 June 1997.                                               |
| MIL-HDBK-1379-4 | Department of Defense Handbook: Glossary for Training, 9 June 1997.                                                                                 |
| MIL-M-38784C    | Manuals, Technical; General Style and Format Requirements                                                                                           |
| MIL-M-81927     | Manuals, Technical; General Style and Format of (Work Package Concept).                                                                             |
| MIL-M-81928     | Manuals, Technical: Aircraft and Aeronautical Equipment Maintenance, Preparation of (Work Package Concept)                                          |
| MIL-M-81929     | Manuals, Technical: Illustrated Parts Breakdown, (Work Package Concept); Preparation of                                                             |
| MIL-PRF-28000A  | Amendment 1, Digital Representation for Communication of Product Data: IGES Application Subsets and IGES Application Protocols, 14 December 1992.   |
| MIL-PRF-28001   | Markup Requirements and Generic Style Specification for Electronic Printed Output and Exchange of Text, 1 October 1991.                             |
| MIL-PRF-28002   | Raster Graphics Representation In Binary Format, Requirements For, 14 December 1992.                                                                |
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| MIL-PRF-87268   | Implementation Guide, Manuals, Interactive Electronic Technical: General Content, Style, Format, and User-Interaction Requirements, 30 August 1995. |
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## Appendix G

# Navy IETM Information

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- ✓ Background
- ✓ Compatibility with ATIS
- ✓ Data Conversion Efforts
- ✓ Navy IETM Display Equipment
- ✓ Development Resources
- ✓ Classroom Instruction
- ✓ Software Licensing
  - Navy CALS DTD Repository
  - Anonymous FTP
- ✓ CD Guidelines
- ✓ Point of Contact

## Appendix G

### Navy IETM Information

#### Background

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When Navy IETM development began in earnest in the early 1990s, NAVSEA, NAVAIR, and SPAWAR, as well as many individual codes within each command, initiated exploratory IETM programs.

The AEGIS community funded and developed an IETM for the Radio Communication Set, as did the submarine community for the AN/BSY-2 Sonar Set. Based on the impressive feedback as a result of these IETM deployments, NAVSEA 04 selected a mature Hull, Mechanical and Electrical equipment program to prove that legacy systems could be cost effectively migrated to Class II/III IETM status. The LM2500 Gas Turbine, prime mover for many of the Navy's surface combatants, was selected as the candidate program. Thousands of pages of material were scanned, placed in Optical Character Recognition (OCR) format and SGML tagged. View packages were built from the resulting SGML instance and displayed using the Info Access browser. Conversion and developmental costs were within acceptable parameters, and positive feedback was obtained through demonstration of the Gas Turbine Systems IETM within the Navy community.



To avoid potential conflicts and inefficiencies when paper technical manuals were converted to IETM format by individual NAVSEA/ SPAWAR Program Managers, NAVSEA 04 was designated as the central authority for digitizing legacy data. Over the past several years, nearly a million pages of technical data, including drawings, maintenance data and operational procedures, have been digitized in the form of SGML and/or raster images. The data is stored and maintained in an SGML relational database and disseminated on CD-ROM when requested. IETM data can be viewed/printed from Adobe Acrobat, the Dynatext browser, or Guide Reader.

NAVAIR had a different set of criteria it wanted to meet when converting paper to SGML. NAVAIR determined it needed more of the benefits resulting from a Class III/IV IETM to support its Advanced Maintenance Environment (AME) concept.



For new systems, the overall Navy strategy is to pursue acquisitions of Class IV/V IETMs when the acquisition cost model substantiates financial savings over the life cycle of the weapon system. For the conversion of legacy systems, refer to *Data Conversion Efforts* on page G-3 of this appendix.

## Compatibility with ATIS

The Advanced Technical Information Support (ATIS) system provides software that performs library functions and supports the display of all Classes of digital TMs. Once the user selects a TM to view, ATIS locates it and launches the appropriate viewer for that IETM. ATIS provides a guaranteed set of hardware that enables IETMs created by different programs to be viewed on the same display hardware, minimizing the amount of unique display equipment. Additionally, ATIS and a 240 CD jukebox will be available on Shipboard Non-tactical ADP Program (SNAP) terminals on ships.

While it is desirable for all IETMs to be compatible with ATIS, it is recognized that there may be conditions where that is not possible or practical; for example, on IETMs where:

- ✓ Software programming is integrated into the weapon system operating software
- ✓ The ATIS software constraints and/or restrictions severely impact on a program or user or preclude a specific IETM implementation (Cognizant managers should be aware of those restrictions and ensure that they do not impact.)



If for any reason the IETM chosen is not ATIS compatible — particularly those integrated into the weapon system or equipment, the program assumes the responsibility for roles that ATIS currently fills and must ensure that all potential legitimate users have access to the data. For directions on making IETMs ATIS compatible, please contact the ATIS Help Desk.

## Data Conversion Efforts



Raster TMs have two mature conversion processes in place at NSWC, Philadelphia and NATEC. Any legacy hard-copy TM should be referred to these sites for conversion. Conversion is already under Government contract, and programs should not attempt to convert legacy TMs into this raster format other than at these conversion sites. In many cases, NSWC, Philadelphia, and NATEC may be funded to convert the TMs into raster format. If conversion funds have not been allocated, NSWC, Philadelphia and NATEC will be able to quote the costs of converting the TMs.

NAVSEA, NAVAIR, and SPAWAR have scanned the majority of existing hard-copy TMs. NSWC, Philadelphia, or NATEC can assist the program in determining whether required TMs have already been converted into these Class I/II formats and whether the configuration of the Class I/II IETM is current. These scanned images are also used as the source data for Technical Manual Publish On Demand System (TMPODS) that provides hard-copy manuals without the need to store excesses or dispose of obsolescent material.

### The Conversion Process

- Step 1: Contact NSWC or NATSF to initiate Class 1 conversion process. (NSWC – Philadelphia 215-897-1557 (DSN 443); NATEC 619-545-3975)
- Step 2: NSWC/NATSF determine whether hard-copy TM is a raster candidate (e.g., front matter indexing in basic and changes, page quality, security classification, size of the TM, and whether color is used in the TM all determine suitability for scanning).
- Step 3: If the TM is not a Class I/II candidate, decide whether conversion of the TM to a higher, more costly IETM Class is justified.
- Step 4: NSWC/NATSF determine if funding is available to support the conversion.
- Step 5: If not, NSWC/NATSF provide the program with an estimate of conversion costs.
- Step 6: Determine whether the conversion costs are acceptable.
- Step 7: If the conversion costs are not acceptable, evaluate the costs and benefits of converting to a more interactive Class of IETMs.
- Step 8: If the costs are acceptable, send the TMs and necessary funding to support conversion.
- Step 9: NSWC/NATSF will return the converted TM on the agreed upon media.
- Step 10: Procure ATIS software from NAVSEA Logistics – Indian Head Detachment and ensure that appropriate display hardware exists where IETM is to be used. ([www.nslc.fms.navy.mil/](http://www.nslc.fms.navy.mil/))

## Navy IETM Display Equipment

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Where a common infrastructure, such as NTCSS exists or is being formed, that manager will be responsible for ensuring the availability of items under his or her cognizance. When programs decide not to use the common infrastructure or develop IETMs that will not effectively play on the common architecture, the program remains responsible for display equipment availability until another activity assumes full responsibility, including funding.



With the exception of NTCSS, there are also no current mechanisms that require programs that share common work places to coordinate the use, distribution, and support of IETM display hardware. It is imperative to do so in order to minimize the costs associated with IETM display hardware support, as well as minimizing other impacts (e.g., space onboard ship). These logistics support issues must be evaluated and addressed to ensure the effective availability of the IETMs provided by the minimum number of units at reasonable costs.

Display equipment that is to be part of the NTCSS infrastructure (SNAP LAN) will follow the procedures established by NTCSS. These procedures include certification of display hardware as to its hardware and software compatibility on the LAN. SPAWAR Systems Center Chesapeake and NAVSEA SEAADSA support NTCSS in performing the certification process.

Once certified, NTCSS will manage the sparring, LAN, and warranty management involved with the displays. NTCSS has existing display hardware acquisition contracts that it can make available if needed. NAVAIR has also released a performance specification for Portable Electronic Display Devices (PEDDs).

## Development Resources



A copy of the Navy IETM Process Plan (S0005-AD-PRO-010), signed out by NAVSEA and SPAWAR in December 1995, is available at <http://calsric.crane.navy.mil/refinfo.htm>. This document is intended to instruct and guide programs in the development of IETMs in a way that provides for their life-cycle use and maintenance within the Department of the Navy infrastructure. The Navy IETM Process Plan is to be used by NAVSEA and SPAWAR programs in the acquisition of new, or conversion of existing hard-copy technical manuals into IETMs.

## Classroom Instruction

NSWC, Port Hueneme regularly provides classroom instruction on both the East and West Coasts, for the acquisition and development of Navy technical manuals, including IETMs.

## Software Licensing

SEA 04TD has considerable experience in qualifying and licensing IETM-related software tools for wide-scale application. NAVSEA (04TD) has agreed to act as the software clearinghouse for programs seeking advice and assistance concerning licensing issues.

## Navy CALS DTD Repository

The Navy Continuous Acquisition and Life-Cycle Support (CALS) Coordination Office tasked Carderock Division, Naval Surface Warfare Center (CDNSWC), as the central site for registration, testing, and distribution of Department of the Navy (DoN) DTDs (and Formatting Output Specification Instances [FOSIs], where applicable). CDNSWC is only responsible for DTDs and FOSIs developed in compliance with MIL-PRF-28001 and MIL-PRF-87269 SGML. CDNSWC established the Navy CALS DTD Repository to:

- ✓ Minimize duplicative DTD investments
- ✓ Register DTDs and tag sets
- ✓ Perform technical testing and approval
- ✓ Coordinate functional testing of Navy DTDs and FOSIs

DTDs are complex SGML constructs that can be costly to develop. NSWC-CD maintains an electronic repository of DTDs and SGML tags and constructs for re-use by Navy activities in implementing digital technical manual applications. NSWC-CD provides technical support to Navy activities for application of digital interchange technology and standards in support of the DoN CALS Program. NSWC-CD is also the Navy custodian for CALS data interchange specifications and has extensive experience in CALS interchange specifications for engineering data, technical manuals, and IETMs.

### What's Available

The following **Navy DTDs** can be retrieved from the Navy CALS DTD Repository:

- ✓ MIL-M-38784C - Manuals, Technical; General Style and Format Requirements
- ✓ MIL-M-81927 - Manuals, Technical; General Style and Format of (Work Package Concept).
- ✓ MIL-M-81928 - Manuals, Technical: Aircraft and Aeronautical Equipment Maintenance, Preparation of (Work Package Concept)
- ✓ MIL-M-81929 - Manuals, Technical: Illustrated Parts Breakdown, (Work Package Concept); Preparation of
- ✓ MIL-PRF-87269, Interactive Electronic Technical Manuals DataBase (IETMDB) DTD
- ✓ NAVSEA C2 Revision D - Naval Sea Systems Command Electronic Technical Manual Class 2, DTD

The following **FOSIs** are undergoing development in the Navy and can be accessed through the Repository:

- ✓ NSWCCD-SSES Engineering Operational Sequencing System (EOSS DTD)
  - ArborText Adept Series FOSI
  - INSO DynaText Style Sheets
- ✓ Fleet Technical Support Center Planned Maintenance System (FTSC PMS DTD)
  - INSO DynaText Style Sheets

To facilitate rapid distribution of information, the CALS DTD Repository can be accessed via Internet, the WWW, anonymous FTP, e-mail, and U.S. Mail. The information provided on the CDNSWC WWW server includes:

- ✓ Approved Navy SGML DTDs and FOSIs
- ✓ Navy SGML Baseline Tag Set
- ✓ Navy CALS Reports and Technical Memoranda
- ✓ CALS Standards Information
- ✓ IETM Information (Standards and current research efforts)
- ✓ Links to other pertinent on-line repositories
- ✓ Information on emerging and de-facto standards

### Access to the Navy DTD Repository World Wide Web (WWW)

The WWW provides a user-friendly connection to the Repository. WWW pages guide the user through hyperlinks to desired information. The WWW Uniform Resource Locator (URL) address for the Navy CALS DTD Repository is:

<http://navycals.dt.navy.mil/dtdfosi/repository.html>



### Anonymous FTP

The DTDs installed in the Navy DTD Repository may also be retrieved via the “anonymous guest” FTP protocol. The pub directory contains the files associated with the Navy CALS DTD Repository. The Internet address for the FTP Repository is:

<ftp://navycals.dt.navy.mil/pub/dtd/>

## E-Mail



Information in the Navy CALS DTD Repository may be requested by an e-mail message. The request will automatically be sent to the appropriate person and the requested information will be sent to register electronically. The e-mail address is:

[webmaster@navycals.dt.navy.mil](mailto:webmaster@navycals.dt.navy.mil)

## Telephone or Mail

Requests may also be sent to DTMB either by phone or U.S. mail at:

Advanced Information Systems Branch, Code 183  
Naval Surface Warfare Center  
Headquarters, Carderock Division  
Bethesda, Md. 20084-5000  
Telephone: (301) 227-3348  
DSN 287-3348



## CD Guidelines

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For compatibility with ATIS systems, network, and jukebox, CDs should be tested at NAVSEA Logistics - Indian Head Detachment, prior to replication. The Navy CALS website, <http://navycals.dt.navy.mil>, contains information related to ATIS and CD-ROM publication. Refer to page G-10 for a point of contact.

## Point of Contact

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Other questions related to points of contact for specific Navy IETM-related functions should be directed to:

Wayne Honea – NSWC-PHD (5E03)  
Chair of Navy Technical Manual Working Group

Internet: [honea\\_wayne@phdnswc.navy.mil](mailto:honea_wayne@phdnswc.navy.mil)  
DSN 296-0365 (805) 228-0365

## Appendix H

# Common IETM Standards

- ✓ MIL-STD-1840, Automated Interchange of Technical Information
- ✓ MIL-PRF-28000, Digital Representation for Communication of Product Data: IGES Application Subsets and IGES Application Protocols
- ✓ MIL-PRF-28001, Markup Requirements and Generic Style Specifications for Electronic Printed Output and Exchange of Text
- ✓ MIL-PRF-28002, Requirements for Raster Graphics Representation in Binary Format
- ✓ MIL-PRF-28003, Digital Representation for Communication of Illustration Data: CGM Application Profile
- ✓ MIL-PRF-87268, General Content, Style, Format, and User Interaction Requirements for Interactive Electronic Technical Manuals
- ✓ MIL-PRF-87269, Revisable Database for Support of Interactive Electronic Technical Manuals
- ✓ DoN Policy on Digital Logistics Technical Data (ASN(RD&A)) Memorandum, 2 November 1999

# Appendix H

## Common IETM Standards

Continuous Acquisition and Life Cycle Support (CAL S) standards and specifications apply to IETM acquisition and development. They serve as controls to ensure that information systems are independent of hardware platform and proprietary data format.

### MIL-STD-1840, Automated Interchange of Technical Information

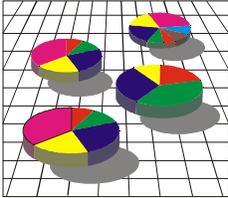
MIL-STD-1840 is the interface standard that defines the means for exchanging large quantities of engineering and technical support data among heterogeneous computer systems. MIL-STD-1840 is often called the “parent” or “umbrella” standard for CAL S because it identifies other standards, specifications, and practices to be used in a CAL S solution. It applies selected Federal, DoD, international, national, and Internet standards/specifications/practices for the exchange of digital information between organizations or systems and for the conduct of business by electronic means.



The initial areas addressed by MIL-STD-1840 involved automating the creation, storage, retrieval, and delivery of technical manuals and engineering drawings. The standard defines a logical file identification and bundling convention for device- and medium-independent transfer of technical information. MIL-STD-1840 also addresses electronic product data, packaging of data for electronic commerce, and electronic product data technology. Revision C of the standard adds several new data types, provides for new transfer media in addition to 9-track tape, and supports increased Information Security (INFOSEC) capabilities including digital signature and encryption.

This standard applies to technical information which is part of the traditional technical data package used for system or item acquisition; technical information used to design, manufacture, field, and dispose of a system or item; and the technical documentation used for system or item support. MIL-STD-1840 also can be employed for information exchange applications; its use is not limited to technical data exchange in a defense acquisition environment.

## MIL-PRF-28000, Digital Representation for Communication Of Product Data: IGES Application Subsets and IGES Application Protocols



MIL-PRF-28000 is the performance specification, which defines DoD requirements for the application of the Initial Graphics Exchange Specification (IGES). This specification provides a mechanism for the digital exchange of product data among CAD and CAM systems. This specification is required when procuring three-dimensional illustrations (e.g., 3-D models, wire frames, etc.)

MIL-PRF-28000 applies IGES as specified by the U.S. Product Data Association (USPRO) standard. It defines application protocols, or “classes”, which are subsets of the IGES entities identified according to the application for which the digital data was prepared. The following IGES classes will appear in Revision B of MIL-PRF-28000:

- ✓ Class 1 - Technical Illustration Subset
- ✓ Class 2 - Engineering Drawing Subset
- ✓ Class 3 - Electrical/Electronic Applications Subset (Withdrawn)
- ✓ Class 4 - Geometry for NC Manufacturing Subset
- ✓ Class 5 - 3D Piping Application Protocol
- ✓ Class 6 - Layered Electric Products Application Protocol
- ✓ Class 7 - 3D Geometry

Most SGML browsers cannot view IGES illustrations natively. Therefore, the IGES drawing is typically converted to a Computer Graphics Metafile (CGM) format for viewing within an IETM application.

## MIL-PRF-28001, Markup Requirements and Generic Style Specification for Electronic Printed Output and Exchange of Text

MIL-PRF-28001 is the performance specification which defines DoD requirements for the application of the Standard Generalized Markup Language [defined by ISO 8879, Information processing – Text and office systems – SGML]. This specification provides a mechanism for the digital interchange of technical publications and other text data. MIL-PRF-28001 is designed to facilitate the automated storage, retrieval, interchange, and processing of technical documents from heterogeneous computer systems.

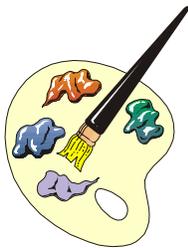


SGML provides the ability to mark up (tag) textual data in a manner to define data content and document structure. SGML is the basis for HyTime and for the HTML, which are used in electronic presentation (notably, the WWW). SGML evolved from a mid-1960s effort for an electronic ability to format printed text.

MIL-PRF-28001 establishes a DoD application protocol of SGML that defines the following requirements for page-oriented technical documents in digital form:

- ✓ Procedures and symbology for markup of unformatted text in accordance with this specific application of the SGML.
- ✓ SGML compatible codes that will support encoding of a technical publication to specific format requirements applicable to technical manuals.
- ✓ Output processing requirements that will format a conforming SGML source file to the style and format requirements of the appropriate FOSI based on the Output Specification (OS). Revision C of MIL-PRF-28001 introduces a Formatting Presentation Specification Instance (FPSI) as an OS for the electronic display of SGML documents. Future versions of MIL-PRF-28001 will emphasize the document content rather than structure to provide more content tagging, and database interfaces, as well as capabilities for hypertext constructs and applications.

## MIL-PRF-28002, Requirements For Raster Graphics Representation in Binary Format



MIL-PRF-28002 is the performance specification, which defines DoD requirements for the standardized encoding and compression of raster (bit-mapped) image data. This specification provides for the digital binary representation of 2D bitonal images or pictures for display or interchange. MIL-PRF-28002 also defines data compression to reduce file size.

In Revision C of the MIL-PRF-28002 specification, the digital representation of raster data is classified as the following four types:

- ✓ Type 1, Untiled Raster Data
- ✓ Type 2, Tiled/Untiled Raster Data, Office Document Architecture (ODA) Raster Document Application Profile (DAP)
- ✓ Type 3, Tiled/Untiled Raster Data, Navy Image File Format (NIFF)

- ✓ Type 4, Tiled Raster Data, Joint Engineering Data Management Information and Control System (JEDMICS) C4

Essentially, MIL-PRF-28002 selected a popular graphics file format, the Tagged Image File Format (TIFF), and the Navy derivative (NIFF), as the required graphics format for scanned images. Other graphic formats, especially those containing color (GIF, JPEG, BMP, etc.), have surpassed TIFF in popularity. However, TIFF remains the preferred graphics file format for black and white line art found in many technical publications.

## MIL-PRF-28003, Digital Representation For Communication of Illustration Data: CGM Application Profile

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MIL-PRF-28003 is the performance specification which establishes the DoD requirements for 2D picture description or illustration data that is vector-based (or mixed vector and raster). MIL-PRF-28003 is the CALS application profile of the Computer Graphics Metafile (CGM), as specified by the Federal Information Processing Standard, FIPS PUB 128.

CGM provides a standardized electronic format for the capture, storage, retrieval, transmission, and interchange of 2D pictures, independent of system architecture, device capabilities, or transmission medium. CGM viewers and plug-ins are available for many SGML and Web browsers to easily view 2D vector data.

Revision B of MIL-PRF-28003 is being written to follow closely the Air Transport Association (ATA) application protocol for CGM, thereby providing a bridge for the interchange of 2D vector data between Government and private industry.

## MIL-PRF-87268, General Content, Style, Format, and User Interaction Requirements for Interactive Electronic Technical Manuals

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This was the first in a series of documents released by NSWC, Carderock in an attempt to standardize requirements for military IETMs. The specification contains common requirements for the General Content, Style, Format, and User Interaction Features (GCSFUI — pronounced *gucks phooey*), which are required for IETMs. This specification established the “look and feel” and navigational aspects of the IETM viewing software. Although intentionally broadly written to permit increased browser functionality, many software vendors have not followed MIL-PRF-87268, developing their own interpretation of the specification

instead. The end result has been a variety of IETM viewing software that does not provide a common look and feel for each equipment/system.

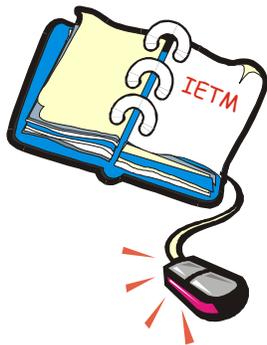
## MIL-PRF-87269, Revisable Database For Support of Interactive Electronic Technical Manuals

This specification prescribes the requirements for an Interactive Electronic Technical Manual Database (IETMDB) to be constructed by a weapon-system contractor for the purpose of an IETM. Mainly applying to Class IV and above IETMs, this specification suffered the same fate as its sister GCSFUI specification. The intention of 87269 was to specify how a revisable database of technical data elements could be constructed to permit interchange of data with other 87269 database driven IETMs. Software vendors and original equipment manufacturers (OEMs) often interpreted 87269 to fit their own program needs. While Class IV type IETMs have provided many of the benefits first envisioned by IETM pioneers, routine interchange of 87269 data has not been possible.

The requirements of the specification for the IETMDB are intended to apply to one or both of two modes as specified in a contract:

- ✓ The interchange format for the database to be delivered to the Government
- ✓ The structure and naming of the elements of the database created and maintained by the contractor for purposes of creating IETMs, which are in turn delivered to the Government.

The MIL-PRF-87269 specification delineates two layers to define the IETMDB: the generic layer and the content layer.



The IETMDB Generic Layer provides mandatory requirements for the definition of IETMDB conforming DTDs. Both SGML and HyTime features have been used to implement the functionality of the IETMDB mechanisms.

The Generic Layer is not a DTD. It is a layer of constructs that can be used by any DTD and IETM application implemented in accordance with the requirements of MIL-PRF-87269. It is provided by referencing an SGML attribute defined as the “ietmdb-a” entity at the beginning of the application.

In the Generic Layer, the two requirements that are of importance to the acquisition manager are the use of Architectural Forms and the required SGML element types. These two requirements for the IETMDB are briefly discussed in the following sections.

Architectural forms are a way of logically describing building blocks for an application without constraining the application-specific information that a developer might need to add. Only information that must be standardized for interoperability is defined rigorously.

Architectural forms enable the DTD designer to rapidly create a “blueprint” or template for the hypermedia application. That design is the IETMDB DTD. Any instance of that design is an IETM.

Just as standard window styles and sizes are used by an architect to create a design for a house, architectural forms, element types and attribute specification lists of the Generic Layer of the IETMDB enable an IETMDB designer to create a Content Layer DTD that meets the needs of a specific IETM.

Only necessary components are rigorously defined, but the general needs for MIL-PRF-87269 implementers are flexibly supported to enable applications to tailor the design to the mission requirements. The designers of the IETMDB specification may add element types to the Generic Layer according to evolving requirements. The IETMDB specification can evolve independently of IETMDB applications, yet continue to provide new capabilities for them, as needs dictate.

MIL-PRF-87269 specifies five IETMDB architectural forms, or “functional node types.”

### IETMDB Architectural Forms

- ✓ **Node.** The fundamental node type used to model an independent unit of information.
- ✓ **Node-alts.** A node type used to model alternative units of information.
- ✓ **Node-seq.** A node type used to model sequential presentation of units of information.
- ✓ **If-node.** A node type used to model a decision.
- ✓ **Loop-node.** A node type used to set sequential nodes to present repeatedly.

Nodes are units of information for the human reader or for the IETM presentation system. Some nodes determine order or presentation, enable the selection of alternative versions of the same information, or set criteria for deciding if and how many times a unit is to be presented. A unit of information may be used by the processing system or the user. Each node contains information about a subject.

The relationships among nodes are expressed both through the hierarchy of the nodes as declared in the DTD, and by references made in some nodes to other nodes. These references are called “links”.

The use of links permits alternative organization of the information. The user can traverse the information in different orders, depending on the type of link and various conditions that must be met before that information is presented.



**A major advantage . . .**

The ability to traverse the nodes in different orders depending on the need of the user of the information at different times is a major advantage of the IETM over conventional technical manuals.

A simple example is when a technical manual describes different models of a single system in one TM. In conventional manuals, lists of effectivity are used to guide the technician to the repair and replace procedure appropriate for a given serial or version of the equipment. In the IETM, conditions can be recorded and used to determine which repair and replace node to present to the technician based on information such as the current version number.

To the user of the IETM system, it appears as if the information is presented in a smooth and continuous flow. To the IETM system itself, conditions are continuously evaluated and decisions are made about which node to present next.

The Generic Layer is a mandatory component of the IETMDB specification. Application designers should not add or customize components in the Generic Layer since this weakens the layer as a mechanism for a standard exchange of interoperable files. It is just as easy and more effective to add these definitions to the Content Layer.

The regular element types of the Generic Layer are SGML element types that conform in all ways to the requirements of ISO 8879. These element types are resources for use in any Content Layer as they define a base set of elements that any MIL-PRF-87269 application might need to support.

Link is an element derived from the “ilink” architectural form of the ISO/IEC 10744 HyTime standard and is included in the Generic Layer. All implementers of IETMDB applications must use the same definition for a link element.

IL-PRF-87269 uses an Organization Level (O-Level) Technical Manual DTD to illustrate the default content layer. However, it is not required to be used in its exact form in order to produce a conforming IETMDB. This DTD would be based on the required elements of the Generic Layer of MIL-PRF-82769 and would provide for the Content Layer of the IETMDB. The O-Level DTD of MIL-PRF-87269 could be used as a guide, but specific tailoring will be required for each IETM acquisition.

## DoN Policy on Digital Logistics Technical Data (ASN(RD&A)) Memorandum, 2 November 1999

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The following sections are quoted directly from this recent policy memorandum in light of their impact on planning for IETM acquisition and IETM/training interfaces.

### 4.1 New Technical Manuals

All new technical manuals should be acquired and authored in digital form in the Standard Generalized Markup Language (SGML) in accordance with MIL-PRF-28001 as defined below. The U.S. Marine Corps acquisitions should follow specific USMC guidance contained in Section 4.2.

#### 4.1.1 Formats and Deliverables for New Technical Manuals

All new technical manuals (TMs), Electronic Technical Manuals (ETMs), and Interactive Electronic Technical Manuals (IETMs) will be acquired in Standard Generalized Markup Language (SGML) format in accordance with MIL-PRF-28001. MIL-PRF-28001 is the DoD performance specification defining the DoD requirements (Military interpretation or profile) for the application of the International Standard for SGML, ISO 8879, *Information Processing – Text and Office Systems – Standard Generalized Markup Language (SGML)*. Proper creation of a document in SGML requires a Document Type Definition (DTD), an SGML data construct defining the structure and content of the type of document to be created as well as the definitions and rules for applying SGML in the authoring process. DTDs are complex and costly to develop but may be created to satisfy a broad range of documents. Authors and contractors should be encouraged to use existing Document Type Definitions (DTDs) and style sheets or FOSIs for all TMs/ETMs/IETMs. DoN DTDs are currently stored in the Navy DTD/FOSI Repository (<http://navycals.dt.navy.mil/dtdfosi/repository.html>).

TM/ETM/IETM delivery to the Government must include the SGML source file, the associated DTD, entity files, DTD Data Dictionary, and Tagging Conventions Document, all of which are necessary to manage, maintain, edit, and re-author the documents. Delivery must also include style sheets, FOSIs, filters, necessary to produce the desired presentation to users. The SGML source file consists of the TM text with the embedded SGML tags. This file is what will be stored and maintained in a repository or database at the document management activity. Entity files are files associated with the source file that may be created and referenced by the DTD. They usually are created when there is standard text in the document that will be used or shared among instances of a class of documents. The contents of the entity files are available to any document using the associated DTD. The DTD Data Dictionary defines the meaning of SGML tags used, and the Tagging Conventions document describes the rules for applying each SGML tag, especially if new or custom DTDs are being used. The information contained within the Dictionary and Conventions documents will be helpful in the maintenance and revision of the TMs and should also be provided to the Navy DTD/FOSI Repository.

#### 4.1.2 HTML for New Manuals

The Hyper Text Markup Language (HTML) is a specific SGML application, a standardized SGML DTD, commonly used for the formatting and delivery of data on the World Wide Web (WWW) using standard software browsers. It consists of a limited, fixed set of tags and merely identifies areas in a document to affect formatting. HTML contains no content tags and only minimal structure tags.

HTML is not a suitable format for the storage and management of new technical manual data. DoN activities should receive and manage documents in SGML in accordance with a DTD that describes some degree of multi-level structure and content of the manual. If an HTML version of the manual is desired for delivery and presentation, program and document managers should require delivery of the manual in SGML in accordance with a MIL-PRF-28001 compliant DTD in addition to the HTML deliverable. If a contractor develops conversion software or filters to convert the SGML document to an HTML document, the DoN procurement activity should request delivery of the conversion software also.

Programs choosing to acquire or create manuals directly in HTML will have very limited content management capability and

limited ability to use the data re-use and content searching functionality provided by SGML document management tools. If, however, a program choose to author manuals in HTML, it should require the delivery of the HTML DTD used for authoring. Since there are many versions and browser extensions of the HTML DTD, a copy of the one actually used for authoring should be retained with the manual(s) to do updates and revisions.

## Appendix I

# Classes of IETMs

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- ✓ IETM Definitions
  - Class I: Electronically Indexed Page Images
  - Class II: Electronic Scrolling Documents
  - Class III: Linearly Structured IETMs
  - Class IV: Hierarchically Structured IETMs
  - Class V: Integrated Database IETMs

## Appendix I

# CLASSES OF IETMs

### IETM Definitions

As IETMs began to proliferate, so did the methods for converting and presenting digital data. While careful not to inhibit innovation, the military did not want contractor proprietary solutions either. With the release of the draft IETM specifications, CDNSWC also released a document entitled “DoD Classes of Electronic Technical Manuals,” which addressed five classes of IETMs based on the source data format of the IETM and its functionality.



#### Classes of IETMs

- ✓ Class I: Electronically Indexed Page Images
- ✓ Class II: Electronic Scrolling Documents
- ✓ Class III: Linearly Structured IETMs
- ✓ Class IV: Hierarchically Structured IETMs
- ✓ Class V: Integrated Database IETMs

The class of IETM to be acquired is derived from the IETM Concept of Operations document discussed in the IETM Process Plan.



The Classes are defined in fairly general terms that necessarily overlap. They facilitate discussion of options and differences, but they are *insufficient to serve as a basis for contractual use* (e.g., direct the contractor to prepare a “Class III” manual). The SOW or TMCR should specify exact functionality requirements without referring to this set of definitions.

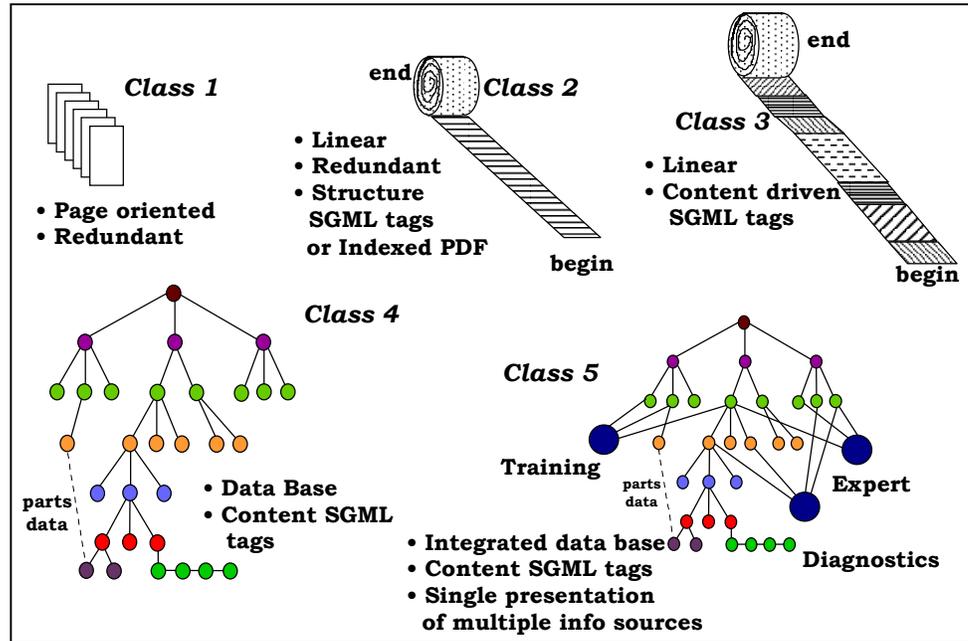
The structure of each class is illustrated in the figure on page I-2.

### Class I: Electronically Indexed Page Images

Class I IETMs include digital page images obtained from raster scanning, using the Navy Implementation of Raster Scanning/Navy Image File Format (NIRS/NIFF). They are intelligently indexed, based on the front matter (table of contents, list of figures/fold-outs/tables etc.) and rear index.

This indexing allows the user:

- ✓ To select a topic from front matter and have the corresponding raster page from the body of the TM automatically displayed, or
- ✓ To create an automatic collation of page changes. They retain a page orientation and can be directly printed.



Graphical Representation of IETM Classes

## Class II: Electronic Scrolling Documents

Most of these ASCII-based IETMs conform to SGML, per MIL-PRF-28001, and link front matter to corresponding material in the body of the TM. They may have additional links to cross-references, tables, figures, etc. and to voice, video, expert systems, or other special external applications. They generally have word search and bookmark capabilities, and electronic sticky notes, and they may contain raster or vector graphics. The linked manual can be viewed electronically or be printed in compliance with existing military style and format specifications.



While MIL-PRF-28001 is the preferred format at this time, other emerging SGML formats (e.g., HTML) provide similar benefits. A second format, Adobe's Portable Document Format (PDF) is also being used for basic conversion. PDF, which is based on Adobe's Postscript printer language, allows Class II interactivity. However, PDF files cannot currently be edited. Consequently, if the Government chooses to maintain the TM data through PDF files, it must first own or have access to the publishing system that generated those files before it can ensure that data maintenance and update responsibilities can be transferred between technical manual maintenance activities. Disagreements exist both within and between the services about classifying PDF as a Class I or Class II document.

### Class III: Linearly Structured IETMs

Class III IETMs have enhanced functionality over Class II. They may have MIL-PRF-28001 or MIL-PRF-87269 SGML tags applied to the ASCII text to allow user interaction through "viewpackages". Viewpackage requirements can be developed to emphasize functional subjects, such as training, maintenance, and system overview.

Being linearly structured, Class III IETM files can be used to print hard-copy TMs. But while all of the data will appear in the proper sequence, the printed copy will not necessarily be in the same format as the traditional "MIL SPEC" manual. Class III IETMs can include optional linkages, such as voice, video, expert systems or special applications.

Some caution and planning are required, however, if a single database is intended to produce the IETM and publish the hard-copy TM.

### Class IV: Hierarchically Structured IETMs

Class IV is a complete departure from the previous classes in which data is structured to support a classical publishing environment based upon sentences, paragraphs, chapters, pages, etc. Class IV data is created, or re-authored and rebuilt into, and then managed as hierarchical objects within a database. In acquisition, Class IV technical data is built into a structured database using LSA disciplines and formats to create the database. Data is created only once with no duplication.

For legacy TMs, two types of duplicate data are found:

- ✓ Identical data is exactly repeated each time it is found. Examples include warnings, cautions, notes, common procedural steps, and graphics.
- ✓ Redundant data sets convey the same information but cannot be substituted for one another. Examples include paragraphs that contain essentially the same steps but must be managed as individual data sets, because the words within the paragraph provide a different context for each occurrence (e.g., refer to different figures or different preceding paragraphs).

With Class III, identical data can be eliminated. Because re-authoring is avoided to minimize cost or to preserve the ability to print hard copy, much redundancy remains. For conversion of legacy data to Class IV, data is re-authored to remove its formatting and to rebuild the data into a structured database. Paragraphs or information can be decomposed to simple statements that approximate LSAR type of entries at the step level. As the new structure eliminates previous need for duplicate data, the redundant data also is eliminated. The application (view) program then provides the necessary context and transition.



The total amount of data being stored and managed is significantly reduced, and multiple updates within the IETM are eliminated. Other SGML-based databases found in Class II and III IETMs also have the ability to store data once and apply it many times. They, however, can share these information objects only within a single IETM.

Data linkages in Classes I through III rely on application programs such as scripting or hyperlinks to define the linkages between data. Their DBMS manages the objects, if applicable, but not the structure. For Class IV, building a hierarchical database structure (typically following an LSAR) provides the inherent logic and the linkages among and between data.

This principle greatly simplifies the processing of change data and the use of application programs. IETM data modules are structured in conformance with MIL-PRF-87269 and may be represented as SGML-tagged files. All item links are built into the structure of the DBMS. The availability of modules (e.g., figures, text, tables, video, voice clips) enables the user to access information in a highly interactive manner and from a variety of paths. The text is created or edited to have the same “look and feel” as the steps in LSAR entries.

IETMs have user interfaces developed in accordance with MIL-PRF-87268 and provide “frame-,” rather than “page-” oriented displays. The Class IV IETM can prompt the user or may directly receive fault code information from which the IETM software determines the appropriate path to display through the database.

A third primary difference between Class IV and the first three IETM classes is that the Class IV product is not bound by a predetermined sequence of presentation. While the sequencing of data may be different for different viewpackages, Class II/III would have to establish the sequenced data files for each viewpackage; Class IV would create it directly. Classes IV IETMs (and Class V IETMs that use Class IVs as a base) have the ability to naturally apply precondition and applicability statements within the IETM database and to “branch on condition found.” The program analyzes each condition and brings in the necessary data. This process continues through to a logical conclusion.

By using these features, a Class IV IETM can display only “user specific” data from the database and can tailor presentations based on several input criteria. For example, it may only present certain maintenance choices to a trainee, but present additional choices to a journeyman working with the same equipment configuration and fault indicators. Class IV IETMs can share data sets among users, thereby making data maintenance even more efficient.

The persistent comparison of investment in existing systems with investments needed to execute new technology generally fails to consider all costs involved in product creation and review or of the potential savings to be achieved throughout the life cycle.

Nonetheless, the acquisition of SGML-tagged “linear databases” can provide many of the end-user features and some of the advantages found in maintaining object-oriented databases through different strategies of use. Whether object oriented or linear, SGML-tagged databases support the longer-term goal of the CALS data integration philosophy.

As its contents are contained in a hierarchically structured database, a Class IV IETM cannot be printed as a unit for distribution in hard-copy form.

**note:**

Program Offices may encounter contractors with significant investments in legacy publishing systems and legacy IETM software tools, but a shortage of workforce training in or understanding of Class IV production processes. These factors tend to weigh IETM recommendations away from Class IV functionality and toward the status quo.

## Class V: Integrated Database IETMs

The Class V IETM combines the functionality and capabilities of an expert system with a technical database to allow the user to perform tasks more quickly and accurately. The system and equipment diagnostic programs can “talk” directly to the user through the IETM; relatively unskilled technicians can be led through complex procedures. Seldom-used processes and procedures (e.g., annual inspections) can be properly planned and executed without significant research. Programs also typically analyze the data received and add it to the knowledge base to allow the software to “learn” and apply the knowledge to future analytical processes. For a more complete discussion of the IETM classes, especially Class V, refer to the IETM Process Plan.

**note:**

This appendix does not address the requirements of expert systems or the efforts needed to achieve the full integration of a multi-functional Class V system. It does address the IETM component of a Class V manual and the interface to an expert system. Class V IETMs allow the subject matter experts in all areas (e.g., troubleshooting, fault isolation, accomplishing repairs, establishing alternate repair paths) to bring their knowledge to the maintenance unit and apply it in a specific situation.

## Appendix J

# IETM Development and Viewing Software

- ✓ Developing and Editing Software – Class II and III
  - ASCII Editors
  - ADEPT\*Editor
  - FrameMaker+SGML
  - Interactive Authoring and Display System (IADS)
- ✓ Developing and Editing Software – Class IV
  - TechSight Developer's Kit
  - Boeing Quill<sup>21</sup> System
  - Advanced Integrated Maintenance Support System (AIMSS)
  - Joint Integrated Maintenance Information System (JIMIS)
- ✓ Parsers
  - SP
  - Omnimark
- ✓ IETM Viewing Software
  - Advanced Technical Information Support (ATIS)
  - Adobe Acrobat
  - InfoAccess
  - Dynatext
  - Internet Explorer 4.0/Netscape Communicator 4.0 or later
- ✓ SGML Database Managers

## Appendix J

# IETM Development and Viewing Software



Discussion of software products in this section in no way implies endorsement by DoD.

Selecting IETM software is dependent upon many factors, but mainly upon the class of IETM that is to be developed. This appendix provides information on software available to accomplish an IETM development program.

IETM software falls into four distinct categories:

- ✓ Development and editing software
- ✓ Parsers (an application that checks conformance to a DTD)
- ✓ Display or viewing software
- ✓ Data management software

## Developing and Editing Software - Class II and III

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### ASCII Editors



Since SGML is an ASCII file, any text editor can develop or modify an SGML instance. This approach is not recommended for large SGML files or for SGML novices. Authors who are unfamiliar with structured documents or the target DTD can introduce too many structural mistakes. The most common process when using a text editor is to edit a previously developed instance, run the SGML through a parser, and correct the errors until the instance parses. Common text editors include:

- ✓ Notepad
- ✓ Wordpad
- ✓ Textpad
- ✓ Program File Editor (PFE)
- ✓ Emacs
- ✓ Word, WordPerfect

## ADEPT\*Editor

A product of Arbortext in Ann Arbor, Michigan, ADEPT was the first widely distributed SGML development/editor software program on the market. It combined the ease of a word processing/desktop-publishing environment with an SGML tagging environment. ADEPT is an SGML development tool — not an IETM development program. It produces SGML that can be used as the source data for IETM viewers. An ADEPT session typically consists of:

- ✓ Opening a new Arbortext document
- ✓ Selecting a precompiled DTD (The program reads the DTD and stores it in memory.)
- ✓ Beginning to develop a document

Whereas an inappropriate element could be introduced at any point within the SGML by a text editor, the ADEPT development environment permits the author to create only the elements that conform to the structure defined by the DTD. A “quick tag” feature displays a list of structural elements that can be created at a given location within the document.

A screen FOSI and a print FOSI (if necessary) that conform to the target DTD need to be developed prior to authoring. Fortunately, many of the Services have already developed these FOSIs for popular DTDs. The graphical user interface of Arbortext can be customized with a separate program called the ADEPT Command Language (ACL).



As long as a document conforms to the DTD loaded into memory, ADEPT will accept pre-tagged SGML files. ADEPT will parse a file upon loading should be corrected before importing an SGML-tagged file into ADEPT.

## FrameMaker+SGML (FM+SMGL)

FM+SGML is an Adobe System product that is based on Adobe’s popular FrameMaker desktop publishing software. FM+SGML is an SGML development tool — not an IETM development program. It produces SGML that can be used as the source data for IETM viewers. The FM+SGML authoring environment provides both a What You See is What You Get (WYSIWYG) and an SGML view of the data during author and edit.

The approach to development of SGML files is very similar to that of ADEPT. Instead of FOSIs, Adobe substitutes:

- ✓ Electronic display definitions
- ✓ read/write rules
- ✓ SGML application support files.

Through the development of filters and scripts, FM+SGML files can be exported to HTML and/or PDF for Web display. FM+SGML treats non-conforming SGML files as unstructured documents. SGML construction errors can be corrected by traversing the document and correcting them, as required.

## The Interactive Authoring and Display System (IADS)

IADS was developed at the Army's Redstone Arsenal in response to many Army Program Managers' requests for an IETM viewing software free of licensing requirements. IADS also releases DoD from committing to any one proprietary method of displaying IETMs. It uses SGML as the source data but requires the data to be chunked (separated) into frames of logical topics. A first level paragraph can be a frame, table, or figure.

The frames are given specific ID attributes; they are then hyperlinked based on the ID value. The resulting file is delivered with the IADS reader for viewing on a standard PC.

## Developing and Editing Software — Class IV

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### TechSight Developer's Kit

The TechSight Developer's Kit was developed by General Dynamics as a MIL-PRF-87268/87269-compliant authoring program that provides the tools needed to create an Class IV IETM, either as a single IETM or as part of a collection of documents that supports cross-referencing and data object-sharing.

The TechSight database structure separates information by data type for ease of maintenance and minimal redundancy of common objects. Users have complete flexibility in authoring tools and can readily transform TechSight data to other DTDs or formats using COTS tools, providing data portability and durability. TechSight integrates with FM+SGML to provide SGML editing features.

The TechSight Viewer provides the capabilities:

- ✓ To view hierarchical illustrated repair parts
- ✓ Navigate procedures with complex branching
- ✓ Link to integrated training modules

It also has a feature that automatically requires the user to log-in upon accessing the IETM.

In addition to the normal views of text, tables, and graphics, TechSight provides a procedure execution mode that can be authored to show procedures — either as step-by-step, or with multiple steps shown with the active step highlighted.

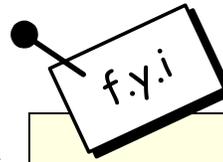
The table viewer supports complex tables as allowed by MIL-PRF-87269, and permits the replication of complex tables that are frequently used in legacy documentation. Within a single IETM, a user can view data in multiple windows simultaneously (e.g., descriptive text in one window, an associated graphic in a second window, a procedure in a third, and repair part sparing and ordering information in a fourth). The viewer also provides full navigation and search capabilities, and the ability to include notes, bookmarks and directed change notations.

## Boeing Quill<sup>21</sup> System

The Boeing Quill<sup>21</sup> system consists of an authoring system, a database, and a presentation tool. The authoring system is a C++ X-Windows application that

populates an object-oriented database (based on the Versant engine). MIL-PRF-87269 compliant SGML is generated for the object-oriented database and parsed into a relational database for presentation. The presentation tool is a cross platform application that displays dynamically constructed panes of data. All user activity through the IETM is captured in an audit log that can be downloaded into a customer's maintenance network.

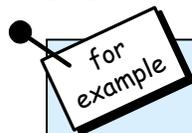
The presentation system runs on the Windows 95/NT, SCO Unix, Solaris and HP operating systems using an Oracle, Informix or Sybase RDBMS.



Quill<sup>21</sup> has been used in support of the Apache Longbow, Hornet, and Super Hornet.

## Advanced Integrated Maintenance Support System (AIMSS)

AIMSS, a Windows-based product developed by Raytheon Systems, combines an IETM with state-of-the-art object database technology. AIMSS uses a common graphical user interface to display maintenance information in text, graphics, and table windows that can be easily manipulated by the technician for preferred viewing. Hypertext and graphic "hot spots" are embedded in descriptions and procedures to



While viewing a fault isolation procedure, the technician is provided direct access to related information such as schematics and parts lists by way of links that are embedded in the text of the procedure and its associated graphics.

provide rapid access to related information contained in the database.

One of the most powerful features of the system is its fault isolation capability. The troubleshooting approach used is much like the

traditional fault logic diagrams provided in technical documentation. However, AIMSS eliminates the navigation problems sometimes experienced with lengthy flow diagrams.

Troubleshooting information is presented to the technician in a linear, step-by-step fashion. Each step contains detailed instructions and a question that requires a simple yes-or-no answer or a type-in response. The system then:

- ✓ Branches directly to the next step on a yes-or-no response or
- ✓ Performs an arithmetic operation on the technician's type-in response to determine the next step to be displayed.

Using a combination of yes-or-no answers, type-in responses, and arithmetic operations, AIMSS can simplify complicated procedures.

## Joint Integrated Maintenance Information System (JIMIS)

JIMIS, a product of the Northrop Grumman Corporation, is also an object-oriented database that is capable of producing MIL-PRF-87269 compliant IETMs. Currently deployed in the Joint Surveillance Target Attack Radar System (JSTARS) community, JIMIS is also being used for IETM development in the V-22 Osprey Helicopter program.

Technical data for the entire aircraft is stored on a ruggedized laptop computer. Fault codes supplied to the maintenance chief by the flight crew are imported to the IETM as an identifier to rapidly access the appropriate location of the IETM and resolve the problem quickly and efficiently. A program running in the background records each keystroke and time to perform procedural steps. The output data from the recording program can be used to update Mean Time to Repair (MTTR) parameters and provide updated statistical information on Mean Time Between Failures (MTBF) for parts/equipment.

## Parsers

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A parser is a software application that can analyze the structure of a document. Two input files are required for a parser to validate a document:

- ✓ The SGML instance itself
- ✓ The DTD

A parser checks the tree structure and permitted elements from a DTD against the tree structure and elements of an SGML instance. Some parsers check the entire instance and produce an output error file. The error file contains information about the line number on which the SGML error occurred and why it was an error. Other parsers exit upon encountering the first SGML error, requiring the user to repeatedly parse and correct.

Some parsers are pre-packaged with an application (such as ADEPT), while others are free. The two most popular parsers, SP and Omnimark, are discussed below.

## SP

SP is a free parser and toolkit. SP contains:

- ✓ A parser: nsgmls
- ✓ Two SGML normalizers: SP Added Markup (SPAM) and sgmlnorm.

The normalizer is an application that takes SGML input and substitutes all the proper entities enabling a formatter to produce a complete SGML document. SP is written in C++ and is available for many types of Unix, MS-DOS, and Windows 95/NT platforms.

**note:**

SP can be downloaded at:  
[www.jclark.com/sp](http://www.jclark.com/sp).

## Omnimark

Although Omnimark is used mainly as a parser, it can also be used for pattern recognition, hypertext processing and conversion of other file formats (RTF, ASCII) to SGML. Omnimark understands structured documents and employs a sophisticated pattern matching language that permits easy identification of character and text strings to marked-up data.

Conversion utilities, rules, and script development within Omnimark allow fast translation between DTDs and instances (i.e., SGML to HTML).

Although the full version is costly, Omnimark offers a Limited Edition (LE) version that developers can use for familiarization in developing Omnimark scripts.

**note:**

OMLE can be downloaded at: [www.omnimark.com](http://www.omnimark.com).

## IETM Viewing Software

Displaying SGML files with a simple text editor is not recommended for the SGML novice. Users would quickly become annoyed at viewing tags and marked up documents. A reader or browser is needed to interpret and display the SGML instance as well as provide the functionality offered by the SGML. Functionality can include hyperlinked references (“*see Table ...*”), full word/phrase search and quick navigation of document elements (figures, paragraphs, etc.). HTML-based IETMs complying with the JIA described in Appendix K are viewed with standard commercial Web browsers.



note

*All Class IV IETM development software is delivered with its own viewing software. Class IV viewers can only read their databases and cannot be used to view a different database.*

## Advanced Technical Information Support (ATIS)

ATIS is the Navy’s document and library management software that is installed in many surface combatants and shore-based facilities. It includes a graphic viewer to display raster-scanned technical manuals compliant with NIRS/NIFF (Class I IETM). Documents are intelligently indexed to include hyperlinked Table of Contents, List of Figures and List of Tables. The presentation is page oriented and can be printed directly. The library management software is also capable of indexing Class II/III IETMs and digitized engineering drawings.

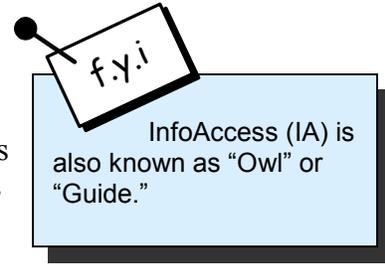
## Adobe Acrobat

Acrobat is the freely distributed PDF viewing software from Adobe Systems. PDF files retain their page orientation and can also be hyperlinked. When a PDF has been internally hyperlinked via an indexing process, the resulting file is known as ‘Indexed’ PDF (IPDF).

Acrobat cannot be used to view SGML documents. Acrobat is used by all the services for displaying various types of technical data. Because the Adobe Acrobat Reader is fully DDE-aware, it supports the viewer requirements for the automated interface outlined in the TIIG.

## InfoAccess (IA)

IA was one of the first commercially developed hypertext programs to be used by DoD. It can accept structured languages (HTML, SGML) and convert them to IA's Hypertext Mark-up Language (HML, *not HTML*). Formatting styles are applied to the HML document for presentation and display of ETMs. IA is used extensively by the submarine community for displaying ETMs.



The user interface can be customized using built-in tools within the Guide Professional Publisher suite. The Guide Reader is fully DDE-aware and, therefore, supports the viewer requirements for the automated interface outlined in the TIIG.

## DynaText

DynaText is one of the most popular SGML browser displaying IETMs within DoD. Owned by the INSO Corporation, DynaText compiles an SGML instance into an electronic book. Stylesheets add functionality to the IETM, resulting in a fully hyperlinked document with a consistent look and feel. Users can create personalized electronic sticky notes, hyperlinks and bookmarks. DynaText books can be printed in whole or in chunks based on containerized SGML elements.



With the purchase of the optional System's Development Kit, the DynaText interface can be tailored according to user needs. The Dynatext viewer is fully DDE-aware and, therefore, supports the viewer requirements for the automated interface outlined in the TIIG.

## Internet Explorer 4.0/Netscape Communicator 4.0 or later

Consistent with the philosophy of the JIA to use de facto Industry Standards, the browser requirements for HTML-based IETMs are established by two particular commercial products, which together have captured essentially the entire Web browser market. While it is possible to develop, assess, and evaluate a long list of needed and desirable requirements for the IETM browser, such an exercise would serve little purpose in light of economic and marketplace realities. New Web browsers are software products that are very complex and expensive to develop. Furthermore, the current products are being offered in the marketplace free of charge, effectively precluding the development of additional commercial general-purpose browser products. These two products are Netscape Navigator and Microsoft Internet Explorer.

Except for a few (but very important) capabilities discussed below, these two products are functionally identical. For existing Web pages, they perform in a similar fashion.

The JIA Browser Technical Description will specify the appropriate version of the commercial browser products and a set of standard extensions (i.e., controls and/or plug-ins) to these browsers. These extensions will include common DoD data viewers for file formats such as PDF, SGML/XML, CGM Version 4 Graphics, and CALS raster images. Since an XML capability will be in the basic functional set, the Version 5 release of these two products will probably serve as the baseline. These will be the first versions of both browsers to support XML and both companies (Microsoft and Netscape) have aggressive plans to add this capability.

One major area of difference between the two browsers lies in the area of object brokering and the automatic downloading of components. Ideally, it would be desirable to require that IETMs operate with either browser in its out-of-the-box form; however, the JIA Study Team concluded that such a policy would restrict some much-needed capabilities regarding the “downloadable” components necessary for the JIA object-encapsulation concept. The differences are due to the lack of cooperation on the part of the two competing companies (Netscape and Microsoft) to provide compatible solutions for the marketplace. The generic capability to automatically download and install software components is essential to the JIA, so it may be necessary to choose one over the other for a specific implementation. To support users of Microsoft Windows 95, 98, or NT-based devices (which includes the vast majority of portable devices available), it is desirable to utilize products supporting the Microsoft DCOM object standards that provide turnkey support of this feature. For communities employing Microsoft software, it is strongly recommended that both browser products be enhanced (by third party plug-ins if necessary) to support DCOM objects (especially the downloadable ActiveX controls). These are the most efficient formats for executable programs running in a Microsoft 32-bit operating system.

There is also a marked degree of difference in the way the two products handle Dynamic HTML (DHTML), an emerging technology for putting intelligence into actual Web pages. However, because of the lack of consensus in the vendor community on DHTML standards and the fact that there are options for this functionality, the JIA Study Team has not yet established this requirement as part of the minimal baseline and currently discourages its use in DoD programs.

The eventual goal is that all valid DoD IETMs be compatible with both the Internet Explorer and Netscape products. This may require some

installed extensions to make the two products interchangeable to the maximum extent possible.

## SGML Database Managers

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One of the early benefits noted with SGML and IETMs was the ability to share and reuse information objects both internal to a document and external to the IETM. For example, a specific warning is repeated ten times within a technical manual and is physically recreated in the authoring software at each occurrence. If the content of the warning was modified, it was necessary to change the warning ten times.

Relational database managers allow an author to create an object once (a warning object) and establish the object's relation to other technical data in the manual. When the object is modified, it is changed once and accessible throughout the document. Although the warning example is simplistic, the implications for storing parts data once and having changes reflected throughout an entire set of manuals can be highly desirable.

Class IV programs use a relational database as the engine to power the IETM and have information reuse capability. Until recently, this capability could not be extended to Class II and Class III level IETMs. It is important to note the following software products do not produce a MIL-PRF-87269 compliant database, nor is the database delivered with the IETM. The Class II and Class III viewing software programs previously described are still required to be packaged with the SGML source data contained in the database. These products are SGML managers and provide the Class II/III IETM Life Cycle Manager with a tool to reap the benefits of information object reuse. They can also manage the data with SGML editors, export SGML for electronic distribution, or forward data to composition engines for hard-copy printing.

NSWC Philadelphia and Port Hueneme Divisions use the Texcel Information Manager (IM). IM is a comprehensive content and process management system for creating and managing SGML and non-SGML documents. IETM authors working simultaneously can use IM's collaborative tools to find, edit, review, reuse, and assemble information managed in a secure database.

The information manager establishes a collaborative environment in which the participants in the IETM life cycle, authors, editors, reviewers, and subject matter experts can interact with each other as well as with the document database. Texcel's integrated workflow system pushes a task (and its associated data) to the correct user and, upon completion, instantly notifies those assigned to the next step in the process. The Electronic Review tool captures the electronic comments of local and remote

reviewers, which are immediately available to IETM authors and editors. SGML objects and fragments can be checked out of the repository for off-line editing. When the object is checked-in, it is parsed to ensure conformance to the DTD.

Appendix K  
Sample SGML Files Optimized for  
IETM/Training Interface

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- ✓ SEAWOLF and 688 Class SSM DTD
- ✓ NAVSEA C2 DTD

# Appendix K

## Sample SGML Files Optimized for IETM/Training Interface

### Introduction

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This appendix provides samples of SGML files based on several commonly used Document Type Definitions (DTDs). These files have been optimized to support the functionality required for an automated interface between IETMs based on these DTDs and the various training tools described in Appendixes A and B of the TIIG. Specifically, these files illustrate the functional capabilities defined in Tables B-1 and B-2 of:

- element titles
- unique element IDs
- persistent element IDs
- version information at the element level

This version of the TIIG provides samples of the SEAWOLF/688 Class SSM DTD and NAVSEA C2 DTD. Other DTDs will be added to subsequent versions of the document as requested by users.

## Sample SGML Files

### **SSM SGML file (Change 1):**

```

<ssm ID="S027101" DOCSTAT="PRELIMINARY" BOATTYPE="SEAWOLF">
<vol2 ID="S04E202" LABEL="2" CHNGLEVEL="0"><title>COMBAT
SYSTEM</title>  [IDs ideally should be provided for ALL elements that
will be extracted as part of the TOC structure. The
inclusion/exclusion of IDs should be consistent for element types. See
Notes 1 and 2.]
<PARTVOL2 ID="SSM2-0" LABEL="0">  [Versioning information ideally
should be provided for ALL elements that will be extracted as part of
the TOC structure. See Note 3.]
<title>INTRODUCTION TO XXXXX SYSTEM</title>
...

<section ID="S04E2012"><title>GENERAL INFORMATION</title>
<para0 ID="S04E2013" CHNGLEVEL="0"><title>GENERAL</title>
<para CHNGLEVEL="0">The XXXXX ....</para>
<para CHNGLEVEL="0">Portions of the XXXXX .... (See <xref
XREFID="XS04E201" PRETEXT="Reference">
.) This system contains ... features which are described in <xref
XREFID="XS04E202" PRETEXT="Reference"> .</para>
<para CHNGLEVEL="0">A list of acronyms and abbreviations is provided
in <xref XREFID="XS04E203" PRETEXT="Table"> .</para>
</para0>
<para0 ID="XS04E2024" CHNGLEVEL="0"><title>PHYSICAL
ARRANGEMENT</title>
<para CHNGLEVEL="0">The XXXXX system is primarily .... <xref
XREFID="XS04E204" PRETEXT="Figure">
shows the ....</para>
<figure ID="XS04E204" CHNGLEVEL="0" TOCENTRY="1"><title>AN/BSY-2
System Equipment Location</title>  [The extraction program files can be
set up to take advantage of additional attributes, such as the
TOCENTRY, to determine whether an element should be extracted for the
TOC structure. See Note 6.]
<graphic BOARDNO="T016M031.TIF" GRAPHSTY="OUTLINE">
</figure>
<para CHNGLEVEL="0">The majority of the .... As shown in <xref
XREFID="XS04E204" PRETEXT="Figure"> , the principal spaces containing
XXXXX system equipment ....</para>  [Occasionally, there are children
under the para element that should be included in the TOC structure.
The extraction program files are set up to traverse the para element,
even though it will not be included in the TOC structure. See Note 4.]
<randlist ID="S04E2014"><item ID="S04E2015" CHNGLEVEL="0"><para
CHNGLEVEL="0">First Level: ...</para>
</item>
<item ID="S04E2016" CHNGLEVEL="0"><para CHNGLEVEL="0">Second Level:
...</para>
</item>

```

```

<item ID="S04E2017" CHNGLEVEL="0"><para CHNGLEVEL="0">Third/Fourth
Level:
...</para>
</item>
</randlist>
<para CHNGLEVEL="0"> <xref XREFID="XS04E206" PRETEXT="Figure"> shows
the plan view of the .... <xref XREFID="XS04E207" PRETEXT="Figure">
shows the ....</para>
<subpara1 ID="XS04E2025" CHNGLEVEL="0"><title>XXXXX XXXXXX
XXXXX</title>
<para CHNGLEVEL="0">The ..., as shown in <xref XREFID="XS04E206"
PRETEXT="Figure">
. ....</para>
</subpara1>
<subpara1 ID="XS04E2026" CHNGLEVEL="0"><title>XXXXXX XXXXXXXX</title>
<para CHNGLEVEL="0">Immediately aft ...</para>
<figure ID="XS04E206" CHNGLEVEL="0" TOCENTRY="1"><title>XXXXX</title>
<graphic BOARDNO="T016M032.TIF" GRAPHSTY="OUTLINE">
</figure>
</subpara1>
.
.
.
<PARTVOL2 ID="SSM23" LABEL="3" CHNGLEVEL="1"> [The extraction program
files can be set up to take advantage of additional attributes, such
as the LABEL, to add additional information to the element title. See
Note 5.]
<title>YYYYYYYY YYY</title>
. . .
<section ID="XS04F4C1"><title>GENERAL INFORMATION</title>
<para0 ID="XS04F4C48" CHNGLEVEL="0"><title>GENERAL</title>
...

```

#### Notes:

1. Ideally, all elements that should be included in the Table of Contents (TOC) "structure" should have an ID. However, the AIM extraction program registration files can be set up to allow for inclusion of elements even if they do not have an ID; these elements would be "placeholders" in the TOC only and would not be able to be positioned to within the IETM viewer/browser.
2. All elements should be consistent in their inclusion/exclusion of ID information. For example, if the decision is made that some <para> elements have IDs, then all <para> elements should have IDs.
3. Versioning information ideally should be provided for each individual element. If no versioning information is provided for an element, it receives the versioning information of its parent. In the above example, the first <partvol2> element would ideally have versioning information, similar to the second <partvol2> element.
4. In the above example, the extraction program files have been set up to traverse the <para> elements even though there is no ID, in order to retrieve any lower

level elements to add to the TOC “structure”. This is usually done in order to find figures or tables that are children of the <para> elements.

5. The extraction program registration file can be set up to take advantage of information in attributes. For example, the label attribute value in the above example can be appended to the element title, in order to mimic even more closely the TOC seen in the IETM viewer. In addition, the specific registration file corresponding to this DTD is set up to additionally use the “tocentry” attribute as an indication of whether an element should be added to the TOC “structure” that is extracted.

### **SSM SGML file (Change 2): (illustrates persistence of IDs across multiple versions of an IETM)**

```
<ssm ID="S027101" DOCSTAT="PRELIMINARY" BOATTYPE="SEAWOLF">
<vol2 ID="S04E202" LABEL="2" CHNGLEVEL="1"><title>THE COMBAT
SYSTEM</title>
<PARTVOL2 ID="SSM2-0" LABEL="0">
<title>INTRODUCTION TO XXXXX SYSTEM</title>
...
<section ID="S04E2012"><title>GENERAL INFORMATION</title>
<para0 ID="S04E2013" CHNGLEVEL="0"><title>GENERAL</title>
<para CHNGLEVEL="0">The XXXXX ....</para>
```

#### Notes:

1. All elements IDs are the same in this Change 2 of the IETM and in the previous Change 1 of the IETM. Persistence of IDs is critical in order to allow for the appropriate indication of an individual element’s impact on the course based upon a change in the IETM.

**NAVSEA C2 DTD-based SGML file:**

```

<docnavseac2 id="z0001" chglvl="3">
<front><idinfo>
<pubno><docno>XXXXX-XX-XXX-XXX</docno><docno>XXXX-XX-XXX-
XXXX</docno></pubno>
<chgnum>H</chgnum>

<body id="z0001b0001" chglvl="3"> [IDs ideally should be provided for
ALL elements that will be extracted as part of the TOC structure. The
inclusion/exclusion of IDs should be consistent for element types. See
Notes 1 and 2.]
<figure id="z0000f001" label="1-1." chglvl="1"> [Versioning
information ideally should be provided for ALL elements that will be
extracted as part of the TOC structure. See Note 3.]
<title>YYYYY YYYYYY YYYYYYYY YYYYYY</title>
<graphic boardno="fig2"></figure>
<!-- pgrk pgnumber="1-0"-->
<chapter id="z0001c001" label="1" chglvl="1">
<title>GENERAL INFORMATION</title>
<para0 id="z0001p0001" label="1-1." chglvl="1">
<title>PURPOSE YYYYYY YYYYYYYY YYYYYYYY YYYYYY.</title>
</para0>
<para0 tocentry="0" id="z0001p0002" label="1-2." chglvl="2"> [The
extraction program files can be set up to traverse an element but not
add it to the TOC structure. In this case, the para0 element should be
traversed in order to look for other children that perhaps should be
added to the TOC structure. The tocentry="0" attribute informs the
extraction program that the para0 element itself should not be added
to the TOC structure. See Note 4.]
<para> YYYYYY YYYYYY YYYYYYYY YYYYYY provides ... to perform the
following functions: <seqlist numstyle="arabic">
<item id="z0001l001" chglvl="1">....</item>
<item id="z0001l002" chglvl="1">Monitor ....
</item>
<item id="z0001l003" chglvl="3">Transmit ....</item></seqlist> </para>
</para0>

```

**Notes:**

1. Ideally, all elements that should be included in the TOC "structure" should have an ID. However, the extraction program registration files can be set up to allow for inclusion of elements even if they do not have an ID; these elements would not be "placeholders" in the TOC only and would not be able to be positioned to within the IETM viewer/browser.
2. All elements should be consistent in their inclusion/exclusion of ID information. For example, if the decision is made that some <para> elements have Ids, then all <para> elements should have Ids.

3. Versioning information ideally should be provided for each individual element. If no versioning information is provided for an element, it receives the versioning information of its parent.
4. In some cases, it has been noticed that an element should not be added to the TOC structure even if there is an ID, but it should be traversed in order to retrieve children to add to the TOC structure. Again, the extraction program registration file can be set up to traverse elements but not include them in the TOC structure.