



The Advantages of Integrated Military IETMs or IETPs in the Field

Ensuring that combat personnel can keep their weapons up and operating – no matter where they are, no matter what their mission.

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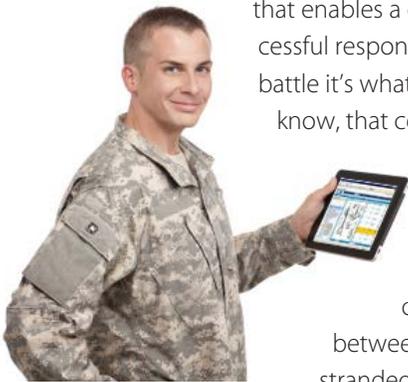
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In today's military environment, it is increasingly likely that soldiers, sailors, airmen and marines will need to perform maintenance work on their own equipment. This is due in part to strong pressures across all military divisions to minimize operational and maintenance costs. Many factors, however, can complicate this task including the actual maintenance of the equipment itself. Rapid-response deployments place military personnel in isolated environments that require them to fix advanced weapon systems – even though they haven't been formally trained for this job. They may not be familiar with maintenance techniques. They may not understand the task required. They may not know which parts they need. They may not know where to look for (or even that they should look for) updated service procedures. They may be in a hostile environment. They're probably in a hurry, and they almost certainly have other things on their minds.

The Need for an Interactive Electronic Technical Manual or Publication

For troops in combat scenarios, an Interactive Electronic Technical Manual (IETM), also known as an Interactive Electronic Technical Publication (IETP), provides the tools needed to get the job done. The challenge is that an IETM or IETP is only as useful to the troops in the field as the technology behind it. And it's this underlying technology – the information delivery system, the user interface, the technical library, the integration capabilities, the extensive search and filtering, and the multiple modes of

accessibility – as much as the content itself that enables a quick, accurate and successful response and repair. In the heat of battle it's what people do, not what they know, that counts most. That means that using the right IETM or IETP can make the difference between pressing an advantage or being forced to fall back, between getting home or getting stranded.



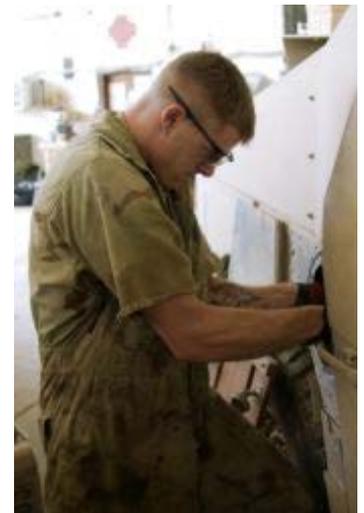
The premise that drives advanced IETMs and IETPs is simple: the people that use a weapon system must be able to fix it when it breaks. Combat personnel – not just technicians back at the maintenance depot, hangar or port – are increasingly the ones making repairs. Even back at base, factors such as force flexibility and the rapid rate of changing technology make the idea of “keeping up” on every piece of hardware or software an

impossible task. In fact, one of the greatest strengths of modern military equipment is also one of its greatest weaknesses: the ability to quickly adapt, while deployed, to account for current combat experience. The potential issues that arise from such extensive flexibility, of configuration, of mission, of ordinance, and the resulting impact on required service procedures are hard to document – and even harder for service personnel to follow. That's especially true for combat personnel who lack the detailed training to maintain the complex weapon systems on which they rely. That's why a complete, comprehensive IETM or IETP is so important. It keeps everyone on the same page, and it keeps that page up-to-date.

Consequences of NOT Having an Interactive IETM or IETP

The personal and strategic sacrifices of not employing an interactive IETM or IETP can be disastrous. A mission might fail or be delayed as a result of an aircraft being impaired or an armored personnel carrier being stuck. The wrong parts might be ordered causing further delays or the equipment could be damaged or rendered inoperable. Personal injury could result. Friendly forces could be captured or killed. Multiply this over a large force and the impact is enormous and potentially devastating.

Operational and maintenance goals can be undermined. Military organizations may resort to cannibalizations, where parts or components are taken off one platform and put onto another for a variety of reasons such as parts not being available when needed or mechanics not being trained well enough to diagnose or fix problems. This increases maintenance costs by increasing workloads and also reduces the equipment that is ready for deployment at any given time.



That's why it's important that an IETM or IETP works as planned and as needed before installing it. The right question to ask is this: will the technology behind the content deliver the right information in the right format to the right place right now to solve the problem in front of your soldier, sailor, airman or marine?

The Power of Integration and Contextual Search

An IETM or IETP is about more than delivering disparate pdf documents with unrelated, unsearchable words and pictures to a remote computer screen and hoping for the best outcome. A complete, comprehensive IETM or IETP ensures that good equipment maintenance decisions and actions happen and bad ones don't by providing integrated and searchable sources of easily accessible, accurate information.

An IETM or IETP doesn't exist in a vacuum. Integration, both internally within the IETM or IETP and with other maintenance or legacy systems is a powerful factor in delivering the exact content needed for the specific action at hand. An IETM or IETP may rely on multiple data sources for service procedures, parts diagrams, available inventory and other resources. It may need to cross reference all sorts of searchable document formats such as SGML, XML, PDF, DOC, JPG, or even video to present the in-field troop with the right information at any particular time, depending on the task that's required.



Internal application integration. A technical library is the heart of an integrated IETM or IETP system. It makes sure that all the information needed is available in one central repository. It contains the most accurate, up-to-date and current technical publications, service manuals, service updates, parts information and even tutorials. Today it's possible to fit all the knowledge that a weapons technician will need on a handful of DVDs, a laptop's hard disk drive or thumb drive. The question is: out of all that data, which information is most relevant? And what about information that gets changed or has become obsolete? Maintenance procedures change, parts change, designs change

– not to mention that the weapon configuration, the combat scenario and the fault codes might change too. Service information is in a constant state of flux, so finding the right data can be difficult. Also subject to change is the technology available to the field technician. They could have access to a network, or not. They could be working from a desktop, a laptop, a tablet or a handheld. They could be in a forward deployment or in a repair depot. For any of these scenarios, if the required content is available but the user can't get to it, the IETM or IETP is no longer an asset – it's a liability.

A technical library combined with an extensive search and filtering system inside an intuitive graphic user interface delivers exactly what's needed. Content is no longer hard to find, connect to or access, but is universally available and operates online, wirelessly, or as a stand-alone system (that updates when Internet connection is re-established). It marries the content to the action, based on context – what needs to happen right here, right now, given the current situation.

External system wide integration. A fully integrated IETM or IETP will connect to existing organizational applications and legacy systems to streamline operational work flow and expedite activities. A shopping cart is a great example of this. Instead of simply listing which parts need to be replaced on a broken vehicle (and have to re-enter the information in another program), a fully integrated IETM or IETP allows direct requisitioning of parts by clicking on them within the actual repair procedure and having the requested part sent automatically to the procuring entity. That one simple example is one of many benefits that can be realized with an integrated IETM or IETP. Another example is where the field users have access to basic Maintenance Tasks in the Maintenance System, and with integration to the IETM or IETP they can link directly to the technical instructions for each step. The significance is clearly recognized and appreciated when a repair needs to be completed quickly.

The previous example helps explain the importance of system-wide integration, or how well the IETM or IETP integrates with existing organizational software and applications. The following are some questions to ask when considering a new IETM or IETP:

- Does it mesh with the organization's data standards, hardware standards, maintenance software, legacy software, personnel training, etc.?
- Does it support both base and field requirements? Will it become a barrier to future (technology) innovation?

- Can it build on legacy investments – taking advantage of PDF, SGML, XML and other installed data formats?

To be useful over the long term, an IETM or IETP must keep pace with rapidly changing technology, advancing complex equipment standards and challenging work environments. It has to get three things right – internal application integration of content with situational context, external integration with existing business systems, and improved inventory management – and it must do so in the face of rapid and unrelenting change.

What Does the Military Want?

The importance of addressing these integration and contextual challenges is critical enough that the military has clearly identified them as requirements. In the U.S. Department of Defense IETM specification, [MIL-PRF-87268A](#), (1995, with January 15, 2001 amendment) the attention to integration, access and contextual searching is clear. The specification states that:

The users shall have access to information relating to the technical content of the IETM, such as information on the weapon system itself (e.g., theory of operation or schematics) or assistance in using of the authored procedures. The help function shall also permit the user to access context sensitive help which applies to the user's current activity and situation. It shall permit the user to access descriptive information to further explain technical points, define specific terms, or provide a fuller explanation of processes covered very briefly by the technical information.

In a November 2000 "[Cost-Benefit Assessment of Interactive Electronic Technical Manuals in Navy Training and Education](#)" report, the Logistics Management Institute, called attention to integration, this time in terms of equipment under service:

IETMs allow a user to locate required information faster and more easily than is possible with a paper manual. They are easier to comprehend; more specifically matched to the system configuration under diagnosis ... Powerful interactive troubleshooting procedures, not possible with paper technical manuals, can be made available using the intelligent features of the IETM display device.

The [UK Ministry of Defence](#) calls for S1000D (the latest XML-based specification for technical publications) delivery solutions that extend way beyond documents by matching the customer's needs:

S1000D is gaining international acceptance as the preferred standard for the delivery of technical information. Not only that, it is being used for applications outside its original market. The standard allows the control of data at the module level which ensures configuration control and allows customer-made packages to be assembled and, more importantly, allows a delivery to exactly match a customer's need. (Dennis Hoyland, Head of ILS and Engineering Policy, Technical Enabling Services, UK MoD)

Evolution of IETM specification. Many years ago, the DoD defined IETM functionality in terms of a "help hierarchy" with six layers or classes. The hierarchy started out with "technology-free" content (i.e., Class 0) and extended to Class V, which described an IETM as something approaching the integrated logistics application. Rather than a computerized repair manual, what emerged might more appropriately have been called a portable repair depot – a seamless environment of interlocking information systems, each optimized for its own functional role yet properly integrated to accelerate the service and support of complex equipment.

Class 0	Paper with multiple volumes not linked or integrated. Maintainer searches for data. High false removals rates probable.
Class I/II	Page turners and scrolling documents with indexing and maybe some hyperlinking. Maintainer searches for data. High false removals rates probable.
Class III	SGML or XML-tagged documents, some level of intelligence added, hyperlinking through linear structure. Maintainer searches for data. High false removals rates probable.
Class IV	Authored directly to database for interactive electronic output, authored for maximum viewing ease. False removal rates non-existent, hierarchical structure.
Class V	IETM linked to EQUIP and/or maintenance network, integrates with equipment diagnostics and expedites, troubleshooting, spares ordering and maintenance planning for increased equipment availability.

Table 1: IETM Classes from the original "Interactive Electronic Training Manual (IETM) Guide" published by Defense Systems Management College Press, Fort Belvoir in 1999)

The problem with the classes is that they were never recognized as "official," and so over time they were reduced to two main Types:

Type I	More basic IETM incorporating Classes I through to III
Type II	More advanced IETM incorporating Classes IV and V

Table 2: IETM Types

In more recent times, the S1000D Functionality Matrix has been introduced in an effort to remove the concept of the IETM classes and instead to look at all core functionality required in an IETM or IETP. This includes:

Content	What types of content may be included in an IETM or IETP, such as Wiring Diagrams, Descriptive or Operational data, Maintenance Procedures, Service Bulletins and Materials Information.
Functionality	What functionality may be included in an IETM or IETP such as Navigation and Search, Support for 3D Modeling, Videos and Photos, Diagnostics and Prognosis, Annotations, Redlining of images and Maintenance Data Collection, Parts Ordering and other external processes to retrieve and transmit data.

Table 3: IETP Functionality Matrix [S1000D Specification for Technical Publications – Issue 4](#)

Note that in all classifications and specifications, the attention is on content and functionality. A fully functioning IETM or IETP is neither a standalone document, nor an electronic version of one. It is a dynamic product encyclopedia that delivers service information and is deeply integrated with other systems such as parts ordering, maintenance planning and equipment diagnostics to provide a system that supports the service and maintenance requirements. Unfortunately, none of these other systems was originally designed to work with the other or with any particular IETM or IETP solution. That's another burden that the IETM or IETP must carry. In short, the IETM or IETP must 1) get the content right; 2) get the user context right; 3) get the organizational context right; and 4) overcome barriers to meeting the first three requirements.

The Military also wants less parts waste. According to the United States Government Accountability Office, (USGAO) "The Department of Defense (DOD) spends billions of dollars to purchase, manage, store, track, and deliver spare parts and other supplies needed to keep military equipment ready and operating." They go on to say that "we have identified DOD supply chain management as a high-risk area due in part to ineffective and inefficient inventory management practices and procedures, weaknesses in accurately forecasting demand for spare parts, and challenges in achieving widespread implementation of key technologies aimed at improving asset visibility. These factors have contributed to the accumulation of billions of dollars in spare parts that are excess to current requirements."

Their 2010 Inventory Management Plan was to improve supply chain processes, including inventory management practices and to establish a comprehensive, results-oriented management framework to guide implementation.

Fully integrated IETMs or IETPs address these concerns by providing the technology and functionality necessary to better manage the maintenance of complex equipment. This reduces excess inventory purchases, management, storage, tracking, and delivery of spare parts and supplies.

What Should You Look For?

Knowing the criteria for success is critical for judging a particular IETM or IETP. Even better is to know which indicators reveal whether those criteria are actually being met. Like the equipment they are intended to support, organizations with a highly effective IETM or IETP strategy typically realize some clear advantages. These include:

- Dramatically smaller logistical footprints
- Much higher states of operational readiness
- Disproportionately lower costs for equipment operation and repair
- Much faster deployment and maintenance of weapon upgrades
- More capable/flexible personnel (rapidly implementing field experience)
- Rapid adoption of technology innovations (enabling new capabilities)
- Technology independence (adaptability)



Taken independently, each of these benefits is important, but taken as a whole these benefits work together to deliver significant value. For example, take logistical footprint – the amount of spare parts, people, and other resources needed to keep a piece of equipment working in the field. If fewer logistics resources are required, then greater operational readiness will be achieved because smaller support units can be organized and deployed more quickly. Furthermore, the military will experience greater logistics flexibility because vital support equipment can be rapidly re-deployed elsewhere. Finally, deployment costs will decrease because fewer personnel and less support equipment need to be transported and maintained in-theater, and because weapons can be repaired in the field.

The impact of disconnected systems goes beyond cost. Operational readiness can be significantly improved when information is integrated better and delivered faster. It is a simple fact that instant access to critical information improves the quality of decisions. When weapons need to be repaired quickly, service personnel can't afford to wait for the right information. Operational readiness is further enhanced when service and support information reflects experience. With an integrated IETM or IETP,

as new repair procedures evolve – whether in the field or at the factory – those can be automatically deployed to all relevant locations. Service personnel do not have to waste time figuring out new solutions to old problems or trying to figure out if more current information exists. For most maintenance personnel, that would be a big improvement.

As an example, even though the maintenance and procedural manuals are located next to the aircraft, aviation technicians often spend up to 40% of their time away from the airplane looking for additional information that's needed to perform service. Today, some military organizations are trying to reduce the levels of maintenance support by half, which saves in training, organization, and personnel. It also improves operational autonomy, allowing a force that's been deployed to be completely self-sufficient. The right IETM or IETP will support a more generic workforce by providing multiple paths to search data so information is available in a more "contextual" format to the maintenance personnel – whether they are warriors or mechanics.

In general, a failing IETM or IETP strategy is easy to recognize. It's one where equipment arrives at the service depot with a report of all suspected problems. A successful IETM or IETP strategy is one where equipment is fixed in the field, maintenance histories are updated remotely and, when complex repairs are required, the fault diagnosis is already in hand before the weapon arrives at the service depot – not because the soldier, sailor, airman or marine has trained to be a mechanic, but because the IETM or IETP took care of the paperwork. It guided the user to diagnose the problem in the proper context – recognizing the particular equipment model, type, configuration, symptom, mission and operating environment.

This has several advantages. For one, the diagnosis (or at least the reporting of symptoms) is more accurate if communicated immediately. (Symptoms may not occur later when the equipment arrives for service because the conditions that prompted the symptoms may no longer be present.) Another advantage is that the service depot will already have the correct spare parts in hand when the equipment arrives, which reduces the time needed to return the weapon to service.

Technology choices play an important role in developing the right IETM or IETP strategy. But what is most important is that the military has choices. No service should be locked into a particular vendor, or find themselves unable to exploit innovation, based on technology choices made in the past. That approach simply propagates the problems evident today and drives the organization further from the benefits of a true, common off-the-shelf solution (COTS).

So, what kind of IETM or IETP technology should organizations choose in order to acquire these benefits? How do they meet waste reduction mandates while promoting full integration and while keeping the needs of the in-field troop's contextual search needs in mind?



What's Under the Hood?

As previously stated, an integrated IETM or IETP empowers untrained personnel to service a variety of equipment in potentially difficult environments. That in turn requires the IETM or IETP to handle four things well: diverse content, user context, organizational context, and technology barriers. Given those capabilities, an integrated IETM or IETP delivers a new model of equipment maintenance and repair. It's a model that offers significant benefits to both warriors and military planners – including improved readiness/effectiveness, and lower support/logistics costs.

To assure themselves of those benefits, military planners need to look under the hood of the technology they procure. Here's what they should expect to find:

- Scalable architecture
- Open architecture
- Evolving documents (in various formats)
- Standards compliance

Scalable Architecture. Probably the most important attribute an IETM or IETP can have is scalability. Scalable simply means that IETMs or IETPs performance remains acceptable regardless of the size of the implementation. In an IETM or IETP solution, the idea of "size" can mean many different things, some of which might not be immediately obvious:

- Number of users
- Types of users

- Types of media
- Amount of content
- Types of content
- Number of content updates
- Types of content updates
- Frequency of content updates
- Number of integrations
- Types of integrations
- Number of weapons systems/equipment
- Types of weapons systems/equipment
- Number of deployments
- Types of deployments (availability of bandwidth)

A scalable architecture allows you to grow the size of your IETM or IETP with respect to any of these factors virtually without limit. In a non-scalable architecture, you typically reach certain load thresholds beyond which the application no longer works or becomes prohibitively complex or expensive. Performance may degrade below a tolerable level, the application may become untenable to deploy or manage, or it may even crash. When that happens, per-user costs spike and operational readiness decreases because the organization generally has to replace the old application with a new one – with all the reengineering and data conversion that entails.

The reason some architectures are more scalable than others is because they employ an n-tier, web-based deployment model. N-tier means the application is logically partitioned into discrete blocks of functionality – data sources, business logic, and presentation. Web-based means that these blocks do not have to be “hardwired” together but can interact with each other over an IP network, such as the Internet. The advantages of an n-tier, web-based deployment model include:

Thin client

A thin client architecture eliminates proprietary code from the user’s laptop, PC or handheld. That makes it easy to add users and inexpensive to distribute content. It also makes it easy to change business logic, data sources and functionality because those changes are implemented on the server, not spread across all clients that use them.

Shared Middleware

Middleware such as J2EE provide services that are common to application blocks, such as message services, data caching, and

channel management, to name a few. By using shared services, the application becomes more stable because it doesn’t have to provide and maintain custom versions of these services.

Plug & Play

As application loads grow, power needs to be added – CPUs, database capacity, network links, and so on. In an n-tier, web-based model, these additional resources can be specifically targeted at whichever application blocks need them most. Making it easier to optimize performance and minimizing the hardware footprint and cost.

Open architecture. The IETM or IETP should be capable of interacting with other systems in order to provide a solution that meets an organization’s equipment operation and maintenance needs and processes. Here are just a few of the integrations that an IETM or IETP may have:

Diagnostics System

Integration with a diagnostics system enables field engineers to effectively troubleshoot equipment problems and quickly ascertain what is required in order to fix them (in many cases in the field without having to return the equipment to the depot).

Parts Ordering / ERP System

Using the equipment’s parts catalogs manuals (IPC/IPD), users rapidly identify the correct parts required and immediately create a demand in the parts ordering or inventory system.

Maintenance System

When integrated, maintenance planners can directly access the technical documents in order to ascertain the steps that need to be performed. When required, they can create job cards for the depot which contain both the planning information and the relevant technical documents or even document components.

Capturing inputs from depot mechanics or field combat personnel (either through electronic notes to the IETM or IETP documents, or as comments and signatures in the task/job cards) and submitting them to the maintenance system, ensures a primary system of record and provides all relevant information required for tracking or the authority-regulated audit trails.

Evolving Documents. The presentation of service information should adapt dynamically to reflect user and organizational context. This should be relevant for all document formats, specifically PDF, SGML and XML. Here are some benchmarks:

Context sensitive delivery

Information relevant to each step of the diagnosis procurement and repair process is filtered and presented based on a specific piece of equipment. Related information is propagated across multiple IETM or IETP views (such as between parts lists and maintenance tasks). Neither the user nor the IT department should need to tell the IETM or IETP how or where to make these types of logical connections.

Incremental updates

The ability to update service information easily and often is a requirement. An IETM or IETP must support the addition of new content outside of the usual 1-2 year revision model. Repair procedures in a maintenance manual should include information contained in the latest service bulletins – even when issued months after the manual was released.

Embedded data

Some text in a repair procedure should be treated as data in a parts ordering or inventory system. Since these other systems may not know how to interpret a maintenance manual, responsibility for that translation lies with the IETM or IETP.

Device portability

An IETM or IETP should adapt content to different devices, like laptops, tablets and handhelds. That could mean that a complex diagram that won't display well on a handheld might be excluded from the default view of a repair procedure – but would be included when viewed on a laptop or PC.

Standards Compliance. Surprisingly, some IETM vendors don't fully support Web, data and interchange standards even though it is those very standards that make many of the benefits of an integrated IETM or IETP possible. They will, for example, utilize a proprietary web browser to access server-based functionality or develop proprietary interfaces and messaging systems to connect to other applications. Proprietary, non-standards compliant IETM or IETP software has many drawbacks for the military:

- Programs are locked into a single vendor
- Special training is required to support proprietary browser code
- Changes in applications, user interfaces and government standards (e.g. DTDs) require browser or application upgrades
- New IETM functionality takes longer and costs more to deploy to the field

- System integrations are costly and time consuming
- Migration to new systems is costly and time consuming

All these limitations oppose two key objectives of an integrated IETM or IETP – to increase readiness and reduce total cost of ownership. But browsers are just one example where IETMs or IETPs can leverage standards. Some standards are de facto and are based on market dominance. They tend to exploit traditional common off-the-shelf solution advantages. Other standards are committee-based, like XML, and exploit advantages similar to COTS, because they are so widely supported in the commercial marketplace.



Interactive Electronic Technical Manuals as Strategy

Clearly, military planners should expect more from an IETM or IETP than what they've been getting. The rate of change of technology, and the resulting complexity of modern weapon systems, will continue to accelerate. However, in today's rapid-response environment, the ability to deploy forces that can operate with a minimal logistics footprint is crucial.

Soldiers, sailors, airmen and marines must be able to maintain and repair their own equipment. Malfunctions should be recognized sooner, diagnosed and trouble shot more easily and resolved faster. Weapons upgrades should be rolled out more rapidly, implemented less expensively and require less training. While reducing the number of equipment failures is always a priority, combat is abusive to military hardware. Therefore, the right IETM or IETP strategy should reduce repair times, troubleshooting errors, parts misorders and inventory costs. Service personnel should be able to diagnose and fix more equipment in the field – even for problems they have not been previously

trained to diagnose or fix. Service information must be made more accessible to today's warriors but it must be filtered to better reflect what they actually need to know when they need to know it. With the right IETM or IETP strategy, innovation and change come to be viewed as advantages, not as impediments.

Implementing an integrated IETM or IETP can be like finding the higher ground in battle – a strategic advantage that opens up new vantage points and new possibilities. The difference lies in the extent to which the technology enables, facilitates, and then guides action – both for the user and the organization. At a time when the military is being asked to do more with less, this is a strategy that must be considered.

About Enigma

Enigma provides a software product suite that improves the efficiency, consistency and profitability of maintenance, repair and overhaul (MRO) operations and aftermarket sales and service organizations. Enigma's unique products integrate with product lifecycle management, supply chain management, enterprise resource planning and other enterprise applications to provide a dynamic encyclopedia of service, parts and diagnostic information that captures technicians' expertise and manages an optimal service and support workflow. By facilitating aftermarket maintenance, parts logistics and equipment uptime, Enigma helps service and support organizations maximize their profitability.

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