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Executive Summary

This report describes an Institute for Defense Analyses (IDA) cost-benefit analysis of a project to improve the Navy's Integrated Logistics Support (ILS). The project involves integrating, or "bridging," the management of technical information for producing Navy technical manuals and training courses. Integration would lower the cost of producing manuals and courses and would increase shipboard readiness by having the appropriate logistics support on hand when new systems and equipment upgrades are fielded. The Bridge project achieved the integration by designing new software and proposing new technical and business procedures for managing the technical information.

The Bridge project was funded by the Office of the Under Secretary of Defense for Acquisition, Technology and Logistics (OUSD(AT&L)). It was part of the Reduction in Total Ownership Cost (RTOC) program conducted by the Office of the Secretary of Defense (OSD). The initial beneficiary of the funding is the Littoral Combat Ship (LCS) Mission Modules Program (PMS 420), which is integrating the mission modules into the LCS.

The costs of the Bridge project are those for investment and implementation. Investment is the personnel and related expenses of the project. Implementation is the expenses of training technical writers and course developers in using the Bridge, plus the license and user fees to cover the additional costs of maintaining the networks and the repositories for processing and storing the technical information.

The study conducts separate cost-benefit analyses for two perspectives. The OSD perspective recognizes OSD's broad interest in seeing whether the new software and technical and business processes that constitute the Bridge will lead to net cost savings—benefits exceeding costs—if implemented by the Navy and other Services as a whole. Analysis of this perspective is therefore conducted for an "aggregate" sample: the Navy's yearly production of all Hull, Mechanical, and Electrical (HM&E) technical manuals produced by the Naval Ship System Engineering Station (NAVSSES) in Philadelphia, and all Computer-Based Training (CBT) courses delivered by Navy eLearning (NeL), a part of the Naval Education and Training Command (NETC).

The second perspective reflects the focus of Program Offices on their individual systems of interest. The analysis for the Program Office perspective concentrated exclusively on the benefit side—whether the Bridge would save money in producing future technical manuals and training courses. It focused on the benefits of a "single-system"

sample: the AN/AQS-20A mine-hunting sonar for the LCS. To expect that these savings would cover the full investment and implementation costs of the Bridge would be unreasonable.

The aggregate analysis finds that the Bridge would achieve net benefits of $78.1 million in 10-year costs: a savings of $86.8 million in producing future HM&E manuals and NeL-delivered courses less $8.7 million in investment and implementation costs. The single-system analysis finds that the Bridge would produce substantial savings of almost $306, 000 over 10 years.

These results are uncertain because of the newness of the Bridge. Although much of the analysis is based on historical data, some of the inputs are projections of the new Bridge's productivity. A sensitivity analysis of the five most uncertain inputs shows a range of 10-year net benefits for the aggregate analysis varying from $32 million to $120 million. These benefits would be much greater if the Bridge were applied to the technical manuals and training courses of the entire Navy and other Services. This intriguing innovation deserves further study.

Contents

1. Introduction

This report describes an Institute for Defense Analyses (IDA) cost-benefit analysis of a project to improve the Navy's Integrated Logistics Support (ILS). The project involves integrating ("bridging") the management of technical information for producing Navy technical manuals and training courses to support fielded systems and equipment upgrades. The principal benefits analyzed in this study would be lower costs of producing future manuals and courses. Also included is a parametric analysis of the improvement in shipboard readiness that results from supporting newly fielded systems and equipment upgrades with the most reliable and timely information.

The project was conducted for the Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics (OUSD(AT&L)). It was part of the Reduction in Total Ownership Cost (RTOC) program conducted by the Office of the Secretary of Defense (OSD). The initial beneficiary of the funding is the Littoral Combat Ship (LCS) Mission Modules Program (PMS 420).

The integration results from new software and technical and business processes the project developed to integrate the production of technical manuals and training courses. The new methods would be used in conjunction with the S1000D technical data specification and the Sharable Content Object Reference Model (SCORM).[1]

A. Terminology

The meaning of "Bridge" in this project has changed. It originated in the early planning stage conducted during September–December 2008. At that time, the project's focus was on identifying why Naval technical training content is often out of date and not factored into system life-cycle management.

An analysis of Navy management and production practices revealed that tools for processing learning content cannot easily access Common Source Data Bases (CSDBs) that contain related technical data. The project's focus therefore shifted to developing an Application Programming Interface (API) to improve this access. The API became known as the "API Bridge.

[1] SCORM is a group of specifications for standardizing the *packaging* of training content—not the content itself—so it can be delivered by any Learning Management System (LMS). An LMS is a Web-based e-learning system.

However, as the project matured, it became apparent that using the API Bridge required additional innovation: a package of software tools and technical and business processes to foster interoperability by integrating technical data and learning content throughout system life cycles. This entire package of improvements, now referred to as the "Bridge" project, is the subject of this cost-benefit analysis.

B. Outline of the Report

This report is organized around the following topics:

- How technical manuals and training courses are currently produced by non-integrated processes
- The Bridge project's proposals to integrate these processes
- The analytical approach to estimating the costs and benefits of the proposals
- The quantitative analysis of costs and benefits

The first three topics are addressed in the remainder of this chapter. Section 1.C discusses the shortfalls of not integrating the production of technical manuals and training courses, Section 1.D describes the Bridge Project's proposals to relieve the shortfalls, and Section 1.E outlines the cost-benefit analysis—the overall analytical approach and the particular costs and benefits to be evaluated. The chapter ends with caveats (Section 1.F).

The fourth topic, the quantitative analysis of costs and benefits, is addressed in succeeding chapters: the investment and implementation costs of the Bridge (Chapter 2), the benefits measured by the reduction in costs of producing future technical manuals and training courses using the Bridge (Chapter 3), and the benefits through improvements in Fleet readiness (Chapter 4). The summary (Chapter 5) presents a sensitivity analysis of the major uncertainties and briefly describes the need for additional work.

Several appendixes augment material referred to in the body of the report:

- Appendix A. Detailed Staff-Hour Estimates for Producing a Nominal 500-Page Technical Manual Under Current and Bridge Processes
- Appendix B. Detailed Staff-Hour Estimates for Producing a Nominal One-Content-Hour Training Course Under Current and Bridge Processes
- Appendix C. Timeliness of Technical Manuals and Training Courses
- Appendix D. Navy Learning Centers
- Appendix E. Content Hours and Computer-Based Training (CBT) Courses Delivered by Navy eLearning (NeL)

C. Current Non-Integrated Production of Navy Technical Manuals and Training Courses

A major goal of ILS is that crucial support resources, such as technical manuals and training courses, are in place when new systems and equipment are deployed.[2] Although the goal is clear, its attainment often falls short for two major reasons:

- Technical training and learning and performance requirements are not consistently factored into the early system acquisition documents (e.g., milestone documents and Acquisition Logistics Support Plans (ALSPs)).
- The methods for producing technical data and learning content fail to make maximum use of interoperability to achieve integration. This lack of integration causes two major problems: technical manuals and training courses cost more to produce because of duplication of effort, and disparities may appear in the content and timeliness of the information they present.

The second reason is the subject of the present analysis. Here are the particular features of non-integrated production that lead to unnecessary cost:

- **Production process.** Technical manuals and training courses are generally produced by separate processes. Course developers use technical manuals as inputs, but they also obtain their own contractor data and job task analyses and then process the data using separate techniques.
- **Authoring tools.** Training course developers use authoring tools (editors) that do not have easy access to the CSDBs where technical data are stored.
- **Storage format.** Technical and training data are stored in different formats that are not designed for easy integration and data reuse.
- **Storage repositories.** Technical and learning data are usually stored in different and disconnected repositories.
- **System and equipment upgrading.** Although fielding of new systems is typically followed by periodic equipment upgrades described by such mechanisms as Engineering Change Proposals (ECPs), we lack common or automated identification systems (metadata) or technical and business processes for linking ECPs to the specific technical and training content that might require modification.

[2] Defense Acquisition University course in *Fundamentals of Systems Acquisition Management*, Lesson 19 (Acquisition Logistics: Fundamentals) and Lesson 20 (Acquisition Logistics: Supportability Planning).

This lack of integration can lower Fleet readiness through several mechanisms:

- **Disparities in information.** Technical manuals and training courses may not deliver the same information.
- **Information lags following the fielding of new systems.** Delayed production and distribution of manuals and courses can create the possibility that the supporting technical information might lag the fielding of new systems. (Courses may always lag the manuals to which they turn for information, but these courses and manuals must be available for newly fielded systems to ensure readiness.)
- **Information lags following equipment updates via ECPs and similar mechanisms.** Delayed production might also create lags in updating manuals and courses in response to equipment upgrades through ECPs.

Over time, experienced maintenance technicians develop a general understanding of how equipment works and may not always need up-to-date manuals or courses for a particular repair. Nevertheless, providing ships the up-to-date documents is the only way to ensure that the correct information is always available when needed.

D. The Bridge Project To Integrate the Production of Technical Manuals and Training Courses

The Bridge project engaged in three broad efforts to relieve the problems of high cost and low readiness:

1. Identification of new technical and business processes for integrating the production of technical manuals and training courses
    a. The textual data for all manuals from Original Equipment Manufacturers (OEMs) would be written by the OEMs or the Navy in the same digital format: the S1000D Issue 4 Data Module (DM) technical data specification. S1000D is an international digital specification for information used in the procurement and production of technical publications. It is a Standard Generalized Markup Language/Extensible Markup Language (SGML/XML) standard. Non-textual material (e.g., illustrations) would be called up by S1000D statements. DMs contain data arranged by product components and subcomponents. One DM, for example, might contain all of the power supplies for DD-963 fire-control systems. Data organized in this fashion would make reuse easier.
    b. All DMs would be stored in CSDBs. The Navy has already begun storing data for many of its systems—including systems for submarines and the Aegis guided-missile cruisers—into a single Navy CSDB.

c. Course developers would use a common interface (i.e., the API)[3] to read the technical data in the S1000D DMs stored in CSDBs. Using these data and information from job performance analyses and OEMs, course developers would structure SCORM-conformant learning content that could be used in any Learning Management System (LMS).

d. All learning content would be structured in S1000D Learning Data Modules (LDMs) for storage back into the CSDBs. S1000D Issue 4, released in 2009, can accommodate LDMs. As with technical data, non-textual learning content (e.g., illustrations) would be called up by S1000D statements.

e. All DMs and LDMs would be described by the S1000D file-naming convention, the Data Module Code (DMC). The DMC, a 37-digit number at present, represents physical and functional information for the systems contained in the various DMs and LDMs.

f. A software application (the Web Service) would be used to identify the DMs and LDMs that must be reviewed for possible modification in response to equipment upgrades specified by ECPs.

2. Development of the API and Web Service

3. Demonstration of the feasibility and attractiveness of applying the new technical and business processes to the production of technical manuals and training courses

   a. Converting the PowerPoint-based, instructor-led training for the AN/AQS-20A into S1000D LDMs.

   b. Converting an AN/AQS-20A technical manual from a normal "page-turning" document composed in Microsoft Word and Microsoft PowerPoint into S1000D Issue 4 DMs.

   c. Conducting the present cost and benefit analysis of the Bridge.

All of these tasks were completed in preliminary draft during the first year of the project. Several tasks will be performed in the second year of the project to fully implement the new products into the Navy infrastructure. These tasks include reviewing the initial programming of the API and Web Service and forming the S1000D AN/AQS-20A technical manuals and training courses into SCORM packages for input into the Navy CSDB.

[3] The API would allow course developers who use different authoring tools to exchange data easily with any CSDB.

E. Outline of the Cost-Benefit Analysis

1. General Description

The analysis will estimate the following costs and benefits of the project:

- Costs
  - Investment
  - Implementation
- Benefits
  - Future cost savings
  - Contributions to Fleet readiness

The costs and benefits are estimated over 10 years and discounted to FY 2010 present values using the annual 2.4% discount rate mandated for 10-year projects by the Office of Management and Budget (OMB) Circular A-94, *Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs (*Appendix C of the Circular, January 2009 update).

The investment costs are the project's expenses for completing the second year of the project. The first year was largely completed when the cost-benefit analysis was begun. The implementation costs are the estimated future expenses for training Navy personnel in using the Bridge and for the site/program licenses and user fees to cover the costs of maintaining and upgrading the networks and CSDBs.

The first benefit is the cost reduction achieved by using the Bridge to produce future technical manuals and training courses. These savings were calculated in three steps:

- Estimating the reduction in staff hours for producing a single nominal technical manual and a single nominal training course,
- Applying pay rates to convert the staff hour savings to cost savings, and
- Scaling up the savings for the nominal manual and course to the estimated 10-year production of the two samples of Navy technical manuals and training courses described in the next subsection.

The second benefit is the improvement in Navy readiness that will occur by providing ships newly fielded systems and equipment upgrades only when the appropriate logistics support is available (see Appendix C of this paper). In this case, we lacked current Fleet data and performed a parametric analysis instead.

2. Cost Savings

We analyzed the cost savings for two samples based on the different perspectives of OSD and the PMS 420 Program Office. PMS 420's task is to integrate the mission modules into the LCS.

The OSD perspective, reflected in its RTOC program, is to achieve net savings (benefits exceeding cost) for all defense systems. We analyzed an aggregate sample for this case: all Hull, Mechanical, and Electrical (HM&E) technical manuals, which are produced by the Naval Ship Systems Engineering Station (NAVSSES) in Philadelphia, and all CBT courses delivered by NeL, which is a part of the Naval Education and Training Command (NETC). The question for this aggregate analysis is whether this sample's savings cover the investment and implementation costs. The aggregate sample is not complete, since it excludes the technical manuals for electronic and ordnance components and the Navy CBT courses other than those delivered by NeL. However, the sample is large enough to indicate whether the benefits will cover the costs if the Bridge is implemented over a large force.

The Program Office perspective, by comparison, focuses on a single system, the AN/AQS-20A underwater sonar mine detector that is towed by the MH-60S helicopter as part of the LCS mine-warfare mission package. Interest here is only on the benefit side: Would the Bridge save money in producing future technical manuals and training courses without regard for the investment and implementation costs? Determining whether the savings for a single system would cover the full investment costs of the Bridge is not of interest.

3. Improvements in Readiness

Lowering cost is not the only benefit of the Bridge. Improvements in Fleet readiness are also possible. A recent Navy policy, described in Appendix C, dictates that new systems and equipment upgrades should not be installed on ships during yard availabilities unless the support logistics—up-to-date technical manuals and training courses—are available. The Bridge supports this policy, since integrating the production of technical manuals and training courses is expected to improve the consistency of technical information and its timely delivery to the Fleet. We carried out a parametric analysis for insight into whether the benefits might be significant. This analysis used cost data for the new Zumwalt DDG-1000 class destroyers.

F. Caveats

The Bridge involves the development of new software and new technical and business procedures for managing technical data and related training content. Many of the inputs for this analysis are based on historical data:

- NAVSSES data on the production of HM&E technical manuals,
- NETC data on the production of training courses delivered by NeL,
- The pay rates of people who produce technical manuals and training courses for the AN/AQS-20A system at the Naval Surface Warfare Center (NSWC) in Panama City, Florida, and
- The site program licenses and user fees for supporting the CSDBs and networks.

The cost savings, however, are also based on the projections of the final costs and the future capability of the Bridge at the halfway point in the Bridge project. This study is the first time that the cost savings of integrated production have been estimated, and the training course savings are derived from experience in only 1 of the 14 Learning Centers listed in Appendix D. Chapter 5 includes a sensitivity analysis of five uncertain inputs that significantly affect the quantitative results. The second year of the project will be devoted, at least in part, to efforts to refine these inputs.

2. Investment and Implementation Costs

A. Investment Costs

Table 2-1 shows the full investment costs for the Bridge project, which are the expenses for conducting the project during the 2 years between February 2009 and April 2011. The first year expenses are sunk costs since they were largely spent when the cost-benefit analysis was begun and are therefore excluded from the analysis. Because they are based on historical data, however, they are used to estimate the costs for the second year, whose tasks are similar to those of the first year.

Table 2-1. Bridge Project Investment Costs (Full Cost to the Government)

Year	Cost (FY10 $)
Year 1, February 2009–February 2010 [Note]	*1.77 million*
Year 2, February 2010–April 2011	1.79 million
Total	3.56 million

Note for Table 2-1: These are sunk costs not included in the comparisons with the future benefits of the Bridge.

The investment costs include the fully burdened salaries of the contractors and government personnel who worked on the study, plus their travel, Other Direct Charges, and the costs of administering the contract. The contractor costs are the figures from the Navy contract for the project and are thus fully burdened without modification. (No additional administrative costs were incurred since the contractors generally work in their firms' offices.) The costs of the government personnel were obtained by multiplying their staff hours by their General Schedule (GS) base pay rates, increased by the burdening allowances shown in Table 2-2. The 2% 2010 government pay raise the president signed in December 2009 was added to bring costs to 2010 dollars.

B. Implementation Costs

Table 2-3 shows the implementation costs for the aggregate sample: $2.86 million for the HM&E technical manuals and $4.02 million for the NeL training courses. The implementation costs consist of three components: (1) **Trainee Personnel**, the salary of personnel enrolled in a postulated 2-week course to train technical writers and course

Table 2-2. Burdening Allowances

Locality differential for DC/MD/VA/WV/PA	23.10%
Fringe benefits[Note 1]	35%
Overhead[Note 2]	40%
G&A[Note 3]	10%
2010 pay raise	2%
Total allowance[Note 4]	161%

Note 1 for Table 2-2: Medical, retirement, and so forth.

Note 2 for Table 2-2: Secretarial support staff, building rental, utilities, and so forth.

Note 3 for Table 2-2: Management and departments (human resources, accounting, computer, and so forth).

Note 4 for Table 2-2: The 161% is the resultant of the previous allowances: (1 + 23.1%)*(1 + 35%)*(1 + 40%)*(1 + 10%)*(1 + 2%) – 1 = 1.61 (161%).

Table 2-3. Implementation Costs for the Aggregate Sample

Cases	Technical Manuals	Training Courses
Trainee Personnel		
Number of people who require training	70	170
Bridge training session (hours)	80	80
Hourly contractor pay rate	$65.00	$65.00
One-time cost	$364,000	$883,830
Occurrences in 10 years	4	4
10-year cost, present value (FY10 $)	$809,947	$1,966,638
Trainee Course		
Staff hours to produce a one-content-hour course	360	360
Number of content hours for training session	10	10
Average hourly pay	$65.00	$65.00
One-time cost	$234,000	$234,000
Occurrences in 10 years	4	4
10-year cost, present value (FY10 $)	$520,680	$520,680
Site/Program Licenses and User Fees		
Cost per site/program	$25,000	$25,000
Number of sites/programs	6	6
Cost per user	$1,200	$1,200
Number of users	20	20
One-time cost	$147,800	$147,800
Occurrences in 10 years	10	10
10-year cost, present value (FY10 $)	$1,300,265	$1,300,265
Total	$2,861,386	$4,018,076

developers in using the Bridge, (2) **Trainee Course**, construction of a trainee CBT course for use in the 2-week training course, and (3) **Site/ Program Licenses and User Fees** to cover the additional costs of maintaining and upgrading networks and CSDBs. A NAVSSES official believes that this training would enable the Navy to obtain Bridge-capable technical writers at the same pay rates that it is now paying for SGML writers.

We lacked data to estimate the implementation costs for the AN/AQS-20A case. The workloads for this case (number of pages of technical manuals and number of content hours of training courses) are approximately 1% of those for the aggregate case, so the implementation costs would also be much lower.

1. Trainee Personnel

The personnel cost for an individual training session is the product of (1) the instructor and the number of people who require training, (2) the number of hours in the estimated 2-week training period, and (3) the contractor average hourly pay rate calculated in Table 2-4. The 10-year present value assumes that the training session is held four times during the 10-year period (every 3 years, in years 1, 4, 7, and 10) because of staff changes through retirement and new hires and because of assumed improvements in techniques and technology. Since these changes accumulate over time, we assumed that the follow-on training sessions would become more important over time and multiplied the one-time cost by 30%, 50%, and 70% in years 4, 7, and 10, respectively. Thus, the present value of a one-time cost of $1 calculated using a 2.4% discount rate is calculated as follows:

$$\text{Present value} = \frac{\$1}{(1+2.4\%)^1} + \frac{\$1 \text{ x } 30\%}{(1+2.4\%)^4} + \frac{\$1 \text{ x } 50\%}{(1+2.4\%)^7} + \frac{\$1 \text{ x } 70\%}{(1+2.4\%)^{10}} = \$2.23. \quad (2.1)$$

Table 2-4. Hourly Pay Rates

Use	Pay Rate
Training courses, contractors in some past studies	$64.89
Training courses, government in some past studies	$61.35
AN/AQS-20A for technical manuals and training courses	$65.00
Used in this study	$65.00

The number of technical writers who require training for the aggregate sample (70) is a NAVSSES estimate of the number of technical writers who are not already fluent in S1000D, DMs, and CSDBs. The number of course developers who require Bridge training (170) is derived in Table 2-5. The total number of staff (760) was calculated by multiplying the number of content hours delivered by NeL in 2009 (3,292 hours, see Table 2-6 and refer to Appendix E for more details) by the number of staff hours

Table 2-5. Number of Course Developers Requiring Bridge Training

Number of NeL content hours produced in 2009	3,292
Number of staff hours to produce one-content-hour training course	425
Total number of staff hours per year	1,399,100
Number of staff hours per staff member per year	1,840
Total number of staff	760
Percentage of staff requiring training	22.4%
Total staff requiring training	170

Table 2-6. Production of CBT Delivered by NeL

Year	Total Content Hours
2004	1,637
2005	2,196
2006	2,207
2007	4,124
2008	3,322
2009	3,292

to produce a 1-content-hour training course (425 hours, derived in Appendix B) and dividing the resulting total staff hours per year by 1,840, the number of working hours per year, assuming 2 weeks for sick leave, 2 weeks for annual leave, and 10 federal holidays. The resulting 760 staff members are multiplied by 22.4%, the percentage of total staff hours (calculated in Table 2-7) contributed by people with the professional skills assumed to require Bridge training.

The 3,292 content hours that NeL delivered in 2009 were produced by various Navy agencies. We used the estimate for 2009 from Table 2-6 without extrapolation because although the trend is up, it is not consistent.

The $65.00 hourly pay rate from Table 2-4 is the average fully burdened rate paid for contractors involved in producing technical manuals and training courses for the AN/AQS-20A system at NSWC in Panama City, Florida. As the other rates in the table show, it is close to the historical pay rates paid for some recent training courses. We will use this pay rate in the following calculations but consider the sensitivity of the final results to this number in Chapter 5.

2. Trainee Course

The cost of computer-based software for the training session is the product of three factors: (1) the number of staff hours to produce a 1-content-hour training course

Table 2-7. Professional Skills Involved in Producing Training Courses

	Staff Hours for Developing a 1-Content-Hour Course	
Professional Skill	**Total**	**Requiring Training**
Training Director	2	
Rate Lead (Subject Matter Expert (SME))	90	
Learning Standards Officer	29	29
Content Sponsor	4	
Course Supervisor	8	
Contracting Officer	1	
Instructional Systems Designer	43	
Graphics	168	
Animation	14	
Programmer	31	31
Editor	29	29
Lead	6	6
Total	425	95 (22.4%)

derived in Appendix B, (2) the assumed number of content hours per training session, and (3) the average fully burdened hourly pay of $65.00 from Table 2-4. The 10-year cost is calculated as before.

3. Site/Program Licenses and User Fees

Weapons and support programs are currently charged site/program licenses and user fees under a Navy-vendor CSDB license agreement. (NAVSSES licenses are charged by the site and by the program.) The license fees are paid to NAVSSES to cover the costs of maintaining the infrastructure, and the user fees are paid to vendors to cover the costs of maintaining the networks and CSDBs. The annual costs are calculated as follows:

$$\text{Annual cost for licenses and fees} = \$25{,}000 \times (\text{number of sites/programs}) + \$1{,}200 \times (\text{number of users}). \quad (2.2)$$

The 10-year present value is calculated as in Eq. 2.1 but with equal contributions during all 10 years since these are yearly costs. For example, the 10-year present value for a $1 one-time cost would be calculated as follows:

$$\text{Present value} = \frac{\$1}{(1+2.4\%)^1} + \frac{\$1}{(1+2.4\%)^2} + \frac{\$1}{(1+2.4\%)^3} + \ldots + \frac{\$1}{(1+2.4\%)^{10}} = \$8.80. \quad (2.3)$$

A NAVSSES official reports that 6 sites/programs and 20 users are currently used to input data for HM&E technical manuals into a Navy CSDB, and we assumed that an

additional 6 sites/programs and 20 users would be needed for producing training courses if the Bridge were implemented for the aggregate case.

Some of these additional licenses and fees might not be additional costs to the government. Rather, they would only be a transfer of maintenance funds—from how they are already being spent under current production processes to how they would be spent if the Bridge were implemented. To the extent that the added costs are really a transfer, we have overestimated the implementation costs in Table 2-3 and therefore underestimated the net present value (benefits less costs) of the Bridge.

3. Cost Savings

A. Methodology

The cost savings for producing future technical manuals and training courses using the Bridge were calculated by estimating the savings for producing a nominal technical manual and a nominal training course and then scaling up the results to the production of manuals and courses for the aggregate and single-system samples. Here are the detailed steps:

- Construct a "Current" flow chart of the major processes now used for producing and delivering information from manufacturers to the Fleet through technical manuals and training courses (see Section 3.B).
- Construct a "Bridge" flow chart for the processes expected to occur using the Bridge (see Section 3.C).
- Using these flow charts as a guide, list the detailed tasks (see Appendixes A and B) required to produce the nominal products: a 500-page technical manual and a 1-content-hour training course. (The training course is Interactive Level 2, which involves limited participation in that students make simple responses to instructional cues.)
- Estimate the staff hours needed to perform the detailed tasks for the nominal products, currently and using the Bridge (see Appendixes A and B).
- Subtract these estimates to obtain the savings in staff hours to produce the nominal products using the Bridge. Convert these savings to cost savings by applying average hourly pay rates for technical writers and course developers. The savings are described in Section 3.D., along with a description of why they occur.
- Scale up the cost savings for producing the nominal products to estimate the Bridge savings for producing the two samples described in Section 3.E and shown below. The aggregate sample consists of all Navy HM&E technical manuals and all Navy training courses distributed by the NeL LMS. The single-system sample consists of the technical manuals and training courses for the AN/AQS-20A mine-hunting system deployed on LCS ships.

B. Current Processes Flow Chart

Figure 3-1 portrays the current processes for producing technical manuals and training courses. The processes cover the conversion of information from standard descriptions—normal, page-turning documents written by OEM personnel—to the production of technical manuals and training courses and the distribution of these materials to the Fleet. For the production of HM&E technical manuals (left side), Navy personnel and contractors at NAVSSES use the OEM descriptions to produce the information in the SGML markup language. (In some cases, the OEMs are tasked to provide the SGML documents.) NAVSSES puts the documents into a CSDB repository and uses publication tools to generate technical manuals in various formats for distribution to the Fleet. These formats include hard-copy texts, Interactive Electronic Technical Manuals (IETMs), and Portable Document Format (PDF) files.[1]

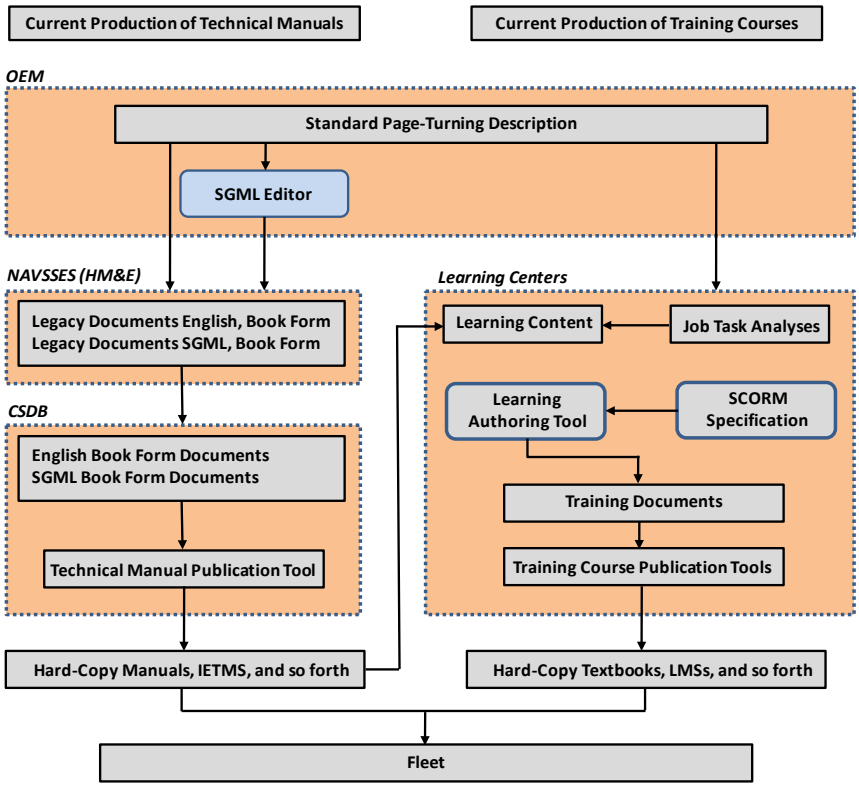

Figure 3-1. Current Processes for Producing Technical Manuals and Training Courses

The right side of Figure 3-1 shows the current processes for producing training courses. Contractors and government personnel who have the skills described in Table 2-7 use the OEM descriptions, completed technical manuals, and the results of job task analyses to construct learning content. Authoring tools are used to transform the

[1] NAVSSES also produces documents for Engineering Operation Sequencing Systems and Preventive Maintenance Systems, but only the technical manuals are considered in this study.

learning content into instructor-led and SCORM-conformant training courses. These documents are used with publication tools to produce training course outputs such as hard-copy texts, digital versatile disks (DVDs), and content for LMSs.

C. Bridge Flow Chart

Figure 3-2 describes the major processes involved in using the Bridge. The entirely new processes are shown in blue, and the processes that exist but are substantially changed are shown in red. The major differences from the Current processes flow chart (see Figure 3-1) are as follows:

- The S1000D DM technical data specification is used for all text.
- All DMs are stored in CSDBs.
  - Course developers (1) use the API to employ their individual authoring tools to obtain technical DMs from the CSDBs, (2) reuse and repurpose the information into LDMs, and (3) use the API to store the LDMs back into the CSDBs. ("Reuse" implies no change; "repurpose" implies change.)
- All outputs—technical manuals and training courses—are produced from the DMs and LDMs.
- A Web Service is used to identify those DMs and LDMs that require review for possible modification in response to ECPs.

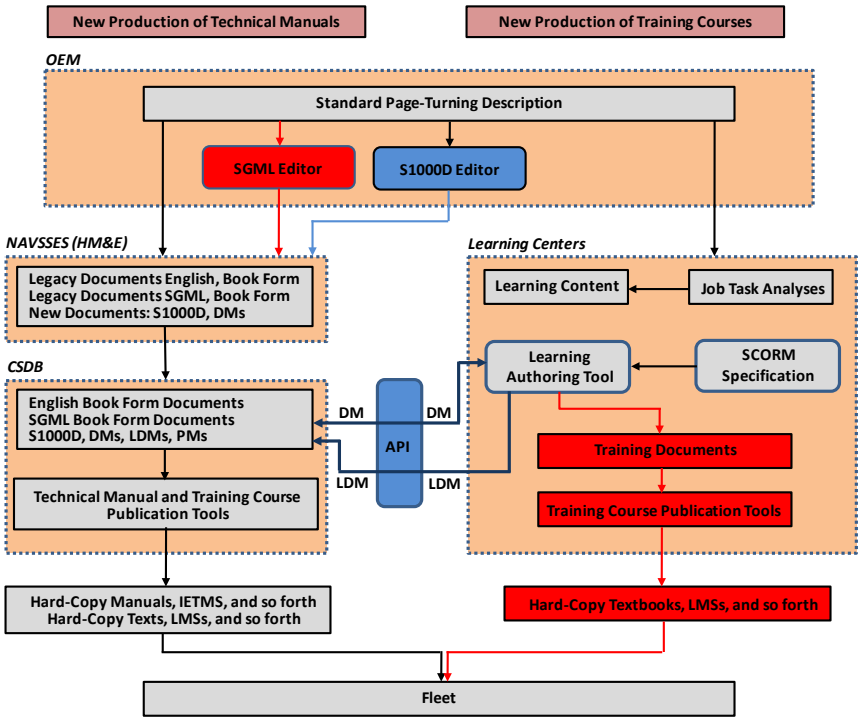

Figure 3-2. Processes for Producing Technical Manuals and Training Courses Using the Bridge

D. Cost Savings for Producing the Nominal Products

1. Calculations

Table 3-1 shows the calculation of the cost savings for the nominal products. The number of staff hours is discussed in the following subsection. The pay rate was derived in Table 2-4. The remainder of this subsection discusses the issue of soft vs. hard skill training.

Table 3-1. Cost Savings for Producing the Nominal Products Using the Bridge

	500-Page Technical Manual	1-Content-Hour Training Course
Number of staff hours		
Current	9,172	425
Bridge	8,682	360
Savings (hours)	490 (5.3%)	65 (15.3%)
Pay rate		
Hourly pay, fully burdened	$65.00	$65.00
Total	$31,850.00	$4,225.00

2. Total Staff Hours

The Current and Bridge staff hours for the nominal technical manual are obtained from the detailed 38-task analysis in Appendix A. The numbers for the nominal training course are obtained from the 80-task analysis in Appendix B. The numbers in these appendixes were estimated by senior analysts who have extensive experience in technical and training analysis.

The Bridge saves many more staff hours in producing technical manuals than in producing training courses (490 vs. 65). However, the percentage changes go in the opposite direction: 15.3% saving for training courses vs. 5.3% for technical manuals.[2] The percentage differences are consistent with the idea that the integration affects the production of training courses more than that of technical manuals (see Figure 3-1 and Figure 3-2).

Listed below are the principal reasons for the Bridge savings in producing the nominal products. These reasons are also those for the full savings discussed in the next section, which are scaled-up versions of the nominal savings.

[2] The absolute values are not significant because they simply reflect the different size of the nominal manual and course that the project analysts chose to develop.

- Features of the Bridge that lead to initial increases in staff hours:
  - Structuring the integration of training and technical data
  - Forming new business rules to develop LDMs
  - Constructing a reuse strategy
- Features of the Bridge that lead to an eventual reduction in staff hours:
  - Integrated production, which reduces duplication
  - Structuring technical data in DMs stored in centralized CSDBs, which allows course developers to avoid the time and cost of collecting and processing material from OEMs and other sources
  - Organizing data by product-defined DMs and LDMs, which makes it easier to reuse technical and training content
  - Using the Web Service and S1000D, which reduces the time needed to identify the DMs and LDMs that require review for modification in response to ECPs

The 5.3% savings for the technical manuals is consistent with recent NAVSSES calculations based on alternative inputs to Table A-1 in Appendix A. The NAVSSES calculations indicate that the Bridge would save approximately 1.5% staff hours for a small (10-page maximum) technical manual for equipment updates, and percentage changes approximately three and five times higher for medium (30-page) and full revision (50-page) updates. These numbers average 5.9%, using the total number of pages from Table 3-2 as weights: (1,300 × 1.5% + 3,900 × 4.5% + 7,000 × 7.5%)/ (1,300 + 3,900 + 7,000) = 5.9%. The savings for the larger manuals for new systems would be even higher. Our estimate of 5.3% savings thus understates the full savings.

E. Cost Savings for Producing the Aggregate Sample

1. Technical Manuals

The cost savings for HM&E technical manuals are estimated in Table 3-3 by multiplying the savings per page for the nominal 500-page technical manual calculated from Table 3-1 by the future yearly production of HM&E technical manual pages estimated by the number of manual pages that NAVSSES produced in 2009 (see Table 3-2).

Manuals are produced yearly, so the 10-year present value is calculated as in Eq. (2.3). We do not assume any effort to systematically update all legacy manuals. The only such manuals that are updated in NAVSSES's 2009 production are those that are required to support current equipment upgrades.

Table 3-2. Production of Navy HM&E Technical Manuals in 2009

Category (Nominal Number of Pages)	Hours per Technical Manual	Total Hourly Cost	Average Cost (FY10 $)	Technical Manuals per Year	Total Pages
Updates					
Small (10)	23	$150	$3,500	260	1,300 [Note]
Medium (30)	67	$150	$10,000		3,900 [Note]
Full Revision (50)	167	$150	25,000	140	7,000
New					
DDG-1000	333 (500)	$150	$50,000	67	33,500
Total	–	–	–	–	45,700

Note for Table 3-2: The 260 manuals per year were distributed evenly between small- and medium-size technical manuals.

Table 3-3. Cost Savings From Producing HM&E Technical Manuals Using the Bridge

Bridge savings in cost per page	$63.70
HM&E technical manual pages produced per year	45,700
Yearly cost savings (FY10 $)	$2,911,090
Occurrences in 10 years	10
10-year cost savings, present value (FY10 $)	$25,610,204

2. NeL-Delivered Training Courses

The cost savings for NeL-delivered courses are calculated in Table 3-4 by multiplying the total cost savings per content hour ($4,225, see Table 3-1) by the number of training content hours delivered by NeL in 2009 (3,292, see Table 2-6, with more detail in Appendix E) and then multiplying the product of this calculation by the estimated percentage of content hours involving hard skills (50%). Hard skills are those that are needed to use equipment or that otherwise involve substantial technical content. They are therefore the courses whose cost would be directly reduced by integration of technical and training content. The training courses are produced yearly, so the 10-year present value is calculated using Eq. (2.3), as with the technical manuals.

Table 3-4. Cost Savings From Producing NeL Training Courses

Total cost savings per content hour (FY10 $)	$4,225
Training content hours delivered by NeL during 2009	3,292
Estimated percentage of content hours involving hard skills	50%
One-time cost savings (FY10 $)	$6,954,350
Occurrences in 10 years	10
10-year cost savings, present value (FY10 $)	$61,180,632

The estimate that 50% of training courses would involve hard skills was obtained by inspecting the titles of NeL courses for mention of equipment or other technical content. We looked at the titles of the 450 most accessed courses, a 10% sample of the 4,504 courses accessed at least once during the first 5 months of FY10. The sample comprised approximately 90% of total accessions. The 10-year saving of $61.2 million is an underestimate since it ignores the possibility that the Bridge might also achieve some savings with soft skill courses by virtue of its ability to organize data. We vary the 50% factor in the sensitivity analysis in Chapter 5.

F. Cost Savings for Producing the Single-System Sample

1. AN/AQS-20A Technical Manuals

Table 3-5 calculates the cost savings for AN/AQS-20A technical manuals by multiplying the savings per page for the nominal 500-page technical manual (see Table 3-1) by the number of pages in the technical manuals of the AN/AQS-20A and the MH-60S helicopter (the detector's tow vehicle).[3] Recent Navy inputs indicate that the AN/AQS-20A manuals contain 120 and 210 pages, respectively. The MH-60S helicopter manual is reported to be much larger. We will assume it is 500 pages, for a total of 830 pages for the three manuals. The 10-year present value assumes the technical manual is updated every 3 years (produced in years 1, 4, 7, and 10) to account for upgrades in equipment and changes in maintenance procedures. The calculation follows Eq. (2.1).

Table 3-5. Cost Savings From Producing AN/AQS-20A Technical Manuals Using the Bridge

Bridge savings in cost per page	$63.70
Number of pages	830
Yearly cost savings (FY10 $)	$52,871
Occurrences in 10 years	4
10-year cost savings, present value (FY10 $)	$117,645

2. AN/AQS-20A Training Courses

Table 3-6 applies the costs savings per content hour from Table 3-1 to the production of training courses for the AN/AQS-20A. Although the 2007 Navy Training System Plan (NTSP) stipulates 21 days (168 hours) of schoolhouse training, we assume that the Navy would eventually transition to "blended" training of 148 hours of school-house training plus 20 hours for CBT. We assume that all of the AN/AQS-20A courses train

[3] Table IV.B.3 in the AN/AQS-20A Navy Training System Plan (NTSP) of June 2007 lists two manuals for the detector (A1-H60SA-720-400, AN/AQS-20A *Organizational Level Maintenance Manual, and* A1-960QA-150-000, AN/AQS-20A *Intermediate Level Maintenance Manual*) and one manual for the helicopter (A1-H60CD-60S-000, MH-60S *Organizational Level Maintenance Manual*).

Table 3-6. Cost Savings From Producing AN/AQS-20A Training Courses Using the Bridge

Cost savings for one-content-hour course	$4,225
Planned course, C-102-0114 [Note]	21 days of schoolhouse training
Assumed transition to blended training	148 hours schoolhouse; 20 hours CBT
Estimated percentage of content hours involving hard skills	100%
One-time savings (FY10 $)	$84,500
Occurrences in 10 years	4
10-year cost savings, present value (FY10 $)	$188,023

Note for Table 3-6: See N85-NTSP-P-30-0305/A, June 2007, *Navy Training System Plan for the AN/AQS-20A Sonar, Mine Detecting Set,* Table III.A.2.b.

hard skills. Multiplying the 20 hours of CBT by the savings per content hour yields the one-time savings. The 10-year present value savings assumes that the training course would be updated every 3 years (i.e., produced in years 1, 4, 7 and 10) to account for changes in technique and technology.

4. Contributions to Fleet Readiness

As discussed in Chapter 1, the Bridge may improve Fleet readiness and save on cost. Technical manuals and training courses, unless they are systematically integrated, might offer somewhat different/dated information, and the delivery of training courses might lag the fielding of new systems and equipment upgrades. These effects could degrade the efforts of shipboard operators and maintainers (and could also add to cost by creating a need for immediate retraining of recently graduated trainees).

The Navy has recently taken steps to minimize these problems of disparity and delay by adopting a policy of not deploying ships following the installation of new systems and equipment until the updated support documents are in place (see Appendix C). Implementing the Bridge would support this policy if it shortens the time for making updated technical manuals and training courses available to the Fleet. We have not obtained data on the incidence of disparate and lagging information, but we have carried out a parametric calculation to determine whether such delays (if they do exist) might result in a substantial loss of readiness. If they do, implementing the Bridge might offer the Navy the substantial benefit of ensuring against losses in readiness.

A. Methodology

The main question is how to convert assumed time delays in delivering technical information to the Fleet to losses in the value of effectiveness expressed in dollar terms. Say the Navy produces an improved power supply for a fire-control system that it fields as an ECP equipment upgrade. Suppose that the power supply has a 10-year lifetime and a unit cost of $10 million in amortized research and development (R&D) and procurement. It is ready for deployment in 2010, and the accompanying technical information (technical manuals and training courses) is also available in 2010. What is the value of the effectiveness the power supply would give the Navy? *The crucial step of the methodology is to realize that the Navy would not spend $10 million on the power supply unless it thought that the power supply was worth (at least) that much.* Assuming that the $10 million is spent this year (the present value of the investment), Eq. (4.1) regards the $10 million present value as spending of $1.14 million annually for the power supply:

$$\text{Present value} = \sum_{1}^{10} \frac{\$1.14\text{M}}{(1 + 2.4\%)^{\text{n}}} = \$10.00 \text{ million.} \qquad (4.1)$$

Now, suppose technical manuals and training courses with consistent and up-to-date information are not available until 2011, and, in accord with the new policy, the ship sails in 2010 but without the new equipment. The present value in 2010 is now less:

$$\text{Present value} = \sum_{2}^{11} \frac{\$1.14\text{M}}{(1 + 2.4\%)^{\text{n}}} = \$9.79 \text{ million.} \quad (4.2)$$

The Navy therefore loses the effectiveness the power supply would have delivered in 2010, but now receives effectiveness in 2021. The Navy has therefore lost effectiveness that it values at $0.21 million or greater ($10.00 million less $9.79 million). The loss in 2010 exceeds the gain in 2021 because the terms of the sum are monotonically decreasing. The loss would be even larger if we did not discount but assumed the value of the power supply was a constant $1 million per year. Thus, if integrating the production of technical manuals and training courses were to avoid the year delay in delivering consistent and timely information to the Fleet, the Bridge would have achieved a 10-year present-value benefit of $0.21 million.

B. The DDG-1000 Zumwalt Class Destroyer

We will now apply this method to an analysis of monthly data for the first DDG-1000 Zumwalt guided-missile destroyer. All the components (electronic, ordnance, and HM&E) for the first two ships were funded at $2.100 billion in FY07 as listed in the FY10 President's Budget—or $1.096 billion per ship in FY10 dollars. Assuming the components have a 10-year life, the Navy is paying approximately $10.29 million monthly since the present value of $10.29 million monthly over 120 months (10 years) at 0.20% monthly (2.4% yearly) yields the FY10 present value cost of $1.096 billion.

The 120-month present value of the value of effectiveness would be $1.094 billion in the case of a 1-month delay (see Eq. (4.3)) and $1.096 billion if the delay were eliminated (see Eq.(4.4)). Eliminating the 1-month delay would therefore grant the Navy a benefit equal to a $2 million increase in the value of effectiveness:

$$\text{Benefit if the logistics support is 1 month late} = \sum_{2}^{121} \$10.29/(1 + 0.2\%)^{\text{n}} = \$1.094 \text{ billion.} \quad (4.3)$$

$$\text{Benefit if the logistics support is on time} = \sum_{1}^{120} \$10.29/(1 + 0.2\%)^{\text{n}} = \$1.096 \text{ billion.} \quad (4.4)$$

Table 4-1 shows the results for delays of 0, 1, 6, and 12 months. The benefit is approximately $2 million per 1-month delay of technical information for all components per ship. Ensuring against lags might therefore have significant value for readiness and suggests that an empirical analysis should be conducted using actual Fleet data.

Table 4-1. Bridge Reductions in Delays of Delivering Technical Information to the Fleet

	Delay in Availability of New Systems or Equipment			
	0 Month	**1 Month**	**6 Months**	**12 Months**
10-year cost, present value (FY10 $)	$1.096 billion	$1.094 billion	$1.083 billion	$1.070 billion
Saving from using Bridge (FY10 $)	$0	$2 million	$13 million	$26 million

5. Summary

This chapter summarizes the analysis: the Base Case, a sensitivity analysis of the major uncertainties, future work, and overall implications.

A. Quantitative Results Base Case

Table 5-1 summarizes the quantitative results of the analysis. The analysis of both samples support the attractiveness of the Bridge.

Table 5-1. Summary of Cost-Benefit Analysis

	10-Year Present Value (FY10 $)		
	Technical Manuals	**Training Courses**	**Total**
Aggregate Sample (the OSD Perspective)			
Cost			
First year investment (see note 1)			*$1.8 million*
Second year investment			$1.8 million
Implementation cost	$2.9 million	$4.0 million	$6.9 million
Total cost second year			$8.7 million
Benefits	$25.6 million	$61.2 million	$86.8 million
Net present value			$78.1 million
Parametric analysis of readiness			Note 2
Single-System Sample (the Program Office Perspective)			
Benefits	$117,600	$188,000	$305,700

Note 1: These are sunk costs and therefore are not included in total (future) cost.

Note 2: Loss of $2 million worth of effectiveness per 1-month delay of technical information for all components per ship.

For the aggregate analysis (the OSD perspective), the $86.8 million present value of the benefits of the Bridge more than covers the $8.7 million present value of the cost for a sizable portion of the Navy's technical manuals and training courses. These savings are approximately 9.9% of the estimated current 10-year present value of producing these manuals and courses, using the methodology employed in this study. The net present value (benefits less costs) of $78.1 million would be even higher if the Bridge were used

The benefits of the AN/AQS-20A analysis (the Program Office perspective) are almost $306,000, or a savings of approximately 8.9% of the current 10-year present value. As we said in Chapter 1 Section E.2, we are ignoring the costs for this case since it is not reasonable to compare the full investment and implementation costs of the Bridge with the benefits of implementing it for just a single system. The benefits could, of course, be compared with only the implementation costs, which are likely to be a small fraction of those for the much larger aggregate sample. The workloads for the AN/AQS-20A sample (number of pages of technical manuals and number of content hours of training courses) are only approximately 1% of those for the aggregate case. Therefore, if the implementation costs scale as the workload scales, they would be less than $70,000 (1% of $6.9 million)—much less than the benefit of $306,000.

B. Sensitivity Analysis of the HM&E/NETC Case

As noted earlier, the analysis in this study depends on the values of several uncertain inputs. This section discusses the effect of these inputs on the base case results of the aggregate case shown in Table 5-1. The results of this analysis are shown in Table 5-2. The first two cases yield higher net benefit than the Base Case, and the three cases following the Base Case yield lower cost. This table also shows the net benefits from taking the variations in combination.[1]

1. 50% Higher Pay Rate

The $65 fully burdened hourly pay rate used in Table 2-4 is close to the rates actually observed for recent technical manuals and training courses. A higher rate might be needed to attract people trained in using the Bridge. We tried using $97.50, which is 50% higher. (This rate is approximately equal to the burdened rate for a GS-12, which seems more than sufficient.) This new rate increases the implementation costs because of higher training costs, but the benefits in lowering the staff hours to produce future manuals and courses rise much more, leading to a much higher net benefit: $119.6 million compared to $78.1 million, a rise of 53%.

[1] Another uncertainty is the size of the aggregate samples. Although we lack quantitative analysis, its effect on net benefit is clearly large and positive. The Navy produces technical manuals for electronics and ordnance equipment—not just those for HM&E—and training courses delivered by LMSs and those delivered by NeL. In addition, the Navy would not be the only Service to realize the benefits of using the Bridge. The methodology of the aggregate analysis is quite general and would also lead to net benefits for the other Services.

Table 5-2. Sensitivity Analysis

	10-Year Present Value (FY10 $)						
	Costs			Benefits			
Change From Base Case	Investment	Implementation	Total	Technical Manuals	Training Courses	Total	Net Benefit
1. 50% higher pay rate	$1.8 M	$8.8 M	$10.6 M	$38.4 M	$91.8 M	$130.2 M	$119.6 M
2. 50% more hard skills	$1.8 M	$6.9 M	$8.7 M	$25.6 M	$91.8 M	$117.4 M	$108.7 M
Base Case	$1.8 M	$6.9 M	$8.7 M	$25.6 M	$61.2 M	$86.8 M	$78.1 M
3. 100% higher investment cost	$3.6 M	$6.9 M	$10.5 M	$25.6 M	$61.2 M	$86.8 M	$76.3 M
4. 200% higher implementation cost	$1.8 M	$20.6 M	$22.4	$25.6 M	$61.2. M	$86.8 M	$64.4 M
5. 50% lower training course savings	$1.8 M	$6.9 M	$8.7 M	$25.6 M	$30.6 M	$56.2 M	$47.5 M
6. Combination of 3–5	$3.6 M	$20.7 M	$24.2 M	$25.6 M	$30.6 M	$56.2 M	$32.0 M
7. Combination of 1–5	$3.6 M	$26.4 M	$30.0 M	$38.4 M	$68.8 M	$107.2 M	$77.3 M
8. Combination of 1 and 2	$1.8 M	$8.8 M	$10.6 M	$38.4 M	$137.7 M	$176.1 M	$165.5 M

2. 50% More Hard-Skill Courses

Table 3-4 assumed that 50% of NeL training courses involved substantial technical data and would therefore show direct cost savings from integrating technical manuals and training courses. This percentage was obtained by counting the number of titles of NeL-delivered courses that mentioned equipment or other technical data. We looked at 10% of the titles— a 10% sample that comprises 90% of total accessions. Applying the 50% to the entire cost savings, however, produces an underestimate of the cost savings because it does not consider the fact that courses used to train hard skills are usually longer and more likely to receive upgrades and would thus benefit more from integration. Moreover, it ignores the benefits for producing soft-skill courses (e.g., leadership) because of the Bridge's greater organization of information and the savings of using the Web Service for making upgrades. The sensitivity analysis estimates these effects by assuming that 75% of courses train hard skills. The net benefit would rise from $78.1 million to $108.7 million, a rise of 39%.

3. 100% Higher Investment Cost

Investment cost would rise if it takes longer than the second year of the RTOC project to develop the Bridge software to the point that it is ready for implementation by

the Navy. We assumed that a third year would be required, resulting in a 50% increase in total cost (from 2 to 3 years). However, this additional time would cause a 100% increase in investment cost, since the first year is sunk cost and not considered in the calculations. The investment cost is much smaller than the benefits, so net benefit would fall by only 2%, or less than $2 million.

4. 200% Higher Implementation Cost

Implementing the Bridge would require a cultural shift in the technical manual and training course workforce, which could increase all three components of implementation cost: trainee personnel cost (increased training time), trainee CBT course (more extensive learning content), and site/program licenses and user fees (more programmers being involved). We have assumed a 200% increase, or tripling of implementation cost. Net benefit would fall from $78.1 million to $64.4 million, an 18% decrease.

5. 50% Lower Training Course Savings

The analysis of Bridge savings detailed in Appendixes A and B and summarized in Table 3-1 found a 5.3% reduction in staff hours and cost for producing technical manuals and a much larger 15.3% reduction for training courses. The larger reduction for training courses is understandable, given that integration will permit course developers to use the API to access technical data stored in DMs in CSDBs. However, if these savings proved smaller by half, net benefit would fall from $78.1 million to $47.5 million, or a 39% decrease.

6. Combined Effects

The last three rows of Table 5-2 show that combining the variations leads to a range of net benefit varying from $32.0 million (a 59% decrease relative to the Base Case) to $165.5 million (a 112% increase relative to the Base Case):

- $32.0 million if the three negative inputs (items 3–5) and none of the positive inputs were to occur simultaneously
- $77.3 million if all five inputs occurred simultaneously (coincidentally close to the $78.1 million for the Base Case)
- $165.5 million if only the two positive inputs (items 1 and 2) occurred

C. Future Work

This study develops a methodology for analyzing the effects of the Bridge, and it provides initial quantitative results that are planned to be refined in the second year of the project by these steps:

- Validating the analysis of cost savings by more detailed analysis and by obtaining inputs from other professionals in the technical information community
- Discriminating between the cost savings for new systems and equipment upgrades via ECPs
- Obtaining data on the current delays of providing timely technical information to the Navy to estimate the readiness benefit of the Bridge

D. Overall Summary and Implications

Our analysis suggests that the Navy could realize substantial savings by integrating, or bridging, the future production of technical manuals and training courses. We found that 10-year savings (benefits less costs) ranged from $32.0 million to $165.5 million for integrating the yearly production of all HM&E technical manuals and CBT courses delivered by NeL.

The single-system analysis found that applying the Bridge to the AN/AQS-20A mine-hunting sonar for the LCS would produce 10-year benefits of $307,700. These would be net savings if the full investment and implementation costs were already paid. If not, it would take 5.8 years to cover the $1.8 million cost of investment, plus some additional years to cover the small but uncalculated implementation costs for the AN/AQS-20A alone.

The integration would be achieved through new processes and software developed by the Bridge project: adopting a common data format (S1000D DMs) and repository (CSDB), using the new API to read the data, and the new Web Service to identify the DMs that would require modification by ECPs.

The resulting strategic collaboration between the technical and training communities could also produce other efficiencies, such as improved consistency and timeliness of the manuals and courses.

Appendix A
Detailed Staff-Hour Estimates for Producing a Nominal 500-Page Technical Manual Under Current and Bridge Processes

Table A-1 compares the staff-hours under current and Bridge processes for producing the nominal 500-page technical manual. The hours are performed by contractors (Cont.) and government (Govt.) personnel. The definitions for the acronyms used in the table are in the list of abbreviations at the end of this report.

Table A-1. Technical Manual Staff-Hours: Current and Bridge

	Current			Bridge				
Task	**Cont.**	**Govt.**	**Total**	**Cont.**	**Govt.**	**Total**	**Changes**	**Notes**
Definition								
Obtain LSAR data (if available)	240	80	320	240	80	320		
Obtain OEM content	240	40	280	240	40	280		
Obtain engineering drawings	320	80	400	320	80	400		1
Collect provisioning data	320	80	400	320	80	400		
Obtain preventive maintenance data	320	40	360	320	40	360		
Identify special support and test equipment requirements	160	40	200	160	40	200		
Identify source data formats	40	8	48	40	8	48		2
Specify deliverable formats (IETM/ hardcopy)	40	8	48	40	8	48		3
Construct the functionality matrix	120	20	140	120	20	140		
Register with TDMIS	8		8	8		8		4
Identify any conversion issues	80		80	80		80		
Conduct a guidance and planning conference	160	120	280	160	120	280		
Resolve any NIAPS/TDKM/NMCI/ATIS issues	80	8	88	80	8	88		
Development								
Develop and update a book plan			0			0		
Commence content development			0			0		
Business rules	480	120	600	520	140	660	–60	1
Reusable objects/strategy	160	0	160			0	160	2

Table A-1. Technical Manual Staff-Hours: Current and Bridge (Continued)

	Current			Bridge				
Task	**Cont.**	**Govt.**	**Total**	**Cont.**	**Govt.**	**Total**	**Changes**	**Notes**
Development (Continued)								
Search ADL-R	0	0	0	1		1	–1	
Develop a DMC/SNS strategy	200	40	240	200	40	240		
Develop DMRL (Training DMRL)	160	40	200	160	40	200		
Coordinate with training activities	10	16	56	8	4	12	44	3
Produce a review draft copy	1,280		1,280	1,280		1,280		
Produce a preliminary draft copy	960		960	960		960		
Produce final copy	960		960	960		960		
Develop PMs	80	16	98	80	16	96		
Perform three QA reviews			0			0		
Conduct	440	360	800	440	360	800		
Validate	240	80	320	240	80	320		
Verify	160	200	360	160	200	360		
Delivery								
Produce CDs and hardcopy manuals								
Coordinate delivery with SNIP production modules								
Life-Cycle Maintenance								
Modify technical information in response to ECPs			0			0		
Technical data DMs	80		80	1		1	79	4
Training DMs	40		40	1		1	39	4
PMS DMs	40		40	1		1	39	4
Parts DMs	80		80	1		1	79	4
Testing DMs	40		40	1		1	39	4
Update links with training products	80		80	8		8	72	4, 5
Total	7,768	1,404	9,172	7,270	1,412	8,682	490	

Note 1 for Table A-1: Additional Business Rules are needed to develop Learning Data Modules (LDMs) and to structure the interaction of training content with technical data content.

Note 2 for Table A-1: Although more time will be needed initially to document a reusable objects strategy, the use of Data Modules (DMs) will eventually save time by making the reuse of technical and training content more convenient.

Note 3 for Table A-1: Once the processes to coordinate the production of technical data and training content are initially established, these processes should lead to future cost savings.

Note 4 for Table A-1: Engineers should no longer have to spend large amounts of time discovering which DMs and LDMs will require review for possible modification in response to Engineering Change Proposals (ECPs).

Note 5 for Table A-1: The granularity of data in DMs should lead to faster updating (i.e., less time to make the modifications).

Appendix B
Detailed Staff-Hour Estimates for Producing a Nominal 1-Content-Hour Training Course Under Current and Bridge Processes

Table B-1 shows detailed staff-hour estimates for producing the nominal one-content-hour training course under current processes, and Table B-2 shows the estimates using the Bridge. Table B-3 highlights the changes. The definitions for the acronyms used in the tables are in the list of abbreviations at the end of this report.

Table B-1. Training Course Staff-Hours: Current Processes

	Government						Government or Contractor						
Task	Training Director	Rate Lead (SME)	Learning Standards Officer	Content Sponsor	Course Supervisor	Contracting Officer	Instructional Systems Designer	Graphics	Animation	Programmer	Editor	Lead	Total
Identify training requirements													0
Identify training product and training environment; review OEM descriptions of systems and equipment		2											2
Specify training content requirements (through job duty task analysis and other resources)		1											1
Initiate Navy Enlisted classification request (if required)		1											1
Designate sites where training will occur		1											1
Designate course curriculum model manager (if required)		1											1
Request CIN/CDP			1										1
Construct learning objective statements		1	1										2
Sequence learning objective statements		1	1										2
Determine assessment strategy		1	1										2
Determine training delivery method		1	1										2

Table B-1. Training Course Staff-Hours: Current Processes (Continued)

	Government						Government or Contractor						
Task	Training Director	Rate Lead (SME)	Learning Standards Officer	Content Sponsor	Course Supervisor	Contracting Officer	Instructional Systems Designer	Graphics	Animation	Programmer	Editor	Lead	Total
Identify training resource requirements		1											1
Identify instructor requirements													0
Identify training device requirements													0
Identify classroom and lab requirements													0
Access the CSDB via the API to search for reusable DMs													0
Search existing material		4											4
Determine level of reuse between technical data and training data modules													0
Create course outline of instruction		1	1										2
Develop an initial list of required LDMs													0
Determine evaluation plan (formative and summative evaluations)		1	1										2
Develop training project plan		1	1										2
Assemble resources													0
Prepare acquisition/production package (if contracting)						1							1
Specify deliverables (LDMs, SCORM content package module, training products)													0
Select the team (SMEs and so forth)		1	1									1	3
Kick off the project		1	1				1	1	1	1	1	2	9
Hold technical data/training planning conference													0
Hold learning objective statement conference		1	1				1					1	4
Announce course delivery dates (content announcement form)													0
Create instructional media design package							4						4
Coordinate, establish, and agree on standard numbering system for project													0
Review the instructional media design package and agree on business rules		1	1										2
Create test package		1	1				2						4

Table B-1. Training Course Staff-Hours: Current Processes (Continued)

	Government						Government or Contractor						
Task	Training Director	Rate Lead (SME)	Learning Standards Officer	Content Sponsor	Course Supervisor	Contracting Officer	Instructional Systems Designer	Graphics	Animation	Programmer	Editor	Lead	Total
Create content													0
Prepare content prototype							1			2	1		4
Develop and obtain approval of DM requirements list for LDMs and develop beta training products in runtime environment													0
Get DMs from the CSDB via the API													0
Design interface and controls							1	1	1				3
Design for accessibility										2			2
Comply/conform to SCORM										2			2
Review ILE content prototype		1	1										2
Construct assessments (i.e., test bank)		1	1				1						3
Load LDMs into CSDB													0
Develop test design (i.e., length, question type, location, and so forth)		1	1				2						4
Develop storyboards, trainees guides and lesson plans													0
Storyboards							29	39			16		84
Trainee guides		5	1					10					16
Lesson plans, instructor guides and exercise controller guides		5	1					10					16
Portion-mark content		5						20			1		26
Review storyboards, trainees guides, and lesson plans		2	1										3
Construct assets (i.e., media and so forth)								86	11	8	7		112
Construct enabling learning objects										1	1		2
Construct terminal learning objects										2	1		3
Develop work flow; review and approve LDMs and training products													0
Translate LDMs into training products for display in Web-based browser													0
Check LDMs in CSDB													0

Table B-1. Training Course Staff-Hours: Current Processes (Continued)

	Government						Government or Contractor						
Task	Training Director	Rate Lead (SME)	Learning Standards Officer	Content Sponsor	Course Supervisor	Contracting Officer	Instructional Systems Designer	Graphics	Animation	Programmer	Editor	Lead	Total
Review and accept learning objects		2	2										4
Publish content in LMS				1						10			11
Publish content in LMS using API													0
Conduct government acceptance testing		1	1							2			4
Submit content submission form on content forecasting system				1								1	2
Deliver course													0
Execute pre-pilot checklist			1		1								2
Perform pre-pilot conference			1		1								2
Set up classroom					1								1
Deliver course documents		1											1
Conduct Train-the-Trainer			1										1
Identify pilot participants					1								1
Perform pilot					2								2
Execute post pilot checklist					1								1
Finalize training course control document			1										1
Perform content corrections		1	1				1	1	1	1	1	1	8
Perform post pilot conference		1											1
Recommend promulgation	1		1										2
Promulgate	1												1
Manage content													
Review ILE content		1	1		1								3
Register SCORM-conformant courseware with ADL-R				1									1
Modify technical information in response to ECPs		40											40
Total	2	90	29	4	8	1	43	168	14	31	29	6	426

Table B-2. Training Course Staff-Hours: Bridge Processes

	Government						Government or Contractor						
Task	Training Director	Rate Lead (SME)	Learning Standards Officer	Content Sponsor	Course Supervisor	Contracting Officer	Instructional Systems Designer	Graphics	Animation	Programmer	Editor	Lead	Total
Identify training requirements													0
Identify training product and training environment; review OEM descriptions of systems and equipment		1											1
Specify training content requirements (through job duty task analysis and other resources)		1											1
Initiate Navy Enlisted Classification request (if required)		1											1
Designate sites where training will occur		1											1
Designate course curriculum model manager (if required)		1											1
Request CIN/CDP			1										1
Construct learning objective statements		1	1										2
Sequence learning objective statements		1	1										2
Determine assessment strategy		1	1										2
Determine training delivery method		1	1										2
Identify training resource requirements		1											1
Identify instructor requirements													0
Identify training device requirements													0
Identify classroom and lab requirements													0
Access the CSDB via the API to search for reusable DMs		1											1
Search existing material		0											0
Determine level of reuse between technical data and training data modules		1											1
Create course outline of instruction													0
Develop an initial list of required LDMs		1	1										2
Determine evaluation plan (formative and summative evaluations)		1	1										2
Develop training project plan		1	1										2

Table B-2. Training Course Staff-Hours: Bridge Processes (Continued)

	Government						Government or Contractor						
Task	Training Director	Rate Lead (SME)	Learning Standards Officer	Content Sponsor	Course Supervisor	Contracting Officer	Instructional Systems Designer	Graphics	Animation	Programmer	Editor	Lead	Total
Assemble resources													0
Prepare acquisition/production package (if contracting)													0
Specify deliverables (LDMs, SCORM content package module, training products)						1							1
Select the team (SMEs and so forth)		1	1									1	3
Kick off the project													0
Hold technical data/training planning conference		1	1				1	1	1	1	1	2	9
Hold learning objective statement conference		1	1				1						3
Announce course delivery dates (Content Announcement Form)				1									1
Create instructional media design package													0
Coordinate, establish, and agree on standard numbering system for project							4						4
Review the instructional media design package and agree on business rules		1	1										2
Create test package		1	1				2						4
Create content													0
Prepare content prototype													0
Develop and obtain approval of DM requirements list for LDMs and develop beta training products in runtime environment							1			1	1		3
Get DMs from the CSDB via the API										1			1
Design interface and controls							1	1	1				3
Design for accessibility										2			2
Comply/conform to SCORM										0			0
Review ILE content prototype		1	1										2
Construct assessments (i.e., test bank)													0
Load LDMs into CSDB		1	1				1						3

Table B-2. Training Course Staff-Hours: Bridge Processes (Continued)

	Government						Government or Contractor						
Task	Training Director	Rate Lead (SME)	Learning Standards Officer	Content Sponsor	Course Supervisor	Contracting Officer	Instructional Systems Designer	Graphics	Animation	Programmer	Editor	Lead	Total
Develop test design (i.e., length, question type, location, and so forth)		1	1				2						4
Develop storyboards, trainees guides and lesson plans													0
Storyboards							19	39			10		68
Trainee guides		5	1					10					16
Lesson plans, instructor guides, and exercise controller guides		5	1					10					16
Portion-mark content		5						20			1		26
Review storyboards, trainees guides and lesson plans		2	1										3
Construct assets (i.e., media and so forth)								86	11	8	7		112
Construct enabling learning objects										1	1		2
Construct terminal learning objects										1	1		1
Develop work flow; review and approve LDMs and training products		1	1							2			4
Translate LDMs into training products for display in Web-based browser				1						3			4
Check LDMs in CSDB										1			1
Review and accept learning objects		1	1										2
Publish content in LMS													0
Publish content in LMS using API				1						1			2
Conduct government acceptance testing		1	1							1			1
Submit content submission form on content forecasting system				1								1	2
Deliver course													0
Execute pre-pilot checklist			1		1								2
Perform pre-pilot conference			1		1								2
Set up classroom					1								1

Table B-2. Training Course Staff-Hours: Bridge Processes (Continued)

	Government						Government or Contractor						
Task	Training Director	Rate Lead (SME)	Learning Standards Officer	Content Sponsor	Course Supervisor	Contracting Officer	Instructional Systems Designer	Graphics	Animation	Programmer	Editor	Lead	Total
Deliver course documents		1											1
Conduct Train-the-Trainer			1										1
Identify pilot participants					1								1
Perform pilot					2								2
Execute post pilot checklist					1								1
Finalize training course control document			1										1
Perform content corrections		1	1				1	1	1	1	1	1	8
Perform post pilot conference		1											1
Recommend promulgation	1		1										2
Promulgate	1												1
Manage content													0
Review ILE content		1	1		1								3
Register SCORM-conformant courseware with ADL-R				1									1
Modify technical information in response to ECPs		1											1
Total	2	48	29	5	8	1	33	168	14	24	23	5	360

Table B-3. Changes in Staff-Hours To Produce Training Courses Using the Bridge

Task	Current	Bridge	Change	Notes
Identify training requirements	0	0		
Identify training product and training environment; review OEM descriptions of systems and equipment	2	1	1	1
Specify training content requirements (through job duty task analysis and other resources)	1	1		
Initiate Navy Enlisted Classification request (if required)	1	1		
Designate sites where training will occur	1	1		
Designate course curriculum model manager (if required)	1	1		
Request CIN/CDP	1	1		
Construct learning objective statements	2	1	1	2
Sequence learning objective statements	2	2		
Determine assessment strategy	2	2		
Determine training delivery method	2	2		
Identify training resource requirements	1	1		
Identify instructor requirements	0	0		
Identify training device requirements	0	0		
Identify classroom and lab requirements	0	0		
Access the CSDB via the API to search for reusable DMs	0	1		
Search existing material	4	0	4	3
Determine level of reuse between technical data and training data modules	0	1	–1	1
Create course outline of instruction	2	0	2	
Develop initial list of required LDMs	0	2	–2	
Determine evaluation plan (formative and summative evaluations)	2	2		
Develop training project plan	2	2		
Assemble resources	0	0		
Prepare acquisition/production package (if contracting)	1	0	1	
Specify deliverables (LDMs, SCORM content package module, training products)	0	1	–1	
Select the team (SMEs and so forth)	3	3		
Kick off the project	9	0	9	
Hold technical data/training planning conference	0	9	–9	
Hold learning objective statement conference	4	3	1	
Announce course delivery dates (Content Announcement Form)	1	1		
Create instructional media design package	4	0	4	

Table B-3. Changes in Staff-Hours To Produce Training Courses Using the Bridge (Continued)

Task	Current	Bridge	Change	Notes
Coordinate, establish, and agree on standard numbering system for project	0	4	–4	
Review the instructional media design package and agree on business rules	2	2		
Create test package	4	4		
Create content	0	0		
Prepare content prototype	4	0	4	
Develop and obtain approval of DM requirements list for LDMs and develop beta training products in runtime environment	0	3	–3	1
Get DMs from the CSDB via the API	0	1	–1	
Design interface and controls	3	3		
Design for accessibility	2	2		
Comply/conform to SCORM	2	0	2	1
Review ILE content prototype	2	2		1
Construct assessments (i.e., test bank)	3	0	3	1
Load LDMs into CSDB	0	3	–3	
Develop test design (i.e., length, question type, location, and so forth)	4	4		
Develop storyboards, trainees guides, and lesson plans	0	0		
Storyboards	84	68	16	1
Trainee guides	16	16		
Lesson plans, instructor guides, and exercise controller guides	16	16		
Portion-mark content	26	26		
Review storyboards, trainees guides, and lesson plans	3	3		
Construct assets (i.e., media and so forth)	112	112		
Construct enabling learning objects	22			
Construct terminal learning objects	3	2	1	1
Develop work flow; review and approve LDMs and training products	0	4	–4	
Translate LDMs into training products for display in Web-based browser	0	4	–4	
Check LDMs in CSDB	0	1	–1	
Review and accept learning objects	4	2	2	1
Publish content in LMS	11	0	11	
Publish content in LMS using API	0	2	–2	
Conduct government acceptance testing	4	3	1	

Table B-3. Changes in Staff-Hours To Produce Training Courses Using the Bridge (Continued)

Task	Current	Bridge	Change	Notes
Submit content submission form on content forecasting system	2	2		
Deliver course	0	0		
Execute pre-pilot checklist	2	2		
Perform pre-pilot conference	2	2		
Set up classroom	1	1		
Deliver course documents	1	1		
Conduct Train-the-Trainer	1	1		
Identify pilot participants	1	1		
Perform pilot	2	2		
Execute post pilot checklist	1	1		
Finalize training course control document	1	1		
Perform content corrections	8	8		
Perform post pilot conference	1	1		
Recommend promulgation	2	2		
Promulgate	1	1		
Manage content	0	0		
Review ILE content	3	3		
Register SCORM-conformant courseware with ADL-R	1	1		
Modify technical information in response to ECPs	40	1	39	
Total	426	360	66	

Note 1 for Table B-3: All Original Equipment Manufacturer (OEM) technical data are stored in a centralized Common Source Data Base (CSDB).

Note 2 for Table B-3: Constructing learning content is more efficient.

Note 3 for Table B-3: Eliminates the time to collect training material from many sources and locations.

Appendix C
Timeliness of Technical Manuals and Training Courses

Chapter 4 of this report discusses the possibility that Navy crews might not have the appropriate Integrated Logistics Support (ILS) following ship alterations (SHIPALTs). This appendix shows that the Navy has had a policy to keep this from happening since 2004. The following paragraphs cite material that supports this policy in Naval Sea Systems Command (NAVSEA) Document TS9090-310E, *Alterations to Ships Accomplished by Alteration Installation Teams*.[1] It was issued April 2009 and supersedes TS9090-310D, dated February 2004.

Section 1.5.1 (Naval Supervising Activity), Item 15 states that the Naval Supervising Activity (NSA) has the responsibility to "ensure that Integrated Logistics Support (ILS) products from the AIT [Alteration Installation Team] are properly distributed." ILS products include technical manuals. The NSA and the Regional Maintenance and Modernization Coordinating Office (RMMCO) have the responsibility to ensure that the ILS products are in place before the ship leaves the yard.

Appendix H, Definitions, Item 33 states that the NSA is "The single Naval Activity charged with the responsibility of oversight of work being accomplished on U.S. Naval ships during any type of availability," and, moreover, "NSAs have the authority and responsibility to preclude and/or stop AITs from performing work when they are found to be in non-compliance with this or other invoked specifications."

However, Section 1.5.4, AIT Manager, allows for the possibility that the policy may not be followed. "In cases where the AIT is unable to complete the installation within the availability, the AIT Manager shall

- Document the amount of work left to be accomplished.
- Ensure the NSA has been informed.
- Verify and concur in writing that the AIT assessment of the impact of the missing equipment or capability and function is accurate and complete.

[1] Available at http://www.navsea.navy.mil/Organization/TS9090-310E_%20Apr09.pdf.

- Add amplifications or clarifications as appropriate.
- Obtain NSA concurrence that all required mitigating actions and documentations have been performed."

Appendix C, Messages Checklists & Reports, contains a form called *Exceptions to ILS Verification*. This form lists items that might not have been provided upon completion of the alteration or ship change, and technical manuals are one such item.

NAVSEA Document TS9090-310E clearly indicates that the Navy does allow for the possibility that the appropriate technical manuals and training courses may not be in place. The interesting questions are, why are the manuals/courses not ready on time and what are the incidence of delays?

Appendix D
Navy Learning Centers

1. Center for Security Forces (CSF)
2. Center for Explosive Ordnance Disposal (EOD) and Diving
3. Center for Naval Engineering (CNE)
4. Center for Naval Leadership (CNL)
5. Center for Seabees and Facilities Engineering (CSFE)
6. Submarine Learning Center (SLC)
7. Center for Sea, Air, and Land (SEAL) and Special Warfare Combatant-craft Crewmen (SWCC)
8. Center for Information Dominance (CENINFODOM)
9. Center for Force Health Protection/Naval Medical Education and Training Command (NMETC)
10. Center for Naval Aviation Technical Training (CNATT)
11. Center for Naval Intelligence (CENNAVINTEL)
12. Center for Personal and Professional Development (CPPD)
13. Center for Service Support (CSS)
14. Center for Surface Combat Systems (CSCS)

Appendix E
Content Hours and Computer-Based Training (CBT) Courses Delivered by Navy e-Learning (NeL)

Table E-1 shows the content hours and courses delivered by NeL, a part of the Naval Education and Training Command (NETC), from 2004 through 2009.

Table E-1. Content Hours and Courses Delivered by NeL

	Fiscal Year (FY)					
	2004	**2005**	**2006**	**2007**	**2008**	**2009**
Total instructional hours	1,637	2,196	2,207	4,124	3,322	3,292
All schools/centers hours	518	1,564	1,560	1,353	1,353	1,353
Courses						
Learning centers				49	55	34
A school available		7	1	6	18	288
A school unavailable	206	517	607	155	374	
C school				21		58
General military training	16	14	14	7	11	9
Navy department	280	186	137	1,346	475	532
Total	502	724	759	1,584	933	921

Illustrations

Figures

Tables

Abbreviations

ADL-R	Advanced Distributed Learning Registry
AIT	Alteration Installation Team
ALSP	Acquisition Logistics Support Plan
AN/AQS-20A	Towed Underwater Sonar Mine Detector
API	Application Programming Interface
ATIS	Advanced Technical Information Support
Bridge	Collection of new software and technical and business processes used for the integrated management and production of technical data and learning content analyzed in this study
Bridge Project	The RTOC project analyzed in this report
CBT	Computer-Based Training
CDP	Course Design Plan
CENINFODOM	Center for Information Dominance
CENNAVINTEL	Center for Naval Intelligence
CIN	Course Identification Number
CNATT	Center for Naval Aviation Technical Training
CNE	Center for Naval Engineering
CNL	Center for Naval Leadership
CPPD	Center for Personal and Professional Development
CSCS	Center for Surface Combat Systems
CSDB	Common Source Data Base
CSFE	Center for Seabees and Facilities Engineering
CSF	Center for Security Forces
CSS	Center for Service Support
DM	Data Module
DMC	Data Module Code
DMRL	Data Module Requirements List
DVD	Digital Versatile Disc (formerly Digital Video Disc)
ECP	Engineering Change Proposal
EOD	Explosive Ordnance Disposal
FY	Fiscal Year
G&A	General and Administrative
GS	General Schedule
HM&E	Hull, Mechanical, and Electrical
IDA	Institute for Defense Analyses
IETM	Interactive Electronic Technical Manual
ILE	Integrated Learning Environment
ILS	Integrated Logistics Support
LCS	Littoral Combat Ship
LDM	Learning Data Module
LMS	Learning Management System

LSAR	Logistic Support Analysis Record
NAVSEA	Naval Sea Systems Command
NAVSSES	Naval Ship Systems Engineering Station
NeL	Navy eLearning
NETC	Naval Education and Training Command
NIAPS	Navy Integrated Application Product Suite
NMCI	Navy Marine Corps Intranet
NMETC	Naval Medical Education and Training Command
NSA	Naval Supervising Activity
NSWC	Naval Surface Warfare Center
NTSP	Navy Training System Plan
PDF	Portable Document Format
PM	Publication Module
OEM	Original Equipment Manufacturer
OMB	Office of Management and Budget
OSD	Office of the Secretary of Defense
OUSD(AT&L)	Office of the Secretary of Defense for Acquisition, Technology, and Logistics
QA	Quality Assurance
R&D	research and development
RMMCO	Regional Maintenance and Modernization Coordinating Office
RTOC	Reduction in Total Ownership Cost
S1000D	An international specification for the procurement and production of technical publications
SCORM	Sharable Content Object Reference Model
SEAL	Sea, Air, and Land
SGML	Standard Generalized Markup Language
SHIPALT	ship alteration
SLC	Submarine Learning Center
SME	Subject Matter Expert
SNIP	Strategic National Implementation Process
SNS	Standard Numbering System
SWCC	Special Warfare Combatant-craft Crewmen
TDKM	Technical Data Knowledge Management
TDMIS	Technical Data Management Information System
XML	Extensible Markup Language

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14. ABSTRACT

This report describes an Institute for Defense Analyses (IDA) cost-benefit analysis of a project to improve the Navy's Integrated Logistics Support (ILS). The project involves integrating, or "bridging," the management of technical information for producing Navy technical manuals and training courses. The Bridge project achieved the integration by designing new software and proposing new technical and business procedures for managing the technical information. The project was part of the Reduction in Total Ownership Cost (RTOC) program conducted by the Office of the Secretary of Defense (OSD). The study conducted separate cost-benefit analyses for two perspectives. The OSD perspective recognizes OSD's broad interest in seeing whether the new software and technical and business processes that constitute the Bridge would lead to cost savings if implemented by the Navy. This analysis found that the Bridge would achieve net benefits—cost savings for producing technical manuals and training courses that exceed the costs of implementing the Bridge. The Program Office perspective focuses on their individual systems of interest and concentrates exclusively on the benefit side—whether the Bridge would save money in producing future technical manuals and training courses for their systems of interest. The benefits proved positive.

15. SUBJECT TERMS

Bridge Project, computer-based training (CBT), cost-benefit analysis, Reduction in Total Ownership Cost (RTOC), technical manuals, training courses

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