

RESOURCE CENTER FOR CROSSCUT INITIATIVES

FINAL REPORT

April 28, 2000

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Bath Iron Works
Cascade General
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National Steel and Shipbuilding Corporation
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University of Michigan Transportation Research Institute

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Report Documentation Page				Form Approved OMB No. 0704-0188	
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1. REPORT DATE 28 APR 2000		2. REPORT TYPE N/A		3. DATES COVERED -	
4. TITLE AND SUBTITLE Resource Center for Crosscut Initiatives Final Report				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Surface Warfare Center CD Code 2230-Design Integration Tower Bldg 192, Room 128 9500 MacArthur Blvd Bethesda, MD 20817-5000				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release, distribution unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT SAR	18. NUMBER OF PAGES 10	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

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INTRODUCTION

The purpose of this final report is to describe the activities that have taken place in the past eight months relative to the World Class Resource Center for Crosscut Initiatives.

A collaborative team consisting of Electric Boat Corporation, Avondale Industries, Bath Iron Works Corporation, Cascade General, National Steel and Shipbuilding Company, Todd Pacific Shipyards Corporation, and the University of Michigan Transportation Research Institute submitted a proposal to design and develop a resource center for crosscut initiatives. The proposed resource center would focus on the support required for addressing the people and organization needs important to the revitalization of the shipbuilding and ship repair industry. These needs cut across the industry and include education and training, organizational change, human resources, and technology transfer. The resource center would focus on assisting industry professionals from the crosscut areas, personnel from MARITECH-ASE projects, and professionals from other industries.

The long-term intent of this project was to design and develop an initial implementation of a crosscut resource center for the U.S. shipbuilding and ship repair industry. Technical Investment Agreement (TIA) 99-01130 was awarded for a first phase of the project. The first phase was to concentrate on identifying the requirements for the resource center, defining the architecture of the center, and then creating a set of design guidelines for use in developing prototypes and applications that will be used in the center. The second phase, recently awarded under Technical Investment Agreement 2000928, will develop the center services based upon the outcome of the requirement assessment and center design deliverables from phase one. The end result will be an on-line crosscut resource center that can be used by crosscut professionals, MARITECH-ASE participants, and the shipbuilding industry as a whole to address concerns and needs associated with people and organizations within the industry.

Among the issues facing U.S. shipbuilding are that crosscut elements and their potential impact are not well understood or accommodated by industry personnel responsible for developing or implementing shipyard technological or process changes. While necessary resources and assistance may exist in crosscut areas to help these personnel, they often are not aware of this support. In addition, the supporting resources frequently are not readily available or well organized for use by personnel who are not professionals in crosscut areas.

Addressing these key elements also is a problem for crosscut professionals. These professionals are confronted with limited resources in addressing crosscut needs at a time when meeting these needs is important to the industry's revitalization efforts. At present, there is no organized means within the industry for helping crosscut professionals to easily obtain resources for innovative crosscut solutions or to address common, emergent crosscut problems. In addition, the entire industry is impacted by an inability to efficiently collaborate and communicate with each other and with the extended community of industry partners. The lack of effective communication mechanisms also hinders the transfer of new technology and processes across the industry.

PROJECT SUMMARY

There were five major tasks for TIA 99-01130. Each task had one of the team members as the task leader. The task leader was responsible for the completion of any associated task deliverable. Generally, the balance of the team supported the team leader for a given task. For example, team members performed research or they provided material to be used in a particular deliverable. Or, they acted as a review agent.

Crosscut Conference (Task Leader: Bath Iron Works)

The first task was to hold a crosscut conference. The conference was held September 8, 1999 in Charleston, SC. The purpose of the conference was to provide a forum for the exchange of ideas with MARITECH project participants. The conference provided a means for identifying the needs the resource center might satisfy. The conference included four main activities:

- Presentations focusing on project approaches to crosscut needs
- Mr. John Howe, a guest speaker, recently retired from General Motors, addressed some of the crosscut issues he faced while at General Motors.
- A sharing of representative crosscut resources by the Resource Center project team

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- A discussion of potential Resource Center requirements

After the project presentations, the team shared additional resources such as contacts, literature, and web sites. The team also left time during the conference for a general question and answer session relative to crosscut issues. For the conference, the team compiled easily available, effective resources for immediate use by the participants. The Crosscut Conference also hosted a speaker from the automotive industry who highlighted where to focus efforts. All of the comments and ideas suggested during the conference were later used in the development of the Resource Center Requirements Document.

Team Communications (Task Leader: Cascade General)

The second task was to investigate communication tools that the team could use for conducting team business. A Team Communication Plan was developed to document the communication methods that should be used by the project team. To complete the project activities, the team had to function as a “virtual team”. It was anticipated that the Plan also could provide insight into the requirements that would exist for other industry teams attempting to collaborate on activities.

A literature search noted three common virtual teaming methods: audio teleconferencing, video teleconferencing, and virtual conferencing using Internet technology. Typical constraints identified for virtual teaming included computer platform differences for team members, firewall restrictions, and participation costs. The product search for virtual teaming tools found a wide spectrum of capability and cost, and potential limitations related to bandwidth capacity and firewall intrusion. The virtual teaming capabilities of four different businesses were examined to identify typical U.S. industry practices. All four businesses were making use of some type of virtual teaming capability either internally or externally. The results of a survey of team communication needs suggested that team members would like video as well as audio communication and robust file sharing.

Upon completion of the literature and product search, the review of industry practices, and the team communication survey, a recommendation was made to maintain temporarily the basic communication methods that the team had employed during proposal development activities. These methods included biweekly teleconferencing and file sharing through email. The recommendation for the use of teleconferencing and email teaming methods was based upon a recognition of the short timeframe associated with the first year resource center design contract, and the need for further evaluation of virtual teaming tools.

Resource Center Requirements (Task Leader: NASSCO)

The third task was to develop a Resource Center Requirements Document. The purpose of the Resource Center Requirements Document was to:

- Determine needs of potential Resource Center users, including MARITECH ASE project awardees and Major Initiative (MI) teams, and the shipbuilding community;
- Benchmark best practices relative to existing virtual resource sites;
- Recommend products and services for inclusion in the Center.

The approach used to identify the requirements for the Crosscut Resource Center consisted of the following:

- Meet with MARITECH project leaders to identify requirements (Crosscut Conference).
- Conduct initial project team assessment of user needs and preliminary requirements for the Resource Center.
- Use NSnet data to determine past requests and requirements of NSnet users
- Conduct a user survey of shipbuilding community to validate needs and determine available system capabilities
- Benchmark existing virtual resource sites

As a result of the surveys and data collection efforts of the first four tasks listed above, input and recommendations for Resource Center requirements were compiled from the following sources:

- About 15 MARITECH project leaders and their representatives from the Crosscut Conference

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- The Crosscut Resource Center project team
- A survey of the shipbuilding industry
- A survey of several non-shipyard, marine-related organizations

Table 1 summarizes the priorities expressed by these four groups.

Table 1. Summary of Priorities of All Groups

MARITECH Leaders	Project Team	Shipyard Survey	Non-Shipyard Survey
Demonstrate project results	Library of training courses	Crosscut research	Referrals and contacts for Crosscut
Attracting people	Referrals and contacts for Crosscut	Attracting people to the industry	Proposer's/managers' guide for Crosscut
Continuing education/workforce development	Proposer's / managers' guide for Crosscut	Referrals and contacts for Crosscut	Review existing projects for crosscut
Sponsor a forum to identify training needs	Annual forum to identify needs	Library of training courses	Demonstrate project results
Communication	Crosscut links	School to work advice	Provide training templates, aids
Put on virtual workshops	Crosscut information sources	Web page for schools	Assist proposers to develop crosscut approaches
Find available grants, lobby for money	Virtual learning capability	Product development, testing, delivery	Library of training courses
Put training, virtual university on web	Virtual workshops or courses	Demonstrate project results	Metrics for benchmarking
Be "consumer reporter" or reviewer	Web page for schools	Editor of available material, sites, etc	Coordinate project workshops
Provide training templates and aids	Industry positive image/attracting people	Find available grants, lobby for money	Product development, testing and delivery
Provide regional workshops on change	Model school / industry programs	Provide training templates and aids	Find available grants; lobby for money
Coordinate project workshops	Project results sharing	Guidance for virtual teams	Editor of available material, sites, etc.

To reconcile the four lists presented in **Table 1**, a weighted-ranking method was employed. First, a combined single list of ideas was created and each idea was assigned its ranking from each of the reviewing groups. Next, each ranked idea was given a value from 1 to 12. The highest ranked idea within a review group (#1) was assigned the highest value (12), and the lowest ranked idea (#12) was assigned the lowest value (1).

A weighting value was then assigned to the input from the four groups. The highest weight of three was given to the ideas of the project team and shipyards. The project team results were given the highest weight because the project team's list initially was based on multiple input from the industry and on a more in-depth analysis of the implementation needs of each idea. The shipyards' survey results were given the same high weight because it was assumed that the initial functions of the Resource Center should emphasize shipyard needs. A weight of two was given to the MARITECH leaders because their view was considered important, but generally did not incorporate the needs of the industry's crosscut professionals. A weight of one was given to the non-shipyard survey results because, while their view was considered important, it was again assumed that the initial functions of the resource center should emphasize the shipyards' needs. The value (1-12) assigned to each idea for each review group was then multiplied by the assigned weighting factor. The total weighted score for each idea was then calculated. **Table 2** lists the center services, resulting from the weighting/ranking assessment, which will be developed in phase 2.

Resource Center Architecture (Task Leader: Electric Boat)

The fourth task was to develop a Resource Center Architecture Document. The purpose of this document was to define the architecture for the Crosscut Resource Center. The architecture was developed to specify the organization and structure for the resource center. It describes the organization of the Resource Center user services, the interactions among the various elements of the Center, and the interfaces outside of the Center. It specified how the Center would interact with the NSnet environment.

To accomplish the architecture activity, four tasks were completed:

- Initial Crosscut Resource Center functional and performance specifications were identified
- Virtual Resource Center architectures were reviewed
- Alternative architectural approaches were examined
- Concepts for the Crosscut Resource Center organization and structure were developed

The results of the architecture activity were summarized in the Crosscut Resource Center Architecture document. Initial performance specifications indicated no significant concerns, except for potential video delivery transactions. Initial functional analysis of the Resource Center services suggested the presence of common system functions among the services. When existing Resource Center sites, including those identified in the requirements assessment, were reviewed for architectural schemes, no one site mapped exactly to the Crosscut Resource Center requirements. The NSnet site shared a number of functions in common with the Crosscut Resource Center. A set of alternative architectures was examined for the Resource Center. Given the high degree of shared functionality found with NSnet, particular emphasis was allotted to architectures based upon variations of NSnet integration with the Crosscut Resource Center. A variety of concept diagrams were developed to capture the various aspects of the Resource Center architecture (See the Resource Center Architecture document for a detailed discussion.). Figure 1 portrays a general system architectural concept for the Resource Center.

Figure 2 portrays the network architecture assumed for the Crosscut Virtual Resource Center. The architecture includes a local area network that provides a communications channel for the hardware and software of the Resource Center. The local network is connected to the Internet through an Internet Service Provider (ISP). It is assumed that the connection to the Internet will include at a minimum a fractional T-1 capability. All of the Resource Center inputs and outputs will take place via the Internet. During the development of design guidelines and the detailed design of the Resource Center, a more precise decision will be made concerning the required network capacity. It is assumed that each user will communicate with the Resource Center via a web-enabled workstation. The end-user requirements associated with each Resource Center function will be identified and collected in a database available online to potential users. As depicted in the architecture diagram, it is anticipated that the Resource Center network solution must accommodate various levels of communications capability. It is anticipated that the capability will include a range from low end 28.8 modem connections to high end communication channels (e.g., T-1, T-3). This variation will dictate the use of alternative levels of participation in some of the Resource Center services. For example, low-end connection users could require alternative solutions to participate in team conferencing and collaboration activities. Again, during the development of design guidelines and the detailed design of the Resource Center, a more precise decision will be made concerning the recommended solution for users participating at varying levels in each of the Resource Center services.

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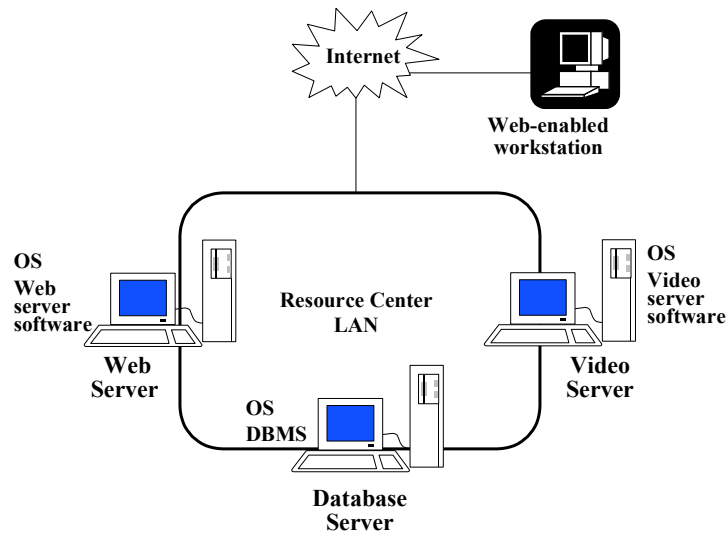


Figure 1. Resource Center Technical Architecture

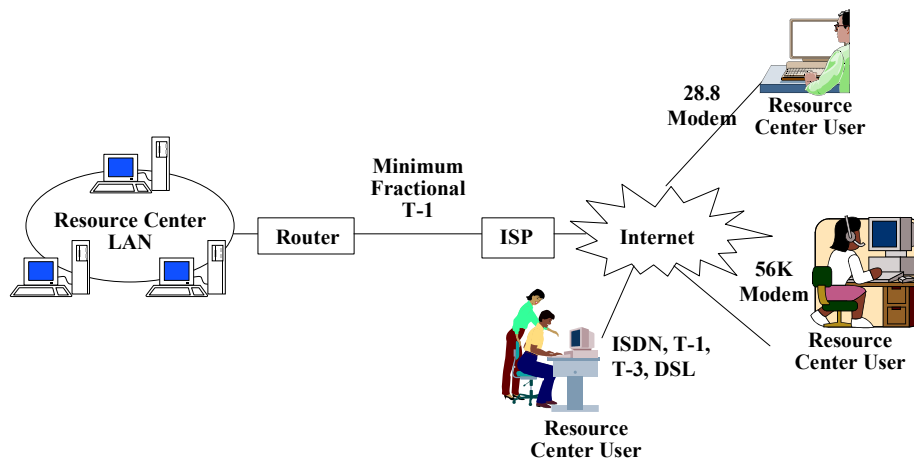


Figure 2. Resource Center Network Architecture

Resource Center Design Guidelines (Task Leader: Electric Boat)

The fifth task was to develop a Resource Center Design Guidelines Document. Using the results from the Requirements assessment as input, a set of design guidelines for the Resource Center was produced. The design guidelines were developed to create initial specifications for system developers and potential resource center contributors. The design guidelines indicated what the resource center services should include and how the resource center should look in general. To prepare the design guidelines, three tasks were completed:

- A specification was developed for each resource center service.
- System-wide design guidelines were developed.
- User interface guidelines were defined.

The results of the design guidelines task were summarized in a Crosscut Resource Center Design Guidelines document. When individual specifications were derived for each of the services, one additional service, Virtual Teaming, was included. Although Virtual Teaming was not one of the dozen services selected for implementation, a specification was developed for this service because its functionality shared much in common with two of the selected services, the Workforce Development Forum and the Virtual Workshops/Classes. All three center services shared common conferencing requirements and technology. The Virtual Teaming service also was a logical extension of the team communication capability marked for further examination during the Team Communication Plan effort.

The output of the service specification effort included an identification of the purpose and a representative scenario for each service, and an accompanying detailed description for each service. Table 3 provides the purpose for each of the recommended center services. The detailed description of each service included the identification of:

- Intended users
- Processes and associated steps
- Business rules associated with processes
- Data requirements and data conversion requirements
- Data sources
- Data validation requirements
- Security requirements
- Usage tracking requirements
- Transaction specifications
- Connectivity requirements
- Maintenance requirements
- Relationship to other center services

Before a detailed description could be completed for the Workforce Development Forum, Virtual Workshops/Classes, and Virtual Teaming services, an analysis was conducted to determine the technological capacity and requirements associated with providing state-of-the-art conferencing and collaboration capabilities in conjunction with these services. A review and evaluation of conferencing tools was completed. As a result of this analysis, it was recommended that more robust specifications be identified for these services. Subsequently, a detailed description of each service was completed.

Upon completion of the specifications for each service, a system-wide set of requirements was derived from the individual specifications. (See the Design Guidelines document for full discussion of analysis). The grouping of system functions identified during the development of the architecture again was confirmed. The results of this activity led to the creation of a set of system-wide design guidelines for the virtual resource center that could be used in conjunction with the individual service specifications.

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To formulate a set of user interface guidelines, information profiling potential center users and their computer platform constraints was reviewed. Virtual resource sites previously identified in the Requirements Assessment and Architecture efforts were also examined. A conceptual model for presenting and organizing the resource center services for users was developed. General guidelines for the physical appearance of the resource center were created.

Service	Purpose
Crosscut Referrals/Contacts	Provide a means by which industry users can obtain the names of contacts willing to help with crosscut topics and can participate in crosscut-related newsgroups
Training Course Library	Provide a means by which industry users can easily share training courses with one another
Industry Positive Image Material	Provide industry users with a set of public relations material that can be used in meetings, presentations, conferences, and with educational institutions and employment agents to portray the industry in a positive light
Project Results Sharing	Provide a means by which industry users can obtain an overview of the results of Maritech ASE and other non-proprietary shipyard projects
Workforce Development Forum	Sponsor, broadcast, and maintain outputs of an industry forum held to discuss continued workforce development needs and to identify course requirements associated with continued workforce development
Crosscut Information Sources	Provide industry users with significant and timely resource material culled out by crosscut specialists on topics pertinent to crosscut concerns and issues
Proposers & Managers Guides	Provide Maritech ASE proposers and industry project managers with guides to help them understand crosscut needs and issues and address crosscut requirements successfully in their proposals and projects
Crosscut Research Service	Provide a means by which industry users can request that research in crosscut areas be conducted and the results provided to the industry
Web Page for Education	Create an online mechanism that would help the industry to foster interactions and communications between the industry and educators and students at all levels
Model School/Industry Programs	Provide industry users with best practice models for school-to-work, intern, and co-op programs from shipbuilding and other industries
Virtual Workshops/Classes	Develop and present an annual course or workshop in response to a need identified in the Workforce Development Forum
Crosscut Web Links	Provide industry users with connections to good, current web sites with crosscut content
Virtual Teaming	Provide industry users with a set of tools that can be used to hold collaborative meetings, forums, and presentations

Table 2. Purposes of Resource Center Services

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CROSSCUT RESOURCE CENTER DELIVERABLES

The following Crosscut Resource Center deliverables are available in electronic form for use on the NSnet or NSRP websites:

- Crosscut Resource Center Team Communications Plan
- Crosscut Resource Center Requirements Document
- Crosscut Resource Center Architecture Document
- Crosscut Resource Center Design Guidelines Document
- Crosscut Resource Center Final Report

TECHNOLOGY TRANSFER AND IMPLEMENTATION

A cross section of shipyards has been involved in the development of the Crosscut Resource Center design to ensure that the center is readily accepted throughout the industry when complete. Shipyards of differing sizes, geographic locations, and product lines, and a university joined together to seek a solution to mutual problems. The team members were working professionals in the crosscut areas within their shipyards and university. Project tasks were designed to be mutually shared by team members to allow cross-fertilization and validation of ideas.

To foster implementation of the resource center technology a broad cross section of the shipbuilding and ship repair industry was involved in the definition of requirements for the Crosscut Resource Center. The involvement by the industry at large helped to ensure that as the resource center capabilities are brought on-line in the second phase of this project they will meet the needs of potential users and find a receptive audience. In addition, the shipyards involved in this project have adopted a collaborative design approach to create the Crosscut Resource Center design. Team members worked collectively to design the resource center features and services. Both of these activities were designed to ensure that industry participants had a vested interest in the success of the technology implementation.

The results of the first phase of the Crosscut Resource Center development will be presented in a paper at the Ship Production Symposium in August 2000. In addition, the Crosscut Resource Center deliverables are available in electronic form for use on the NSnet or NSRP websites.

LESSONS LEARNED

The ensuing discussion outlines several lessons learned in the completion of this Crosscut Center project.

- For financial and reporting purposes, the project was set up as a Prime and Subcontractor arrangement. For all other purposes the project was operated as a collaborative effort. That is, by agreement of the team, decisions regarding general planning, scheduling, issue resolution, task methodology, deliverable content, etc. were made by consensus of the team. The resulting project arrangement was a hybrid of a Prime and Subcontractor, and collaborative methodology.
- The hybrid approach required a tremendous amount of consensus building, coordination and communication. Often, due to other commitments, not all team members were able to participate in discussions, thus requiring additional coordination to ensure all were “up to speed”.
- The chosen method of conducting team business was through teleconferences. In part, this method was chosen as a cost and time savings approach since the team members are physically located on all three U.S. coasts and in the mid west. However, conducting team meetings, for example, required tremendous coordination to find convenient dates and time for meetings. In addition, material, which was to be the subject of discussion, needed to be emailed. Team members were not able to “see” live markups, etc. In the case of the Resource Center Requirements Document, the word file, as a whole, was too large to email.
- One team member was the task leader for a given product. Beginning with the Crosscut Conference, each succeeding deliverable was inherently dependent on the research, content, and the availability of the last.

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Tremendous coordination efforts were required to ensure that the content of each product was complete, at an appropriate level of detail, and available on time for use in developing later products. The succeeding task leaders (or the Program Manager) did not have direct control over schedule and outputs.

- The Resource Center project was originally proposed as a three-year task. Due to technical and budget considerations, only the design phase of the task was awarded. In addition, the task agreement was negotiated about four months later than originally planned. The team enthusiastically embarked on a very ambitious schedule in an attempt to complete the project before the startup of year 2000 MARITECH projects. The schedule was too tight. Despite contingency planning for emergent situations that occurred part way through the project, three deliverables were submitted later than planned.
- The level of commitment on the part of shipyards was well intentioned but when conflicts with ongoing work arise, MARITECH ASE efforts don't get priority over regular shipyard requirements. Shipyard personnel are often called away or provided unanticipated shipyard assignments, and as a result, they complete project work during their own time. This leads to cost underruns. Participants are not rewarded in their yards for MARITECH ASE results to an extent equal to other activities.