

FINAL REPORT



BENEFIT ANALYSIS OF SPC PANEL SP-9 PROJECTS

and

EVALUATION OF SPC PANEL SP-9 MANAGEMENT AND ADMINISTRATION



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In Behalf Of
SNAME SPC PANEL SP-9

EDUCATION AND TRAINING

Under the
NATIONAL SHIPBUILDING RESEARCH PROGRAM



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PREFACE

The National Shipbuilding Research Program has been sponsored during the past 20 years by the Maritime Administration, United States Department of Transportation, and by the United States Navy toward improving productivity in shipbuilding. The Program is operated through several Panels of the SNAME Ship Production Committee. During 1988 a survey was conducted in behalf of SPC Panel SP-3 on Surface Preparation and Coatings to determine (1) the benefit value that had accrued from the research projects sponsored by that Panel during the previous 15 years, and (2) how the management and administration of the Panel itself- meetings, discussions, activities - was seen by the using community. The report of this survey (NSRP 0303, July 1989) was well received. It was therefore decided to conduct a similar survey for each of the other active SPC Panels.

The survey of SPC Panel SP-9 on Education and Training is reported herein. The purpose of this survey was (1) to determine the type of project most beneficial in the past, and therefore most likely to yield the largest benefit in the future, and (2) to determine how the direction of Panel SP-9 itself might be improved.

The Task was conducted by Rodney A. Robinson, Vice President of Robinson-Page-McDonough and Associates, Inc. Personal interviews were conducted with several representative members of the shipyard Education and Training community to gain the necessary information. Conclusions and recommendations based on analysis of the findings are included in the report. The work, under NASSCO Purchase Order No. MUI7117-D, began in October 1991 and was completed in October 1993.

EXECUTIVE SUMMARY

This Task has investigated the benefits derived from the projects sponsored during the past 11 years by SNAME Ship Production Committee Panel SP-9 on Education and Training under the National Shipbuilding Research Program. It has found that those projects involving direct shipyard application have yielded the most value in the shipyard community. The responses from those interviewed endorse the value of such projects, rather than analytical or theoretical exercises which offer little practical application.

This Task has also assessed the opinion of the shipyard using community on the administration and management of Panel SP-9 itself. It has found that the practices currently in effect should be continued with only minor improvements. It has also found, however, that there has been an insufficient number of shipyards represented at and participating in Panel meetings. This deficiency has produced an academic bias in Panel deliberations, which has contributed to the minimal shipyard implementation of research results. Continuing efforts are needed to achieve and maintain an increase in shipyard participation.

The area of Education and Training will experience major challenges as efforts unfold to prepare the U. S. shipyard industry for entry into the international commercial market. Our shipyard community has worked under strict and highly technical Government requirements associated with military ships for the entire productive lifetime of most employees. Professional and trade habits have become so well established that the transition to the quite different world of the international commercial market will require serious and dedicated efforts by Education and Training professionals in order to assist in re-focusing our practices, our workers, and our management at every level. The current attitudes among SPC Panel members are positive, and thoughtfully inquisitive of what the future holds for the shipyard industry. Metrication, the preeminence of time to complete, an up-hill track environmentally, and a vastly different cost profile have generated formidable training targets. Advancements in technology, as we have known them for many years, will not alone solve our future problems. We have a whole new array of softer issues to address. We are fortunate that Panel SP-9 is in place and ready to provide the professional guidance and support needed to confront these challenges.

TABLE OF CONTENTS

	<u>PAGE</u>
BACKGROUND	1
BENEFIT ANALYSIS OF PROJECTS SPONSORED BY SPC PANEL SP-9	2
Detailed Discussion of Individual Projects	3
MANAGEMENT OF SPC PANEL SP-9 ACTIVITIES	14
Meeting Attendee Matrix	15
Panel Meetings and Administration	16
- On Improving Meetings	16
- On Gaining More Assistance from the NSRP	18
- On Potential Projects for Panel SP-9	19
- On Message for Panel SP-9	20
Project Reports and NSRP Information	21
- On Improving NSRP Communications	21
CONCLUSIONS FROM THE FINDINGS	24
RECOMMENDATIONS FROM THE CONCLUSIONS	26
APPENDICES	
Appendix A - Project Benefit Analysis Worksheet, SPC Panel SP-9	
Appendix B - SPC Panel Meeting Management and Administration Questionnaire/Worksheet	
Appendix C - SPC Panel SP-9 Projects Listing based on Benefits Evaluation	

FINAL REPORT



BENEFIT ANALYSIS OF SPC PANEL SP-9 PROJECTS

and

EVALUATION OF SPC PANEL SP-9 MANAGEMENT AND ADMINISTRATION

BACKGROUND

General Discussion

This Project was designed: (1) to investigate the benefits that may have resulted from SPC Panel SP-9 Education and Training projects carried out over the first 11 years of Panel operations; and (2) to evaluate how the management of panel Sp-9 itself is currently viewed by the using community. The aim was to focus on what type of project has been most helpful in the past, and may therefore be presumed to yield the most benefits in the future, and also to explore how the activities associated with Panel SP-9 might be improved.

This Project would consist of interviews with members of the Education and Training community to gain information on these matters. The interviews would be on-site and face-to-face, to yield the most meaningful results. Analysis of findings would be published for principal consumption by SP-9 Panel Members toward their action on panel operations and projects in the future.

This project was a direct follow-on to a similar project conducted in 1989 in behalf of SPC Panel SP-3 to (1) explore the benefits that may have resulted from the projects sponsored by that Panel during the previous 15 years, and (2) to evaluate how the management of Panel SP-3 itself was seen by the using community. The report on that project (NSRP 0303, July 1989) was well received, prompting the development of this current project, which consists of the same kind of analyses for all other SPC Panels, as well as an update on the projects of Panel SP-3 since the original report. The report presented herein covers the area of SPC Panel SP-9 on Education and Training.

O v e r v i e w

Information on both aspects of this effort was gained through personal and anonymous interviews with 9 members of the Education and Training community from 8 different shipyard locations. 9 specific and detailed responses to the questionnaire were gathered, and have been used to formulate the detailed sections of this report. The period of interviews extended from January 1992 through May 1993.

Several questions were designed to explore both aspects of this survey. The worksheets for gathering information on the benefits of individual projects are contained in Appendix A. The worksheets associated with Panel SP-9 direction are contained in Appendix B.

A detailed discussion of the findings is presented below. Those associated with the benefit analysis of panel projects begin on this page. Those associated with panel management begin on page 14. Conclusions reached from the findings are on pages 24 and 25. The recommendations drawn from these conclusions are on page 26.

BENEFIT ANALYSIS OF PROJECTS SPONSORED BY SPC PANEL SP-9

General Discussion

This section contains information on all of the SP-9 projects investigated, including a description of each project, the pertinent information surrounding that project, and an analysis of the benefit value gained from that project to date. The NSRP Number is that assigned to each report in the NSRP Bibliography of Publications 1973-1992, published (now annually) by the University of Michigan for the National Shipbuilding Research Program. The Projects investigated are those listed in this specific publication (1973-1992). The analysis portion has been drawn from the comments offered by those interviewed, and is intended to provide a general indication of how the project has been received by the shipyard industry. It also indirectly provides the feelings of those interviewed on whether that particular type of effort should be sponsored by SP-9 in the future, since those projects with the higher benefit value might better receive the more favorable consideration. Appendix A was the worksheet used during the interviews.

The display below is intended to provide a rapid visual idea of the relative benefit value that has been gained from the SP-9 sponsored projects that were investigated. While these ratings are surely subjective, they represent the general opinions of those interviewed, which constitute a good cross-section of the shipyard industry in the Education and Training area. As such, these opinions reflect the overall industry attitude surrounding these projects, which should be of interest to SP-9 panel members during consideration of what projects to sponsor in the future. The number of *'s against each project report indicates the amount of benefit gained from it to date. The more *'s, the larger the benefit value gained.

<u>Report No.</u>	<u>Benefit Value</u>	<u>Report No.</u>	<u>Benefit Value</u>
NSRP 0170	*	NSRP 0223	* *
NSRP 0180	* *	NSRP 0224	* * * * *
NSRP 0181	* * * *	NSRP 0225	* *
NSRP 0192	*	NSRP 0269	* * * * * *
NSRP 0198	* * *	NSRP 0269	* * * * * *
NSRP 0216	* * * *	NSRP 0290	* * *
NSRP 0219	* * * *	NSRP 0334	* * * * * *

Detailed Discussion of Individual Projects

Each of the individual projects investigated are discussed below in the chronological order in which they were carried out. Included is: NSRP Number Benefit Value Rating (*'s): *TITLE*. *AUTHOR*; *DATE*. *COST* (where available); *ABSTRACT*; and *BENEFIT ANALYSIS*.

Appendix C is an abbreviated listing of these same projects (NSRP Number; *TITLE*, *AUTHOR*; *DATE*, *COST*) arranged according to the benefit value (number of *'s) assigned to each project, highest to lowest. Appendix C is included as an aid to understanding which types of projects were found to be of most (and least) interest and value to the using community, based on user comments received during this survey.

NSRP 0170 *

TITLE: Social Technologies in Shipbuilding Workshop. Proceedings.

AUTHOR: University of Michigan.

DATE: May 1983

COST: \$40,000.

ABSTRACT: The human resource is the single most important asset employed in the production of ships. This document is the proceedings of a workshop devoted to an analysis of how American shipyards might more effectively use this resource through application of social technologies. (67 p.) (Project identified as 9-82-6.)

BENEFIT ANALYSIS: LOW VALUE. 78% of those interviewed were not familiar with this report and had no interest in this material. 22% were familiar with the report. One person commented that the report was "not of much value at the time".

NSRP 0180 * *

TITLE: The Status of Skilled Trades Training in U.S. Shipyards.

AUTHOR: Institute of Applied Technology for The University of Michigan.

DATE: December 1983

COST: \$20,000.

ABSTRACT: The purpose of this project was two fold. The primary intent was to determine, through a survey, the status of trades training at all levels in private U.S. shipyards. In turn, the results of the survey were used to indicate where the need exists to improve training programs, primarily by level of training. A secondary purpose was to develop a directory of current trades training programs in private and Navy shipyards, to be made available to all shipyards. (72 p.) (Project identified as 9-82- 1.)

BENEFIT ANALYSIS LOW VALUE. 1/3 of those interviewed were unfamiliar with this report and had no interest in this material. 1/3 had read the report, but had not used any of the material. One shipyard representative said that he had applied this material on a limited scale, and might do so again. Two people said that they would read the report in the near future, as they were currently interested in benchmarking both nationally and internationally.

NSRP 0181 * * * *

TITLE: A Directory of Skilled Trades Training Courses and Training Aids in U.S. Shipyards,

AUTHOR: Institute of Applied Technology. for The University of Michigan.

DATE: December 1983

COST: \$25,000.

ABSTRACT: This Directory of Willled Trades Training Courses and Training Aids in U.S. Shipyards and the companion report list available training in U.S. shipyards and analyze the needs for training at the apprentice, mechanic, and management levels. (225 P.) (Project identified as 9-82-2.)

BENEFIT ANALYSIS: MIXED VALUE. This report prompted several different comments from those interviewed. One person said that "commercial shipyards are not going to share training materials - Naval shipyards maybe. but commercial shipyards no". Another person said that this material was probably dated by now. A third person recognized this material as part of the AVMAST Program, and as such it was quite valuable to his shipyard. A fourth person said that he had applied this material on a limited scale. and might do so again.

NSRP 0192 *

TITLE: Curricular Needs of Shipyard Professionals.

AUTHOR: The University of Michigan.

DATE: June 1984

COST: \$30,000.

ABSTRACT: A study of U.S. shipyards was conducted to identify the knowledge and skills required of entry-level graduate professionals in the design, engineering, planning, and production functions. A major conclusion of the study is that additional cooperative engineering curricula need to be established, so that engineering students can acquire broader knowledge and skills through periodic work and/or research assignments in shipyards. Recommendations concerning other curricular changes include addition of certain courses now usually absent in statistics, materials and metallurgy, production processes, principles of supervision, and engineering economics, along with an increase in realistic exercises in written communications throughout the four or five years of undergraduate studies. A recommended five-year

82-3.)

BENEFIT ANALYSIS: LOW VALUE. 44% of those interviewed were not familiar with this report and had no interest in this material. Another 44% had read the report, but had not applied any of this material. One person commented that this report "was not too useful". Another said that it was "directed at Naval Architects and Marine Engineers".

NSRP 0198 * * *

TITLE: Evaluation of Two Multi-Shipyard Cooperative Apprentice Training Programs.

AUTHOR: Data Design Laboratories/ Omni Engineering, for The University of Michigan.

DATE: March 1985

COST: \$40,000.

ABSTRACT: Two cooperative training programs have played a valuable role in the Norfolk, Virginia, and Seattle, Washington, shipbuilding communities. The programs are, respectively, the Tidewater Maritime Training Institute, and the Cooperative Apprentice Training Program. The purpose of this report is to show the results of an investigation and evaluation of the two separate programs. The project has identified information which will assist those in other geographical areas to establish similar programs. (135 p.) (Project identified as 9-83-5.)

BENEFIT ANALYSIS. LOW VALUE. 1/3 of those interviewed were not familiar with this report and had no interest in this material. 44% had read the report, but had not applied any of this material. One shipyard representative said that he had applied some of this material on a limited scale, and might do so again. Comments suggested that this report was intended for small repair shipyards that might establish their own apprentice programs.

NSRP 0216 * * * * *

TITLE: Human Resource Innovation in Shipbuilding and Ship Repair - Workshop Proceedings.

AUTHOR: The University of Michigan.

DATE: May 1985

COST: (Not available)

ABSTRACT: These proceedings document the second national Workshop On Human Resource Innovation in Shipbuilding/Ship Repair, which was held on November 26th-28th. 1984. The text of the proceedings consists of case studies and technical reports presented by shipbuilding labor and management members from around the world. The objective of the workshop was to introduce new management practices and organizational structures designed to better utilize the shipbuilding human resource. This workshop was designed to convey its theme to an audience consisting of representatives from United States and overseas shipyards, labor unions, The United States Department of Labor, The Maritime Administration, and major universities. (57 p.)

BENEFIT ANALYSIS: MIXED VALUE. This report seems to have been published on behalf of SPC Panel SP-5 on Human Resources. It is not clear why it appears in the Bibliography under SP-9. Workshops of this type have been quite successful for Panel SP-5. Comments from those interviewed suggest that portions of these proceedings were of some use to them.

NSRP 0219 * * * *

TITLE: Engineering for Ship Production.

AUTHOR: Thomas Lamb. for The University of Michigan.

DATE: January 1986

COST: \$20,477.

ABSTRACT: This publication represents a consolidation of the views of an experienced shipbuilder on the principles of advanced ship production technology. The application of the design-for-production technique is described and illustrated through examples. The concept that ship designers should develop all design for production is essential. Once the best production-oriented designs are developed, it is necessary to transmit the design information to the various departments in the shipyard that use the information. improvements to existing shipyard methods are presented. The book was developed from the author's 1978 SNAME paper. "Engineering for Modern Shipyards". and University of Washington lectures on Ship Production Technology. (465 p.) (Project identified as 9-84-10.)

BENEFIT ANALYSIS: MIXED VALUE. 56% of those interviewed *were* not familiar with this report and had no interest in this material. 22% had applied portions of this report as reference material in their shipyard training programs, and might do so again. One other person commented that this material had been used extensively at the University of New Orleans as notes for teaching a class on ship production. and that it was "a good book. and useful".

NSRP 0223 * *

TITLE: Statistical Analysis of Data and Quality Assurance for the Shipbuilding Industry - Tutorial and Workbook.

AUTHOR University of Massachusetts, for The University of Michigan

DATE: September 1985

COST: \$50,000.

ABSTRACT: The Tutorial/Workbook was developed in conjunction with a set of four (4) videotapes to convey the need and applicability of statistical quality control concepts to the shipbuilding industry. The titles of the video tapes are: (1) The Deming Philosophy of Modern Management, (2) Statistical Control Charts, (3) Statistical Techniques for Discrete Random Experiments, (4) Statistical Techniques for Continuous Random Experiments. (129 p.) (Project identified as 9-83-2.)

BENEFIT ANALYSIS: LOW VALUE. 78% of those interviewed were not familiar with this report and had no interest in this material. One person familiar with the report called it "difficult to use and understand". He added that the report "did not make much sense, because it was too advanced". Another person said that he had used some of the material, but that his shipyard had a corporate system that was "a better arrangement".

NSRP 0224 * * * * *

TITLE: European Craft Training: A Trip Report.

AUTHOR: The University of Michigan.

DATE: December 1985

COST: \$28,454.

ABSTRACT: A study was undertaken to identify training methods used to train shipbuilding craftsmen in Northern European countries: the United Kingdom, Sweden, Denmark, and West Germany. Information was gathered through European training literature and on-site inspection of shipyard training centers. It was found that institutional factors such as history of vocational training, educational systems, regulation, and the status of the shipbuilding industry significantly affect training in the shipbuilding industry. (95 p.) (Project identified as 9-84-5.)

BENEFIT ANALYSIS: MIXED VALUE. 44% of those interviewed were not familiar with this report and had no interest in this material. One person said that he was reading it now. One person familiar with the report said that he had "read it extensively and passed it around", although he did not cite any application of this material. One other person who had participated in this study found it a "highly useful endeavor, more from participation than from the information in the report". He added that he was "now familiar with the European models", and said that "good ideas were generated" from his involvement.

NSRP 0225 * *

TITLE: Manufacturing Technology for Shipbuilding - Project Condensation.

AUTHOR: Webb Institute of Naval Architecture. for The University of Michigan.

DATE: February 1986

COST: \$22,077.

ABSTRACT: As part of the government/industry-supported National Research Program (NSRP), a technical evaluation of the operations of Avondale Shipyards, Incorporated (ASI) was performed by consultants from Ishikawajima-Harima Heavy Industries Company. Limited (IHI). in 1980. ASI subsequently implemented four major IHI systems recommended in that evaluation: Accuracy Control. Production Planning, Design Engineering for Zone Outfitting, and Process Lanes. The implementation of these systems has decreased production time and increased productivity, thus materially reducing costs. ASI's experience with these improvements was shared with the shipbuilding community via four seminars held at the shipyard between 1982 and 1984. This report is a condensation of the lecture notes of those seminars. The complete work is available in the NSRP Microfiche Library (refer to NSRP report numbers 0137.0138,0139, and 0140). (176 p.) (Project identified as 9-84-9.)

BENEFIT ANALYSIS: LOW VALUE 2/3 of those interviewed were not familiar with this report and had no interest in this material. One said that this report was published on behalf of another SPC Panel (other than SP-9). One person said that he was reading it now. One person familiar with the report said that some information was "useful, if not directly". Another said that the report "rang no bells".

NSRP 0269 * * * * *

TITLE: Basic Naval Architecture - Instructor Guide and Problem Set.

AUTHOR: Giannotti and Associates for the University of Michigan.

DATE: January 1989

COST: \$46,756.

ABSTRACT: This project is a unique teaching resource for a course in Basic Naval Architecture. It consists of 45 videotapes covering basic topics in naval architecture as well as a 3-volume Instructor Guide and Problem Set containing notes to instructors, suggested lesson plans, problems and solutions. (The Instructor Guide and Problem Set are only available as a part of a total package with the videotapes. For further information, contact the Audio-Visual Material Available for Shipyard Training (AVMAST) Library at the University of Michigan, (313) 763-2465.) (Project identified as 9-84-3.)

BENEFIT ANALYSIS: HIGH VALUE. 44% of those interviewed were not familiar with this project and had no interest in this material. However, this project produced the highest benefit value of all SP-9 reports surveyed. One shipyard representative said that these tapes were purchased for use in his apprentice school, where the material has been used for course development and instruction. Another said that these tapes were purchased by his shipyard, that they were "too boring for direct use". but that they had been used for instructor preparation. Another shipyard representative called these tapes "excellent". He added that some parts of the tapes were used by his Design Division. He said that these tapes had "paid for his involvement with SP-9", as he got two sets of the tapes free of charge. He felt that the keywords in the Bibliography were not accurate, however, as computer-aided activities are not a big part of the tapes.

NSRP 0289 * * * * *

TITLE: Ship Production.

AUTHOR: R.L. Storch, C.P. Hammon. and H.M. Bunch.

DATE: January 1988

COST: \$104.608.

ABSTRACT: This book describes the principles and practices of ship production employing state-of-the-art group technology. Topics covered include shipbuilding management theory; product-oriented work breakdown structure: manufacturing and construction processes; shipyard layout; planning, scheduling, and production control: accuracy control; and ship conversion, overhaul, and repair. While the overall system described by the book is not likely to reflect practice in any one shipyard, it presents a unified shipbuilding system from which understanding of the total process can be obtained. (Note: This book is available from the above address in microfiche format only. Hard copies of the book may be purchased from the publisher: Cornell Maritime Press, P.O. Box 456, Centreville, MD 21617.) (Project identified as 9-82--4 plus 9-83-3.)

BENEFIT ANALYSIS : MIXED VALUE. 22% of those interviewed were not familiar with this book and had no interest in this material. One person said that he was reading it now. 1/3 of those interviewed were familiar with the book but did not cite any application of the material. One shipyard representative said that the book had been used at the University of New Orleans, but "more as a reference than as a text". Another person said that there was "not much use of it in the shipyard world". Another person said that his shipyard "has purchased many copies, which have been given to management trainees" Another person said that the book had been "used not literally. but generally". No other textbook was available on this subject when the project was sponsored.

NSRP 0290 * * *

TITLE: Writing Shipyard Reports.

AUTHOR: J. C. Mathes and Dwight W. Stevenson.

DATE: January 1989

COST: \$48,376.

ABSTRACT: Written communication is extremely important in increasing shipyard efficiency. However, written communication can reduce productivity because reports take time to write and to read. Writing Shipyard Reports is intended to help shipyard managers, engineers, and other professionals to write and prepare reports in a more efficient manner. This manual is divided into two sections. The first section is a text for use with an in-house course in report writing; the second section is reference information for use in writing reports - checklists, guidelines, and sample reports. This manual was written after extensive interviews with shipyard managers, engineers, and other professionals and specifically addresses their concerns. An accompanying Training Instructor's Guide provides a framework for training instructors in U.S. shipyards to use in developing a course to improve the written communication skills of shipyard professionals. (61 p.) (Project identified as 9-84-4.)

BENEFIT ANALYSIS: LOW VALUE. 44% of those interviewed were not familiar with this report and had no interest in this material. Another 44% were familiar with the report, but cited no application of this material. One said that his corporation already had a course on this subject that his people attend. One shipyard representative said that "some pieces were good", that the material had been applied on a limited scale, and might be applied again in the future. Another said that the report was "lousy, and not worth the money". A third shipyard representative said that "it was a mistake to get into this project. It was poorly earned out. This was not a good project for SP-9 to promote. There was enough of this material on the shelf already." He added that "SP-9 should aim at shipyard needs not covered elsewhere".

NSRP 0334 * * * * *

TITLE: Recommendations on the Use of Interactive Instruction for Training Shipyard Trade Skills

AUTHOR: Richard Cooper

DATE: June 1991

COST: (Not available)

ABSTRACT *This is an overview* of interactive instruction, including its applications and cost-effectiveness: (1) describes the characteristics of shipyard trade training; (2) identifies commercial interactive courseware applicable to trade training; (3) discusses the potential use of authoring systems by shipyards; (4) provides guidance for the integration of interactive instruction into existing shipyard training programs; and (5) concludes with detailed recommendations for the development of a two-lesson demonstration of interactive instruction for trade training to be presented to shipyard management and trailing personnel. (31 p.)

BENEFIT ANALYSIS: MIXED VALUE. Only one person interviewed was not familiar with this report and not interested in this material. 1/3 of those interviewed were familiar with the report but cited no application of the material. One person said that application was currently being planned. The remaining 44% said that the material had been applied on a limited scale, and that it might be applied again in the near future. Comments on this report suggested that this material was most useful to the larger private shipyards, and that it fits under the present SPC initiatives. It was intended for the shipyards "not up to speed" in order to advance the concept of interactive instruction as it was being used by some shipyards. Its value may be in how interactive training can save time. One shipyard representative was not so complimentary, however. He said that this project was "nearly a waste of time". that it "got off the track" and "became a description of what the technology was, rather than what is being used". He added that it "missed the mark, and became a lot less usable, that it was "too generalized", and that it "should have focused on the few items that were good and useful".

MANAGEMENT OF SPC PANEL SP-9 ACTIVITIES

General Discussion

This section describes the opinions of those interviewed relative to the administration of SPC Panel SP-9 meetings, including such things as the use of pre-planned agenda, the actual format for a meeting, who should attend, how often a meeting should be held and under what circumstances (e.g., during the same time frame as the meeting of another SPC Panel, or an NSRP Symposium), what matters should/should not be discussed, how meeting minutes should be handled, and similar considerations that bear on the mechanics of the panel meeting itself. It also describes the thoughts of those interviewed on how the NSRP can be of more assistance to them, what projects should be prosecuted, and in general what message they would like to have transmitted back to Panel SP-9.

The discussions that produced these opinions were open and serious. Each person interviewed was anxious to offer a position on the matter at hand. The persons interviewed constitute the core of Panel SP-9 as it is known today, and so their feelings are surely important to the future well-being of the Panel and its activities.

On the following page is a matrix showing SPC Panel SP-9 Meeting Attendees for the 10 most recent meetings. This matrix reveals which shipyards and other activities have been supporting SP-9 by having a representative in attendance at these meetings. The date and location of each meeting is indicated, along with the company affiliation of those in attendance. Note that 41% of these companies have had a representative at three at more of these meetings.

Attendee Affiliation	Date - Location									
	Feb '89 - Ann Arbor, MI	Sep '89 - Arlington, VA	Feb '90 - Miami, FL	Aug '90 - Milwaukee, WI	Feb '91 - Charleston, SC	Sep '91 - San Diego, CA	Nov '91 - New Orleans, LA	Feb '92 - Honolulu, HI	Oct '92 - Bath, ME	Mar '93 - Vallejo, CA
ARKHON									X	X
Atlantic Marine										X
Bath Iron Works	X	X	X	X	X	X	X		X	X
Bethlehem Steel Corp. - SP					X		X			X
Charleston NSY	X	X		X	X		X			
Corporate Comics		X								
Dannemiller Tyson						X				
DTRC (NSWC - Carderock)	X	X	X	X	X	X	X	X		
GD/EB Div.									X	
Ingalls Shipbuilding Div.	X	X								
JJG Associates						X				
Lamar University at Orange									X	X
Managing Change, Inc.		X	X		X	X	X			
Mare Island NSY						X				X
Maritime Administration, U. S. DoT		X				X				X
Mississippi State U.		X		X	X	X	X	X		
MIT						X				
NASSCO		X	X	X	X	X	X	X	X	X
NavSea	X	X	X	X	X	X	X	X	X	X
Navy Postgraduate School						X				
Newport News Shipbuilding	X				X	X	X		X	X
Norfolk NSY	X	X	X	X			X			
Omnibus Services						X				
Pearl Harbor NSY	X	X	X			X		X		
Peterson Builders, Inc.		X	X	X					X	
Philadelphia NSY		X		X						
Portsmouth NSY					X				X	X
R-P-M and Associates, Inc.				X						
S.E.A. Inc.		X								
San Francisco S/Ys Training Center										X
Ship Analytics					X	X				
SNAME				X						
Tidewater Community College		X								
U. Michigan	X	X	X	X	X	X	X	X	X	X
U. Newcastle		X								
U. Washington		X				X		X		
U.S.C.G.		X								
Versatile Pacific Shipyards			X							
Wilkins Enterprise, Inc.		X				X				

Meeting Attendees
SPC Panel SP-9
Education and Training

Detailed Discussion of Findings

The responses are summarized under the headings of each question, following the order and language of the worksheet, Appendix B, that was used during the interviews.

PANEL MEETINGS AND ADMINISTRATION

How often do you attend?

44% of those interviewed attended all of the meetings. 33% of those interviewed attended 1 or 2 meetings each year. Two interviewees had attended a meeting several years ago.

Do/should others in your Company attend?

77% answered the question in the negative, indicating that their solo attendance should be continued. The rest offered no response.

Are the meetings of value to you?

67% answered this question favorably. One shipyard representative said “no”, adding that the meetings were “too lofty, and too academic”. He added that he “felt out of place”. He went on to explain that “they (the academics) wanted the shipyards present so that they could inform them of what they were going to do. The academics did all of the talking. The shipyards were not comfortable”. The rest offered no response to this question.

How can the meetings be improved? In particular,

Increase/decrease number of meeting days?

67% felt that the present meeting arrangement of 2 days / 2 days / 1 day, for the three meetings per year, should be continued. 1 interviewee felt that 1-1/2 day was adequate for the two longer meetings per year. The rest offered no opinions.

Continue/change meeting format?

While 44% said that no changes were needed, and 22% voiced no opinion, there were three specific comments on this matter, as follows:

1. The meetings should avoid domination by academics;
2. The meetings need a better focus
3. More meeting preparation is needed.

Continue/change content of meeting?

Responses to this question indicated satisfaction with the present meeting content, although one person suggested that the meetings should have more input on training needs.

Broaden/restrict who should attend?

33% of those interviewed found the present mix of attendees to be satisfactory. One person felt that SP-9 members should attend the meetings of other SPC Panels. There were three comments on increasing the attendees at SP-9 Panel meetings, as follows:

1. More representatives from shipyards (comment made by two different people);
2. More representatives from smaller shipyards;
3. More representatives from private shipyards;

What should be added to the agenda?

Those responding to this question said that “nothing” should be added to the agenda.

What should be dropped from the agenda?

The consensus here also was that “nothing” should be dropped from the agenda.

Should meetings be held in conjunction with other organizations?

89% of those interviewed said that holding a meeting in conjunction with other SPC Panels, or during the same time frame as a related technical/NSRP symposium, would be worthwhile, and would assist some potential attendees in their efforts to obtain approval of the associated travel expenses. 2 of these interviewees said that this practice should not be done regularly for every meeting, however. One person favored having SP-9 members attend the meetings of other SPC Panels since training needs are identified by these other Panels. He added that this situation was peculiar to Panel SP-9, in that this Panel meets the needs of others rather than themselves.

Are meeting minutes of value to you?

22% answered “yes”, and 11% said “no”. Three specific comments were made in response to this question, as follows:

1. Minutes need to be taken and published by the same staff person each time;
2. Minutes need to be issued sooner (comment made by two different people);
3. Shorter minutes would be preferred.

How can the NSRP be of more assistance to your company?

This question prompted a series of comments which reflect some serious difficulties with the NSRP in general. These comments also illustrate serious and deep concerns on the part of those interviewed for the future of the NSRP and the shipyard industry. These comments are summarized below:

- Training is a support function, and not a stand-alone function. SP-9 should go out to shipyard people and ask them about their needs. Then we can setup to train accordingly. We should structure according to the best way to provide each type of training. We need: (1) documentation, which is self sustaining; (2) research in the delivery of training (specifically rejected by the ECB); and (3) support and service in accordance with shipyard needs.
- SP-9 could support the other Panels by having a representative in each Panel to provide assistance with the training needs of that Panel.
- We should first find out what the NSRP should be doing. Then when this answer is available, we can propose ways to do it. This may be the key to fixing the NSRP. We rush to solutions before we know the problem. There is a disciplined way to approach this question. The root of the problem is that we do not know what our goal really is.
- You cannot ask people to cooperate and compete at the same time. If you want them to compete, there must be a reward - which does not always occur in a competitive atmosphere. Synergism is better than competition for the NSRP.
- We should hold a common meeting of all Panels at one time, once every three years. This might prove to be useful. Even if it breaks down into a social experience, that is not bad either.
- From a shipyard perspective, standardizing approaches to doing work processes is a good focus for the NSRP. Exchange of information is the asset. This would mean that training would be less expensive because it is all the same training.
- The AVMAST Library is already a sizable contribution to the NSRP.
- Establish a central focus at our shipyard for NSRP reports and information. Give a 5-minute presentation on this material to the shipyard managers at one of their regular meetings, and do it often enough to keep them tuned in.
- We need more communication with the ECB.
- Shipyards need to organize themselves internally. They need to talk to their own people and management.

- We need good benchmarking information on national and international competition. We need to know how they are organized, what production techniques are being used, and what labor productivity they are achieving. We need a comparison in the area of labor and material costs, and productivity levels. We need to look at training expenditures as a % of payroll, and as a % of sales. We need to know what kind of training is going on, and how it is related to the broader initiatives within their organizations.
- We should document what is happening to the shipyard industry, including the barriers to our competitive posture (subsidies). We need to document the decline of the U. S. Merchant Marine with its effect on our industrial base and national emergencies. We should record the effect of the decline of shipbuilding on regional and national economies. This should include the impact on the Country - economic issues, national security issues, loss of high skill/high wage jobs, the impact of losing apprentice programs on younger workers. We need a real assessment of the decline and its effects.
- ✗ To not publish and study the ISIS (Infrastructure Study In Shipbuilding) findings is helping to continue the problem. We were denied a competitive position in the electronics industry through ignorance. So it is with our future shipbuilding opportunities.
- I We need either an aggressive Government building program, or a level playing field in the international commercial market. Without one or the other, we are done for! The NSRP might provide some help here.
- I Even SNAME should be sensitive to finding ways to stem the ebb tide of employment opportunities for Naval Architects and Marine Engineers, despite the fact that the issues involved may not be technical ones. Even the name might suggest a dead discipline. There is more to it than technical preparation.
- I Shipyard owners realize that they cannot balance a 6000 person repair effort with a \$25M/yr investment in facilities and equipment. It does not balance. We should & industry leaders what they need, and how we can provide it through the NSRP.

What Projects would you like to see carried out?

56% of those interviewed had specific comments on this question, as follows:

- We should literally do a cost/benefit analysis in dollars and cents on the value of doing training. we should look to Europe for a checkpoint. The work force, management, and engineers should all be contributors.
- We need basic skills material for shipyard training, not only textbooks and management training.
- The base is there (SP-9), but we need other people involved to determine which projects would help them.

- We might look at projects of use to segments of the industry, rather than the whole industry. Our efforts to make them generally useful might render the projects less useful to all. We may need to target the projects.
- We need more on supervisory and management training, which should tie in with the new management styles designed to make us competitive - TQM/ISO 9000/etc.

Do you have on-going NSRP Projects?

The responses to this question were all negative, except for one shipyard representative who was making regular contributions to the AVMAST Library.

What problem areas would you like to see investigated?

This question was quite similar to the earlier one that asked “What Projects would you like to see earned out?”, but prompted a few rather different responses, as follows:

- Developing curriculum for basic trade skills training. We need a directory-type collection of ideas for developing in-house training programs, not a cut-and-dried fixed prescription.
- Apprentice training in Naval Shipyards needs help. Fundamental training of skilled labor is slow and expensive. There must be better ways, and information that can be shared. The big needs are not being addressed - you do not get much for \$ 100K. There is no long-term emphasis in the NSRP, and the chances of (project) approval are low.

What message would you like transmitted to this Panel?

This question was added to the list so that the people being interviewed could have a direct voice back to the Panel, anonymously, on any point that they might wish to raise. Some comments were favorable, and some not so favorable. Responses were as follows:

- SP-9 has a credibility problem with the ECB. Only a very few projects have been approved, SP-9 is not hardware oriented, and so has a hard time communicating the value of their initiatives to the ECB.
- SP-9 needs to support the transition to the international commercial market. Training will be an important part, but will require a better alignment with the needs of the shipyards - at a lower level than previously. More shipyards, and more people, need to be involved.
- Project abstracts are weak, because there is not enough discussion of the details so that the attendees can contribute to the content. The whole effort is done “off-the-cuff”, rather than thoughtfully and in depth.
- “Soft” items should receive consideration for projects as much as the ones that have a “bang for the buck”.

- Ally member can propose a project, and all projects are openly discussed. I feel that there is no problem in advancing a project, and that the selection process reflects the consensus of the group.

PROJECT REPORTS AND NSRP INFORMATION

Do you receive adequate information on NSRP Project Reports?

89% of those interviewed answered “Yes”.

Do you get the “Yellow Book” NSRP Bibliography of Publications?

Here 100% of those interviewed answered “Yes”.

Have you ever ordered a Report from the NSRP Library?

78% of those interviewed said that they had ordered a publication personally, and that the items had been received without difficulty. It is clear that the procedure for obtaining project reports and training materials from the NSRP Library is working satisfactorily.

Is the NSRP Newsletter of value to you?

78% of those interviewed answered this question in the affirmative, and 22% answered in the negative. Three people asked to have their names added to the mailing list for the Newsletter, which is a favorable indication that they feel the Newsletter has the potential of being useful to them.

How can NSRP information be communicated more effectively?

Since it was apparent at the beginning of this Project that communications were a major weakness of the NSRP, this question was added to explore with those interviewed how improvements might be made. Responses to this question were as follows:

- Why not have a contest, with a prize to the shipyard with the best recognition program!
- ▼ Maybe newspaper articles can help. The new NSRP tape and brochure are good.
- There is a general problem with communications, and it exists at our shipyard. We have about 10% of our people on the distribution list for the Ship Production Journal, and we should have more. Our technical library is defunct - it was eliminated as a cost saver 10 years ago - and so many people do not know what is available. At least we should have all NSRP information in a single area where people have some chance of finding it.
- One answer is a shipyard NSRP User’s Group. Also, we must get senior management on board.

- The NSRP Newsletter is the best way, but we should attach a fill report on something now and then, saying that this is representative of what is in the library and what we produce.
- A video newsletter probably would not be a good medium - you cannot pass it around easily. Perhaps a video tape or computer disk at the (Naval Shipyard) Commanding Officer's Conference, but not on-going.
- An article offered to our shipyard newspaper would be considered for publication. This might be a workable idea.
- The value of a brochure is dependent on the distribution of it.
- The NSRP film is excellent. We need to expand the distribution of the video tape and the brochure.
- Internally the NSRP needs more combined Panel meetings. Once a year we should have all Panels meet together. Regulatory bodies need to be included. along with the USCG, ABS, ISO, Lloyds US, etc. Maybe the NSRP Newsletter should be used to get this done.

We should present information on the application of NSRP research, with the benefits derived from it. We should personalize it more. Use an interview format with a member of the industry, or a case study of what advantages have been gained from the NSRP.

- We were told that Ship Production Journal articles must be first-time papers. However, 85% of the items contributed by the INSRP have already been published.
- The Chairman of the SPC put a synopsis of the past year's NSRP accomplishments in the Marine Technology publication, which has 10,000 recipients. He could do the same thing with ASNE (American Society of Naval Engineers). ASNE may not want to publish what SNAME has published, but one year it could go to SNAME and the next year to ASNE. On the negative side, ASNE may be too military-oriented for the NSRP, particularly with the present focus on the international commercial market. Flyers for the Ship Production Symposium go to the whole SNAME mailing list. Marine Technology then simply has a quick announcement with no details. The T&R Committee of SNAME is supposed to do the overall coordinating of the technical committees, but they do not do it. Now there are discussions about setting up another group to do it.

Would you prefer to have a single point of contact within your company for information on meetings, availability of NSRP reports on projects, and other NSRP matters?

This question was included on the list to suggest the idea of a single point of contact to those who have not as yet tried it. It would also provide some feedback from those who have attempted this idea in their shipyard. Responses were all positive. One person commented that this idea was good from the standpoint of communications, that it accommodates changes in personnel assignments, and that it is good for internal purposes to determine the value received from the NSRP.

What person in your company would best serve as this point of contact?

This follow-up question prompted the suggestions that it should be the NSRP User's Group leader if one exists, the NSRP Program Manager if one is located in that shipyard, or the Industrial Engineering area which has been found to be a satisfactory point of contact in several shipyards.

CONCLUSIONS FROM THE FINDINGS

Analysis of the responses offered by those interviewed suggests the following conclusions on matters of interest to SPC Panel SP-9.

Those Associated with the Benefits derived from Project Reports

1. The projects yielding the MOST benefit value were those offering direct shipyard application.
2. The projects involving academic assessments of certain areas and techniques, conducted in anticipation of shipyard community interest, have yielded low benefit value.

Those Associated with the Suitability of Panel Meeting Administration

3. The present administration of Panel Meetings is quite satisfactory.
4. Several specific points are pertinent:
 - A. Meetings of 2 days/2 days/1 day duration, three times per year, at varying locations, are favored. The 2 day sessions might be shortened to 1-1/2 days in length.
 - B. The present meeting format and content have been satisfactory and should be continued. However, there is a need for:
 - Avoiding domination by academics;
 - Providing a better focus to the meetings;
 - Providing more preparation in advance of each meeting;
 - Providing more input on training needs.
 - C. The present mix of attendees is satisfactory. However, the addition of more shipyard people, particularly from small shipyards and from private shipyards, is clearly needed and should be beneficial to meeting deliberations.
 - D. Meeting agendas have been satisfactory.
 - E. A meeting in conjunction with another SPC Panel or a technical symposium would assist some attendees in justifying their attendance and obtaining travel approval.
 - F. Meeting minutes taken and published by the same staff person each time are preferred. In addition, minutes should be shorter, and should be published sooner.

Those associated with the Administration of Project Reports and Information

5. Panel members are receiving adequate information on NSRP project reports.
6. The NSRP Bibliography of Publications has been available to those who need it.
7. The procedure for obtaining project reports and training materials from the NSRP Library has been working satisfactorily.
8. The NSRP Newsletter has been mostly satisfactory, with a few people desiring to be included on the mailing list.
9. A single point of contact within a shipyard for obtaining information on NSRP matters would be helpful.

Those associated with NSRP matters in general

10. Communications between the Panel members and the ECB have been weak.
11. Attendance by SP-9 Panel members at meetings of other SPC Panels would help in identifying the training needs of those Panels, and thereby provide a better focus for SP-9 Panel meeting deliberations.
12. The NSRP needs a clear definition of its goals and intentions, so that the SPC Panels can propose ways to satisfy them.
13. International shipyard benchmarking is needed, particularly in training areas.
14. In summary, SPC Panel SP-9 is active, well supported by the academic community, less effectively supported by the shipyard community, and has contributed to the National Shipbuilding Research Program in behalf of the shipyard community in general, and the Education and Training area in particular.

RECOMMENDATIONS FROM THE CONCLUSIONS

The following recommendations have been drawn from the conclusions.

Those Associated with Panel Projects

1. The voting members of Panel SP-9 should weigh the potential for shipyard implementation of each proposed project, and temper their decisions accordingly. Workshops and other interactive opportunities should receive serious consideration. Academic studies offering little practical application in shipyard production or operations areas should have other redeeming features of major proportions before they are supported.

Those Associated with Panel Meeting Administration

2. The present practices for Panel meetings should be continued, with only minor adjustments (see page 24 under Conclusions for a discussion of several pertinent points).

Those Associated with the Administration of Project Reports and Information

3. The distribution of project reports to shipyard people outside of the Education and Training area, specifically to production and operations people, should be encouraged.

4. Extension of the NSRP Newsletter to a broader distribution, and the introduction of timely feature articles of interest to most readers, should be supported.

5. The idea of establishing of a single point of contact within each shipyard for NSRP information should be developed and implemented. `

Those Associated with NSRP Matters in General

6. The area of communications between the ECB and Panel members should be studied, and improvements should be effected as soon as possible.

7. SP-9 Panel members should maximize their attendance and involvements at meetings of the other SPC Panels in order to identify and be able to respond to the education and training needs of all NSRP participants, especially shipyards.

8. Establishment of clear goals and intentions for the NSRP should be supported.

9. International shipyard benchmarking should be pursued, particularly in training areas.

APPENDIX A

Project Benefit Analysis Worksheet

SPC Panel SP-9

SP-9 PROJECTS LISTING

NSRP	KEY	REMARKS
0170	Social Technologies in Shipbuilding Workshop - Proceedings 1983	
0180	The Status of Skilled Trades Training in U.S. Shipyards 1983	
0181	A Directory of Skilled Trades Training Courses and Training Aids in U.S. Shipyards 1983	
0192	Curricular Needs of Shipyard Professions 1984	
0198	Evaluation of Two Multi-Shipyard Cooperative Apprentice Training Programs 1985	
0216	Human Resource Innovation in Shipbuilding and Ship Repair - Workshop Proceedings 1985	
0219	Engineering for Ship Production 1986	
0223	Statistical Analysis of Data and Quality Assurance for the Shipbuilding Industry - Tutorial and Workbook 1985	

NSRP	SP-9 KEY	REMARKS
0224 European Craft Training: A Trip Report 1985		
0225 Manufacturing Technology for Shipbuilding - Project Condensation 1986		
0269 Basic Naval Architecture - Instructor Guide and Problem Set (45 videotapes) 1989		
0289 Ship Production (Textbook) 1988		
0290 Writing Shipyard Reports 1989		
0334 Recommendations on the Use of Interactive Instruction for Training Shipyard Trade Skills Jun 1991		

KEY RATING DESCRIPTION

0	No knowledge / no interest
1	Interested; will look at information
2	Have information; considering it
3	Have studied information; no application intended
4	Information looks useful; application planned
5	Applied once; no further application seen
6	Have applied on limited scale; may apply again
7	Have applied substantially information useful
8	Constant application on-going; information valuable
9	Need more information; wider application

RATING SYSTEM FOR NSRP PROJECTS EVALUATION

APPENDIX B

**SPC Panel Meeting
Management and Administration**

Questionnaire/Worksheet

NATIONAL SHIPBUILDING RESEARCH PROGRAM
+ + +
PROJECT BENEFIT ANALYSIS
and
EVALUATION OF PANEL MEETINGS AND ADMINISTRATION
+ + +
INTERVIEW QUESTIONNAIRE

Date _____

Shipyard Coded Identity _____

(Note: Shipyard identity will not be revealed in the published report.)

Shipyard/Company Name _____
Location / Address _____

Persons Contacted _____	_____
Position/Title _____	_____
Mailing Address _____	_____
Telephone _____	_____
Panel Interest _____	_____

Shipyard / Company Size (#) _____ Production Workers (#) _____

Ship Types _____

New Construction (Y/N) _____ Repair (Y/N) _____ Union (Y/N) _____

Current Workload Size _____

Remarks _____

QUESTIONNAIRE

Panel S P - _____

Name _____ Company _____ Date _____

PANEL MEETINGS AND ADMINISTRATION

How often do you attend _____

Do/should others in your Company attend _____

Are the meetings of value to you _____

How can the meetings be improved _____

Increase/decrease number of meeting days _____

Continue/change meeting format _____

Continue/change content of meeting _____

Broaden/restrict who can attend _____

What should be added to the agenda _____

What should be dropped from the agenda _____

Should meeting be held in conjunction with other
organizations _____

Are meeting minutes of value to you _____

How can the NSRP be of more assistance to your company _____

What Projects would YOU like to see carried out _____

Do you have on-going NSRP Projects (identify) _____

What would you like to see investigated - problem areas _____

What message would you like transmitted to this Panel _____

PROJECT REPORTS AND NSRP INFORMATION

Do you receive adequate information on NSRP Project Reports _____

Do you get the 'Yellow Book' NSRP Bibliography of Publications _____

Have you ever ordered a Report from the NSRP Library _____

Is the NSRP Newsletter of value to you _____

How can NSRP information be communicated more effectively _____

Would you prefer to have a single point of contact within your company for information on meetings, availability of NSRP reports on projects, and other NSRP matters? _____

What person in your company would serve best as this point of

APPENDIX C

SPC Panel SP-9 Projects Listing based on Benefits Evaluation

APPENDIX C

SPC Panel SP-9 Projects Listing based on Benefits Evaluation

This is an abbreviated listing of SPC Panel SP-9 projects, based on the benefit value (number of *'s) assigned to each project, highest to lowest. This listing is included as an aid to understanding which types of projects were found to be of most (and least) interest and value to the using community, based on the user comments received during this survey.

NSRP 0269 * * * * *

TITLE: Basic Naval Architecture - Instructor Guide and Problem Set.

AUTHOR: Giannotti and Associates for the University of Michigan.

DATE: January 1989

COST: \$46,756.

NSRP 0289 * * * * *

TITLE: Ship Production.

AUTHOR: R.L. Storch, C.P. Hamrnon, and H.M. Bunch.

DATE: January 1988

COST: \$104,608.

NSRP 0334 * * * * *

TITLE: Recommendations on the Use of Interactive Instruction for Training Shipyard Trade Skills

AUTHOR: Richard Cooper

DATE: June 1991

COST: (Not available)

NSRP 0224 * * * * *

TITLE: European Craft Training: A Trip Report.

A UZHOR: The University of Michigan.

DATE: December 1985

COST: \$28,454.

NSRP 0181 * * * *

TITLE: A Directory of Skilled Trades Training Courses and Training Aids in U.S. Shipyards.

AUTHOR: **Institute of Applied Technology**, for The University of Michigan.

DATE: December 1983

COST: \$25,000.

NSRP 0216 * * * *

TITLE: **Human Resource Innovation in Shipbuilding and Ship Repair - Workshop Proceedings.**

AUTHOR: The University of Michigan.

DATE: May 1985

COST: (Not available)

NSRP 0219 * * * *

TITLE: Engineering for Ship Production.

AUTHOR: Thomas Lamb, for The University of Michigan.

DATE: January 1986

COST: \$20,477.

NSRP 0198 * * *

TITLE: Evaluation of Two Multi-Shipyards Cooperative Apprentice Training Programs.

AUTHOR: Data Design Laboratories/ Onmi Engineering, for The University of Michigan.

DATE: March 1985

COST: \$40,000.

NSRP 0290 * * *

TITLE: **Writing Shipyard Reports.**

AUTHOR: J. C. Mathes and Dwight W. Stevenson.

DATE: January 1989

COST: \$48,376.

NSRP 0180 * *

TITLE: The Status of Skilled Trades Training in U.S. Shipyards.

AUTHOR: Institute of Applied Technology for The University of Michigan.

DATE: December 1983

COST: \$20,000.

NSRP 0223 * *

TITLE: Statistical Analysis of Data and Quality Assurance for the Shipbuilding Industry
Tutorial and Workbook

AUTHOR: University of Massachusetts, for The University of Michigan

DATE: September 1985

COST: \$50,000.

NSRP 0225 **

TITLE: Manufacturing Technology for Shipbuilding - Project Condensation.

AUTHOR: Webb Institute of Naval Architecture, for The University of Michigan.

DATE: February 1986

COST: \$22,077.

NSRP 0170 *

TITLE: Social Technologies in Shipbuilding Workshop. Proceedings.

AUTHOR: University of Michigan.

DATE: May 1983

COST: \$40,000.

NSRP 0192 *

TITLE: Curricular Needs of Shipyard Professionals.

AUTHOR: The University of Michigan.

DATE: June 1984

COST: \$30,000.

Additional copies of this report can be obtained from the National Shipbuilding Research Program Coordinator of the Bibliography of Publications and Microfiche Index. You can call or write to the address or phone number listed below.

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