JULY 1987

NSRP #0279

THE NATIONAL SHIPBUILDING RESEARCH PROGRAM

ANALYSIS OF CURRENT MANPOWER ESTIMATING AND CONTROL PROCEDURES

U.S. DEPARTMENT OF TRANSPORTATION
Maritime Administration
& U.S. NAVY

in cooperation with
National Steel and Shipbuilding Company
San Diego, California

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
30 JUN 1987	**N/A**	**-**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
The National Shipbuilding Research Program, Analysis of Current Manpower Estimating and Control Procedures	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 Tools Building 192 Room 128 9500 MacArthur Blvd Bethesda, MD 20817-5700**	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	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**SAR**	**35**	

FINAL REPORT

TASK EC-25

ANALYSIS OF CURRENT MANPOWER ESTIMATING AND CONTROL PROCEDURES

Prepared by
Robinson-Page-McDonough and Associates, Inc.
Post Office Box 9
Greenland, New Hampshire 03840
(603) 436-7762

For
SNAME Ship Production Committee
Industrial Engineering Panel SP-8

Under The
National Shipbuilding Research Program

July 1987

PREFACE

The National Shipbuilding Research Program is sponsored by the Maritime Administration, United States Department of Transportation, and by the United States Navy toward improving productivity in shipbuilding.

The Task reported herein is a survey and analysis of the procedures currently being used by the shipbuilding industry for estimating and controlling shipyard manpower. A somewhat similar survey was conducted in 1976, forming the basis of activities sponsored by SNAME Ship Production Committee Panel SP-8 during the past ten years. Since the initial survey, changes in technology, philosophy, and market conditions have occurred which have had a major impact on shipbuilding in this country. In order to set the direction for future SP-8 efforts in this area, an assessment of methods now being employed or under development was deemed appropriate, hence this Task.

The project was conducted by Rodney A. Robinson, Vice President of Robinson-Page-McDonough and Associates, Inc. Nineteen shipyards were visited for personal interviews with managers actively involved in appropriate matters of interest. The work began in August 1986, and was completed in July 1987.

EXECUTIVE SUMMARY

We often need to step back from everyday activities and think about where we are and where we are going. We should not allow ourselves to become so enamoured with the leaf on any one tree that we loose sight of where the forest is going. So it is with shipbuilding. We need on occasion to study where we are, what the industry sees for problem areas, and how our own operation fits into the community spectrum.

This Task reports on the present situation in shipyards as regards procedures for estimating and controlling manpower, the largest and most expensive resource in this industry. Results are grouped by shipyard size, to help in relating conditions to your own case. Included also is a section that presents the feelings of shipyard managers on several topics of importance.

Overall, the survey suggests that the main concern in shipyards is for improving the capability for planning and scheduling work, and for controlling the productive process. Closely related and, indeed, vital to success, is the collection, analysis, and display of certain information about shipyard operations and the performance of the workers. Not surprisingly, the concerns of the larger shipyards are not so different from those of the smaller and midsize activities.

The common interests of those in the shipbuilding community argue strongly for a concerted and cooperative effort to upgrade the whole industry. The National Shipbuilding Research Program offers just such an opportunity for participating shipyards. This Task, performed under sponsorship of SNAME Ship Production Committee Panel SP-8 on Industrial Engineering, should help to illuminate areas for future consideration.

TABLE OF CONTENTS

FINAL REPORT
Task EC-25
Analysis of Current Manpower Estimating and Control Procedures

1.0 BACKGROUND

This Task was proposed on 20 February 1986 as an investigation into the methods currently in use within the United States shipbuilding industry to estimate and control manpower utilization within commercial and Government shipyards.

A survey would be conducted through personal contact with shipyard managers to gain answers to certain questions, Appendix A, related to manpower estimating and control procedures. The survey and data analysis would be designed to assist the members of SNAME Panel SP-8 in setting the direction for future National Shipbuilding Research Program (NSRP) efforts in this area. A representative group of shipyards in each size bracket would be contacted and asked to participate in the survey. Particular attention would be directed at the use of labor standards for labor estimating and for shop loading. Those shipyards willing to participate would be kept anonymous, in order to maximize the probability of obtaining cooperation from contributing shipyard managers.

A similar survey was conducted in 1976 for SP-8. This latest Survey would provide a measure of the progress made during the past' ten years in getting industrial engineering techniques installed in the shipyard community.

2.0 OVERVIEW

The Task was initiated on 19 August 1986 and was completed on 29 July 1987. Nineteen shipyards were visited, as follows:

3 - very small - less than 250 people
5 - small - 250 to 1000 people
5 - medium - 1000 to 5000 people
6 - large - over 5000 people

All geographical areas of the United States were included in the survey, which included 5 on the East coast, 4 on the Gulf coast, 7 on the West coast, and 3 on the Great Lakes. Each shipyard visited was clearly interested in the investigation, and supported the survey completely. The only exception to this situation was one shipyard (which would have been the 20th) where unexpected last-minute internal circumstances arose in that shipyard which made it impossible for the managers involved to meet with the surveyor, who was already at their gate! Nevertheless, the cooperation received from the shipyards visited was truly outstanding, and is a most favorable commentary on the general feelings of the shipyard community toward this sort of effort.

The usual pattern to the visits was to contact the shipyard via the SP-8 representative, if there was one, or through some earlier acquaintance of the surveyor if at all possible. Otherwise, the senior person at the shipyard was called directly. Once the visit was accepted, specific arrangements were made for a one-day discussion with appropriate managers in the areas of interest.

The survey questions, Appendix A, were covered in most cases. In addition, the opportunity was presented for the shipyard managers to speak on any related subject as they might wish. Most knew about SNAME Panel SP-8., although several had no knowledge about the specific projects/reports sponsored by the Panel. A few of those contacted had no knowledge whatsoever about the NSRP in general, or Panel SP-8 *in* particular, and their efforts to improve the productivity of the shipbuilding industry. This is a deplorable reflection on the public relations effectiveness of the Panel, if not that of the NSRP as well.

After each shipyard visit, the information gathered was assembled, sorted, and made ready for analysis in concert with similar information from the other shipyards. Once all visits were concluded, the data array which follows *was* assembled and analyzed. In addition, specific comments from various managers have been included in the dialog below. One particular need was expressed repeatedly, it being the need for improved tools for use in predicting the real time needed for work accomplishment at the work package level. SP-8 has explored this area three times to date, finding that the use of scheduling standards can be of considerable assistance in making credible predictions of this type. These predictions can greatly assist in the development of improved procedures and techniques for planning and scheduling production work whether new construction or repair/overhaul in nature. The surveyor has forwarded copies of earlier related SP-8 reports to several of the shipyard managers who expressed interest in them.

3.0 DETAILED DISCUSSION OF THE TASK RESULTS

Findings from the survey are discussed below in detail. For purposes of placing the shipyards into comparable groups for analysis, the following size divisions were used:

Group 1 - Very small shipyards of under 250 people
Group 2 - Small shipyards of from 250 to 1000 people
Group 3 - Medium sized shipyards of from 1000 to 5000 people
Group 4 - Large shipyards of over 5000 people

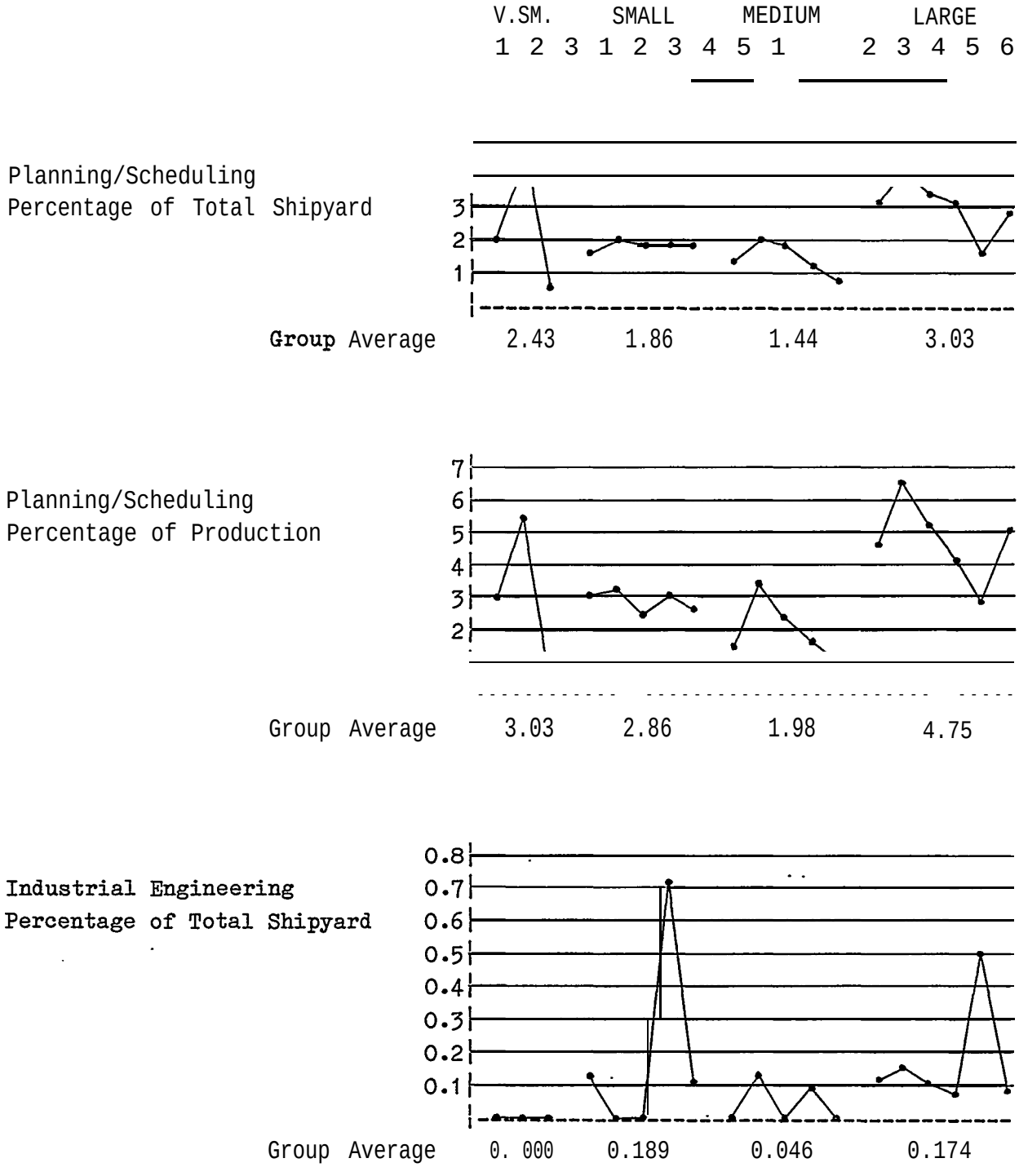
Throughout the data which follows, the identity of each shipyard is consistent. That is, small shipyard No. 2 is the same one throughout the body of the report. Although some shipyard readers will undoubtedly recognize their own shipyard, the anonymity of the information sources to others should be preserved. Indeed, the specific identity of any one shipyard is not important to the use of the information contained herein. Rather, the reader should consider the group of shipyards in which his falls to be of relative interest to him. Panel SP-8 members should regard the whole spectrum of shipyards to be of interest to them as they consider how the future efforts of the Panel should be directed.

Several areas of interest are reported below in tabular or graph form. Although some questions were difficult to resolve into “yes” or “no” answers, the surveyor has made his best and most decisive judgement in each case. If an answer shows as ? in the table, this indicates that either the manager interviewed did not have any position on the matter, or (as in a very few cases) it did not come up for discussion.

	V.SM.			SMALL				MEDIUM				LARGE				
	1	2	3	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	6
STATISTICS																			
New Construction (Y=yes, N=no)	N	N	N	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	N	Y	N
Repair/Overhaul/Refit	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y
Navy Work	Y	N	N	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Labor Unions	Y	N	N	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

The new construction vs. repair profile is as shown. Note that all but three of these shipyards are involved in Navy work, not unexpectedly in the current market. Labor unions are present in all but four of the smaller shipyards.

Profiles of the planning/scheduling groups (combined) and the Industrial Engineering personnel in the **shipyards** are as follows:



	V. SM.			SMALL					MEDIUM					LARGE					
	1	2	3	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	6
LABOR EXPENDITURE COLLECTION																			
Time cards, punched in and out	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y
Foreman enters Charge number & Hours	Y	Y	Y	Y	Y	Y	C	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Worker enters Charge number & Hours	Y	N	N	N	N	N	H	Y	N	N	N	?	N	N	N	N	N	N	N
Separare check for correct entries	Y	Y	N	Y	N	Y	Y	Y	N	N	N	?	N	Y	N	N	N	Y	N
Automated collection (bar code, reader) Coming soon, Partial	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	C	N	N	P	N
Supervisor keeps own records	Y	N	N	Y	Y	Y	Y	?	?	N	N	?	N	N	?	Y	N	N	N
Computer-produced printouts	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Computer-produced charts, visuals	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Track at worker level	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	Y	Y	Y	Y	Y	N	Y
Timeliness of data - days old (Two weeks)	1	1	1	1	2	1	7	7	7	1	7	7	1	T	T	T	7	7	T
Problems visible from data	Y	y	?	y	y	y	y	?	y	y	y	?	y	N	?	Y	?	Y	N

All shipyards (except one) use time cards, with charges entered by either the supervisor or the worker, or both. This system is fraught with difficulties of accuracy and timeliness, which impact the use of these data for planning and scheduling purposes. Even so, over one-half of the shipyards have no auditing going on toward improving charging accuracy. One shipyard visited has automated labor charge collection in place, and two others are working in this direction. Note that although all shipyards. have computer-produced printouts available, only one is using computer-produced charts and graphics to assist in understanding the data. Several shipyards do not track labor at the worker level, which may be a problem should they wish to reduce the level at which they plan and schedule their work. The smaller shipyards, not surprisingly, have more timely data than do the larger shipyards, although two weeks seems excessive for meaningful use of these data for controlling the productive processes. Note that responses to the question “Are problems visible from the data?” were mixed, with some simply not knowing while others (larger shipyards) saying flatly “NO”. This is quite inconsistent with our present level of data processing capability.

	V. SM.			SMALL					MEDIUM					LARGE					
	1	2	3	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	6
LABOR ESTIMATIHG																			
Historical data as basis	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	N	Y	Y
Labor standards used	Y	N	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Standards coverage (%/10)	8	0	?	8	0	1	6	0	1	1		?	6	9	1	5	6	8	9
Rates developed from hist. data	Y	N	Y	Y	N	Y	?	N	Y	Y	N	Y	Y	N	N	Y	N	Y	N
Estimate at work order level	y	N	?	y	y	y	y	N	y	N	y	N	y	y	y	y	y	y	y
Estimate by trade	y	y	?	y	y	y	y	y	y	N	y	N	y	y	y	y	y	y	y
Estimate material separately	y	y	?	y	?	y	y	y	y	y	y	y	y	y	y	y	y	y	y
Have multi-trade workers	N	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Lead shop concept used	Y	N	N	Y	Y	Y	N	N	N	N	Y	N	Y	Y	Y	N	Y	Y	Y
Service work orders used	N	N	N	Y	Y	N	Y	Y	Y	Y	Y	?	Y	Y	Y	Y	Y	Y	Y

Historical data is the basis of labor estimating in all but three shipyards visited. Labor standards usage is growing, however, with coverage increasing dramatically over that seen in the survey of ten years ago. Most shipyards estimate at the work order level, with separate material estimates. Only the smaller shipyards have multi-trade workers, usually drawn from a local labor pool. Service work orders are generally in use, with charges pro-rated later. The average size of a work order was found to be about 350 manhours. Some of the larger shipyards break the work orders down into smaller units of about 40 manhours for control purposes. The spread of manhours per work order was found to be quite wide, from less than one manhour to 100,000 manhours, but the usual size was between 300 and 1000 manhours.

FORMAL PUBLISHED SCHEDULES																			
Layers of schedules	5	1	1	3	3	2	5	3	6	3	3	5	5	3	3	5	4	5	5
Top down from contract window	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Bottom up from performance experience (Repair only)	N	N	N	Y	N	R	N	N	N	N	N	N	N	Y	N	N	N	N	N
Computer used for processing data (Partial - lowest layer only)	Y	N	N	Y	Y	Y	Y	Y	N	Y	N	Y	Y	Y	Y	Y	Y	P	Y

Varying degrees of schedule detail are being used, but in all cases the schedules are formed from the top down to suit the contract window already established by the bid/award. In only three cases did the shipyards acknowledge that a bottom up analysis was conducted to ensure that the capability existed to get the work done in the allotted time) and one shipyard did this only for repair work. Several shipyards continue to produce schedules manually, at least at the higher levels of interest.

	V. SM.	SMALL							MEDIUM						LARGE		
	1	2	3	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	6
TRADE/SHOP MANPOWER ESTIMATES																			
Historical data as basis	Y	Y	N	Y	Y	Y	Y	T	Y	Y	H	Y	Y	Y	Y	Y	Y	T	Y
Labor standards used	Y	N	N	Y	N	N	N	N	N	Y	Y	Y	N	Y	N	Y	Y	Y	Y
SWBS breakdown	Y	N	N	?	Y	Y	Y	Y	N	Y	Y	Y	Y	N	Y	N	Y	N	Y
PWBS breakdown	N	N	N	?	N	?	N	N	N	N	N	N	N	N	Y	N	Y	N	
Computer-produced curves used	y	y	?	?	?	?	?	?	Y	N	N	Y	Y	Y	Y	Y	Y	Y	
TRADE/SHOP MANPOWER ASSIGNMENTS																			
Made by supervisor	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	Y	N	N	N	N	N
Made by others (e.g., planners)	N	N	N	N	N	N	N	N	N	Y	Y	N	N	Y	Y	Y	Y	Y	Y
Frequency of assignments (Daily Weekly-As needed-Monthly)	D	D	D	D	D	D	D	?	A	M	M	W	D	?	?	W	W	W	?
Estimates used in making aggignments	Y	N	N	Y	Y	Y	N	N	N	Y	Y	?	Y	Y	?	Y	Y	Y	N
Pull workers from trade pool	Y	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
CONTROLPROCEDURES																			
Progress Assessment																			
Made by supervisor/foreman	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	N	N	N	?	Y	Y
Made by others (e.g., planners)	N	Y	N	N	N	N	N	N	N	N	Y	Y	N	Y	N	Y	?	N	N
Frequency (Daily-Weekly-Biweekly Monthly)	D	D	D	W	B	D	W	W	W	D	B	W	M	D	?	W	?	W	W
Based on on-site evaluation (Sometimes)	Y	Y	Y	Y	Y	Y	Y	S	N	Y	Y	Y	Y	Y	N	Y	?	Y	Y

Historical data is the usual basis for estimating trade/shop manpower needs. Some labor standards are in-use, however, as are computer-produced curves for fitting the estimates to the overall workload and time frame. Two shipyards have gone to a product-oriented work breakdown arrangement, rather than the more traditional ship system breakdown. These are larger shipyards that may retain financial reporting by a SWBS, but prefer to manage by a PWBS.

The trade supervisor assigns workers in all but the larger shipyards where some other group such as planning, or in some cases scheduling, makes the assignments on a longer-term basis. Use of estimates in making these assignments is sporatic, which, is a commentary on the estimate itself. Only the smallest shipyards have local Labor pools from which workers are pulled as needed.

Progess assessments are generally made by the supervisor on-site, except in the larger shipyards where a separate group does an assessment, either instead of or in addition to the supervisor. The smaller shipyards conduct the assessment more frequently than the larger shipyards, probably because of

their shorter contract cycles. Nearly all shipyards say that on-site evaluation is the basis of their assessment, rather than simply a data check.

	V. SM.	SMALL				MEDIUM					LARGE				
	1	2	3	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	6
Accounting Control																			
Automated system used	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Standby/lost time charge number used	N	Y	N	Y	N	N	N	N	N	Y	N	Y	N	Y	Y	Y	Y	Y	Y
Rework charged separately	Y	N	N	Y	N	Y	Y	Y	Y	?	N	N	Y	Y	Y	Y	Y	Y	Y

Automated accounting is used in all cases. Most shipyards have a standby/lost time charge number, although usage is slight in all but two of the shipyards. This corresponds with little review of usage toward understanding the causes for the entries. Rework charges are usually collected separately, either via a special digit added to the work order number, or by designating as rework all charges collected after the work order is first closed to labor charges.

Schedule Compliance Control

Control by supervisor on-site	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	N	Y	Y	N	N	?	?	C	Y	Y
Worker knows start/complete dates	Y	N	?	Y	Y	Y	N	Y	N	N	Y	N	N	N	Y	Y	Y	Y	Y	Y	N
Worker knows labor estimate for job	Y	N	?	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	N	
Track at worker level	y	y	?	N	N	N	Y	N	Y	Y	Y	N	Y	Y	N	Y	Y	N	Y	Y	N
Track at supervisor level	y	y	?	y	y	y	y	y	Y	N	Y	Y	Y	Y	N	Y	Y	N	Y		
Track at trade level	y	y	?	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	y	N	y	y	~	y		
Track at system level	N	Y	?	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N	?	Y	Y	Y		
Timeliness - days old (Two weeks)	1	1	?	7	3	7	7	7	7	T	T	7	1	T	T	3	T	7	T		
Data available when needed (Steel only, not outfit)	Y	Y	?	Y	N	Y	N	N	Y	S	Y	N	Y	?	?	Y	?	Y	N		
Problems visible from data (Steel only, not outfit)	Y	Y	Y	Y	N	Y	Y	N	Y	S	Y	N	Y	?	?	Y	?	Y	N		

Controlling compliance with the schedule is done by the supervisor on-site, except in the larger shipyards. Whether the worker knows the start/complete dates and the estimated labor content of the job was mixed. Some shipyards felt that the worker should be deliberately told, while others felt just the opposite. Most shipyards had no strong feeling either way. The level at which progress is tracked varies considerably, with the higher levels apparently preferred by all but one shipyard. Again, two weeks seems excessive for data timeliness, assuming that the shipyard is serious about promoting improvements in lagging situations. Problem visibility from the data is mixed, and does not bode well for the larger shipyards. The continuing and more difficult problem of assessing progress for outfit work was highlighted in one shipyard, where steel work was judged much less of a

problem. This condition undoubtedly exists elsewhere as well, due to the different nature of outfit work.

	V. SM.	SMALL					MEDIUM					LARGE				
	1	2	3	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	6
Communications Used																			
Periodic meetings held - number	1	1	1	1	1	1	43		1	1	321				223342				
Frequency (Daily-Twice a week-Weekly-Biweekly-Monthly-Quarterly)	D	D	D	W	W	W*	W	W	T	W	#	W	W	W	W	&	W		
Agenda for meeting (*=WN,MY)	N	N	N	N	?	N	N	N	N	N	N	*	Y		Y	Y	Y	Y	N	Y
Meeting minutes kept and used (*=WN,MY)	N	N	Y	N	?	N	N	N	N	N	N	*	N		Y	Y	Y	Y	N	Y
Schedule used during meeting	Y	N	N	Y	Y	?	Y	N	N	Y	Y	N	N		Y	N	N	Y	Y	N
Schedule markup after meeting	Y	N	N	Y	Y	?	Y	N	N	Y	Y	N	N		Y	N	N	Y	Y	N

*=2D+2W #=lW+lM
'=lD+IW &=lD+lW+lM+lQ

The usual practice for communicating is a periodic meeting, daily in the smaller shipyards and weekly in the larger ones. Agenda for the meetings are absent except for the larger shipyards, as are meeting minutes. The schedule doesnot seem to play unimportant part in most of the meetings, which is a commentary on the usefulness of it. (These meetings are the ones to treat the prosecution of work, and not those for other purposes such as the corporate-level concerns of senior management. The latter meetings would be in addition to those cited here.)

COMMENTS MADE BY SHIPYARD MANAGERS

Listed below, and arranged in several categories of interest, are the comments made by the shipyard people contacted during this survey. As far as possible, these statements are actual quotations of the remarks made. The size of the shipyard from which each comment originated is shown in parenthesis after each statement.

These comments should not be treated individually. Rather, the composite message of all the comments is of more importance. Note how many of the concerns expressed by these people are not peculiar to any size of shipyard, but reflect situations that exist throughout the shipbuilding and ship repair industry.

Comments on Labor Expenditure Collection, Analysis, and Display

- Would like bar code collection of worker badge via reader at the workplace. (Very small)

- We are really at the mercy of the person entering the time (charges) on the time card. (Small)

- Timekeeping takes too long for the first line supervisor to do his thing. We need some system that takes less of the supervisor's time. (Small)

- We would like a bar code reading system (for labor expenditure collection). It is easier to collect (the data) and has less keying error. (Small)

- Note that entries on time cards may be stale if the foreman gets busy. The "entry system" is poor, hence (there will likely be) problems with the quality of the data - and this is the only source of information for, and the only tool used by, the estimator. (Small)

- We need (labor expenditure) measurement at the individual worker level. (Small)

- Need training in handwriting. This would cut down on bad numbers greatly. This is not just for production people. Everyone needs to write numbers legibly. (Medium)

- (We are) working to have workers enter their own time on time cards as an accuracy improvement device. (Large)

Comments Directed at Information Collection, Analysis, and Display

- Would like more visibility of rework. (Small)

- Need better data processing for tracking events and seeing the impact of changes. (Small)

- We would like the ability to analyze performance data - know how to build the database, then enter (it) for regression analysis, graphics presentations, etc. We do not do any of this right now. (Small)

- Want more timely data. (Our) current presentation is OK, but we need it more often. (Small)

- Need better measurement and analysis of actual costs at the worker level. (Small)

- Need more and better computer support for manpower forecasting, scheduling, and planning manager functions. (Medium)

- We need more personal computers. (Medium)

- Should track at shop/ship level, and compare to overall ship cost. At lower level, we have too much data . . . (Large)

- Working on MIS reports going to graphic presentation, since we cannot see what is happening. (Large)

- Formalizing data is difficult, and it is equally difficult to translate it to the used community. (Large)

- Need more freedom and ability to get computer equipment and software for use by planners and estimators. There are too many restrictions and gates to go through now. These are tools for planning people which they need just as much - if not more - than the production workers. (Large)

- It is difficult to get data processing people to do programming for the users. (Large)

- Need several different sorts of MIS reports. (Large)

Comments on Planning and Scheduling Matters

- We need more involvement of active production supervisors with schedules (leading to) a better understanding and application of the scheduling information. (Very small)

- Scheduling is as much a diplomatic function in a repair yard as it is a technical function. (Very small)

- We need a system (for scheduling) that the owners/managers can use, and that an existing person can use. We cannot (afford to) hire an industrial engineer for doing this thing. (Very small)

- (Individual) process work is pretty well understood. The problem comes in trying to tie processes together, like mixing painting with sheetmetal, etc. (Small)

We would like better planners and more experience in understanding information from the waterfront. (Small)

- Planning and scheduling is where it is at. Begin with basics. Let each shipyard refine and apply as needed. (Small)

- We need to know how far in the future we should plan, and in what degree of detail. We need to know how valid is the planning effort. (Small)

- We need better feedback to the planners of what is happening. They cannot find out by themselves, and never will be able to do so. (Small)

- We need help with planning and scheduling. The scheduling standards idea is promising. We need more of it. (Medium)

- Pleased that this survey is addressing only planning, scheduling, and production control. This is where the big improvements are needed. (Medium)

- All we need is a few more people to help support our existing systems. (Medium)

- Good budgets and schedules are vital to good progress assessments. (Medium)

- Would like a work package sized so that it can be opened and closed within a month. (Medium)

- Schedule compliance control is non-existent. If the schedule is met, it is accidental. (Medium)

Would like planning at the work center level, broken down by foreman. (Large)

- We need a stable estimate more than a correct one. (Large)

- Need workload forecasting at the work center level. (Large)

- Need schedules at the work center level. (Large)

- Make the schedule realistic, not minimum achievable. (Large)

Workload forecasting and the schedules should be done together. (Large)

- Need good, accurate scheduling data. Do not have it now in most areas. (Large)

- On-board scheduling is a major problem area. (Large)

- The interface between zone-oriented construction and the activation of systems and equipment is fraught with conflicting interests. The transition from zone to system must be made at some point. We need to decide when and where. (Large)

Comments on Manpower end Resource Loading

- A single-trade man will not survive in a small shipyard. (Very small)

- We need a system to look at all resources - equipment, space, manpower, etc. - and level the load on all these things. (Small)

- Trade/shop manpower assignments (loading, levelling, satisfying the schedule) is a problem area that should be worked on by SP-8. (Small)

- We need a way to input a particular bell-shaped curve so that a manpower analysis/forecast can be done by computer. This will solve the "what if" questions on bidding for new work. (Medium)

- Would like to know how other shipyards load manpower - build strategies vs. manning curves. (Medium)

- Biggest problem is knowing what shipyard workload is (currently), and what the employment level will be (in the future). (Large)

- Resource control efforts are needed for levelling and resource-weighted schedule inputs. (Large)

- Resource scheduling, interfacing labor with resource levelling input, is the direction desired and needed. (Large)

Comments on Production Control Matters

- Would like to compare the location of the production control effort in several shipyards. Is it better top-down or bottom-up? What is the best organizational location and authority? (Small)

- Would like improvement in the visibility and accuracy of outfitting progress. (Our) assessments are not timely or accurate. We need a better way. Steel is OK. (Medium)

Comments Directed at Material and Associated Hatters

- Would like to computerize material disbursements using bar codes, on a micro. We manually produce all material disbursements to the job, priced, etc. (Very small)

- Ability to procure long lead time material is a big problem. It is a cockpit problem, rather than a material availability problem per se. Competitive vs. proprietary vs. standardize, plus political issues. This seriously restricts the ability of the shipyard to function. The procurement regulations are the rub here. They need to be fixed. (Small)

- Material is a problem, but this is more administrative than ''real". It is a rare case when long lead time material cannot be obtained in time. The material people do not seem to understand the shipyard problems, and the impact of material items on the shipyard's ability to produce. (Small)

- We need improvement in specification definitions (for material) both in requirements and in timeliness. The adversarial relationship with the contract people in the Navy is not in the best interests of the commercial shipyards. The Navy will find an obscure rule someplace in a procurement regulation that they will hit you with. The shipyard cannot afford to spend the time and effort to truly understand the regulations - the working people, that is. (Medium)

- We should buy to the highest grade of bolts/nuts/screws/etc. It is not worth the cost and trouble to keep (maintain) a family of material grades. (Medium)

- Need better information on material for use in estimating, both GFE and CFE. Material unavailability impacts the shipyard's ability to do work, and so affects the estimate. (Large)

- Need material cost returns at the key operation level. (Large)

Comments Directed at Specifications and Work Definition

- Ships Force people do not identify needed repairs. They do not keep up with performance and repair profiles. The only alternative is a ship check, since histories are not current. (Small)

- Need better quality information in a more timely manner on what is to be built, with more up-front design information. A better history base is also needed. (Small)

- We have a major problem with (Government) specifications for the work. The problem is huge, and it has been there for years. (Medium)

- We need help in getting Government agencies to answer questions and specify accurately what they want. (Medium)

- Need better work scope information, which is the key to better schedules, and performance by production. (Large)

- Need better understanding of the work required by the customer, and better plans (i.e. drawings) for the work. (Large)

Comments on Bid Matters

- Would like a micro to handle bidding, using the numbers (real time) from the schedule. This is badly needed in small shipyards to illuminate the bid situation. (Very small)

- Would like to have the information developed for the bid be the same information that is used in planning/scheduling/production control reference/ goal for workers/performance evaluation/etc. Do it once. The owners would be able to accommodate the real facts, and would do better if they knew the real risk involved in bidding. If we could have a good bid for 50% of the work that is within 15% of the real numbers, it would be "tremendous". (Very small)

- There is hope that the (SSPP - Reference 1 herein) non-process factor can be applied as a composite number at the bid level. Then once the bid "standard" is produced, it can be used by means of the composite non-process factor. (Very small)

- Need better definition of the work package on repairs. (Small)

- The bid is the reference. The bid may not reflect (our) ability to produce, but only what was needed to get the contract. The bid is different on each hull, therefore the reference is different (on each hull). This confounds the analysis of performance. (Small)

- The Navy needs to allow more time for preparing bids, which may require a ship check, specification research, etc., as well as our own capability to do the work. (Medium)

Comments Directed at Labor Standards

- Would like SSPP very much, but not sure it would be compatible/appropriate for a small repair shipyard. Accuracy (of prediction) within 15% would be "delightful". (Very small)

- Would like to be able to determine-will cost, rather than should cost. Need a handle on how to make this determination, such as via standards like SSPP. This information is needed for planning and scheduling matters. (Small)

- Would be delighted with scheduling level standards (SSPP). Perhaps isolated process improvements via MTM, but not for a long while. (Small)

- We have MOST data from other shipyards, but we cannot use it - we don't have the time or knowledge to apply it. (Small)

- We need "speed and feed" information, and engineered labor standards. (Small)

- Need better schedules from better scheduling standards. (We are) currently trying to make them from performance data. (Medium)

- We would truly like to have scheduling standards. We are making our own as best we can. (Medium)

- Would like rates for" sheet metal fabrication, etc., but for steel the handling capability is the improved way to go. Times (for steel) are dependent on the system/flow used, so it is tough to get good rates from other shipyards. Welding could be handled like the fabrication trades (i.e., rates). (Medium)

- Would like more rates, but they are proprietary to the (parent) shipyard and they won't share them. (Medium)

- Need more standards; E-standards, not A-standards. (Large)

- Need standards; more, and with improved usability. (Large)

- Shipboard standards should be exportable because the workplace is the same . . . unlike shop standards. (Large)

- Need more and up-to-date standards. (Large)

Comments on General Management Matters

- You must have information on process/non-process (activities) if you are going to manage. (Small)

- Need to know which portions of the ship need special treatment, and which areas can be treated with usual techniques. (Medium)

- Service time is generally estimated by means of a percentage of the total work. We need to introduce information on where ships are located, and how they are grouped geographically, because this influences the actual cost of services. We need more involvement of the schedulers in determining service costs. (Medium)

- Non-process time is where it is at. (Large)

- Competition among Naval shipyards is arguing against information exchange. (Large)

- We monitor heavily, but we don't manage. Our idea of management is to beat on people. (Large)

- We have so much going on - so many new ideas being prosecuted - that we don't know what to do, and we don't get anyplace. We need a simple and steady focus. (Large)

Comments Directed at the NSRP

- Would like to know what information is available to us. (Small)

- The NSRP can help in convincing management that industrial engineering techniques and the output of the NSRP can be of advantage to the shipyard. Personal workshops/information sessions look the most favorable. (Small)

- The NSRP should continue as a source of shipyard state-of-the-art information. It helps to know that you are not alone in your needs, concerns, and efforts. (Small)

...

- The NSRP should guide us. Provide information on what others are doing. Tell us what the precedent is out there. Provide us with information on the state-of-the-art. (Medium)

- The NSRP should develop an alternate to the (system oriented) "9000" requirements for financial reporting. (Medium)

- The NSRP can help in producing academically qualified planners/schedulers/production control people. (Medium)

- The NSRP should look into requirements of proposals. Often there is much overkill that makes contracts expensive and proposals expensive to prepare. Be sure requirements are real, as they are costly. (Medium)

- Much of NSRP output is not easily translated into application in a shipyard. (Large)

- Need NSRP emphasis on mid-level matters. (Large)

Comments Directed at Panel SP-8

- SP-8 should provide more on scheduling standards. (Small)

- Tell SP-8 that the presence and support of SP-8 put (X) in a far better position to do industrial engineering at (Y) than without their contribution. SP-8 can provide information on "state-of-the-art" in shipbuilding, quickly and effectively. This put (X) in touch with counterparts, and reference material on a variety of subjects. This is a major contribution to (X) and his ability to perform at (Y). (Small)

- We need projects that try to improve our capability to plan and schedule work, and control the productive process. We do not need projects of special interest/isolated areas peripheral to the main stream of shipyard management. (Small)

- We need to tell senior management the impact of ''cutting overhead" because they may cut the vital "threshold" of support. Then we cannot function. (Medium)

- SP-8 should salvage the MOST (database) so we can use it in the Planning/scheduling process. (Medium)

- Would like to see projects on the application of statistical techniques on shipyard data. Get these techniques down to where they can be used by shipyard managers themselves, rather than require a separate statistics group, which we can neither afford nor make work. (Medium)

- SP-8 should show various techniques for standards development, and related costs/conditions for usage. Then we could pick the one best suited, e.g. MTM, work sampling, statistical, imported, etc. (Large)

- Need information on the cost of industrial engineering techniques, including development and application. Most SP-8 reports do not address associated costs. (Large)

- Application is the real need from a cost-effectiveness stand point. (Large)

- We have no knowledge of SP-8 output over the years. We really need a list. (Large)

- If the SSPP can show that the data is reliable, it would simplify standards application. (Large)

- The SSPP approach should be used at the bid level as an objective assessment of the bid. (Large)

- The SSPP approach could be used to tell design/engineering the "cost" of their design while they are designing it. (Large)

- SP-8 should reinstate the (RADM) Horne initiative on resource (capacity) measurement and control techniques. (Large)

4.0 CONCLUSIOHS AND RECOHMENDATIONS

4.1 Conclusions

The following conclusions seem indicated from the information gathered during this Task. Others will undoubtedly result from review of this information by the members of Panel SP-8.

1. The survey reveals that the current needs of the shipbuilding and ship repair industry are quite basic, and are associated with the main stream of management concern. The general areas of planning, scheduling, controlling the productive process, gathering/analyzing/displaying pertinent information are of most importance.

2. The presence and impact of industrial engineering is considerably larger today than it was during the previous survey, ten years ago. Nevertheless, much more involvement of the industrial engineering community in shipyard matters is clearly indicated.

3. Several basic assists are needed by many in the industry, such as:

   data collection to yield accurate information at the worker level

   - techniques for analyzing and displaying such information in ways most helpful to shipyard managers

   - focus on the benefits of “overhead” functions, so that the vital support provided by this element is not constrained or lost

   data processing capability and understanding for treatment of the larger issues of shipyard-wide manpower and resource loading, bid analysis, and similar global matters.

4. Many in the industry are still unaware of the NSRP, SNAME Panel SP-8, and the associated studies/reports that are available for the asking.

4.2 Recommendations

A. Attention should continue to be placed on the main concerns of shipyard management: planning, scheduling, production control, information collection/analysis/display.

B. Efforts to promote the application of industrial engineering techniques in shipyards should continue, and should be expanded wherever possible.

C. Basic techniques for certain shipyard processes should be examined, improved, and developed into packages of information that can be disseminated to interested managers for application in their shipyard. These processes include (but should not be limited to):

labor expenditure collection - down to the worker level

performance tracking - down to the worker level

graphic presentations via data processing

resource loading and levelling using data processing techniques

scheduling-level standards development and application

extension of SSPP techniques to include the bid level.

D. Efforts should be directed at keeping a wider segment of the industry informed about activities under the NSRP, and of related publications, workshops, and seminars.

APPENDIX A

TASK EC-25

ANALYSIS OF CURRENT MANPOWER ESTIMATING AND CONTROL PROCEDURES

QUESTIONNAIRE

TASK EC-25

ANALYSIS OF CURRENT MANPOWER ESTIMATING ARN) CONTROL PROCEDURES

- - -

QUESTIONNAIRE

Shipyard Coded Ident

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

General Information

Shipyard Name and Location _____

_____

Main Person Contacted _____

Position/Title _____

Address _____

_____ Phone Number ( ) _____

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

Total Planning Personnel (#) _____ I.E.'s (#) _____

Central/Master Planning (#) _____ Trade Planning (#) _____

Ship Types _____

_____

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

Current Workload Size _____

_____

Other Persons Contacted _____

_____

_____

_____

Labor Expenditures

How Collected (Explain) _____

_____

_____

Time Cards (Y/N) _____ How Often Collected _____
Who Fills Out _____
How Verify Correctness _____

_____

For Attendance Record Only (Y/N) _____
Worker Badge via Terminal (Y/N - Describe) _____

_____

Does Supervisor Maintain Personal Record of Each Worker's Time (Y/N) _____
Use Muster For Personnel Attendance (Y/N) _____
Computer System (Y/N - Describe) _____

_____

_____

Printouts Available (List) _____

_____

_____

How Timely Is Data _____
Is Data Available When Really Needed (Y/N) _____
Are Problem Areas Visible From The Data (Y/N) _____
Other System (Describe) _____

_____

_____

Future Intentions (Describe) _____

_____

_____

What Do You Really Need (Describe) _____

_____

_____

Labor Estimating Basis - General

Historical Data Y/N - Explain) _____

_____

How Verify Applicable/Accurate _____

_____

Who Does Estimating _____

How Many Estimators (#) _____

Standards Used (Y/N) _____ Explain _____

_____

_____

Type _____ Number _____

Source _____ Basis _____

Who Applies _____ How Many Appliers (#) _____

Estimate by Trade (Y/N) _____ Estimate by Work Order (Y/N) _____

Estimate by Total Contract (Y/N) _____ Separate Material Estimate (Y/N) _____

Average Size of Work Order (ManDays) _____

How Handle Assist Trades -

Lead Shop Concept (Y/N) _____ Service Job Orders (Y/N) _____

Explain _____

_____

_____

Future Intentions (Describe) _____

_____

_____

What Would You Really Like (Describe) _____

_____

_____

_____

Formal Published Schedules

Types (List) _____

_____

_____

For Each Type Of Schedule - (Type) _____

How Often Issued _____

Who Prepares _____ How Many Preparers (#) _____

Basis (Explain) _____

_____

Top Down (from contract window) (Y/N) _____

Bottom Up (from performance experience) (Y/N) _____

How Reconciled (Explain) _____

_____

How Often Revised _____

_____

Data Processing Involved (to what extent) _____

_____

Who Provides Input to Data Processing (Explain) _____

_____

How Closely Does Production Follow (Describe) _____

_____

How Effective as Management Tool (Assess) _____

_____

_____

Future Intentions (Describe) _____

_____

_____

What Would Improve This Area (Describe) _____

_____

_____

Trade/Shop Manpower Estimates

Basis - Historical Data (Y/N)_____ Standards (Y/N) _____
Top-Down Parametric (Y/N - Explain) _____
Bottom-Up Statistical Formula/Regression Analysis (Y/N - Explain) _____

_____

Who Makes _____ How Often _____
How Verify Correctness (Explain) _____

_____

Increments - Hours _____ Days _____ Shifts _____ Weeks _____
Months _____ Quarters _____ Years _____
Breakdown - SWBS _____ PWBS _____
Other (Explain) _____
Future Intentions (Describe) _____

_____

What Would You Really Like (Describe) _____

_____

Trade/Shop Manpower Assignments

Who Makes _____ How Often _____
Basis (Explain) _____

_____

Are Estimates Used In Making Assignments (Explain) _____

_____

How Closely Does Actual Loading Match Estimate (Assess) _____

_____

How Well Does Actual Loading Satisfy Schedule (Assess) _____

_____

How Effective in Level-Loading Shops/Trades (Assess) _____

_____

How Are “Over” And “Under” Personnel Accommodated (Describe) _____

_____

Future Intentions (Describe) _____

_____

_____

What Would You Really Like (Describe) _____

_____

_____

_____

Control Procedures

Progress Assessment -

Who Makes _____ How Often _____

Basis (Describe) _____

How Much Actual On-Site Evaluation _____

Accounting Control -

System Used (Describe) _____

How Handle Jobs Needing More/Less Than Estimated/Allowed _____

Standby/Lost Time Charge Number Available (Y/N) _____

How Much Time Charged To It (Average) _____

Who Reviews Usage _____

Remedial Action (Describe) _____

Rework Charge Number Available (Y/N) _____

How Much Time Charged To It (Average) _____

Who Reviews Usage _____

Remedial Action (Describe) _____

Schedule Compliance Control -

System Used (Describe) _____

Does Worker Know Scheduled Start/Complete Dates (Y/N) _____

Does Worker Know Estimated Labor Content of Job (Y/N) _____

How Does Worker Find Out (Explain) _____

How Handle Assist Trades (Explain) _____

_____

How Is Performance Tracked -

At What Level - Worker _____ Trade _____ Shop _____

Supervisor _____ System _____ Ship _____

To What Degree Of Detail (Explain) _____

How Timely Is Data _____

Is Data Available When Really Needed (Y/N) _____

Are Problem Areas Visible From The Data (Y/N) _____

Who Reviews (Explain) _____

_____

What Controls Are Exercised (Describe) _____

_____

Who Applies Controls (Explain) _____

_____

Communications Used -

Types and Frequency of Meetings (Describe Each) _____

Output from Each (Describe) _____

Other Means Of Communications (Explain) _____

Future Intentions

For Progress Assessment _____

For Accounting Control _____

For Schedule Compliance Control _____

For Communications _____

What Type And Degree Of Control Would You Really Like (Describe) _____

Thoughts In Conclusion -

How Can The NSRP Be Of More Assistance To Your Shipyard _____

What Projects Would You Like To See Carried Out _____

Do You Have Ongoing Industrial Engineering Projects (Identify) _____

Would You Like To Participate In Panel SP-8 Activities _____

What Message Would You Like Transmitted To Panel SP-8 _____