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FLEXIBLE AUTOMATION
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WORK PLANNING FOR SHIPYARD SURFACE
PREPARATION AND COATING (SP&C)

A TRAINING MANUAL

U.S. DEPARTMENT OF TRANSPORTATION
Maritime Administration

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

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WORK PLANNING FOR SURFACE
PREPARATION AND COATING

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FOREWORD

As part of a continuing effort to improve shipyard efficiency, the Ship Production Committee Surface " Preparation has sponsored this Project, entitled work Planning for Shipyard Surface Preparation and Coating, under the auspices of the National Shipbuilding Research Program, a joint Industry, Navy, and Maritime Administration program. The project is related to recent industry developments (e.g., modular construction, zone outfitting, and advanced surface preparation, coating and painting) which have led to an emphasis on the cost savings that accrue when detailed planning and scheduling are done well in advance of the actual work. The processes of surface preparation and coating are being emphasized because they represent an increasingly significant part of the cost of new ship construction and overhaul, and because historically the proper planning, scheduling and prioritization of those processes have been neglected.

This document is intended as a
reference for the shipyard and
the shipbuilding industry in
the preparation of the shipbuilding
program and the shipbuilding
program.

PURPOSE & SCOPE

The purpose of this training manual is to improve work planning for surface preparation and coating by providing training material directed primarily at those personnel involved in the near-term-planning, - scheduling and direction of SP&C operations.

The training manual will provide (1) the means to use the material for instructional purposes, and (2) work planning factors that will be of value to other levels of work planners within a shipyard.

The training material presented is designed for a user who has a reasonable degree of expertise in the technical requirements of surface preparation and coating.

It is believed that application of this training to work planning within the Surface Preparation and Coating disciplines will result in improved work organization, increased production rates for blasters and painters, and more near term schedule tasks accomplished on time.

The material presented in this training manual has been written for the broadest application to the hull block construction process. This requires each shipyard presenting this material to "personalize" the contents to reflect individual yard work planning organizations processes, and procedures.

SECTION I

WORK PLANNING FOR SHIPYARD
SURFACE PREPARATION AND COATING

SECTION I. INTRODUCTION

1.1 Organization and Objectives of the Training Manual.

This training manual is organized to present its contents as follows:

SECTION I. An introduction to the manual

SECTION II. An overview of the problems in SP&C work planning; a discussion of the reasons for shipyards having different systems for SP&C work planning; a discussion of shipyard SP&C work planning practices which are potentially common to most yards.

SECTION III. The research data - SP&C work planning factors

SECTION IV. Instructor Guide

SECTION V. Student Workbook

SECTION VI. Visual Aids

The topics presented in Section II provide the basis for analysis of the many work planning factors which must be considered in the SP&C work planning process. The manual provides a detailed matrix of work planning factors, their definition, their impacts on the planning process, and suggestions on how the planning factor should be used to improve operations.

The manual uses the term "planning factors" for the planner/scheduler/supervisor in its broadest sense.

For easier application the work planning factors are defined as follows:

- (1) Physical Description
- (2) Location
- (3) Support
- (4) Specifications
- (5) Time/Manpower
- (6) Minimizing Rework
- (7) Material
- (8) Equipment
- (9) Handling/Storage
- (10) Inspection
- (11) Disruption/Interference
- (12) Safety
- (13) Schedules

This provides a structure from which to address the multifaceted problems of SP&C work planning. The work planning factors are designed to assist planners/schedulers and supervisors concerned with near-term SP&C work planning for ship construction or repair. The matrix (Section III) provides information from the research which was used to develop the training manual. To support the instructional process the work planning factors are presented in the context of five shipbuilding planning phases;

- o Management Planning
- o Pre-Construction Planning and Operations
- o Assembly Level Operations
- o Block Level Operations
- o Zone Level Operations

1.2 Objectives of this training manual.

OBJECTIVE #1. Improve the ability of SP&C supervisors to effectively plan and schedule near-term Surface Preparation and Coating work on new ship construction.

OBJECTIVE #2. Increase shipyard management's knowledge of the effects of near term detailed surface preparation and coating planning on overall shipyard production efficiency.

OBJECTIVE #3. Improve the exchange of SP&C work planning information and ideas between shipyard top management, SP&C supervisors and other craft planners and schedulers.

1.3 Definitions.

SURFACE PREPARATION AND COATING (SP&C): The surface preparation of all materials for a ship and their coating for preservation, appearance, and other functions (e.g., anti-fouling).

NEAR-TERM PLANNING: Generally, the lowest level of planning and scheduling (2 week schedule) or to the first level of trades supervision (Foreman).

WORK PLANNING: The means of performing the necessary steps to prepare for and accomplish SP&C tasks - it includes:

1. Determining where, when, and who will perform the work (planning and scheduling)
2. Acquisition of the required materials and equipment to perform the work
3. Scheduling SP&C craftsmen to perform the work
4. Integrating SP&C trades work with work planned for other trades

ASSEMBLY: The second level of construction (the first level is parts fabrication). The joining of two or more component parts to make up a system or an assembly (i.e., deck, sides, and ribs, etc.)

BLOCK: A group of assemblies jointed to form an independent section of the vessel (bow, stern, deck house, etc.). Blocks are completed as far as practical (piping, ventilation, electrical, surface preparation and coating) and then joined (or via grand blocks) to form the complete vessel.

GRAND BLOCK: A relatively large block assembly made from 2 or more blocks.

ZONE: An identifiable space or group of spaces of the assembled vessel, providing for work and control purposes.

PLANNERS: Individuals whose primary job function is to plan work accomplishment through equipment, processes, or manpower applications.

SCHEDULERS: Individuals whose primary job function is to schedule work accomplishment through the various planned processes in the most efficient manner.

SP&C SUPERVISORS: Trades foremen and higher supervisors who are responsible for planning and scheduling SP&C work.

SP&C OPERATIONS: Trades performance of surface preparation and coating work tasks, e.g.; blasting, cleaning, painting, etc.

Reference: NSRP, Integrated Hull Construction Outfitting and Painting,
May, 1983.

SECTION II

SECTION II. OVERVIEW.

2.1 Context and Problems in SP&C Work Planning.

Historically, the surface preparation and coating operations in the shipbuilding and repair industry has been the last planned for item on the ship completion list. Consequently, SP&C planning has been subject to the cumulative effects of delays, omissions and changes that occur in the fabrication, assembly, erection and outfitting process.

With the advent of hull block construction in varying degrees in the United States, surface preparation and coating are integrated at the beginning of the shipbuilding process rather than waiting until the end. The Japanese have been the leaders in this integration. While work organization, planning, scheduling and managing systems differ, depending on the particular process flow and other characteristics of the individual yards, systems that are somewhat generic in nature could be used by all U.S. shipyards.

Recent studies by both the Maritime Administration and the industry confirm the labor intensiveness of U.S. shipbuilding, relative to the international market. Productivity improvements through reduction of man-hours is needed within the U.S. industry. This is being accomplished through improved shipbuilding techniques - such as the work packages associated with Hull Block Construction Method, Zone Outfitting Method, and Zone Painting Method and by improved managerial efficiencies gained through information transfer and training, such as the National Shipbuilding Research Program.

Several major problem areas in surface preparation and coating are inherent in the nature and complexity of ship construction and repair. First and foremost has been the pressure to complete surface preparation and painting just before delivery. Access, lighting, ventilation, staging, and safety are frequently less than optimum. A lack of precision in preparing machinery, equipment, piping and modules for on-board installation requires significant fitting work on-board; thus, surfaces that require reparation and repainting develop. Finally, it is probably true that the shipyard engineers, planners,

fabricators and installers do not normally think in terms of: "Can we prepare and paint early under good conditions and then preserve that paint job through the remainder of the process, thus saving time and money for all?"

The most completely controllable preparation and painting processes occur within a shop where there are installed blasting and coating spaces with adequate ventilation, dehumidification and drying facilities. The day to day problems normally associated with in-shop SP&C are minimal compared to the complexity and magnitude of SP&C production problems associated with on-ship work.

Blasting, surface preparation and coating within the yard, but not on the ship, present the normal problems attributable to wind direction and force, temperature and humidity, and closure/protection of any nearby equipment that could conceivably be damaged by blasting or coating. Reacting to these problems can cause frequent schedule changes.

SP&C on the ship present the most varied situations and the largest number of complex problems. On-board SP&C can be roughly categorized into underwater bottom, tank compartments, superstructure, exterior hull and deck, and bilge situations. Each situation has somewhat different problems that must be considered and dealt with by the painting foreman, planners, and schedulers.

For underwater bottom and appurtenances, various factors must be considered, such as, the type of blasting, the degree of surface preparation desired, abrasive removal, staging or man-lift equipment vendor services, weather conditions, and the placing of preparation and painting materials in drydock on a not-to-interfere basis. In addition, details - such as, heavy smoke exhaust from poorly maintained man-life equipment depositing a film on the bottom prior to painting - all must be dealt with by the SP&C planner, scheduler and supervisor.

Tanks present still additional problems. Gas-free testing and authentication, humidity and ventilation control, abrasive removal, staging within the tank, proper grounding and safety watches must be considered and scheduled. The

cumulative effects of these factors complicate the supervisor's job in advance of and during the surface preparation and coating process.

On board work in compartments or on superstructures not only present the normal types of SP&C work planning problems associated with weather and temperature/humidity; but also the interference problems caused by both planned and unplanned work by other trades makes scheduling difficult.

Bilges, in-place machinery, and equipment surface preparation and coating present a myriad of problems that cover all aspects of the safety, staging, temperature/humidity, and interferences. No two jobs are alike and all require close attention, flexibility, and patience on the part of the SP&C supervisor. For example, if the SP&C involves working on nuclear powered ships for construction and/or repair, then the number of scheduling constraints may be significantly increased.

The computer, sophisticated Gantt charts, and aspects of PERT and CPM are all devices that when used properly will assist the painting supervisor/foreman in accomplishing his difficult job of maintaining productivity with his man/material resources. Sophisticated scheduling must be coupled with a realization that major improvement in SP&C efficiency cannot be accomplished by the blasters and painters in isolation from other trades. The SP&C tasks must be considered in each step of the total ship construction/overhaul work planning process.

2.2 Shipyards Work Planning Differences.

2.2.1 General. There are a number of factors that differ from shipyard to shipyard and from work project to work project. Because of the variety and diversity of these factors it is not possible to set forth, in this manual, hard and fast rules, methods or considerations that the SP&C planner/scheduler can apply directly to his particular situation. Rather, he must apply them within the context of his own shipyard and specific project.

2.2.2 Some of the major factors that cause each yard to be quite different are as follows:

- a. The degree to which block/zone/module pre-construction, preoutfitting, and SP&C of items before on-ship erection is in use, affects all planning and scheduling.
- b. The methods of organization, titles and distribution of responsibility and authority among the design, engineering, planning procurement and production departments can differ significantly from yard to yard.
- c. Methods and systems for work accomplishment can vary significantly because of size of the project and whether it is new construction, major overhaul or repair.
- d. Different projects/jobs can have varying time/cost constraints which affect planning and scheduling.
- e. The actual facilities and equipment for SP&C operations will vary from yard to yard (e.g., a large modern blast house vs. none or an antiquated facility).
- f. The geographical location of the shipyard has considerable affect on planning and scheduling because of weather, water access, and physical restrictions.
- g. Variations from state to state and local municipality with respect to environmental rules and regulations can change methods, schedules and procedures from yard to yard.
- h. The degree to which outside vendor services are used to accomplish SP&C operations affects scheduling flexibility and control.

- i. The differences in customer specifications, inspections and certifications directly affects methods, planning and scheduling.

2.3 SP&C Work Planning Practices Common to Shipyards.

The detailed SP&C plans and schedules with respect to what, where and when in the total process are, of course, a function of the overall work planning system in the shipyard. The type and magnitude of pre-construction operations, fabricating, outfitting, and SP&C work planned for accomplishment prior to erection and/or installation on the ship can vary significantly both from yard-to-yard and project-to-project. It is not possible to specify systems/procedures/plans in detail that would work for all shipyards.

In the training course, depending upon whether the participants are from a single or several yards it is intended that the following basic requirements or subsystems would be discussed from the viewpoint of the most practical and productive means of improving overall SP&C short-term scheduling.

- (1) A method(s) to ensure that SP&C department experts contribute to proposals, paint schedules (specification by project/ship), work flow plans and work planning conferences that integrate trade requirements by space/location on the ship.
- (2) An SP&C feedback data system from on-the-job production to engineers, planners, designers and proposal writers that provides up-to-date time/manpower standards by type job, location, special conditions, and recommendations for alternative methods/equipment, etc.
- (3) A system whereby, once the near-term schedule is fixed, the responsibility for pre-positioning equipment and SP&C materials and ensuring the production employee is properly dressed-out is clearly defined so that the shift supervisor can start actual work immediately.

(4) A material classification and standard SP&C flow pattern through the yard for each classification so that all engineers, planners, scheduler's will be aware of the intended location and type of SP&C planned for each type of material (piece, part, subassembly, module, non-structural component).

SECTION III

SECTION III. SP&C WORK PLANNING FACTORS

3.1 General.

This section presents the details of thirteen major planning factors that must be thought of/considered/planned for or checked on in the total process of arriving at the most efficient SP&C work plan.

This section does not categorize these factors into near, middle or long-term. The near-term SP&C supervisor and work planner is dependent on the long-term planners and how well others in the yard plan for and consider the many aspects of work planning leading to "limited rework" on ship. However, the near-term SP&C planner/scheduler can cause improvements by considering all of the planning factors and contributing his opinions, suggestions and recommendations, both to other planners and ship designers at the beginning of the planning process.

Thirteen SP&C Work Planning Factors

PHYSICAL DESCRIPTION (of the item to receive SP&C)

SIZE	Sq. Ft. Area/Cu. Ft. Area/Quantity Pieces Affects - Handling, transportation - Quantity of labor and material - Schedules and work	Size data comes from SP&C Spec. Drawings, groups, shop mfg. orders or similar instructions included in work packages. Needs to be considered early in the planning process.	For off-ship SP&C work - put primer coat on small pieces/ plates/beams/brackete/foundations/ pipe hangers/nutslbolta/washers doors/hatches, etc.
SHAPE AND APPJR TENANCES	Affects - Handling, positioning - Ventilation, Staging, lighting. access	Impacts decision on how and where SP&C is best accomplished and SP&C efficiency	- put intermediate coat(s) on intermediate size PCS subassem- blies, modules, etc.
WEIGHT	Affects - Handlings (liftings) movings	Important to off-ship work (N.A. to on ship work.)	- put final coats on large pre-erection assemblies and aux. items such as maats/king posts/smokestacks/elevators
OPENINGS	Affects - Ventilation, lighting accessibility/protec- tion/staging/number workers/cleanup/curing	Generally more opening preferred except "In-yard" requires more protection to blank the excess openings	
TYPE MATERIAL.	Whether Mild, HY-80 Steel, S.T.S. Aluminum Stainless Steel, other Affects - Selection of SP&C extent of protection type of blast media	Determines the types of SP&C process and length of time to perform It.	put primer on as soon as structural erection is complete in area
CURRENT MATERIAL CONDITION	New steel, w/wo millscale, Rusty old paint, Toxic/non-toxic, Crease, oil, Special contaminations	Impacts type cleaning Impacts type personnel protection impacts cleanup and disposition of residuals impacts degree of disruption to	put final coats on per compartment completion schedule * NOTE - All plate to be blasted and coated 3/4 mil with pre- election primer

Thirteen SP&C Work Planning Factors

2 LOCATION (where the SP&C work will be performed)

OFF-YARD	Vendor or suppliers items that may arrive already coated - partially coated or not coated at all.	Planners from design or purchasing should have these routed on arrival to provide for In-house SP&C. These items must be receipt inspected and SP&C processed as required.	Require vendor structural items to be primer coated prior to delivery as much as possible. Require vendor outfitting items to be finished coated prior to delivery as much as practical
IN-YARD	Units that are fabricated and SP&C processed - generally outside and exposed to the environments affects community environment, clean water, fumes and fall out noise - protection Affects company environment offices/trades/etc.	Exterior environment impacts SP&C efficiency and quality.	Minimize in-yard SP&C work Utilize a combination of preconstruction primer and subassembly units done in Blast Houses. Planners and SP&C Personnel should collaborate on break out size of units for most efficient SP&C work Where to SP&C Primer Where to SP&C Intermediate Where to SP&C final
IN-SHOP	Units that are SP&C coated in a Blast House - metal finishing paint shop or similar in house company facility. This location is ideal for parts, pieces and small to medium size subassemblies or modules.	Generally the preferred SP&C method for total cost control when proficiently planned and processed. There is some trade-off in total quality due to the mandatory rework of structural make-up of component parts.	Employ computers and blast shop coordinators to regulate the short-term work flow - avoid peaks and valleys and provide priority to the most critical units in support of various project schedules, consistent with production line flow schedules.

Thirteen SP&C Work Planning Factors

2 LOCATION (cont.)

ON-SHIP, EXTERNAL	SP&C work performed on the exterior surfacea of ships - superstructure decks, side shell, bottom Affects - SP methods, & materials coating/methods & materials, cleanup/methods & materials, staging, support functions	The location of the ship at the time of SP&C work must not be overlooked - in dry dock - on building ways - at pier - in stream Impacts - environmental - staging	Test Sample existing paint/coatings for toxicity. Check application of power tool cleaning. Apply a test patch of SP&C (recoating) Use portable air compressors for higher air pressure - faster cutting - uses less grit
ON-SHIP, INTERIOR	SP&C work performed on the interior surfaces of: - ships - tanks/volds - machinery/spaces/bilges - storerooms - hotel spaces	Impacts - access ventilation lighting staging level of Manning method of SP6C work	Use airless spray paint equipment vs. atomizing or other application tools. Strive for SP&C work packages that schedule a block of work (tanks) (compts) (spaces) or area at one time to minimize support functions and disruption.

Thirteen SP&C Work Planning Factors

3 SUPPORT

HANDLING	Functions usually supplied by in-house service trades other than the SP&C trade personnel.		
	Does the subject SP&C work require lifting/turning/moving/hanging? If so, what service trade support is required?	Size and type of handling equipment. Number of moves required.	Preconstruction primer application should include planned facilities for blasting/coating and quick curing of primer applied to steel on receipt at the plant (shipyard).
	Does the subject SP&C work require transporting? If so, what type of transportation is required?	To and from blast house To temp. storage before or after SP&C processing To other yard locations for SP&C	
UTILITY SERVICES	Compressed air for power cleaners, blast equipment, paint spray pumps, grinders, etc.	Services readily available for SP&C schedule	Blast and coat houses generally include provisions for transporting sub-assembly or modules throughout the fabrication and SP&C processes - the Planners Job is to make efficient use of these facilities at all levels of points of SP&C planning.
Air		Set up and operation by SP&C personnel	
Water	Gas to heat buildings/units/shops		
Gas			
Electric power	For cleaners, vacuum machines	Set up by support personnel	Minimize temporary stage construction - use fixed staging - man lifters cranes with personnel floats, etc., whenever you can.
Lighting	Portable lights		
	Fixed lighting to work by		
VENTILATION	For personal health, comfort, safety	Time to perform SP&C	Never enter any tank or space that has just been opened until gas tester or safety rep clears space for entry and designates type of personnel protection required.
	For confined space explosion protection	Safety of personnel	
	For coating/drying/curing	Other trade support	
	Natural or forced ventilation		
STAGING	Type and quantity	For access and maneuvering	Utilize upside down position to minimize scaffolding requirements. Tie staging to drydock NOT ships hull. Consider permanent scaffold clips to remain with ship.
	When and how to set up/initiate	Blocking other work	
	When and how to take down/remove	Necessary to SP&C operations and inspection	

3 SUPPORT (CONT.)

TEMPORARY PROTECTION	What to protect and how?	Service trades required?	Utilize processes, positions, and locations to minimize cleanup
	Who installs protection?	Impacts time for erection and removal	
	Who removes protection - when?	Impacts cleaning/blasting work space	
		Impacts painting and cure time	
CLEANUP	What type cleanup	Impacts schedule length	
	What area or space and when?		
	What magnitude?	Impacts equipment	
	Toxic or not?		
	What disposal of residuals?		
Chemist	When required - why?	Impacts schedule time for confined spaces, for tanks just opened, and highly flammable coatings.	Communication with vendors, suppliers, and equipment reps.
Gas Tester	Who calls/alerts?		
	What is the authority level of chemist - of gas tester?		
Safety Engr.	When is each required - why?	Impacts schedule time and quality	
Lab Services	Who calls/contacts each - why?		
	Authority/responsibility of each?		
VENDOR REPS.	Involved for quality and safety enhancement of the coating work.	Impacts quality, schedule time, and potential rework.	Communication with vendors, suppliers, and equipment reps.
Paint Supplier	Who communicates need for either/each		
Equipment Supplier	SP&C operators work with supply rep. Authority/responsibility of each		

4 SP&C SPECIFICATIONS

SOURCES OF SPECIFICATIONS OR SP&C INSTRUCTIONS	Customer detail specifications Engineering - SP&C instructions taken from known as "Paint Schedule" (paint blueprint) SP&C work package data taken from above two sources	Unclear, incomplete or incorrect specs. result in error. Impacts schedule, rework, material procurement, and manpower.	Specification review by qualified SP&C personnel required in work planning process.
TYPE OF COATING REQUIRED AND ITS IDENTIFICATION	GENERIC FAMILY - Alkyd resin, <u>Vinyl</u> , <u>Epoxy</u> , Inorganic Zinc, Urethane, Latex (water base), coal tar compounds CHARACTERISTICS: <u>Combustible</u> , <u>Flammable</u> , <u>Highly Flammable</u> , <u>Non-Toxic</u> , <u>Toxic</u> , <u>Poisonous</u> , <u>Non-Combustible</u> , <u>Non-Flammable</u> Coating characteristics are obtained from: Product Data Sheets Safety Data Sheets Both should be supplied by paint vendor or manufacturer.	The coating characteristics impact where and how job may or may not be done.	Do not start mixing and coating without reviewing product data sheets and safety data sheets. Always check the shelf life date on paint can - use only known good paint to avoid costly problems.
METHOD OF APPLICATION	Brush/roll/spray/dip/flow; combination of above. Spray application is considered the current basic application method - supported by brush touch up and brush coating of welds, etc.	Impacts rate of production, cure time, equipment, and manpower.	Use airless spray coating as the prime equipment supported by atomizing spray; brush/roller touch-up work.
NUMBER OF COATS	Generally two or more coats required. - At least one prime coat and one top coat	Two coat systems expend less initial application labor than three coat systems and expedite items thru blast paint rooms. <u>Two coat systems are quicker, but usually require more touch-up and more rework so that the three coat system often proves best even at the same total dry roils.</u>	Use three coat system where permissible on most off ship work. - This gives flexibility to job - Potential for reduced rework - Overall lower cost and better quality

Thirteen SP&C Work Planning Factors

SP&C SPECIFICATIONS (cont.)

FILM THICK- NESS	Recommended wet film thickness is obtained from product data sheet; is important monitor at application to ensure that each coat dries to specified dry film thickness to end up with specified total dry film A typical epoxy system may require: 2 Dry Mils of primer 10 Dry Mils of top coat 12 Dry Mils total	Impacts quality, control, application time, potential rework, and equipment required.	Explore your options and apply same thickness on 3 coats: - 2 Dry Mils of primer - 6 Dry Mils intermediate coat - 4 Dry Mils top coat (later)
DRYING/ CURING	Drying generally refers to time between coats before next coat. Curing refers to completion of chemical reactions and/or drying and ready for intended service function.	Drying/curing impact when/where/how long it takes to do a specific job. Long dry/cure can bog down blast house operations	Provide accelerated curing environment in blast paint houses - <u>heat, ventilation, humidity control</u>
INSPECTION	<u>WHO/WHEN/WHERE</u> Inspections may be formal or informal, in-process or upon completion.	Required Inspections influence quality and progress of SP&C work. Unnecessary inspections generate confusion, overlap and rework, and contribute to higher costs.	Make maximum use of in progress inspections. Minimize formal planned inspections and keep those near end of job.
COATING OBJECTIVES	Coatings serve a variety of purposes Purposes - <u>corrosion protection, cosmetic anti-fouling, weather resistance</u>. Sanitation or a combination of these.	The SP&C objective impacts when/where/how coatings are applied and must be considered in long and short-term planning in relation to the SP&C system and to the service function of the paint/coating.	Use wet and dry film gages Monitor total film thickness Too thick is worse than too thin because it consumes excess material and generates <u>re-work</u> thus using more labor - resulting in higher costs overall.

Thirteen SP&C Work Planning Factors

4 SP&C SPECIFICATIONS (cont.)

SURFACE PREPARATION

Method	All surface prep falls under one of these classes: <u>manual cleaning</u> , <u>power cleaning</u> , <u>blasting</u> , <u>chemical cleaning</u> or combinations thereof.	Methods influence when/where/why SP&C work can or cannot be accomplished.	Utilize efficient methods that meet minimum spec. required.
Blast Media	Sand, metal shot, metal grit, Black Reauty resin grit, etc.		
Profile/Anchor Pattern	Dries the spec or paint system require specific profile, anchor pattern?	Media used impacts production rate.	Blast profile should be in accord with product data sheet or as rule of thumb 1/4 to 1/3 of the first coat thickness (dry film).
Options	Does the spec or system allow any options-such as use of mechanical needle guns in lieu of blasting on small areas?		<u>Example:</u> If you wish to apply 3 roils dry film of a given primer that is listed at 50% solids, then you need a 1 mil profile (anchor pattern) on which you apply 5 wet roils of paint that will dry to 3 roils for a well bonded primer. Use the needle gun option where permissible to avoid spot blasting on large units and on ship.

Thirteen SP&C Work Planning Factors

MA

MANPOWER PLANNING

Objective - accomplish acceptable SP&C in the shortest practical time with minimum manpower used and minimum rework required.

Impacts schedule and cost of job.

Planners and operators must recognize that some short-term sacrifices must occasionally be made in time and manpower to support the team objective of overall shortest time and lowest manpower. These are management decisions and line supervisors/planners should not feel guilty at resulting higher costs.

ALLOTTED TIME PER SCHEDULE

Planners allow target times to process designated sizeable units of work through fixed operations.

Planners should communicate with SP&C reps who attend planning meetings.

AVAILABLE MAN- POWER

Planners should communicate with each other as well as SP&C operators to look at total target work load and project manpower needs.

Availability of manpower is more a planning problem between SP&C supervisors and dept. heads.

Always have one or more backup people trained or in training for each spot on your team. An ideal gang would be composed of:

SPACE RESTRIC- TIONS

Affects the type of equipment used and number of workers used at a time, thus controls elapsed time to do job and influences total manhours.

Impacts SP&C facilities - blast/coat houses - etc. and work planned for inside.

35% long-time reliables
35% experienced mechanics
30% new people in training

LABOR SKILLS LEVEL

Affects the elapsed time of job in relation to the average skill of the operations and impacts the total cost in similar manner.

Impacts production rate

Training is a full-time part of SP&C operations. Each foreman should constantly have a percentage of new people blended in

SP&C operators should keep a log of estimated times vs. actual times to complete each SP&C work packages. These should then be made available to and/or discussed with long-term planners, schedulers and estimators.

SP&C OPERATORS ESTIMATED TIME AND LABOR TO COMPLETE

The SP&C operators - foremen and his support elements must recompile all input work from several sources to determine his weekly and daily work plan, thus producing his estimated time on specific tasks/units.

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Thirteen SP&C Work Planning Factors

TIME/MANPOWER (cont.)

SCHEDULE TIME vs. ESTIMATED TIME	Scheduled time is generally a broader target or guide established at earlier planning levels. Estimated time is short-term detail time estimate that needs to be as accurate as possible and feed back to planning meeting so as to make on course corrections in schedules. both current and future schedules. If the planners schedule and time coincides with the SP&C operators schedules and time then <u>output</u> should be on schedule. Of course, the above rarely exists because the SP&C operators have to deal with SP&C planning coming from several sources, such as project managers, different fabrication shops, different planners, etc., and the lack of standard units of SP&C work.	Impacts overall SP&C schedule performance when scheduled time and estimated times are significantly different.	The compatibility of scheduled time and estimated time is a measure of the total team experience and ability in many situations. This compatibility plus a recognized system of SP&C work in any given shipyard will do much to Improve production and reduce costs.

Thirteen SP&C Work Planning Factors

6 MINIMIZING SP&C REWORK

WHEN TO APPLY PRIMER	<u>OPTIONS:</u>	A. The costliest part of SP&C blast work is the removal and disposition of blasting residuals. Therefore, the prime objective is to avoid or at least minimize blasting on ship. B. Application of an accepted preconstruction primer applied at the time of receipt of steel In the yard is a desired step when it is permissible within the spec. and management system. (4. Consider the use of a preconstruction primer in some cases as a preservative and color assist to other trades even if it must be blasted off to use the spec. primer. (1) Accomplish as much off-ship SP&C as permissible and practical within the specification and system constraints. (2) Plan each step of SP&C as close as permissible and practical to the completion of other trades work, especially fitting, chipping, cutting, welding, straightening, piping, wiring, etc. (3) Monitor the status of other trades work; see for yourself that other trades work is ready for SP&C coating at the intermediate or final coat level. (4) Use light colors of primer and intermediate coats where the system permits to highlight and help correct unfinished structural/outfitting prior to application of the final coat; and to improve illumination in constriction areas and spaces.
	(1) As preconstruction primer when steel arrives in shipyard (2) Small subassembly units/pieces on the yard (3) Subassembly./modules/pieces in the blast and paint shop (4) Large subassembly units prior to on-ship erection (5) Post-erection/on-snip application	A. Application of intermediate coat(s) should be considered for small subassemblies done in blast and paint houses or for large subassembly units processed prior to erection on ship.
WHEN TO APPLY INTER- MEDIATE COAT	<u>OPTIONS:</u>	(1) Small subassembly units/pieces on yard (2) Subassembly/modules/pieces in the blast and paint house (3) Large subassembly units prior to on-ship erection (4) Posterection/On-ship application
	(1) Small subassembly units/pieces on yard (2) Subassembly/modules/pieces in the blast and paint house (3) Large subassembly units prior to on-ship erection (4) Posterection/On-ship application	

Thirteen SP&C Work Planning Factors

6

MINIMIZING SP&C REWORK (cont.)

WHEN TO
APPLY FINAL.
COAT(s)

OPTIONS:

- (1) Small subassembly units/pieces on yard
- (2) Subassembly/modules in blast and paint shop
- (3) Large subassemblies prior to on-ship erection
- (4) Post-erection on-ship application

- A. Final coat(s) should be applied (5) When "quality" and/or "coating integrity" is the priority consideration then-and only then should on-ship, SP&C operations considered as the best choice for the bulk of SP&C work. (This eliminates patching in of make-up seams, joints, etc. - permits full continuously covered coats of primer, intermediate and final painting.
- B. Final coat(s) to structural components should be applied off-ship to large subassembly units or on-ship after completion of other work depending on spec. and system requirements. This is a foreman's/planner's consideration, but not their decision.

Thirteen SP&C Work Planning Factors

7 MATERIAL

EXAMPLES OF SP&C MATERIALS

For Surface Preparation - Part of SP&C: Impacts:

(1) Abrasive steel shot (2) Abrasive steel grit (3) Combination of (1) & (2) above (4) White sand (5) Synthetic abrasive (byproduct of other industrial operations) (6) Aluminum oxide (7) Sandpaper and similar mfg. abrasives (8) Chemical cleaners - citric acid, phosphoric acid, etc; soap type cleaners (9) Masking tape, etc.	(1) Material out of stock delays work (2) Poor quality material results in rework (3) Aged material (coatings) will not meet quality standards

For Painting or Coating Part

- (1) Alkyd resin paints
- (2) Vinyl resin paints
- (3) Inorganic zinc coatings
- (4) Epoxy resin coatings
- (5) Polyurethane paints
- (6) Coatings - coal tar products
- (7) Latex (water base) paints
- (8) Other similar paints, coatings
- (9) Solvent cleaners
- (10) Solvent thinners
- (11) Masking tape

SP&C personnel have limited options to decide on the use of cleaning or coating materials - the choices are locked in earlier. You DO HAVE and MUST USE the option of communicating back through your bosses and/or counter parts relative to materials that do not perform well and the need for better performing materials.

Always insist on mat. product data and safety sheets. Review these for each SP&C job.

Always check the shelf life date - insist on newly packaged coatings.

Get control of and maintain a 3 to 5 day supply of SP&C materials for your gang.

Who else is using same type material in same or close by area? Watch this for performance clues and for material supply control.

SAFETY

Is this a new material or one I am familiar with/have used before?

Is there a safety data sheet, and who has it?

How do I check the safety data sheet?

NOTE: Refer to safety heading on sheet () of these considerations

Thirteen SP&C Work Planning Factors

EQUIPMENT

TYPE FOR SP&C SUPPORT OPER- ATIONS (EXAMPLES)	Fork lift	Proper equipment use requires	Minimize
	Front-end loaders	trained operators.	Start/stop operations
	Cranes		Set up time
	Conveyors	Appropriate equipment saves time	Repair/breakdown thru
	Grit-hoppers		effective PM
	Air compressors		Plan equipment utilization
	Air drivers		Maintain equipment inventory
	Dehumidifiers		
	Manlifters		
	Rall cars		
	Tractor-trailers		
	Trucks		
	Aux - heaters		

TYPE FOR CLEANING	Abrasive blast equipment	Other type cleaning	
	Automatic	Power wheels - sanders	
	Manual		
	Fixed portable	Power chippers/scalers/ needle guns	Portable air compressors generally provide cleaner and higher pressure air for blasting, thus they reduce:
	Pneumatic/centrifugal types	Chemical (l)Dip-wipe-etc.)	
	Vacu/veynrs/vacuum cleaners	Manual/sand blast	- elapsed time
		As a rule of thumb for discussion of equipment:	- labor time
		centrifugal abrasive wheels will predominate in small blast machines and small blast grit recycling rooms	- blasting material consumed per unit of work output.
		manually operated blast nozzles with expendable abrasives (non-recycling) usually prevail for off-ship exterior work and all on-ship blasting work	

Thirteen SP&C Work Planning Factors

8 EQUIPMENT (cont.)

TYPE FOR COATING	Spray paint	- Airless spray paint pump type equipment will perform better on viscous coatings and those to be applied in thicker wet films like 6 or more wet film mils per coat.	A combination of airless spray and atomizing spray equipment is the best overall painting equipment; supported by roller/brush, etc.
	- Air/airless		
	- Electrostatic		
	- Combination		
	Brush/roll (power or manual)	- A combination of airless and low pressure atomizing spray equipment works better on interior compts. and machine spaces working in and around obstructions, such as, pipes, cable runs, electronic consoles, machinery, furniture, etc.	Insist on spray operators using "wet film" thickness gages - put on the desired thickness at one time without excess and without <u>rework</u> .
	Dip or flow coating		

Thirteen SP&C Work Planning Factors

9 HANDLING AND STORAGE OF SP&C UNITS/ PIECES OFF-SHIP

<u>HANDLING</u>	Referring to the unit that is to be SP&C processed		
WHAT is to be handled	Identification of SP&C unit by code number or by detail description in case of smaller parts/pieces.	Can be pieces/parts/subassemblies/module/machinery, etc. Impacts equipment and time.	
WHY is it to be handled	For SP&C processing on-yards in-shop or for movement to storage or on ship as part of SP&C processing. Lifting - turning or moving to allow desired processing of SP&C work.	Impacts equipment, schedules, support craft coordination.	
Who is to handle it	Internal SP&C operations or requires service support assistance.	SP&C schedules depend on items moving on schedule. SP&C supervisors must request other moves/situations.	Heavy lifts should be scheduled by planners. SP&C supervisors must be able to handle units/pieces in their spaces without other trade assistance.
ROUTING AND SCNEDULE	From fabrication to SP&C process Step #1 can be primer or interim Step #2 can be interim or storage/ final Step #3 can be final The routing would be targeted at the planning level, but detail schedule would fall to SP&C operations.	Impacts dependent upon shipyard work process procedures for number of moves, required time of travel, number of heavy lifts, etc.	

Thirteen SP&C Work Planning Factors

9 HANDLING & STORAGE SP&C UNITS (cont.)

STORAGE

Units may be stored at the completion of fabrication with no coating or with residual preconstruction primer.

Units may be SP&C primed after fab. and stored at this point.

Units may be SP&C primed and part top coated - then stored awaiting additional assembly or erection.

This determination is a function of the system and where specific units fit in
- the SP&C operations must know the system and fit of the pieces even if they can't change the system.

Length of time in storage should be considered to avoid rust and corrosion of uncoated units and to avoid deterioration of partly

Units should be protected against surface film contaminations during storage or be thoroughly cleaned at end of storage or before additional recoating.

Certain coating systems may not be suspended for storage or other reasons at the primer or intermediate coat level, but must be continued thru final coat application within time constraints. The product data sheets will caution on this and it should always be respected. However, lower temperatures can extend recoat time and higher temperature can reduce recoat time. Judge accordingly. Check with paint lab personnel for added assurances.

Store units or pieces:

- inside where practical
- in position that allows runoff of water. Drill drain holes if runoff can't be relied on
- away from salt water flooding or salt water spray or mist

with spacer pieces between flat faces/surfaces

Thirteen SP&C Work Planning Factors

10 INSPECTION

	Inspection of work performed at any of several levels affects the following concerns: Does spec. require specific inspection? What type inspection? Who conducts inspections? Who witnesses inspections? Who accepts/rejects? NOTE: Spec./owner/customer used interchangeably here. Does the yard management system require inspections? Does the paint vendor/representative inspection?	Impacts based upon spec. are: What criteria? What documentation? At what points? - in process - intermediate - step-by-step - final What type/level? Inspection, or the right to witness in-process operations?	Depend on in-process inspections by experienced inspectors - you or your counterparts Keep formal inspections to the minimum. These disrupt work and and serve no purpose (unless mandatory). The most effective inspection system is composed of: - in-process monitoring that includes wet mil. thickness reading and dry mil. readings after each coat followed by
SPECIFICATION REQUIREMENTS	Does the dept. supt. require inspections by department-trained inspectors, independent of production personnel?	Impacts the scheduling of inspection services.	- one thorough final inspection of each unit/area/tank/compartment, etc. at completion of major coating work
INTERNAL REQUIREMENTS			
FOREMAN'S LEVEL.	Do you, the foreman, faithfully inspect and accurately evaluate the production accomplishments of your gang?		This, when faithfully and accurately done, is the best level of SP&C work inspection.

Thirteen SP&C Work Planning Factors

11 DISRUPTION/INTERFERENCE

GENERATED
BY SP&C

Delays/slow downs/cancellation/damage to other trades or other work functions as a result of SP&C operations.

Applicable SP&C operations on- and off-ship. The most damaging aspects occurring on-ship and on the adjacent dock areas.

SP&C BLAST
OPERATIONS
(CLEANING)

Generates hazards to others in form of dust/flylng abrasives/noise.

Blocks access routes due to masking and closure protective measures.

Precludes other to protect the surfaces being processed.

SP&C preparatory operations involve clean up/cover up to aren/unit, etc. that generate displacement, - move over disruptions for other trades before and after actual blasting and coating operations.

Plan SP&C operations for off shift times, after normal work hours or on weekends.

Utilize blast and coat rooms effectively thru a planned/agreed system.

SP&C COATING
OPERATIONS
(PAINTIG)

Generates flammable/explosive/toxic/irritating fumes.

Generates wet (painted)/slippery/keep off surfaces that preclude other work even if nonflammable/nontoxic coating is used.

Precludes other work due to personal health/safety/well-being of others.

Precludes or strictly limits access and movement thru or within the area/shop/bldg./space/compartment/dry dock or open decks.

Reduce rework. Do it right and once only.

Make use of approved accelerated curing techniques heat/humidity/ventilation control.

Utilize approved "fast cure" versions of available coatings.

SP&C CURING
OPERATIONS

(DRYING TIME)

Coating must cure to he:

- tack free from dust, etc.
- fume free to avoid fire or explosion
- dry hard to permit walking on without damage to the coating
- dry firm to remove protection/covering to release surfaces for continuation of other work.

Generates delays that tie up facilities/areaa/spaces/ compartments. While waiting for coatings to cure.

Thirteen SP&C Work Planning Factors

12 SAFETY

General Note:

Safety must be a totally integrated part of any and all SP&C operations. Safety demands and deserves to be a topic unto itself and is mentioned for limited consideration to show that it must never be neglected or left out. This is not an attempt to provide training in SP&C safety.

Impacts of unsafe operations:

- Injury
- Delay
- Liability
- Loss of work
- Claims

The life you save has a very high probability of being your own: in SP&C operations more than most other shipbuilding functions.

Your personal safety

- the first line supervisor has the prime responsibility

Put safety first; mixed right in with performance, production, quality control, etc.

Your personnel (your gang)

- the planners have aassociate responsibility

Your fellow employees

Your work area/shop/yard/ship

- the safety engineers have joint responsibility

"DO it right for once-only and safely."

Your shipyard/company

- the managers have leadership responsibility

Your community/environment

Your materials

Safety is everybody's business

Your equipment

Dust

- nuisance
- irritating
- toxic

Flying Particles

- abrasive grit
- abrasive shot
- abrasive other

WHAT/WHO

SP&C HAZARDS

Thirteen SP&C Work Planning Factors

12 SAFETY (CONT.)

SP&C HAZARDS (cont.).

High pressure air/fluids

- hose rupture
- nozzle exhaust

High pressure air from blast
or paint equipment.

High pressure fluid from water
blast or from airless spray
equipments.

Fire (explosion)

Fumes

- nuisance
- irritating
- toxic
- oxygen displacing

Falls

- from staging/ladders
- from personnel lift equipment

Chemicals

Affects

- burns
- blisters
- irritants (eyes)
- irritants (respirator)
- irritants (skin)

From

From chemicals used as cleaners
From chemicals being blasted off
From paints/coats containing
chemicals
From solvents/thinners

Thirteen SP&C Work Planning Factors

13 SCHEDULES

CONTRACT SCHEDULES	Management Developed. These target the <u>start</u> and <u>finish</u> of contract	"The beginning and end" of specific jobs No detail concern for SP&C personnel	
MASTER SCHEDULE	<u>A management tool that details :</u> - Key events - Award of contract - Lay keel - Launch - Deliver	This schedule sets the time frames for other more detail/supporting schedules. SP&C personnel can estimate their broad scope of work from this.	
MAIN EVENTS SCHEDULE	Details main events in sequencing order Erection/launching/outfitting/compartment completion/testing/train trail/delivery	Details SP&C of biles in machinery spaces Details SP&C for some tanks Details SP&C completion dates on compts/mach. spaces, etc., but leaves details-to later planning	Generates iteration of SP&C activity with other craft activity at specified times.
SHOP MFG. SCHEDULE	Details items/units/components/sub-assemblies built in shops or on exterior building plattens, skids/areas	Targets subassemblies to the <u>blast/coat house</u> or provides means for SP&C operators to estimate when units are ready for SP&C processes	
MODULE BLAST/COAT SCHEDULE	Short-term composite schedule made up by SP&C personnel to show SP&C loading and work flow from fabrication areas to erection time	This varies widely from yard to yard and from time to time within the same yard.	Points up the need for a SP&C coordinator team to make this a more efficient process in all shipyards.

Thirteen SP&C Work Planning Factors

13 SCHEDULES (cont.)

HULL ERECTION SCHEDULE	Schedules completion of structural work off-ship for erection units and the date of erection of these units on the ship.	Provides the control dates for some SP&C work that is to be done off-ship prior to erection.	60% of all SP&C coating should be completed prior to erection and 90+% of all blasting for SP&C should be complete.
LAUNCHING SCHEDULE	Shows details of structural completion and proposed staging removal prior to ship launching	Provides SP&C dates for underwater work and for exterior hull painting (dress up) prior to launching.	Underwater SP&C operations may be decided by spec - <u>management</u> or project level. Final economics is a function of proposed system and how long between launch and delivery.
DOCKING SCHEDULE	Proposed redocking times between launching and delivery	Provides one or more optional times for underwater SP&C work in whole or in part.	
OUTFITTING SCHEDULE	Provides target SP&C dates by showing completion of external sections/tanks/compts/machinery spaces	Additional short-term schedules are provided by project/depts. to detail SP&C operations.	
o SP&C TANKS	Provides hydro testing of tanks before launch	These are areas where the SP&C foreman can and should make real contributions by direct participation or by indirect representation at or to the planning meetings that schedule and re-schedule these SP&C operations.	Eliminate <u>rework</u> at each opportunity, but <u>do not</u> hesitate to <u>repeat</u> your ideas, suggestions or complaints that may contribute to better performance in SP&C operations.
o SP&C MACH. SPACES	SP&C operators have input into these schedules thru planning meetings to detail start and finish times for each compartment/tank/area		
o SP&C EXTERIOR	Breaks exterior of ship into sections for SP&C work		
o COMPARTMENT COMPLETION SCHEDULE	Targets number of compts. to be completed per week or month and on certain Navy work it targets the compartments/spaces that are turned over to the ship's crew for living and operational purposes		
and/or			
o COMPARTMENT TURNOVER SCHEDULE			Foremen/planners/mat. supervisors/equipment supervisors and similar SP&C personnel can and should play a significant part in long-term scheduling by feeding their ideas and needs through their superiors and back to the long-term planning sources. This can result in more meaningful schedules across the board and reduce total costs of SP&C operations.

SECTION IV

January 1987

SHIP PRODUCTION COMMITTEE
FACILITIES IMPROVEMENTS
OUTFITTING AND PRODUCTION AIDS
INDUSTRIAL ENGINEERING FOR SHIPBUILDERS
SHIPBUILDING STANDARDS **THE NATIONAL**
DESIGN/PRODUCTION INTEGRATION **SHIPBUILDING**
COMPUTER AIDS FOR SHIPBUILDING **RESEARCH**
SURFACE PREPARATION AND COATINGS **PROGRAM**
FLEXIBLE AUTOMATION
TECHNOLOGY TRANSFER
EDUCATION AND TRAINING
WELDING
REAPS

**WORK PLANNING FOR SHIPYARD SURFACE
PREPARATION AND COATING (SP&C)**

INSTRUCTOR GUIDE

U.S. DEPARTMENT OF TRANSPORTATION
Maritime Administration.

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

INSTRUCTOR GUIDE
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SCOPE AND OVERVIEW

Topic	<u>Suggested Hours of Concentration</u>
INTRODUCTION	1/2
SECTION I	
A. Historical Background	1/2
B. Approach to SP&C Work Planning	1/2
c. Shipyard Planning Organization	3/4
D. Thirteen SP&C Work Planning Factors - An Overview	3/4
E. The Five Stages of Work Planning in the Ship Construction Process	1/2
SECTION II	
A. Pre-Award Management Planning and SP&C Planning Factor Utilization	3/4
B. Management Planning Workshop	1
co Preconstruction Planning and Operations	3/4
SECTION III	
A. Special Considerations for Basic Planning	3/4
1. Safety Conditions and Gas Chemistry (w/exercise)	3/4
2. Shift Change Communication/Coordination (w/exercise)	1/2
3. Worker Qualifications (w/exercise)	1/2
B. Assembly level operations (w/exercise)	1/2
c. Block level operations (w/exercise)	1/2
D. Zone level operations (w/exercise)	1/2
E. Foreman Work Planning Checklist	1
SECTION IV	
A. An SP&C Work Planning Exercise	2
Total Hours	13 1/2
SECTION V	
A. Closing Administration	

COURSE OBJECTIVES

1. The purpose of this course is to provide the background information and skills necessary to improve the general ability of SP&C supervisors to effectively plan and schedule near-term surface preparation and coating work on ship construction.
2. A desired second outcome of this course is to increase the shipyard management's knowledge of the effects of near-term detailed surface preparation and coating planning on overall shipyard production efficiency.
3. A third outcome of this course is to increase the SP&C planner's knowledge and awareness of the safety implications and practices, and personnel needs necessary to carry through SP&C operations.
4. Lastly, a desired outcome is an improved exchange of SP&C work planning information and ideas between shipyard top management, SP&C supervisors and cognizant craft planners and schedulers.

NOTE TO THE INSTRUCTOR

This Instructor Guide provides the information required to prepare for, instruct and conduct a workshop on Work Planning for Surface Preparation and Coating. You are provided with workshop objectives and topics that must be covered to reach the objectives.

1. Shipyard Instructor's Qualifications

The instructor is a technically competent and experienced SP&C supervisor, and is knowledgeable in his shipyard's organization and work planning practices. The instructor will review and understand this training manual and the application of the SP&C work planning factor's applicable to the five phases of shipyard work planning. The instructor has the ability to conduct the workshop and mediate group discussions aimed at accomplishing the workshop objectives. An effective instructor should possess the interpersonal skills to effect this group discussions process.

2. Shipyard Participants

The workshop participants will include SP&C managers and supervisors, and other planners from shipyard organizations directly involved in the work planning process. The participants will openly contribute their ideas and experiences as related to the discussions. SP&C supervisors will attend the full workshop without interruption. Senior managers attend the first 4 hours and then complete the final 2 hour exercise with the other participants. No advance course preparation is required.

Composition of the Instructor Guide.

The Instructor Guide lesson pages are made in a two column format for instructor use.

Column One consists of:

1. Lesson objectives
2. Topics for discussion or presentation
3. Transition ideas to aid in the flow of instruction.

Column Two consists of:

1. Related instructor activity directing the necessary action for instruction or discussion.
2. Visual aid keys
3. References to the student workbook or other documents.
4. Discussion points
5. Related participant activity required for exercises or discussion.

NOTE TO THE INSTRUCTOR
(Continued)

The Instructor Guide Appendices contain:

1. Instructions on conducting this course
2. Review of presentation methods
3. All exercises

Please familiarize yourself with the lesson pages and sequence of activities prior to conducting the seminar. We recommend that you devote 16 hours to study, rehearsal, and personalization of the course and materials prior to presentation.

The instructional setting and equipments required for the training presentation are as follows:

1. Space. A suitable training room with comfortable chairs, tables, and quiet surroundings.
2. Equipment.
 - Lectern
 - Chalk/White board and Chalk/Dry-Erase markers
 - Easel pads and markers
 - Screen
 - Overhead projector
 - 35mm Slide projector with remote control
3. Participant Supplies
 - 1 Student workbook
 - 1 Paper tablets
 - 1 Pencils
 - 1 Straight edge

DEFINITIONS

SURFACE PREPARATION AND COATING (SP&C): The surface preparation of all materials for a ship and their coating for preservation, appearance, and other functions (e.g., anti-fouling).

NEAR-TERM PLANNING: Generally, the lowest level of planning and scheduling (two week schedule) or to the first level of trades supervision (Foreman).

WORK PLANNING: The means of performing the necessary steps to prepare for and accomplish SP&C tasks, it includes:

1. Determining where, when, and who will perform the work (planning and scheduling)
2. Acquisition of the required materials and equipment to perform the work
3. Scheduling SP&C craftsmen to perform the work
4. Integrating SP&C trades work with work planned for other trades

ASSEMBLY : The second level of construction (the first level is parts fabrication). The joining of two or more component parts to make up a system or an assembly (i.e., deck, sides, and ribs, etc.).

BLOCK: A group of assemblies joined to form an independent section of the vessel (bow, stem, deck house, etc.). Blocks are completed as far as practical (piping, ventilation, electrical, surface preparation and coating) and then joined (or via grand blocks) to form the complete vessel.

GRAND BLOCK: A relatively large block assembly made from 2 or more blocks.

ZONE : An identifiable space or group of spaces of the assembled vessel, providing for work and control purposes.

PLANNERS : Individuals whose primary job function is to plan work accomplishment through equipment, processes, or manpower applications.

SCHEDULERS : Individuals whose primary job function is to schedule work accomplishment through the various planned processes in the most efficient manner.

SP&C SUPERVISORS: Trades foremen and higher supervisors who are responsible for planning and scheduling SP&C work.

SP&C OPERATIONS: Trades performance of surface preparation and coating work tasks, e.g.; blasting, cleaning, painting, etc.

Reference: NSRP, Integrated Hull Construction Outfitting and Painting, May, 1983.

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4. J.W. Peart, L.L. Jaekel, M. Noma, N.K. Kobuhe, and I. Hirota, "Shipyard Design and Planning for a Zone-Oriented Painting System." Journal of Ship Production 1 (3) Aug. 1985 pp 192-210

INTRODUCTION

NARRATIVE	INSTRUCTOR NOTES
COURSE INTRODUCTION A. Introductory Remarks B. Course Objectives c. Participant Self-introductions D. Course Scope and Overview Section I A. Historical Background B. Approach to SP&C Work Planning c. Shipyard Planning Organization D. Thirteen SP&C Work Planning Factors E. The Five Stages of Work Planning in the Ship Construction Process	Viewgraph #1: <u>Course Title</u> Viewgraph #2: <u>Introduction</u> Viewgraph #3: <u>Objectives</u> Discuss each course objective Provide introduction to self & group. Provide the self-introduction sheets to be completed by participants. Self-introductions 1" each. Have participants turn in self-introduction sheets after introduction complete. Viewgraph #4: <u>Scope and Overview</u>

NARRATIVE	INSTRUCTOR NOTES
Section II A. Pre-award Management Planning and SP&C Planning Factor Utilization B. Preconstruction Planning and Operations Section III A. Special Considerations for Basic Planning 1. Safety Conditions and Gas Chemistry 2. SP&C Shift Change Communication and Coordination 3. Worker Qualifications B. Construction Stage #3, Assembly Level Operations c. Construction Stage #4, Block Level Operations D. Construction Stage #5, Zone Level Operations	

E. Foreman Work Planning Checklist

Section IV

SP&C Work Planning Exercise

F. Conduct of instruction

1. Participant learning activities

State the general types of learning activities, methods and media to be used, types of materials that will be used, and special requirements.

2. Methods and media

3. Materials

4. Special requirements

G. Administrative notes

H. Opportunity for questions

I. Summary

WORK PLANNING FOR SHIPYARD SURFACE
PREPARATION AND COATING (SP&C)

INTRODUCTION WORKSHEET

Instructions: Please use this worksheet to organize a short self-introduction

NAME: _____
SHIPYARD _____
DEPARTMENT : _____

POSITION/TITLE: _____
LOCATION: _____

Shipyard planning experience:

Experience	Types of planning experience
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Specific expectations from this Workshop:

Specific Questions you want answered:

SECTION I

OBJECTIVE

The purpose of this section of the course is to provide the background information and skills necessary to improve the general ability of SP&C supervisors to effectively plan and schedule near-term surface preparation and coating work on ship construction.

In order to meet this objective, the following enabling objectives have been formulated to provide guidance.

Enabling Objectives:

1. Given the necessary background information, be able to state and describe the importance of the 13 SP&C work planning factors.
2. Given information on the practical application of SP&C be able to discuss the benefits derived for work planning in SP&C.
3. Given the 13 SP&C work planning factors, be able to associate the appropriate work planning factor(s) with each of the five stages of construction.
4. Given information on SP&C work planning, be able to describe the advantages of long range planning of SP&C work to overall yard efficiency.
5. Given information on SP&C work planning, be able to analyze the impact of shipyard practices on SP&C work planning.

NARRATIVE	INSTRUCTOR NOTES
SECTION I A. Historical background 1. SP&C planning history a. Historically, SP&C functions have been the last item on a ship's completion list. b. Difficulties existed in effectively managing SP&C work under traditional construction methods. These were: - o Onboard SP&C work creates safety hazards - o Inefficiency due to the inherent nature and complexity of the traditional ship construction and repair processes used - o Pressure for completion of SP&C work, which is planned to be completed just prior to delivery - o Inefficient use of blast & paint houses - (most controllable SP&C process environments) - o Too much work planned to be done onboard - o Not enough finish coats applied under SP&C controlled conditions - o Significant outfitting work done onboard creates rework: - re - prep surface - repaint surface	Viewgraph #1: <u>Historical Background</u> Discuss historical background of topic.

NARRATIVE	INSTRUCTOR NOTES
c. Concern that painter's work still controlled by the design and production methods which are decided by others in the planning process. d. This training package is a result of that concern. B. Approach to SP&C Work Planning 1. Hull block construction serves to improve the long-range work planning process for the entire ship construction process. 2. Practical applications of SP&C work planning: a. Prepare & paint as early as possible in the ship construction process b. Do as much as possible under SP&C controlled conditions c. Use blast & paint houses when possible d. Apply preconstruction primer as an extension of other fabrication processes e. In order to preclude rework, paint final coats only after <u>all</u> other work is done f. Minimize hand work when possible g. It may be cheaper to move the paint than the item to be painted (cost trade off) h. Inspect, before you paint as well as after painting	Viewgraph #5: <u>Approach to SP&C Work Planning</u> Discuss each principle listed. These principles were developed by experienced SP&C professionals. o highlight controls such as: - environments - safety - schedules

NARRATIVE	INSTRUCTOR NOTES
i. Plan the blaster's and painter's work in relationship to other trades which are involved in the construction process j. The Hull Block Construction approach permits and encourages most outfitting and SP&C work to be accomplished earlier under more efficient conditions: - o Safer - o Cleaner - o Tools & materials delivered to work sites quickly, economically k. Plan early and adhere to your plan. 3. Benefits derived from this approach: a. Reduced blast and paint time b. Minimize onboard work - co Simplify SP&C planning & scheduling d. Avoid interference between trades e. Achieve greater efficiency of handling equipment and material f. Improve safety g. Improve working environment h. Improve productivity i. Improve quality j. Minimize rework	Viewgraph #6: <u>Benefits derived</u> Discuss each benefit.

NARRATIVE	INSTRUCTOR NOTES
4. Concluding Note Successful SP&C work in hull block construction is dependent upon hull construction and outfitting planners as well as painting planners, becoming more aware of each other's function. Through finding ways to coordinate and compromise, a reduction in the overall cost of ship construction will result. TRANSITION: Introduce shipyard organization exercise. c. Shipyard Planning Organization Conduct Shipyard Organization exercises. (See Appendix C, Shipyard Organization Exercise). D. Thirteen SP&C Work Planning Factors 1. The following 13 factors should be considered when planning and scheduling SP&C work. This list is meant to serve as an aid to supervisors and planners. a. This list was developed for the improvement of SP&C work planning in the overall yard planning process	<u>Progress check:</u> 1. What difficulties have historically existed in managing SP&C work effectively under traditional construction methods? 2. why have U.S. shipbuilders not been competitive? 3. How does hull block construction serve to improve the long-range work planning process? 4. State the eleven practical applications of work planning for SP&C. 5. What are the benefits derived from the practical applications of work planning for SP&C <u>Suggestions for Further Reading:</u> 1. <u>Outfit Planning</u>, National Shipbuilding Research Program, 1979. Viewgraph #7: <u>Shipyard Organization</u> Viewgraph #8; <u>13 Work Planning Factors</u> State each factor. Developed by SP&C professionals Viewgraph #9: <u>Physical Description</u>

NARRATIVE	INSTRUCTOR NOTES
b. Factor #1. <u>Physical Description</u> (of the item to be painted): - o Size - o Shape - o Openings - o Appurtenances - o Materials types - o Materials conditions c. Factor #2. <u>Location</u> (Where work is to be performed) - o Off-yard - o In-yard - o On-Ship - External - Interior d. (Factor) #3. <u>Support</u> - o Handling - o Transporting - o Utility services - o Ventilation - o Staging - o Temporary protection - o Cleanup - o Chemist - o Gas tester - o Safety	Discuss this factor These factors determine the SP&C options open to the planner. Viewgraph #10: <u>Location</u> Discuss these options Viewgraph #11: <u>Support</u> Discuss this factor Typical elements of support which vary from shipyard to shipyard.

NARRATIVE	INSTRUCTOR NOTES
g. Factor #6. <u>Minimizing SP&C Rework</u> - o When to apply primer - o When to apply intermediate coat - o When to apply final coats h. Factor #7. <u>Material</u> - o Materials for surface prep - o Materials for painting or coating - o Material safety i. Factor #8. SP&C <u>Equipment</u> - o Support operations - forklift - air compressors - o Cleaning - abrasive blast equipment - pneumatic/centrifugal vacuum cleaners - o Coating - sprayers - brush/roll (power/manual) j. Factor #9. <u>Handling and</u> - o Handling units to be Processed - o Routing and Scheduling - o Storage	Viewgraph #14: <u>Minimizing Rework</u> Discuss this factor in terms of component size and system. Viewgraph #15: <u>Material</u> Discuss this factor in terms of both the surfaces to be coated and the SP&C coating resources. Refer to Section 3.8. Viewgraph #16: <u>Equipment</u> Discuss this factor in terms of its implications to SP&C work locations, handling and storage, safety and rework. Viewgraph #17: <u>Handling and Storage</u> Discuss this factor

NARRATIVE	INSTRUCTOR NOTES
k. Factor #10. <u>Inspection</u> - o Routine inspection requirements - o Specifications inspection requirements - o Foreman's inspections 1. Factor #11. <u>Disruption/Interference</u> - o Generated by SP&C - o Generated by other trades - o SP&C blast operations - o SP&C coating operations - o SP&C curing (drying time) m. Factor #12. <u>Safety</u> - o What is involved - o Who is involved - o SP&C Hazards - dust - flying particles - high Pressure - fire - fumes - falls - chemicals n. Factor #13. <u>Schedules</u> - o Contract schedule - o Master schedule - o Main Events schedule - o Shop manufacturing schedule	Viewgraph #18: <u>Inspection</u> Discuss this factor Viewgraph #19: <u>Disruption/Interference</u> Discuss this factor Viewgraph #20: <u>Safety</u> Discuss this factor Viewgraph #21: <u>Schedules</u> Discuss this factor

NARRATIVE	INSTRUCTOR NOTES
- o Module blast /coat schedule 0 Hull erection schedule 0 Launching schedule 0 Docking schedule 0 Outfitting schedule 0 Trials schedule 0 Delivery schedule - Most important but least significant amount of work 2. See Appendix L, 13 SP&C Work Planning Factors (H.O. #1) E. The five stages of work planning in the ship construction process. 1. The following describes the five stages of ship construction related to work planning. a. This list is intended to serve as an aid to planners and supervisors. b. CONSTRUCTION STAGE #1: PRE-AWARD MANAGEMENT PLANNING - o The objective is to develop the overall plan and cost of the potential construction job	<u>Progress Check:</u> 1. State and discuss the 13 work planning factors for SP&C planning and scheduling. <u>Viewgraph #22: 5 stages of construction</u> Discuss the five stages Personalize this section to reflect appropriate terminology as used in this yard. <u>Viewgraph #23: Management Planning</u> Discuss this construction stage

NARRATIVE	INSTRUCTOR NOTES
- o Design planning is: - developing a bid work plan - determining specifications - developing the cost - determining the methods for construction - make/buy decisions - o Initiated by opportunity to bid (RFP) - new ship construction - repair package - o Results in: - cost-effective competitive bid - hull erection plan providing known efficiency - opportunity parameters - work plan to follow when contract awarded c. CONSTRUCTION STAGE #2: Pre-CONSTRUCTION PLANNING AND OPERATIONS The objective is to order material, fabrication of material, preparation of manpower needs, work packages and schedules - o Initiated by contract award - o Includes: - work planning refinements - schedules (master through detail) - project planning	Viewgraph #24: <u>Preconstruction Planning & Operations</u> Discuss this stage of the process.

NARRATIVE	INSTRUCTOR NOTES
- o Results: - work packages - schedules detailed - manpower planning - material ordering & receipt - raw materials preparation, coating, and storing accurate/appropriate SP&C specifications - optimum integration of trades and schedules to minimize interference requirements - yard ready to operate - shop processing of raw materials work commenced on schedule d. CONSTRUCTION STAGE #3: ASSEMBLY LEVEL OPERATIONS - o The objective is to issue work orders, and the initiation of actual work including fabrication, joining, assembly of parts and modules - o Initiated by work packages and short term schedules - o Includes: - off-ship environment - yard/shop joining fabricated parts - joining parts assemblies into subassemblies meeting short-term schedules - least handling - larger surfaces use cost-effective blast/paint houses easier access - most down-hand painting	Viewgraph #25: <u>Assembly Level</u> Discuss this stage.

NARRATIVE	INSTRUCTOR NOTES
- o Results: - SP&C Assemblies ready for block level surfaces protected to intermediate holding levels - some final materials coating - feedback to top mgt. on meeting production rates and schedules e. CONSTRUCTION STAGE #4: BLOCK LEVEL OPERATIONS - o The objective is to begin the outfitting process on the keel block. - o Initiated by: work packages and short term schedules - o Includes: - off-ship environment - yard/shop fabrication - joining assemblies onto blocks - less easy access to SP&C work - more disruption/interference - more safety and equipt. concerns by supervision - less down-hand work - greater coordination between craft planners - o Results: - greater percentage final outfitting and painting in this stage - greater potential for rework - feedback to top management on production rate and schedule performance	Viewgraph #26: <u>Block Level</u> Discuss Sometimes called <u>Section</u> level operations.

NARRATIVE	INSTRUCTOR NOTES
f. CONSTRUCTION STAGE #5: ZONE LEVEL OPERATIONS - o The objective is to complete outfitting of the ship after all blocks of the ship are completed. - o Initiated by: work packages and short term schedules - o Includes: - on-ship SP&C environment - maximum disruption/interference - maximum space preparation/cleanup - maximum safety requirements - maximum equipment handling manually - maximum restricted access - maximum coordination - final coats - touch up (cosmetics) - testing - inspecting - bottom wet - trial schedules - most rework intensive - most costly SP&C work . - environment - o Results: - ship ready for trials - ship ready for delivery - ship delivery area ready.	Viewgraph #27: <u>Zone Level Operations</u>

NARRATIVE	INSTRUCTOR NOTES
f. SUMMARY To this point we have discussed our industry's condition - its progress from traditional ship construction methods to the more sophisticated hull block construction method. We discussed the practical applications that we can employ in our planning and operations. We also discussed the 13 SP&C work planning factors and the five stages of ship construction.	<u>Progress check:</u> 1. State the five stages of planning for ship construction. 2. Describe the pre-award design planning stage. 3. Discuss how each of the following variables relates to pre-construction planning and operations: a) work planning refinements; b) master schedules c) detail schedules d) project planning. 4. Discuss the relationships between assembly, block and zone level operations in terms of SP&C planning. <u>Suggestions for further reading:</u> <u>Integrated Hull Construction Outfitting and Painting (IHOP),</u> National Shipbuilding and Research Program, 1983.

Section II



SECTION II

OBJECTIVE

The purpose of this section is to increase the shipyard management's knowledge of the effects of near-term detailed surface preparation and coating planning on overall shipyard production efficiency.

In order to meet this objective, the following enabling objectives have been formulated to provide guidance.

Enabling Objectives:

1. Given information about planning factors, be able to discuss and describe the SP&C off-ship and shipboard work schedule and production impacts related to management planning.
2. Given inputs on work planning factor information about manpower and schedules describe and discuss how SP&C planning will minimize rework requirements.
3. Given information about preconstruction planning and operations be able to describe and discuss the overall impacts of applicable work planning factors to preconstruction and planning operations.

NARRATIVE	INSTRUCTOR NOTES
o Outputs: - lowest bid price - efficient ship design plan meeting specifications - hull erection plan that is workable at bid price e. We must recognize that SP&C is not the only operation to be considered in identifying efficiency which will help keep yard costs down. Every department represented on the planning team will be offering its optimum cost-saving conditions. This means choices - decisions by top managers - which will result in the yard's optimum efficiencies in the design and resulting bid and workplan. Given the final design concept the hull erection plan is evolved and drives all that occurs once the bid is won. 2. SP&C Work Planning Factors Application to Pre-award Management Planning. It is important to develop a design plan which optimizes each of the applicable work planning factors. This may produce economies for the overall hull erection plan. Considerations are: a. Factor #1: <u>Physical Description</u> - o In-yard. For materials fabricated in the yard, SP&C design planning inputs will consider the type of materials, (composition and purpose), the construction stages and the size, shape, weight, openings and appurtenances at each construction stage, and the client's SP&C specifications. SP&C considers ways to: - put primer coat on small pieces/ plates/ beams/brackets/foundations/pipe handlers/nuts/bolts/washers/doors/hatches, etc. for off-Ship SP&C work	Viewgraph #2: <u>Planning considerations</u> Discuss these considerations

NARRATIVE	INSTRUCTOR NOTES
- put intermediate coat(s) on intermediate size pieces sub-assemblies, modules, etc. - put final coats on large pre-erection subassemblies and auxiliary items such as masts/king posts/smoke stacks/elevators o On-Ship. SP&C considers ways to: - Put final coats on per compartment completion schedule b. Factor #4 <u>Specifications</u>. Working specifications are derived from the client's detailed specifications. If the designer considers and incorporates the optimum SP&C efficiencies based on the specifications, cost-saving will be built right into the design and the price bid. o SP&C professionals can recommend the most efficient painting materials and methods to be planned based upon the given client specifications for finished work. Efficient SP&C can come from exploring alternatives: - the number of coatings and number of applications which can provide accelerated curing environments in blast paint houses - heat, ventilation, humidity are controlled - thicknesses of film. Too thick is worse than too thin because it consumes excess material and generates <u>re-work</u> thus using mere labor, resulting in higher costs overall	Viewgraph #3: <u>Applicable Work Planning Factors</u> Discuss these work planning factors Uncover each WPF in sequence

NARRATIVE

INSTRUCTOR NOTES

- specification reviews by qualified SP&C personnel required in work planning process to look for improvements which use a three coat system where permissible on most off-ship work
- when to use airless spray coating as the prime equipment supported by atomizing spray; brush/roller touch up work

o These alternatives provide for:

- flexibility to job
- potential for reduced rework
- overall lower cost and better quality

c. Factor #5: Time/Manpower. Time and manpower are important concerns of SP&C planners and schedulers.

o SP&C Planners will estimate time to perform work based on a number of factors:

- availability of manpower
- labor skills level
- methods and materials

o If the manpower is available in the desired skill levels and numbers, SP&C planners and schedulers will be able to:

- accurately plan the anticipated work
- maintain schedule when performing
- have efficient SP&C gangs
- always have one or more backup people trained or in training for each spot on the team. An ideal .. gang would be composed of:

35% long-time reliables
35% experienced mechanics
30% new people in training

o Schedule time vs estimated time in design plan development. Optimum planning requires accurate time estimates of the time it takes to complete SP&C tasks.

NARRATIVE	INSTRUCTOR NOTES
scheduled time. is generally a broader target or guide established at early planning levels estimated time is short-terms a detail time estimate that needs to be as accurate as possible - in order for scheduled times to be properly designed, the planner should consult with SP&C planners for the latest time data for the specifications being required - good planning will come from tracking estimated job time and labor against the actual time and labor needed to complete tasks work package schedules should be made available to and/or discuss- ed with long-term planners, schedulers and estimators d. Factor #6 <u>Minimizing Rework</u>. The painting methods, locations, and materials decided upon in the design planning stages will do much to minimize rework in future operations. Selection of the options for paint applications should be done here: - o When to apply-primer - o When to apply intermediate coat - o When to apply final coat(s) - o Efficiencies realized depend on the SP&C opportunities which can be written into the design plan so that SP&C planners can: - accomplish as much off-ship SP&C as permissible and practical within the specification and system constraints	

NARRATIVE	INSTRUCTOR NOTES
- plan each step of SP&C as close as permissible and practical to the completion of other trades work, especially fitting, cutting, welding, straightening, piping, wiring, etc. - use light colored primer and intermediate coats, where the system permits, to highlight and help correct unfinished structural/outfitting spaces prior to application of the final coat; and to improve illumination in construction areas and spaces when "quality" and/or "coating integrity" is the priority consideration then and only then should on-ship SP&C operations be considered as best choice for the bulk of SP&C work. (This eliminates patching in of make-up seams, joints, etc., permits full continuously covered coats of primer, intermediate and final painting e. Factor #7: <u>Material</u>. Beyond Construction stages #1 and #2, in which SP&C materials selection and inventories get locked in, SP&C personnel have limited options to decide on the use of cleaning or coating materials. - o The most efficient and effective methods should be planned <u>now</u> - make choices now - o We are speaking of these kind of materials - o Material for surface preparation part of SP&C:	Highlight as "The Parker Technique (e.g. Inside fresh water tanks and/or other long-term corrosion resistant, inaccessible spots)

NARRATIVE	INSTRUCTOR NOTES
- widely used for blasting recyclable facilities - abrasive Steel Shot - abrasive Steel Grit - white sand (expendable and used onboard) - inexpensive - use for blasting - substances for blasting & hand cleaning - disposal of toxics problem o Material for painting or coating part of SP&C: - alkyd resin paints (traditional low-cost) - vinyl resin paints (highly flammable and hazardous) o To minimize the cost of SP&C materials, SP&C may recommend inventory levels and commodities to meet specifications in design plann stage based on: - specifications required - known/estimated performance of materials on types of surfaces peculiar to the specifications under environmental conditions allowed under the design plan and consistent with yard manufacturing & storage practices and capabilities/resources f. Factor #8 <u>Equipment</u>. SP&C recommendations will. set forth appropriate equipment in optimum SP&C environments in accordance with a hull erection plan. The equipment should be consistent with the materials selected:	

NARRATIVE	INSTRUCTOR NOTES
- o Equipment and trained operators for general support operations: - fork Lift - front end loaders - conveyors - grit-hoppers - air compressors - air dryers - de-humidifiers - manlifters - aux - heaters - o Equipment and trained operators for cleaning surfaces: - abrasive blast equipment (automatic/manual) - fixed/portable equipment - pneumatic/centrifugal types - vacu/veyors/vacuum cleaners - o Equipment and trained operators for coating surfaces: - spray paint (air/airless/electrostatic/combo) - brush/roll (power or manual) - dip or flow coating - o Effective use of the right equipment and consequently, lower bid pricing, can result from the following SP&C equipment-related practices: - minimize start/stop operations - minimize set up time - minimize repair/breakdown thru effective preventive maintenance - plan equipment utilization - maintain equipment inventory - o Maximize use of equipment appropriate to the work and the work environment:	Give examples of how these are used.

NARRATIVE	INSTRUCTOR NOTES
- portable air compressors generally provide cleaner and higher pressure air for blasting. Thus, they reduce elapsed time, reduce labor time, and reduce blasting material consumed per unit of work output - centrifugal abrasive wheels will predominate in small blast machines and small blast grit recycling rooms - manually operated blast nozzles with expendable abrasives (non-recycling) usually prevail for off-ship exterior work and all on-ship blasting work - a combination of airless spray and atomizing spray equipment is the best overall painting equipment; supported by roller/brush, etc. - insist on spray operators using "wet film" thickness gages. Put on the desired thickness at one time without excess and without <u>rework</u> g. Factor #9: <u>Handling and Storage off-ship</u>. A well-planned design will minimize the off-ship handling and storage tasks and minimize repeat handling and consequent SP&C rework tasks. - o SP&C design planning inputs would consider costs based on optimum handling and storage afforded by yard/shop constraints, i.e.: - maximum in-shop handling by SP&C personnel - minimum lifts to items where SP&C is complete - o Maximum economies can come from appropriate storage of appropriately preserved/coated pieces	

NARRATIVE	INSTRUCTOR NOTES
o Storage constraints must be considered: - certain coating systems may not be suspended for storage or other reasons at the primer or intermediate coat level, but must be continued thru final coat application within time constraints. - length of time in storage should be considered to avoid rust and corrosion of uncoated units and to avoid deterioration of partly coated units - units should be protected against surface film contamination during storage or be thoroughly cleaned at end of storage or before additional re-coating - store units or pieces inside where practical - store in position that allows runoff of water, or drill drain holes if runoff can't be relied on - store away from salt water flooding or salt water spray or mist h. Factor #10: <u>Inspection</u>. The inspections relating to SP&C work tasks go beyond the foreman or quartermen checking to see if the surface is clean enough to paint or if the paint is dry. o The number and type of SP&C inspections are derived from several sources: - contract specifications - design plan - yard manufacturing capabilities - QA plan - QC plan - SP&C practices - operational rework - coating material & data sheets - environmental conditions	

NARRATIVE	INSTRUCTOR NOTES
- o SP&C planners are able to provide Design Plan inputs that interpret contract SP&C specs, constraints of yard manufacturing capabilities, and practices against specific SP&C tasks. The result is a lower bid price based on: - cost effective SP&C formal/informal inspection mix - cost effective QA Plan - cost effective QC Plan - close schedule maintenance - o SP&C inspection economies are gained by: - in-process inspection by experienced inspectors - keeping formal inspections to the minimum. These disrupt work and serve no purpose (unless mandatory) - the most effective inspection system is composed of in-process monitoring that includes wet mil thickness reading and dry mil readings after each coat, followed by one thorough final inspection of each unit/area/tank/compartment etc., on the completion of major coating work i. Factor #13: <u>Schedules</u>. There are many different schedules to develop and consider throughout the ship construction project. We can point out where SP&C inputs are critical to design planning. - o Delivery Schedule: - cosmetics (dress up) - least significant of all for SP&C yet most important in the yard.	

NARRATIVE	INSTRUCTOR NOTES
o Trial Trip: - SP&C operations generally complete smooth underwater hull (re: ship's speed and performance) - SP&C short term schedule - visual quality of compartments & spaces impact customer satisfaction o It would seem that the SP&C supervisor would have little input to these two schedules in the management planning stage, but that's not factual. The SP&C input is in: - QA Plan Customer Satisfaction - QC Plan - material factor (coating) meeting specifications - time for underwater hull work o The docking schedule and the launching schedule are critical to certain on-ship work: - exterior hull - underwater hull - underwater SP&C operations may be decided by <u>specifications, management, or project level.</u> Final economics is a function of proposed system and how long between launch and delivery o The following schedules form the core that drive most of SP&C work. It is easily seen that SP&C planning concerns related to these schedules should find their way into the Design Plan: - 60% of all SP&C coating should be completed prior to erection and 90+% of all blasting for SP&C should be complete - the Design Plan must ensure this - SP&C Design Plan inputs will help	Viewgraph #4: <u>Planning Core Five</u> - o Main event schedule - o Shop mfg. schedule - o Hull erection schedule - o Outfitting schedule - o Compartment completion schedule

NARRATIVE	INSTRUCTOR NOTES
- o Consider the Outfitting Schedule. One of its primary functions is the compartment completion schedule, which does the following: - targets number of compartments to be completed per week or month and on certain Navy work targets the compartments/spaces that are turned over to the ship's crew for living and operational purposes - instrumental in SP&C supervisors estimating number of workers required to comply with scheduled number of compartments - SP&C Time/Manpower inputs are clearly affected here - o The relationships between the Core Five and the last four (Docking, Launching, Trials, and Delivery) schedules to the Main Events schedules sequencing and thus the Design Plan are self-evident. The time line is key, and it cannot be estimated accurately for bid pricing unless SP&C inputs and those of the other trades are considered and balanced in a cost-effective Design Plan	<u>Progress check:</u> 1. State the four elements for pre- award management planning 2. Discuss in-yard and on-ship planning considerations for SP&C 3. Discuss the SP&C work planning elements and their relationship to design planning.

NARRATIVE	INSTRUCTOR NOTES
SUMMARY - o Importance of building SP&C into the Design Plan early - o Efficiency aspects of SP&C factors compliment the Hull Block Construction method	<u>Suggestions for further reading:</u> <u>Paint and Surface Preparation,</u> <u>NNational Shipbuilding Research Program, 1979.</u>
TRANSITION o Introduce Management Planning Exercise. See Appendix D.	
MANAGEMENT PLANNING WORKSHOP a. Introduction. The goal of management planning is to develop a ship construction or repair management design which incorporates all known and achievable yard efficiencies to meet client specifications at most competitive prices. - o Achieving the goal requires that design planners: - identify and consider all available shipyard efficiencies - identify all information and recommendation inputs required b. Conduct the exercise (See Appendix D, Management Planning Exercise) c. Opportunity for Questions d. Summary	<u>Viewgraph #5: Management Planning Workshop</u> Sumarize main points where SP&C recommendations and information inputs can support development of price competitive ship construction or repair Design Plans.

NARRATIVE	INSTRUCTOR NOTES
TRASITION:	IDEAS FOR TRANSITION: - o Positive reinforcement on inputs re: above - o Remind trainees to complete their planning aids from the chartpak sheets. - o At this time foremen only need to remain. Senior managers will report back to participate in the Section IV planning exercise, summary and closeout activities. - o Identify next topic/ exercise - o Provide break if appropriate

NARRATIVE	INSTRUCTOR NOTES
B1. Preconstruction Planning and Operations Introduction a. In this stage, we are going to consider that our yard has won the competitive bid for ship construction. We now must execute a new ship construction project within the price and schedule proposed. b. Preconstruction Planning is: - o Planning material processes - o Issuing purchase orders and contracts - o Planning material receipts, processing and storage - o Developing detailed work schedules - o Developing shop load plans - o Writing work packages - o Converting the design plan to a work plan - o Determining module sizes - o Developing work process flow paths c. Preconstruction Operations are: - o Material preservation upon receipt - o Raw material processing - o Material cutting, shaping, bending - o Subassembly manufacture	Viewgraph #6: <u>Preconstruction Planning and Operations</u> Discuss preconstruction planning variables and preconstruction operations.

2. SP&C planning factors are directed toward:
 - a. Influencing the preconstruction planning process and operations to make SP&C work that follows the most efficient as it is translated into:
 - o Detailed work schedules
 - o Material and equipment requirements consistent with the bid specifications
 - o The cost of operations based upon the bid price.
 - b. Once the Design Plan has been translated to detailed work packages and fixed schedules, the SP&C planner has very little influence over his efficiency or destiny on the project. His work is now driven by what others produce for him to paint.
 - c. The most effective operations will be built from this process integrating the SP&C planner into the detailed yard planning process with other craft planners

SP&C work planning factor application to preconstruction planning and operations.

a. Factor #1: Physical Description

- o Plan work packages and Schedules for:
 - size items for in-shop SP&C
 - minimizing in-yard open work on items with many openings
 - minimizing number of item appurtenances
 - minimizing degree of SP&C difficulty

Viewgraph #7: Applicable Work Planning Factors

Discuss application of these factors to planning work packages.

Uncover each WPF in sequence

NARRATIVE	INSTRUCTOR NOTES
o Preconstruction operations for off-ship work: - put primer coat on small pieces/plates/beams/brackets/foundations /pipe hangers/nuts/bolts / washers/doors/hatches - put intermediate coat(s) on intermediate size subassemblies, modules, and pieces - put final coats on large pre-erection subassemblies and auxiliary items such as masts/king posts/smokestacks/elevators/lifts - preconstruction primer application should include planned facilities for blasting/coating and quick curing of primer applied to steel on receipt at the shipyard b. Factor #2: <u>Location of Work</u> o Plan work packages and schedules for off-yard vendor supplied items - planners should have these routed on arrival to provide for in-house SP&C. These items must be receipt inspected and SP&C processed as required - require vendor structural items to be primer coated prior to delivery as much as possible	

NARRATIVE	INSTRUCTOR NOTES
- as much as practical require vendor outfitting items to be finished coated prior to delivery. - o Plan work packages and schedules for in yard-work: - plan least number of handlings - o Planners and SP&C personnel should collaborate on breakout size of units for most efficient SP&C work: - where to SP&C primer - where to SP&C intermediate - where to SP&C final - minimize travel to work in-yard location - o Preconstruction operations - make use of in-shop capabilities - o Blast and paint house - o Prepare and paint after fabrication operations - o Paint to' highest level possible while you are painting c. Factor #3: <u>Support</u> - o Plan work packages and schedules for: - minimizing support functions - maximizing use of SP&C capabilities	

NARRATIVE	INSTRUCTOR NOTES
- insuring all SP&C support requirements are calculated in the work plans to preclude a problem from SP&C supervisors short-term schedule - o Preconstruction operations support considerations: - handling - transporting - utilities - temporary protection - cleanup - blast and coat houses generally include provisions for transporting subassemblies or modules throughout the fabrication and SP&C processes d. Factor #4: <u>SP&C Specifications</u> - o Plan work packages and schedules for adherence to specifications as bid: - detail surface prep as bid - methods - inspection - follow on with proper coating - detail paint processes as bid number of coats - method of application - film thickness - o Preconstruction operations: - maximize controlled SP&C conditions to maintain specification and quality e. Factor #5: <u>Time and Manpower</u> - o Plan work packages and Schedules for: - overall SP&C manpower requirements - determining skill levels mix	

NARRATIVE	INSTRUCTOR NOTES
adherence to labor production rates bid on the job (or to better them) - identify needs for training on new equipment or processes Schedule with manpower acquisition - planners and operators must recognize that some short-term sacrifices must occasionally be made in time and manpower to support the team objective of overall shortest time and lowest manpower. These are management decisions and line supervisors/planners should not feel guilty at resulting higher cost o Preconstruction operations: - plan crews for continuous and efficient in-shop operations the compatibility of scheduled time and estimated time is a measure of the total team experience and ability in many situations. this compatibility plus a recognized system of SP&C work in any given shipyard will do much to improve production and reduce costs f. Factor #6: <u>Minimizing Rework</u> o Plan work packages and schedules for: performing as much work off-ship as possible painting to highest level of spec as possible at the earliest stage the planner's job is to make efficient use of these facilities at all levels or points of SP&C planning.	

NARRATIVE	INSTRUCTOR NOTES
- staging to avoid blocking other work - plan each step of SP&C as close as permissible and practical to the completion of other trades' work, especially fitting, chipping, cutting, welding, straight-g, ening, piping, wiring, etc. - monitor the status of other trades' work; see for yourself that other trades' work is ready for SP&C coating at the intermediate or final coat level o Preconstruction operations: - inspect work to be done before painting to insure other trades have finished their work, i.e. welders and fittersd - minimize handling and its associated damage to preserved and coated items g. Factor #7: <u>Material</u> o Plan material requirements and specifications to incorporate: - proper SP&C specs for vendor provided items to match the SP&C specs done in the yard so material is compatible - establish vendor paint delivery and service agreements for paint department-support to minimize paint inventory - establish paint shop operating materials and equipment maintenance schedules - work with procurement to insure vendor specifications are correct	

NARRATIVE	INSTRUCTOR NOTES
establish level of material preservation for materials to be received - plan processes for material preservation upon receipt for yard storage or processing o Preconstruction operations: check shelf-life dates examine product data and safety sheets try to establish production line type operations fully using blast and paint house, automated angle and sheet steel cleaning and coating equipment h. Factor #8 <u>Equipment</u> o Plan work packages and schedules for: - using equipment as bid maximize use of automatic and latest technology to meet bid specification - planners match the processes and equipment to optimize work plans and schedules o Preconstruction operations: maximize in-shop work and automatic equipment - install paint equipment in other shop areas to minimize material and equipment handling i. Factor #9: <u>Handling and Storage</u> o Plan work packages and schedules for: - heavy lifts to be planned by experienced yard planners	

NARRATIVE	INSTRUCTOR NOTES
coordinate SP&C planning around heavy lift (assembly or block lift) to assure final prep and inspection before movement - integrate handling and storage of all items in yard with respect to SP&C concerns o Preconstruction operations: SP&C plan for handling and storage in and around SP&C spaces with SP&C personnel - provide protection for items completed in pre-construction operations to preserve material condition j. Factor #10: <u>Inspection</u> o Plan work packages and schedules for: establish good inspection practices this stage (to spec & coating obj's) - in-process inspection is the preferred inspection technique for all means and methods of SP&C operations - depend on in-process inspections by experienced inspectors (You or your counterparts). Keep formal inspections to the minimum - these disrupt work and serve no purpose (unless mandatory) specification review by qualified SP&C personnel required in work planning process the SP&C coating objective impacts when/where/how coatings are applied and must be considered in long- and short-term planning in relation to the SP&C system and to the service function of the paint/coating.	

NARRATIVE

INSTRUCTOR NOTES

o Preconstruction operations:

inspect material received for
meeting its SP&C spec
inspect after processing
material for storage or
assembly operations
establish inspection points
in the shops or process lines
as required

k. Factor #11: Disruption/Interferenceo Plan work packages and
schedules to:

- minimize craft interference in
the construction process (this
is the best opportunity to
integrate SP&C planning with
other trades)

o Preconstruction operations:

- generally, minimal trade inter-
ference at this level. Maximize
trade productivity

1. Factor #13: Scheduleso Plan work packages and
schedules for:

- overall yard efficiency
- module blast/coat schedule

short-term composite
schedule made up by SP&C
personnel to show SP&C
loading and work flow
from fabrication areas to
erection time

points up the need for a
SP&C team coordinator to
make this a more efficient
process in all shipyards

NARRATIVE	INSTRUCTOR NOTES
-shop manufacturing schedule details items/units/components/ subassemblies built in shops or on exterior building plattens, skids/areas targets subassemblies to the blast/coat house or provides a means for SP&C operators to estimate when units are ready for SP&C processes o Preconstruction operations: - follow schedules established in work plan to keep other trades on schedule	<u>Progress check:</u> 1. List and discuss the elements of preconstruction planning. 2. List and discuss the elements of preconstruction operations. 3. Describe the SP&C work planning factors as applied to preconstruction planning and operations.

Section III

SECTION III

OBJECTIVE

The purpose of this section of the course is to enable participants to discuss and describe the safety implications and practices and personnel needs necessary to carry through SP&C operations.

To accomplish this objective the following enabling objectives have been formulated.

Enabling Objectives

1. Be able to discuss and describe SP&C safety implications including gas chemistry.
2. Be able to discuss and describe SP&C shift change communication and coordination considerations.
3. Be able to discuss and describe the implications of worker qualifications to SP&C work planning.
4. Be able to discuss the planning factors involved in assembly level operations.
5. Be able to discuss the planning factors involved in block level operations.
6. Be able to discuss the planning factors involved in zone level operations.

NARRATIVE	INSTRUCTOR NOTES
SECTION 111 A. Special Considerations for Basic Planning 1. <u>Safety conditions and gas chemistry</u> a. Personnel health and welfare b. Overall production costs c. Work time loss d. Government regulations e. Unsafe Operations result in: - o Injury - o Delay of work - o Liability - o Loss of work - o Claims against the yard - worker injury - non-performance of contract - o Bad yard reputation in the industry f. Safety becomes more critical as the complexity of SP&C work increases . with each construction stage - o safety planning is required for each construction stage - o safety planning (and supervision) responsibilities are involved at every construction stage	Viewgraph #1: <u>Three Special considerations for Basic Planning:</u> <u>Safety conditions and gas chemistry for Basic Planning</u> Lecture on major topics and facts.

NARRATIVE	INSTRUCTOR NOTES
g- Responsibility - o Foremen - o Planners - o Safety Engineers - o Managers h. The safety aspects of gas chemistry become more critical as the complexity of SP&C work increases. When SP&C work is being done on-ship and interior, it is the most critical environment for gas chemistry applications. Planning for gas chemistry support occurs at every level. i. Conduct the exercise (See Appendix E, SP&C Safety Planning Exercise) j. Opportunity for Questions k. Summary Summarize main points where SP&C efficiencies may be realized. 1. Transition	Viewgraph #2: <u>Safety Planning Exercise</u>

NARRATIVE	INSTRUCTOR NOTES
Special Considerations for Basic Planning 2. <u>Shift Change Communication and Coordination</u> a. An important part of SP&C planning efficiency is the exchange of information between SP&C crews at the change of shift. Coordination must occur between SP&C foremen and foremen of other trades, and between off-going foremen and other key persons, both internal and external to the yard. b. The goal of effective shift change communication and coordination planning is to minimize loss of SP&C productivity. To attain this goal, the following objectives must result from near term planning: - o Total project team coordination - o People on time - o Material in place at the right place - o Proper specifications/work plan crew size - o Contingency plan for change in conditions - o Support arrangements (prior planning) - o Proper equipment - o Other trade interface (prior planning) - o Inspection (overlapping)	Viewgraph #3: <u>Three Special Considerations for Basic Planning: Shift Change Communication and Coordination</u>

NARRATIVE	INSTRUCTOR NOTES
c. The greatest demand for SP&C shift change communication and coordination is most often found in zone level construction stage: ◦ heaviest volume of shift change information to be communicated ◦ accuracy of information is important ◦ heaviest volume of shift change coordination ◦ Heaviest demand on SP&C planners & supervisors ◦ Most frequent requirement for additional SP&C shifts d. Demand for SP&C shift change communication and coordination is usually less in construction stages 4, 3, and 23 (operations), and nonexistent in stages 2A, & 1. e. Conduct the exercise (See Appendix F , Shift Change Communication and Coordination Exercise) f. Opportunity for Questions g. summary Summarize main points where SP&C efficiencies may be realized h. Transition	Viewgraph #4: <u>Shift Change communications and Coordination Exercise</u>

[illegible]

NARRATIVE	INSTRUCTOR NOTES
CONSTRUCTION STAGE #3 ASSEMBLY LEVEL B. <u>Assembly Level Operations</u> 1. Introduction a. Characteristics of assembly level operations: ° Work transitions from SP&C controlled shops and spaces to open yard - Open yard - Spaces controlled by others ° Small assemblies put together as subassemblies - Some work still done in shop ° Subassemblies into sub-block level configurations ° Increased coordination requirements ° Complexity of operations increases for all shipyard trades ° Planners schedule near term against - Other trades deadlines - Availability of personnel mix - Availability of materials - Availability of support , resources ° More restricted opportunities to achieve SP&C efficiencies - o Weather ° Contingency plans required	Viewgraph #7: <u>Construction Stage #3 Assembly Level</u>

NARRATIVE	INSTRUCTOR NOTES
b. The goal of SP&C planners and schedulers is to complete as much SP&C work to the closest to finished condition in accordance with specifications in this stage. c. SP&C Efficiencies • Opportunities exist despite increased complexity - some SP&C controlled shop/ space work - spot opportunities arise from other trade/department mis-scheduling/holdups - supervision is close • Compared w/operational conditions of later construction stages, CS #3 allows greater efficiencies in most WPF's especially: - minimizing rework - support requirements - other trades disruption/ interruption 2. Conduct the exercise (See Appendix H, Worker Qualifications Exercise) 3. Opportunity for Questions 4. Summary 5. Transition	Viewgraph #8: <u>Assembly Level Operations Exercise</u>

NARRATIVE	INSTRUCTOR NOTES
CONSTRUCTION STAGE #4 BLOCK LEVEL C. <u>Block Level operations</u> 1. Introduction a. Characteristics of block level operations: - o Work remains in the open yard - Spaces controlled by others - On block - Erected hull - o Assembly to Block level configurations - o Near-term planning and scheduling - Based on work packages from production control - o Increased safety requirements - o Increased equipment & materials handling requirements - o Increased appurtenances & access openings - o Increased support requirements (lighting, ventilation, etc.) - o Complexity of operations increases for all shipyard departments - o Planners schedule near-term against: - other trades' deadlines - availability of personnel mix - availability of materials - availability of support resources - weather	<u>Viewgraph #9: Construction Stage #4, Block Level</u> Personalize discussion to yard technology and practices

NARRATIVE	INSTRUCTOR NOTES
- o Increased coordination requirements - o SP&C contingency plans required - o Shift work and shift change complexities increased b. The goal of SP&C planners and schedulers is to complete as much SP&C work closest to finished condition in accordance with specifications and construction stage constraints as possible. c. SP&C efficiencies - o Opportunities exist despite increased complexity - spot opportunities arise from other trades misscheduling holdups - coordination lines are shorter due to a need to interact with fewer trades supervisors and personnel - supervision is close - o Compared with operational conditions of later construction stage, CS #4 allows greater efficiencies in most WPF's, especially: - minimizing rework - support requirements - other trades disruption/interruption. 2. Conduct the exercise (See Appendix I, Block Level Operations Exercise). 3. Opportunity for Questions 4. Summary 5. Transition	viewgraph #10: <u>Block Level Operations Exercise</u>

NARRATIVE	INSTRUCTOR NOTES
CONSTRUCTION STAGE #5 ZONE LEVEL D. <u>Zone Level Operations</u> 1. Introduction a. Characteristics of zone level operations: - o Work moves onboard the erected ship - spaces controlled by others - internal and external SP&C tasks - compartment environment - open deck environment - ship in water - o Near-term planning and scheduling - based on work packages from production control - o Vast increase of temporary services (water, heat, elevators) - o Some intermediate and remaining final coats - o Heavy Rework - o SP&C quality work important to sale of ship - o Increased safety requirement - o Increased equipment & materials handling requirements - o Maximum spaces preparation & cleanup - o Increased appurtenances & restricted access to spaces & surfaces	Viewgraph #11: <u>Construction Stage #5 Zone Level</u>

NARRATIVE	INSTRUCTOR NOTES
° Most complex stage of construction for all trades ° Maximum disruption/interference from other trades ° Planners schedule through plan-of-the-day-meetings: - Consider: - other trades' deadlines/ rework - availability of personnel mix - availability of materials - availability of support resources - weather - o Maximum coordination requirements ° SP&C contingency plans required ° Shift work ° Increased supervision requirements b. The goal of SP&C planners and schedulers is to complete SP&C work to finished condition in accordance with specifications. c. SP&C efficiencies ° Opportunities exist despite increased complexity: - spot opportunities arise when other trades Schedules are held up - daily plan-of-the-day meetings allow timely feedback - zone construction promotes supervisory visibility in his zone of work - effective contingency plans	

NARRATIVE	INSTRUCTOR NOTES
° Compared with operational conditions of other construction stages, zone construction is least effective in: - handling and storage - other trades disruption/interruption - overall production 2. Conduct the Exercise (See Appendix J, Zone Level Operations Exercise) 3. Opportunity for Questions 4. Summary Do as much SP&C work as practical in early stages of construction 5. Transition	Viewgraph #12: <u>Block Level Operations Exercise</u>

E. Foreman Work Planning Checklist

1. Introduction

- a. The first line SP&C supervisor needs a checklist of planning factors and specific actions to take as he plans a variety of work assignments.
- b. The work planning checklist (Appendix N) provides the framework for the specific actions he should take as related to the work planning factors.

2. Conduct a detailed discussion of Appendix N.

The discussion results in the detailed actions to be in each checklist item which are to be written down by the student in the student notes column.

This will create a checklist in the supervisors own terms and within the operating structure of that shipyards policy and practices.

(Note: This particular section of the instruction is particularly important and the instructor may wish to substitute it for any or all of the 3 preceding exercises (Appendices H, I, and J).

3. Opportunity for summary discussion on how the supervisor may use the information.

4. Transition

Section IV

NARRATIVE	INSTRUCTOR NOTES
SECTION IV A. SP&C Work Planning Exercise 1. Introduction a. Discuss participant accomplishments to this point. b. This exercise is combined participant grouping. c. Objective is to pull it all together now with an exercise in which top managers and SP&C supervisors, planners and schedulers apply the 13 WPFS to the concerns of SP&C in a case incident exercise. d. Distribute exercise materials. ° On completion of the exercise, these materials can be inserted in the Student Workbook in the space allotted for . Appendix K.	

NARRATIVE	INSTRUCTOR NOTES
2. Conduct the exercise (See Appendix K, SP&C Work Planning Exercise) 3. Opportunity for Questions 4. summary 5. Transition	Viewgraph #1: SP&C Work Planning Exercise Announce course Closing administration ◦ complete evaluation ◦ receive certificates ◦ closing remarks

Section IV

NARRATIVE	INSTRUCTOR NOTES
SECTION V Closing Administration 1. Transitional Statement 2. Complete Course Evaluation Sheets 3. " Award Course Completion Certificates (Local Forms) 4. Closing Remarks	Viewgraph: Course Title Viewgraph Pass out Course Evaluation forms . 10" to complete forms

WORK PLANNING FOR SHIPYARD SURFACE
PREPARATION AND COATING (SP&C)

EVALUATION

Name _____ Date _____

Shipyard _____ Position _____

INSTRUCTIONS:

COMMENTS : Space is provided for your comments, suggestions, and explanations of ratings following each section.

SCALE RATINGS: Please evaluate each aspect of the Course listed below by marking the 5 point scale to the right of each item. Mark the box to indicate your evaluation. Please do not split ratings.

PARTICIPANT'S OBJECTIVES

Indicate your objectives in attending this course

1. _____

2. _____

3. _____

a. To what degree were your objectives satisfied?

_____ Outstanding _____ Excellent _____ Good _____ Fair _____ Poor

COURSE CONTENT

Indicate how useful each item of content was to you.

low	med		high	
1	2	3	4	5

1. Shipyard Organization Exercise

2. Management Planning Exercise

3. SP&C Safety Planning (H.O. #2 issued by instructor during discussion).

4. SP&C Shift- Change Communication and Coordination

5. SP&C Worker Qualifications

6. Assembly Level Operations: work planning Factor and Elements Identification

7. Block Level Operations: Work Planning Factor and Elements Identification

COURSE CONTENT (cont.)

Indicate how useful each item of content was to you.

	low	med	high		
	1	2	3	4	5
8. Zone Level Operations: Work Planning Factor and Elements Identification					
9. SP&C Planning Exercise					
10. Appendix L, 13 SP&C Work Planning Factors					
11. Instructor-led discussions					
12. Participant-led discussions					

TOPIC COVERAGE

Which topics should have received more time? Please cite.

2. _____
3. _____

Which topics should have received less time? Please cite.

2. _____
3. _____

	low		med		high
COURSE DEVELOPMENT	1	2	3	4	5
1. Student Workbook					
2. Learning Environment					
3. Feedback Instrument (this form)					

OVERALL RATING:

low		med		high
1	2	3	4	5

How would you rate the course as a whole?

Comments:

What was the most effective part of the course for you? Why?

What was the least effective part of the course for you? Why?

APPENDIX A

APPENDIX A

HOW TO USE THE INSTRUCTOR GUIDE

This Instructor Guide will provide you with all the information required to prepare for and instruct in this workshop.

Self-Introductions and Administrative Concerns:

1. Introductions.

As an introduction to the workshop, display the workshop title and your name on a viewgraph or other visual aid. Tell the participants your job title, something about your expertise, and why you were chosen to conduct the workshop. Display and explain the objectives of the workshop. Follow this by calling the participants' attention to the Objectives of Sections I, II and III of the Student Workbook. Allow time for participants to read over each set of objectives as they are introduced. Then have the participants complete the participant self-introduction worksheets found in their notebooks. When ready, have participants introduce themselves to the entire group. Collect the participant introduction worksheets, and explain that you will use the information to provide instruction and answer questions focused on the apparent requirements of the group. Carried out in this sequence, the self-introductions should move more quickly. The participants will have the instructor's self-introduction to follow as a role model and will have had a quick orientation to the course through reading the objectives. This will help participants focus their statements of expectations and questions.

2. Administrative Concerns.

Next, make any administrative announcements and answer any questions. Be sure participants are aware of the location and use of such things as: coffee mess, restrooms, telephone, and the like. Finally, go over the workshop agenda, contents of the student workbook (SWB), and emphasize that the workshop, to be successful, requires the input of every subject matter expert present. Remind participants that each is expert in some important aspect of the shipyard's

planning and operations. If you know the expertise of any participant, cite that as an example of expertise available in the workshop.

3. Reading Assignment. There is one "take home" assignment in this workshop. At the end of the first day, require participants to read over in detail the contents of Handout #1, Thirteen SP&C Work Planning Factors. This assignment is necessary to facilitate the following day's individual and group exercises.

Each Section within this Instructor Guide contains the following:

1. Learning Objectives. These objectives are written to support the workshops instructional goals relative to the topics of the section.

2. Content. The basic material of this course has been developed by persons with career experience in shipyard SP&C and management planning. This should be especially evident as you work with the Thirteen SP&C Work Planning Factors. The course content is drawn mainly from the Thirteen SP&C Work Planning Factors, and from discussions with subject matter experts. The main processes of the course are the exercises. These are contained in the Appendices. All information required to prepare for and conduct the exercises is provided in the Appendixes. In most cases an introduction and outline for each exercise will be found within the sections of this Instructor Guide. The outlines should be personalized by the instructor.

3. Content of Appendix B. The presentation methods and techniques contained in Appendix B should be helpful even to experienced instructors. They are intended mainly to support instructors who have not used these methods for some time and require some review. The sections called; "Discussion Group Leader's Guide", and "Questioning Techniques" should be provided as soon as possible to persons selected to lead small group discussions.

4. SP&C Work Planning Factor #12, Safety.

WPF #12, Safety is covered entirely in Appendix E. There is no need to discuss it at length in Section I.

Instructor Preparation, Personalizing the Instructor Guide, and comments on Discussion Groups.

1. Instructor Preparation. The successful instructor will accomplish all tasks in preparing to deliver this workshop.

- a. Read the Training Plan
- b. Review Appendix B: Presentation Methods especially on Conducting Discussion Group Activities, and Questioning Techniques
- c. Review Appendix L: 13 SP&C Work Planning Factors. These Factors are the heart of this course.
- d. Personalize the workshop outline
- e. Conduct at least one (two to three are preferable) self-rehearsals of each element and activity of the workshop in the environment in which the workshop will be presented. Use of a tape recorder is suggested.
- f. Review Student Workbook to become familiar with content and intended application of the materials.
- g* Ensure sufficient copies of instructional materials are available for distribution to each participant (e.g.: H.O. #2, Appendix E, and H.O. #3, Appendix K).
- h. Inspect the training environment at least twice: 24 & 36 hours before presenting the workshop (you don't want any surprises on day #1) .
- i* Review the content of the Appendices and ensure all supporting materials and equipment are available on site and ready to be moved into the training environment.
- j. Identify and brief prospective discussion group leaders as soon as the audience for the course is known.
- k. Prepare instructor's self-introduction viewgraph.

2. Personalizing the Instructor Guide. The Instructor Guide is laid out in a sentence fragment outline which provides topics, objectives and discussion points, along with notes to instructor. Space is provided between entries for the instructor to personalize each discussion point by noting important

supporting points, and examples> and specific questions to be put to the group. Further, the instructor is able to personalize the Instructor Guide to his shipyard and its practices by lining through inaccurate and inappropriate terms and phrases, and writing in those familiar to personnel of his specific shipyard. In order to allow the instructor maximum freedom in this regard, rigid note-taking outlines have been omitted from the Student Workbook.

3. Discussion Groups.

- a. For purposes of this course, Discussion Group Leaders should be identified before the course begins and provided with the pertinent exercise materials and a short briefing.
- b. Because the first day's exercises include the management planning exercise, and because one of the purposes of the course is to accustom top managers and SP&C supervisory personnel to working together, both managers and SP&C personnel should be involved as discussion group leaders. To ensure course unity, members of other trades should also be asked to volunteer or should be assigned as discussion group leaders.
- c. To ensure equitable representation of management, SP&C, and other trades, Discussion Group Leaders should be changed for the second day's exercises. All leaders should be changed to avoid any appearance of poor individual performance. This means that the second day's leaders will require briefing and a materials package for overnight review.
- d. It may help matters to publish the list of leaders for each day, to let the group as a whole know how the discussion leaders are selected, and to ask for the cooperation of all to ensure that objectives of the course are met. The above describes an ideal situation. These decisions rest, finally, with the instructor.

- e. Discussion Group Leaders should be briefed on the material to be covered, given time to review it, to clarify any questions, and to ensure all materials are complete.
- f. Leaders should be cautioned to avoid discussing the forthcoming exercises with or within hearing of the group in general. Misconceptions can arise in such cases and cause the expenditure of greater time in lengthy explanations than is affordable .
- g The professionalism of the persons selected can no doubt be depended on to ensure that the discussion groups get off to a good start on the first day. The instructor should, however, keep all concerned mindful of time available, and require that leaders prepare a quick introduction and establish a pace that will provide a group product within the allotted time.

APPENDIX B

APPENDIX B

Presentation Methods and Tips to the Instructor

1. The contents of this Appendix have been selected and are provided as a study resource for the instructor to assist his orientation to the presentation methods and techniques applicable to this course. While the information may not be needed by some instructors from shipyard training departments, the case may arise in which the person designated as instructor has not conducted training for some time and/or does not have appropriate refresher resources at hand.
2. The following methods/techniques are covered:
 - a. Discussion Group*
 - b. Discussion Group Leader's Guide
 - c. Question Period*
 - d. Questioning Techniques
 - e. Case Study*
 - f. Workshop*
3. The Discussion Group Leader's Guide, and the Questioning Techniques should be copied and provided to participants selected to lead small group discussions.

1. Those Methods asterisked are adapted from: U.S. Office of personnel Management (OPM), Training Course Design and Development, Personnel Management Training Center, 1981

DISCUSSION GROUP

A group of persons meet together to discuss informally and deliberate on a topic of mutual concern.

The Discussion Group May Be Used:

1. To develop a nucleus of leadership and teamwork for service.
2. To identify, explore, and seek solutions for problems and to develop plans of action.
3. To change attitudes through discussion and the examination of information.

Advantages:

1. Group discussion permits full participation.
2. It can establish consensus democratically.
3. It pools the abilities, knowledge, and experience of all to reach a common goal.

Limitations:

1. Group discussion is time-consuming, particularly if the group includes persons of widely different backgrounds.
2. A bossy leader or a few members may dominate the discussion.
3. Some persons will not participate fully.

Physical Requirements:

1. The group is usually seated around a large table (or tables arranged in a rectangle). Face-to-face discussion is essential. An informal and relaxed atmosphere will permit free discussion.

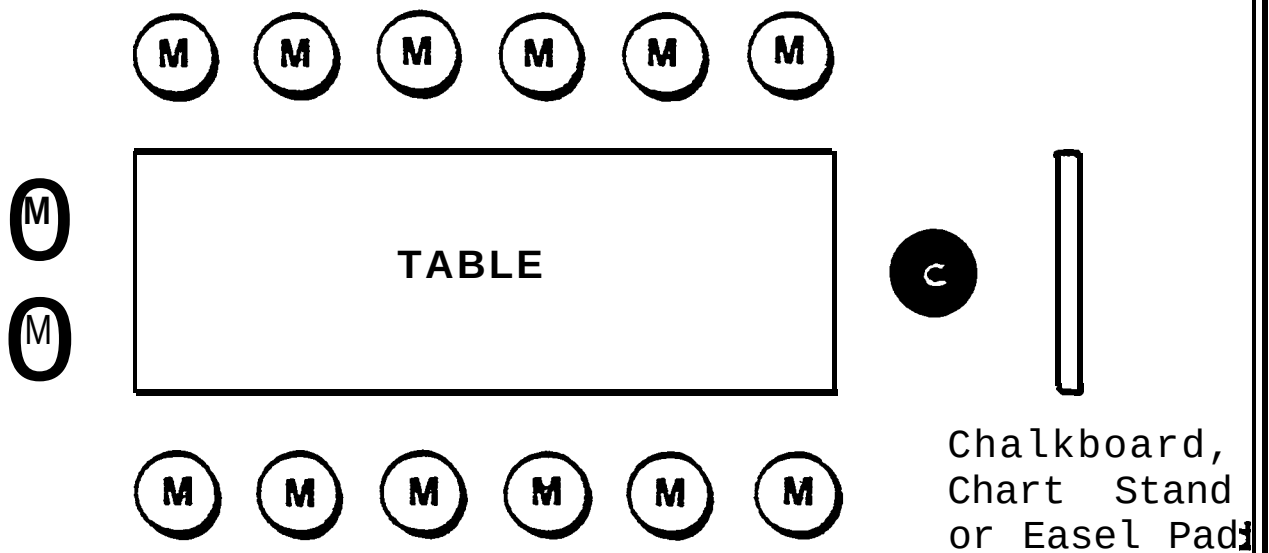
Procedure:

1. Should be governed by the group itself. Generally, the leader will preside and moderate the discussion.
2. A group may meet as long and as often as is necessary and convenient or specified.
3. A change of leaders may be made to utilize special individual abilities. For example, different leaders may be used in the deliberative, planning, and action phases of the group's work.
4. The group may appoint a recorder to keep track of its deliberations and to report on its progress from time to time.

Similar Methods and 1.
Techniques:

The discussion group is considered as a specific method, but the discussion technique can be used as the primary or as a supplementary technique in almost all methods if size of the group permits. Twenty is considered about the maximum number of participants in a discussion group.

ARRANGEMENT FOR DISCUSSION GROUP



O Chairman or Moderator

M Group Members

Alternative Arrangements:

It is not necessary for a discussion group to be seated around a table, but the table top is very helpful if resource materials are being used. It is necessary that discussion group members be in a circular arrangement facing each other. Usually a chalkboard or other large recording surface is helpful.

Discussion Group Leader's Guide

Purpose. To provide guidance on conducting the guided discussion, and employing conference techniques which are applicable to this course.

The Guided Discussion. The difference between a lecture and a guided discussion is that a lecture deals primarily with a one-way communication of ideas (instructor to student) whereas a guided discussion lays heavy stress on getting students to participate in the learning activities 'with a free exchange of ideas (instructor to student/ student to student/student to instructor). In a guided discussion much more attention must be paid to student identification and discussion of the main ideas. For this reason, the primary emphasis in designing and leading a discussion must lie on the questions selected and the questioning technique employed by the discussion leader.

Discussion Group Leader Concerns.

1. The leader will encounter strong opinions, thoroughly grounded views on methods for getting things done. The leader's objective is to get these views and methods out on the table and discussed positively. Each should be considered in order to identify its applicability to solving the problem or developing the idea at hand.

Discussion Group Leader's Guide (cont.)

2. The leader must be conscious of the time, usually about thirty minutes, and allot sufficient time to identification of applicable inputs, their discussion, and formulation into a reportable solution. Affecting the consumption of time and thus the quality of the report, are the makeup of the discussion group itself, and the effective use of questioning techniques by the leader. Thus to control the group - keep the group on track to a quality report.
3. It is important to maintain the cooperation of all discussion group participants. The contributions and dignity of all participants must be acknowledged and maintained by the group leader. Participants should receive positive feedback for their inputs. If the atmosphere is kept informal and positive, discussion soon becomes a free interchange and mutual development of ideas.

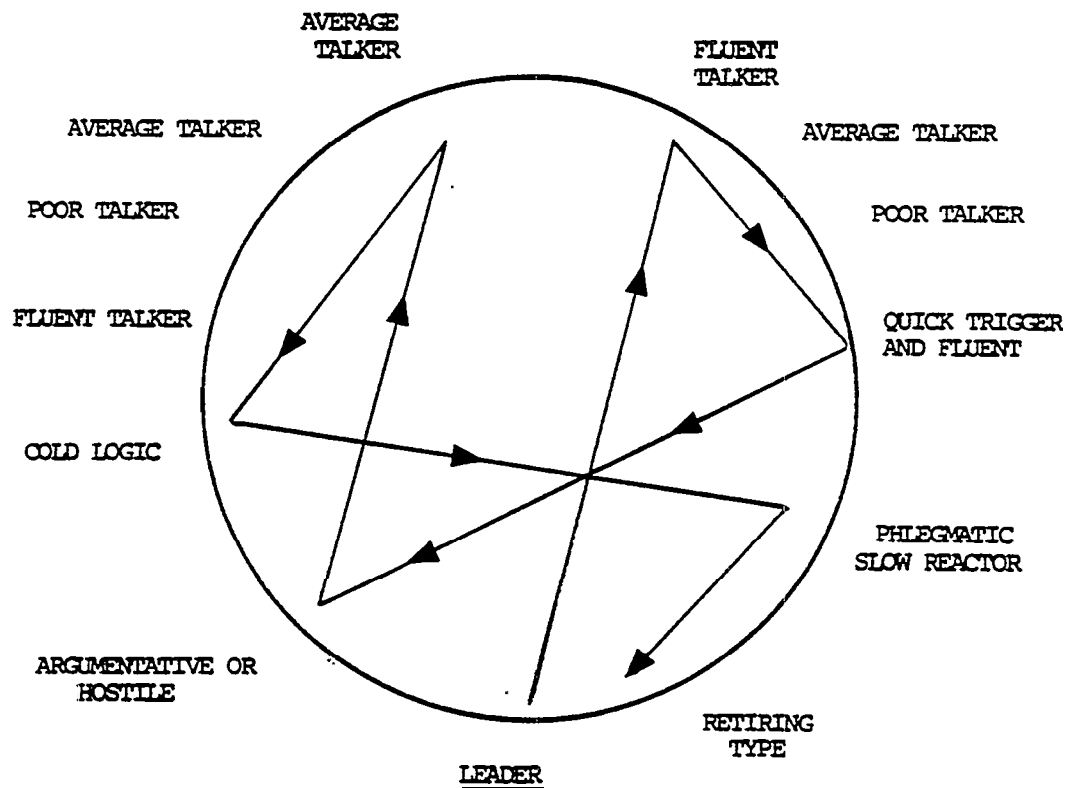
If the leader projects annoyance with one or another of the less helpful types of participants, it will be quickly sensed by all and subsequent inputs may be inhibited.

To keep helpful participants in the discussion, leading questions (yes/no answers) may be a good approach. The participant is acknowledged, makes a contribution, and may at a minimum retain or gain a cooperative attitude.

Discussion Group Leader's Guide (cont.)

4. The following illustration identifies the variety of "types" which may be encountered in the normal discussion group. The discussion group leader should try to identify the types of participants in his group so that the appropriate questioning techniques can be selected and used to stimulate and derive quality inputs to the group's report.

An ideal seating arrangement of discussion group "types" and an overhead view of the flow of the discussion.



Discussion Group Leader's Guide (cont.)

For the purposes of this course the discussion group leader may find it useful to designate persons in the group to review specific Sp&C Work planning Factors before the group meets. This gives the discussion group leader a ready source to bring into the discussion at particular points.

Checklist. Here's a checklist which should be helpful in preparing for and conducting your group discussion.

1. A successful Discussion Group Leader will accomplish the following in preparing for an conducting the discussion:

1. Preparation of discussion material

- a. Rough out an outline of where the discussion should be directed. Include the following:

- ° Introductory statement
- ° Main points that must be covered
- ° Questions, statements, examples designed to stimulate group participation on main ideas.
- ° Follow-on measures designed to anticipate group reaction and response in order to carry the discussion forward.

Discussion Group Leader's Guide (cont.)

- o Examples/that are realistic and take into account the background and interests of the group.
 - o Possible subsummaries as well as transitions designed to tie ideas together.
 - b. Consider the direction you will give the person selected as group recorder. Brief the recorder before the discussion begins.
- 2. Preparation of participants and environment
 - a. Distribute advance material and ensure that group members have brought requisite materials to the table for reference.
 - b. Notify group members of time and place of discussion.
 - c. Ensure that the physical requirements of the discussion facility are prepared.
 - d. Identify additional requirements.
- 3. Lead/Conduct Group Discussion
 - a. Start discussion on time.
 - b. Ensure introduction immediately focuses discussion on the problem.

Discussion Group Leader's Guide (cont.)

- c. Use examples, questions, and discussion techniques to provoke participant discussion.
- d. Discussion techniques:
 - (1) Keep the group on track.
 - (2) Avoid allowing one person to dominate discussion.
 - (3) Avoid leader domination of discussion.
 - (4) Attempt to get all members of the group to participate.
 - (5) Use questions, subsummaries and transitions to tie ideas together and ensure all necessary sides of the issue are covered.
 - (6) Use prepared and impromptu visual aids effectively.
 - (7) Obtain agreement on final conclusion (achieve if possible).
- e. Guide the group recorder. Review the discussion group report with the recorder to clarify any questions before presenting the report to the overall group.
- f. Summarize by:
 - (1) Identifying key areas covered and key areas not covered.
 - (2) Using group ideas to aid in summary.

Remember, reports may not be fully developed and discussed in the time available, but the group leader must get the best he can from his group. The group must cooperate to get out the best solution they can - one presentable to their peers.

QUESTION PERIOD

The question period is an organized follow-up session to a formal presentation in which members of the audience direct questions to the program participants.

The Question Period May Be Used:

1. To get the total audience involved in the activities.
2. To call for clarification of points made in the formal presentations.
3. To give members of the audience an opportunity to ask for information of interest to them and not covered by the speakers.

Advantages:

1. Provides a feedback link between speakers and audience in presentations, and provides for some audience participation.
2. Gives a reflection of audience agreement with the speakers.
3. Encourages the members of the audience to pay close attention to the remarks of the speakers.
4. Psychologically it is good for the members of the audience to know they have the opportunity to participate, but do not have to do so.

Limitations:

1. If the group is large, even with portable microphones, it is physically difficult to handle questions and answers so all can hear.
2. Time for the question and answer period is usually limited, and it is often treated as an incidental part of the overall program.
3. The period comes at the close of the session when audience members are often tired or anxious to adjourn the meeting.
4. A few members of the audience may dominate the discussion.
5. Many members are timid and will not participate.

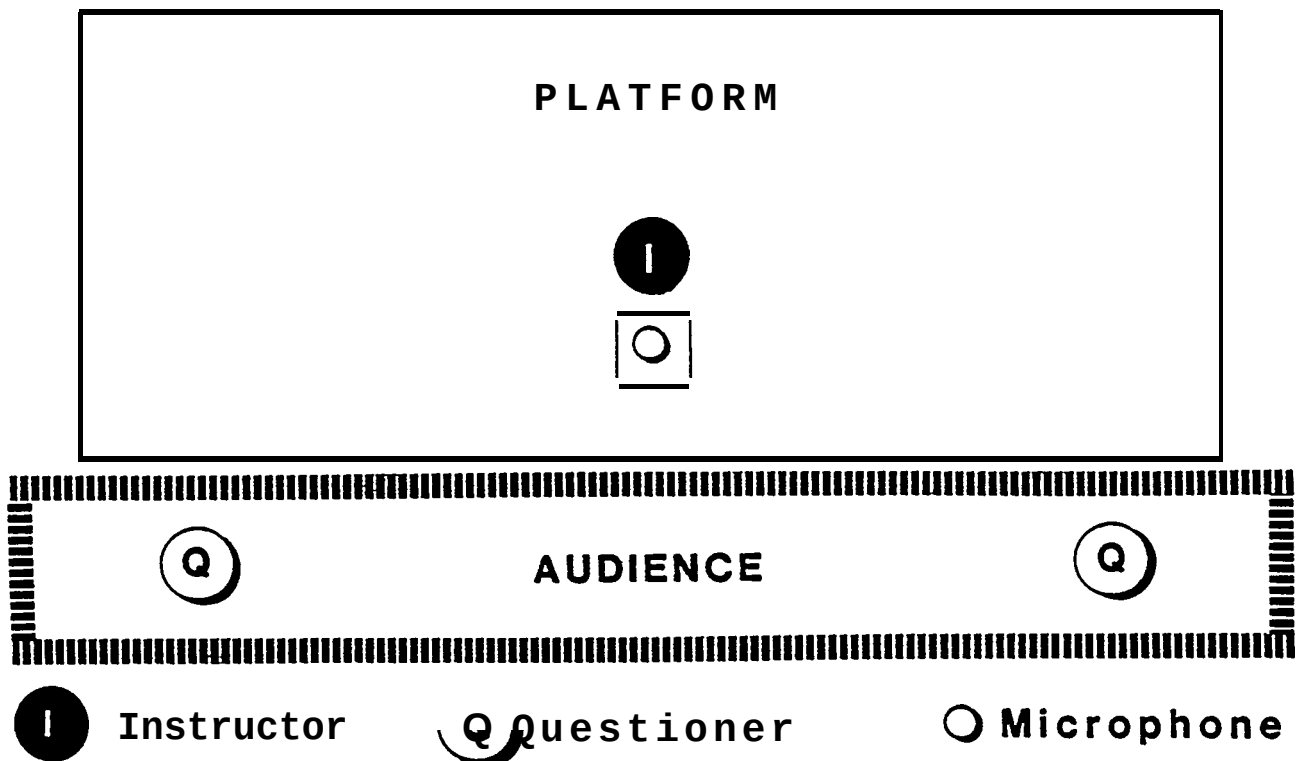
Physical Requirements:

1. Roving or portable microphones if the group is large.
2. Writing materials if questions are to be submitted in written form.

- Procedure: 1. Chairman or Instructor or moderator informs audience that question period will be used and explains the procedure, before the formal presentations.
2. Floor men move roving microphones around, or collect written questions and carry to instructor or moderator.
3. Instructor or speaker reads or repeats the question (if necessary) and responds.

Similar Methods and Techniques: 1. The question and answer period is handled very much like an audience reaction team, a listening team, or a forum.

ARRANGEMENT FOR QUESTION PERIOD



Alternative Arrangements:

The diagram shown here is for a question period following the lecture or speech. The arrangement would be different for other types of presentations. Also, in large groups portable microphones may be handed to the questioner, or the questioner may move to a microphone located in an aisle.

QUESTIONING TECHNIQUES

The power of a question lies in the requirement of an answer so that the group individually and collectively is stimulated to think and motivated to discuss.

Basic characteristics of a good question

1. Must have a specific purpose
2. Have relationship to what is already known
3. Be understood by group
4. Emphasize one point
5. Require a definite answer
6. Discourage guessing
7. Encourage creative thinking
8. Use why, where, when, what, who and how

Important factors in using questions

Three important factors that affect the level of stimulation and motivation are:

1. Framing the question
2. Choosing the right type of question
3. Directing the question

1. Framing the question:

- o Be Brief
- o Cover a single point.
- o Be directly related to the topic
- o Develop thinking from a constructive point of view
- o Use the words that are easy for you to use
- o Use words that have meaning to the group
- o In most cases, phrase to avoid "yes" and "no" answers (closed questions)

2. Choosing the right type question:

The right type of question is dependent upon what the leader wants. Several categories of questions are:

o Factual questions

Used to get information

Also helps broaden the discussion

Example: How might your supervisor benefit from this training?

o Leading questions

Used to suggest an answer and get group to analyze

Also helps broaden the discussion

Example: How might your supervisor benefit from this training?

0 Clarifying questions

Used to challenge old ideas and develop new ones

To avoid snap judgement

Help find real causes or answers

Example: What you're saying then is that you have no trouble with discipline, is that right?

0 Hypothetical questions

Used to suggest or introduce leader's ideas into the discussion

To test conclusion

Example: What might happen if you were given charge of the department and could plan for the department?

0 Alternative question

To make a decision between two or more points

To comparatively evaluate suggested solutions

Example: Are the best supervisors strict, easy or neither?

0 Overhead (General)

Directed at the entire group

Used to promote group thinking

Example: So what can be done about it?

0 Re-Directed

Directed at leader, but returned to the group

Used to promote group activity

Example: That's a good question, Dick. How would you answer that in terms of your job, Helen?

3. Directing the question:

1. Direct questions to the group as a whole, not to individuals
2. If no response, then select individuals to respond
3. Allow sufficient time for a reply
4. Do not hesitate to restate a question if group expression shows confusion
5. Encourage members of the group to question one another

CASE STUDY

The case study is a detailed account of an event or a series of related events that may be presented to an audience orally, in written form, on film, or in a combination of these forms.

The Case Study is Used:

1. To present in detail to a group a problem with which the group is concerned.
2. To present and study the solution of a problem similar to one confronting the group.
3. To teach the problem-solving process.

Advantages:

1. Gives a detailed accounting of the case under study.
2. Helps the learner to see various alternative solutions to the problem.
3. Helps people develop analytical and problem-solving skills.

Limitations:

1. Some individuals may not see the relevance of the case being studied to their own situation or the group's problem.
2. A considerable amount of time and thought is often required to develop the study.
3. Some group members are stimulated to overparticipation while others may assume a non-participatory role.

Physical Requirements:

1. Physical requirements vary with the type of presentation. If visual aids are required in a presentation, the room should be suitable for this kind of presentation. If the case study is a written one, a large table and chairs may be all that is necessary.

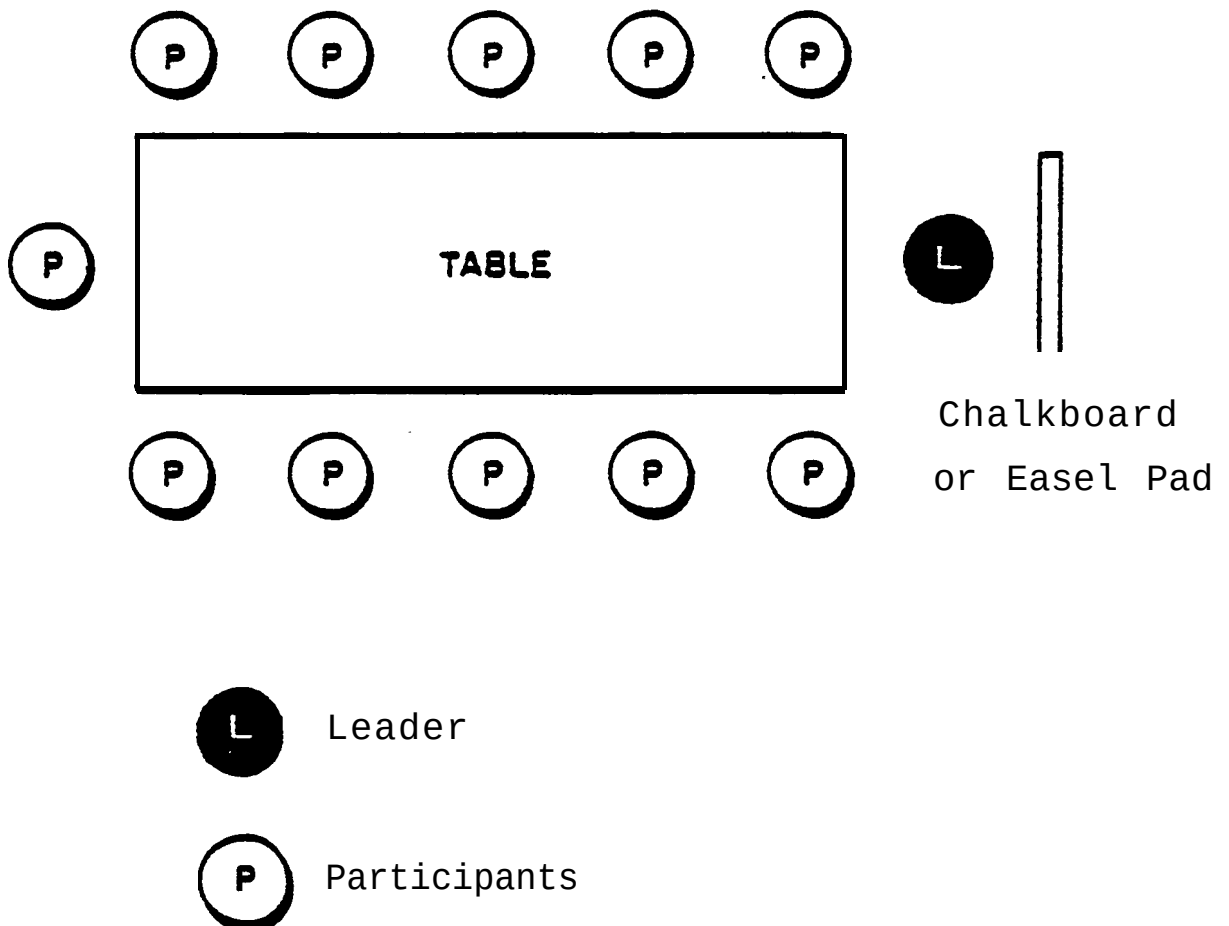
Procedure:

1. Materials are put into the hands of the participants in advance if the case study is in written form and to be read before the meeting.
2. Appropriate techniques to use during the presentation and discussion are selected, and parts rehearsed, if necessary.
3. The chairman, Instructor or moderator introduces the topic, explains what the case study is, and the responsibility of each individual. He then guides the discussion and other activity.

Similar Methods and
Techniques:

1. Written materials, film, the dramatic skit and speech may be used to present the case to the group. Group discussion is used to carry out the second part of the case study.

ARRANGEMENT FOR CASE STUDY



WORKSHOP

The workshop is a group (10 to 25 persons) sharing a common interest or problem meeting together to improve their individual proficiency, to solve a problem, or to extend their knowledge of a subject through intensive study, research, and discussion.

The Workshop May Be Used:

1. To identify, explore, and seek solution of a problem.
2. To permit extensive study of a situation including its background and social or philosophical implications.

Advantages:

1. Provides the opportunity for preparation for specific vocational, professional, or community service functions.
2. Permits a high degree of individual participation.
3. Provides for group determination of goals and methods.

Limitations:

1. Requires a lot of time from participants and staff.
2. Requires a high proportion of staff to participants.
3. May require special facilities or materials.
4. Participants must be willing to work both independently and cooperatively.

Physical Requirements:

1. A room large enough to provide comfortable seating for all around a large table (or tables arranged in a rectangle) with extra space for use of resource materials.
2. Library or other resource materials for research.
3. Chalkboard or other device for recording ideas and notes.

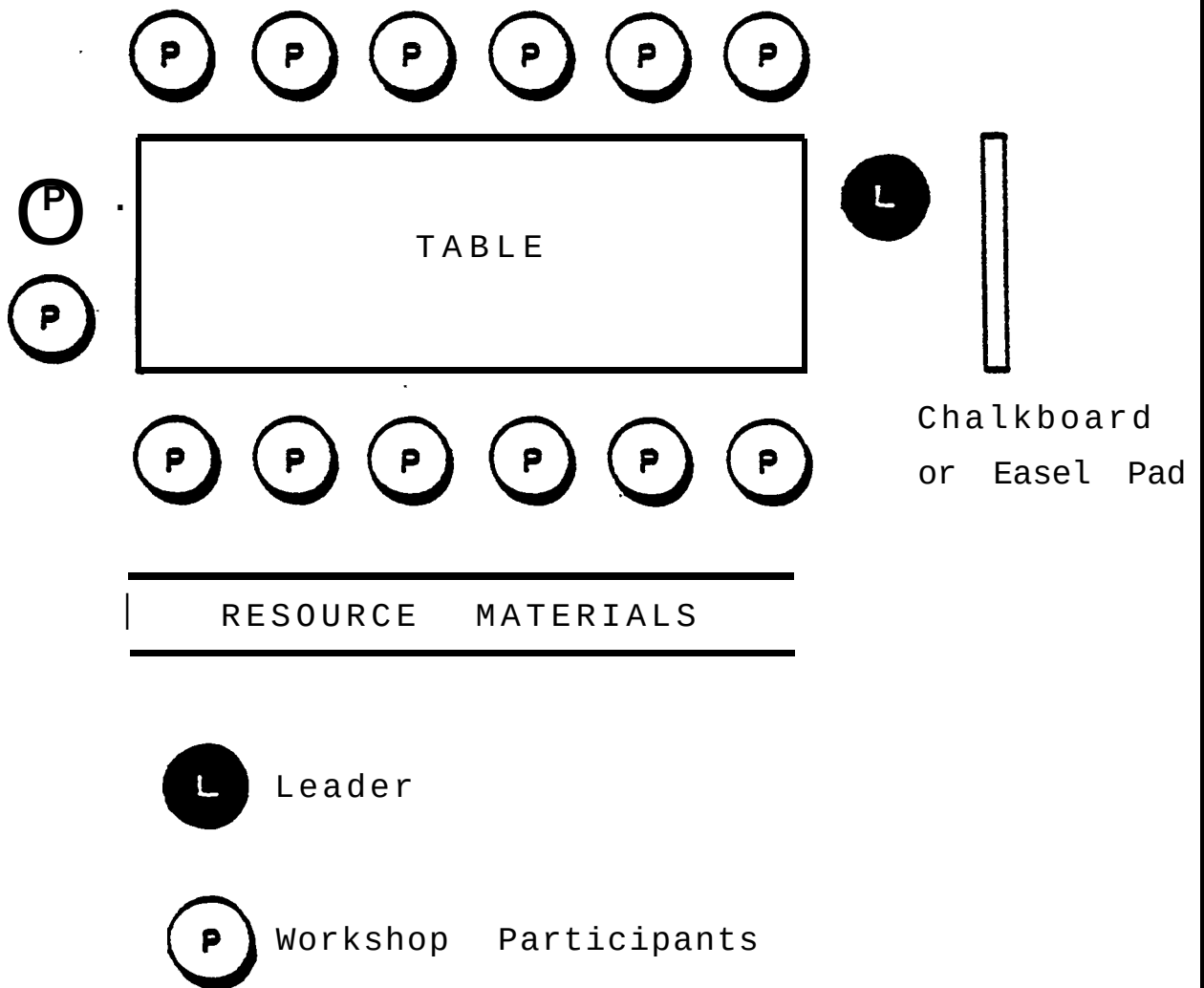
Procedures:

1. Arrangements for physical facilities made well in advance of the workshop.
2. Resource persons and resource materials lined up well in advance.
3. Workshop is conducted.
4. Evaluation and follow-up as needed.

Similar Methods and Techniques:

The workshop is structured similar to clinics and institutes. A series of short workshops on related problems may be incorporated into the program of a convention, institute, short course, or conference.

ARRANGEMENT FOR WORKSHOP



Alternative Arrangements:

If the group is too large or if a large conference table is not available, the group should be arranged in a semicircle.

APPENDIX C

APPENDIX C
EXERCISE I, SHIPYARD PLANNING ORGANIZATION REVIEW

Purpose:

1. Provides all participants with, a functional description of the Shipyard's planning organization.

2. Product:

Annotated shipyard functional organization chart.

3. Instructional Strategy:

- o Method: Lecture, Instructor-led group discussion
- o Media: Viewgraphs, or chalk/white board, or easel pad, worksheets, solution handout.
- o Participant Assignment: Review organization chart, identify omissions, inaccuracies. Contribute to general discussion session. Complete own notes.

4. Resources Required:

<u>Instructor</u>	<u>Participant</u>
Shipyard organization	Pencil
chart mock-up	Eraser
Chalk/white board; easel pad(s)	Shipyard organization chart
Chalk markers	(blank) handout
Viewgraph (blank/mock-up)	
Viewgraph pen(s)	
O/H projector	

5. References:

- o Instructor Guide, Section I
- o Shipyard organization manual.
- o Departmental Standard Operating Procedures (SOP's)

6. Instructions:

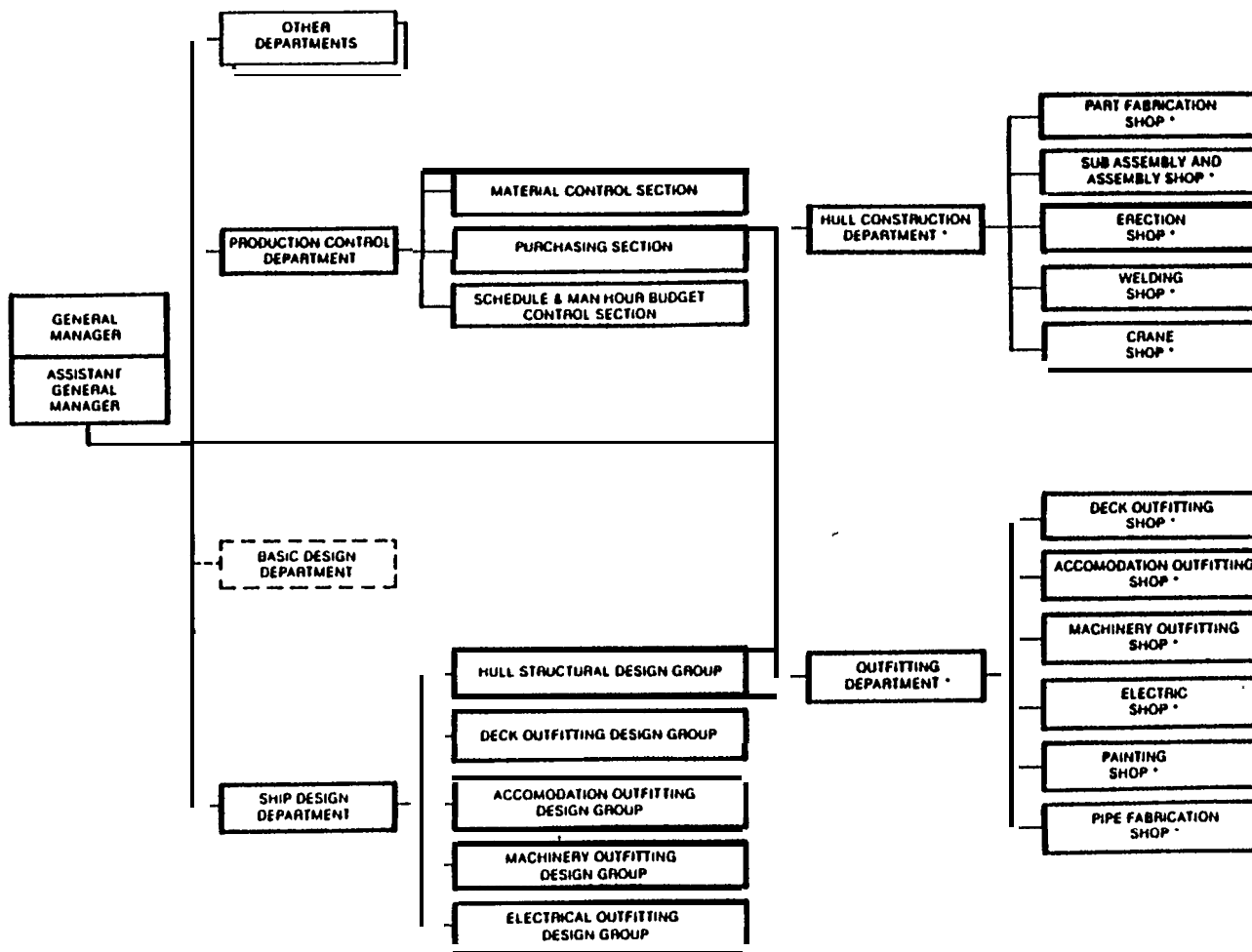
A. Preparation

1. Obtain current copies of shipyard organization manual & chart, and departmental SOP'S.
2. Review chart to identify pertinent department functions, responsibilities, lines of authority.
3. If a suitable chart exists reproduce it as a handout. Signal the areas having the greatest importance to ship construction planning. If a suitable chart does not exist, develop one.
4. Prepare Instructor copy of shipyard organization with list of departmental functions, responsibilities and authorities.
 - o Emphasize: Departments having planning responsibilities for ship construction.
 - o Identify functions, responsibilities, authority.
 - o Identify points of departmental interaction re: planning.

- o Identify points of intra-departmental interaction re: planning and operations.
 - o List of departments.
- 5. Prepare list of questions about organization, functions, responsibilities, authorities. Get answers to questions until information to complete.
- 6. Create viewgraph and/or easel pad illustration of Shipyard Organization.
- 7. Rehearse with these materials in the training environment.
- B. Presentation Strategy
 - 1. Show viewgraph (example organization)
 - 2. Suggest that participants are no doubt familiar with their organization -- especially own departments and offices, their own functions, responsibilities, and authorities.
 - 3. State purpose of this part of the presentation: to review the shipyard's organization in general, but to limit discussion to those departments having planning functions, responsibilities, authority related to ship construction.
 - 4. Hand out copies of the prepared organization chart.
 - o Ask participants to identify any discrepancies and note corrections as the discussion proceeds.
 - 5. Discuss the general organization very briefly, using viewgraph.
 - o State which departments have planning and operations functions, responsibilities, authority.

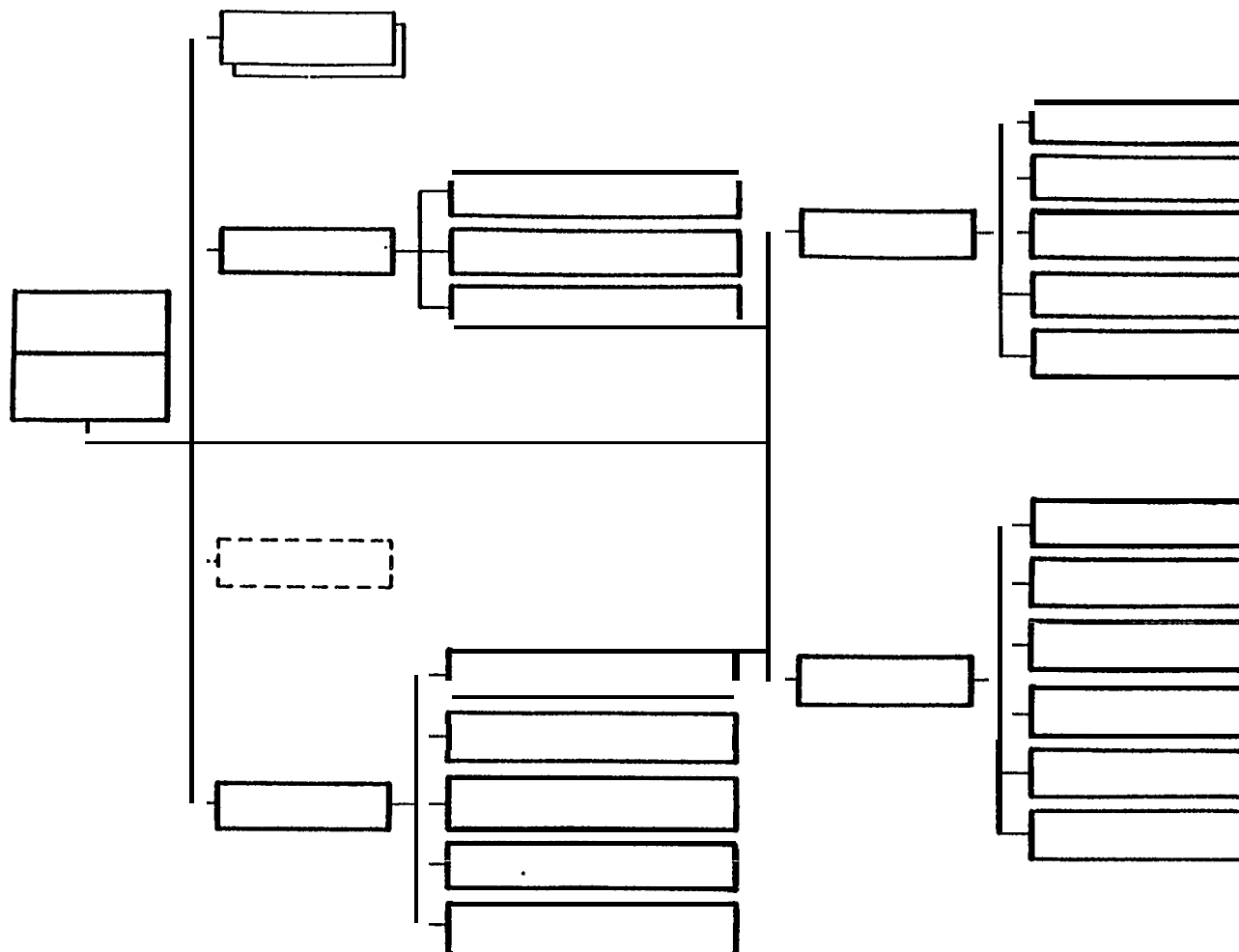
- o Restate which departments have functions, responsibilities , authority (who, what, why, when, where, how, how much).
 - o Get participant input from management side, SP&C and at least one other trade if represented.
7. Summarize, pointing out corrections and the fact that all participants have same minimum organizational data and an annotated organization chart to employ throughout remainder of the workshop.

EXAMPLE SHIPYARD ORGANIZATION



SOURCE: Integrated Hull Construction, Outfitting and Painting (IHOP), P.6;
U.S. Department of Transportation, Maritime Administration, May, 1983.

9-7



SOURCE: Integrated Hull Construction, Outfitting and Painting (IHOP), P.6;
U.S. Department of Transportation, Maritime Administration, May, 1983.

APPENDIX D

APPENDIX D
EXERCISE II., MANAGEMENT PLANNING WORKSHOP:
(RESPONDING TO SHIP CONSTRUCTION RFP)

1. Purpose: Provide top management and SP&C supervisors opportunity to work together to identify the SP&C Work Planning Factors that apply in Construction Stage #1 Management Planning, and to develop a planning aid for their shipyard.
2. Product: List of SP&C Construction Stage #1, Management Planning, input requirements to assist design planners.
3. Instructional Strategy:
 - o Method: Participant-led small group discussion with report
 - o Media: Viewgraphs, or chalk/white board, or easel pad; worksheet
 - o Participant Assignment: Participate in small group discussion and report preparation; complete own worksheet; contribute to overall discussion.
4. Resources Required:

Instructor

Viewgraph example of
Exercise worksheet

Overhead projector

Participant

Pencil

Exercise II (Appendix D)

H.O. #1, 13 SP&C Work
Planning Factors
(Appendix L)

4. Resources Required: (cont.)

Instructor

Participant

Viewgraph pens

Chalk/White board & markers

Guide for Discussion Group
Leaders (Appendix B)

Exercise II, (Appendix D)

5. References:

- o Instructor Guide, Section II.A.
- o Appendix D, Worksheets #1 & #2, Supporting Data Sheet 1
- o Appendix L, (H.O. #1) 13 SP&C Work Planning Factors

6. Process:

A. Preparation

1. Review:

- o Instructor Guide, Section II.A.
 - o Appendix D, Management Planning Exercise Materials
 - o Appendix L, SP&C Work Planning Factors, Handout III
2. Identify and relate each part of the exercise
 3. Review suggested presentation strategy (below).
 4. Prepare planning aid visual for use in presentation: viewgraph or predraw easel pad sheets.
 5. Personalize introduction, content, summary, and transition.
 6. Complete an instructor's copy of the worksheet (suggest at least one element per WPF).
 7. Rehearse with exercise materials in the training environment.
 8. Xerox sufficient copies of materials for participant use.

B. Presentation Strategy

1. Provide advance notice of this exercise by passing out a seating chart at the break preceding this exercise.
2. Introduce the exercise (show viewgraph)
3. Provide following exercise instructions

o General

Designate group leader or, each group elect own leader and recorder (3")

Refer to Student workbook, Section IIA.

One worksheet: Read Management Planning Exercise Workshop scenario along with instructor.

Be prepared to report the table group's findings when asked.

Will have use of lectern and easel pad, overhead projector or chalkboard.

Time: 45"

o Worksheet Completion

- Column 1: Completed.

- column 2: List the WPF elements which generate SP&C recommendations or information inputs to the Design Plan

column 3: Indicate who has responsibility to provide required input

column 4: Indicate the recommendation or information required.

4. Read workshop requirement to participants. Have participants follow by reading the requirement to themselves (silently).
- o Demonstrate completion for one element under one WPF
 - o Ask for questions related to requirement
 - o Start exercise by stating, "You should be ready to report after 30" from NOW."

5. After 25" designate one table group to report.
 - o Have other groups complete lists and prepare to add to the report.
6. Facilitate and guide report and discussions to draw out improvements and additions to the designated report.

APPENDIX D
EXERCISE II., MANAGEMENT PLANNING:
SPECIFIC WORK PLANNING
FACTOR/ELEMENT IDENTIFICATION

Worksheet #1

BACKGROUND

Your yard has received a Request for Proposal (RFP) which seeks bidders for the construction of 118 foot cutters for the U.S. Coast Guard. These new cutters are required to replace the Coast Guard's current fleet of 82 and 95 footers by the 1990s.

REQUIREMENTS

Given the information in Data Sheet #1, and Appendix L, 13 SP&C Work Planning Factors, complete the Exercise Worksheet #2 as instructed. The result should be a listing of SP&C Design Plan input requirements and information which incorporates all known and achievable efficiencies of which your yard is capable with respect to SP&C ship construction operations.

APPENDIX D
EXERCISE II., MANAGEMENT PLANNING:
SPECIFIC WORK PLANNING
FACTOR/ELEMENT IDENTIFICATION

Data Sheet #1

SUPPORTING DATA SHEET

Multi-Mission U.S. Coast Guard Cutter for 1990's

1. Design Requirements

- o Length: 118 foot
- o Displacement: 157 tons
- o Beam: 22 foot
- o Sustained Speed: 30 knots
- o Manning: 16

2. Proposed Cost \$10,000,000 each.

- o Begin prototype construction 1990
- o Test prototype 1991
- o Begin production 1992

3. Other Characteristics:

- o Conventional Steel Monohull
- o Convertible to armed patrol craft in wartime
 - The main deck aft of the deck house to be flat for easy outfitting w/missile or gun mounts
- o Galley and crew compartments consolidated below amidships
- o Deck house of aluminum (single component) attached to steel deck

Worksheet
#2

APPENDIX D
EXERCISE II., MANAGEMENT PLANNING:
SPECIFIC WORK PLANNING
FACTOR/ELEMENT IDENTIFICATION

CONSTRUCTION STAGE #1		MANAGEMENT PLANNING	
Work Planning Factor	Cs #1 - Specific Elements	Responsibility	Recommendation/Information
1. Physical Description			
2. Location			
3. Support			
4. Specs			
5. Time/ Manpower			
6. Minimizing Rework			
7. Material			
8. Equipment			
9. Handling/ Storage			
10. Inspection			
11. Disruption Interference			
12. Safety			
13. Schedules			

APPENDIX E

APPENDIX E

Exercise 111. A.1., SP&C SAFETY PLANNING

1. Purpose: Identify and list SP&C safety long-term planning requirements, operations requirements, associated planning responsibilities, and SP&C efficiencies.
2. Product: Lists of SP&C safety planning requirements, operations requirements, responsibilities, associated planning responsibilities and SP&C efficiencies. The resulting lists to be used by participants as job aids in future planning team efforts.
3. Instructional Strategy:
 - o Method: Lecture, Instructor-led group discussion
 - o Media: Viewgraphs, or chalk/white board, or easel pad, worksheets, solution sheets.
 - o Participant Assignment: Complete worksheets, participate in discussion.

4. Resources Required:

Instructor

Viewgraph Examples III.A.1.a & b

Overhead projector

Viewgraph pen

Chalk/white board & markers

H.O. #2, "A Solution" Handout
Exercise III.A.1. (Appendix E)

Instructor Guide Appendix L,
13 SP&C Work Planning Factors
(H.O. #1)

Participants

Pencil

Exercise III.A.1 (Appendix E
(-))

H.O. #1, 13 Work Planning
Factors (Appendix L)

5. References:

Instructor Guide, Section III.A.1
Instructor Guide, Appendices B & E
Instructor Guide, Appendix L, 13 SP&C Work
Planning Factors

6. Process:

A. Preparation

1. Review:

- o Instructor Guide, Section III.A.1.
- o H.O. #1, 13 SP&C Work Planning Factors
- o Exercise III.A.1 (Appendix E)
- o Review presentation methods (Appendix B)
 - Guided discussion
 - Question techniques

2. Identify and relate each part of the exercise and supporting materials
3. Review suggested presentation strategy (below)
4. Prepare viewgraphs of associated worksheet(s) for use in presentation or, predraw easel pad sheets.
5. Personalize the introduction, content, summary, and transition.
6. Prepare 3 x 5 cards with assigned requirement for each participant.
7. Identify and designate a recorder to assist instructor in the exercise
8. Rehearse with exercise materials in the training environment.
9. Xerox sufficient copies of Solution Handout #III.A.1 for trainee use.

B. Presentation Strategy

1. Introduce the exercise
2. Provide following exercise instructions:
 - o General
 - Refer to Student Workbook, Section III.A.1.

Participants to receive 3 x -5 cards with assignments on them.

Complete two worksheets: WS #111. A.l. a SP&C Long-Term Safety Planning, WS #III.A.l.h SP&C Safety Planning for Operations.

Review worksheets with participants.

Demonstrate completion of one requirement, WS #1 III.A.l.a, (brief illustration, some detail).

Participants to be prepared to report findings during group discussion phase.

Will have 10" to complete assigned requirements.

will receive "A Solution" sheet for further discussion.

Time 45"

0 Worksheet Completion - III.A.l.a.

Column 1: Already complete

Column 2: Already complete

Column 3: Indicate which position holder(s)/ department(s) in the yard has responsibility for planning

Indicate Planning and Scheduling requirement and process.

Column 4: Indicate how SP&C efficiency can be achieved

0 Worksheet Completion - III.A.l.b.

Column 1: Already completed

Column 2: Already completed

Column 3: Indicate location(s) of the work

Column 4: Indicate which position holder(s)/ department(s) in the yard have responsibility for planning

Column 5: Indicate how SP&C efficiency can be achieved

0 Demonstrate completion of element of the worksheet

0 Answer any questions related to these instructions

3. Pass out assigned requirements.
 - o Start exercise time by stating "You should be ready to report after 10" from NOW."
4. After 10" begin discussion by asking for responses to WS # III .A.l.a, Column 3 & 4 requirements.
 - o List abbreviated responses on viewgraph
5. Facilitate and guide the discussion to draw out appropriate inputs on each requirement.
 - o Synthesize inputs on viewgraph
 - o Watch time
6. Hand out prepared "A solution" for comparison and discussion.
 - o Discuss a few major differences only.
 - o Watch time

SP&C LONG-TERM SAFETY PLANNING
EXERCISE

Worksheet III A.1.a

CONSTRUCTION STAGE	UNIQUE REQUIREMENT/CONCERNS	RESPONSIBILITY FOR PLANNING (DESCENDING ORDER)	SPC EFFICIENCY
1. MANAGEMENT PLANNING	1. Concern that prospective contracts may require the use of materials such as paints or chemicals that have not been previously used or approved for use by the shipyard (Your Company). Example - Use of SP&C type anti-fouling paints which contain highly toxic "tin" chemicals or similar products. 2. Concern where new, untried, or not previously approved materials, methods, or techniques are a firm part of the prospective contract. Then management planning must provide coverage in the bid for research, development, training, and other compensatory measures. 3. Concern that prospective contracts may require the use of products that do not conform to EPA clean water or clean air regulations.		

SP&C LONG-TERM SAFETY PLANNING
EXERCISE

Worksheet III A.1.a (cont.)

CONSTRUCTION STAGE	UNIQUE REQUIREMENT/CONCERNS	RESPONSIBILITY FOR PLANNING (DESCENDING ORDER)	SP&C EFFICIENCY
Il. PRECONSTRUC- TION A. <u>PLANNING</u> :	1. Concern that existing and projected new facilities be compatible with the basic projected ship construction method and planned processes and work flow. 2. Concern for SP&C trades compliance with the various Government regulatory agency requirements: - EPA - OSHA - Clean Air - Clean Water - Toxic Waste Control		

SP&C SAFETY PLANNING FOR OPERATIONS
EXERCISE

CONSTRUCTION STAGE	UNIQUE REQUIREMENT/CONCERNS	IN-YARD/B & P HOUSE/ON-SHIP	RESPONSIBILITY FOR PLANNING	SP&c EFFICIENCY
II. PRECONSTRUCTION (cont.)	B. <u>OPERATIONS</u>: 1. Concern for acceptable facilities to accommodate preconstruction SP&C operations: - Concern for qualified SP&C operators shop or area that may not be under SP&C trades control. Example - The blasting and coating of steel plates and shapes by steel fab shop when steel first arrives in shipyard. 2. Concern for handling, storage and use of dangerous SP&C materials - paints, solvents, chemicals, cleaners etc. - especially when SP&C work is done by personnel not fully trained for this.			
B. <u>OPERATIONS</u> :				
III. ASSEMBLY OPERATIONS	1. Concern for the compatibility of SP&C operation in or adjacent to the various manufacturing shop operations: Pipe shop Hanger shop Ventilation shop Foundation shop Switchboard shop These shops generate hot work (fire sparks, etc., while SP&C operations must be shielded from such conditions.			

SP&C SAFETY PLANNING FOR OPERATIONS
EXERCISE

Worksheet

III .A.1.b (cont.)

CONSTRUCTION STAGE	UNIQUE REQUIREMENT/CONCERNS	IN-YARD/B & P HOUSE/ON-SHIP	RESPONSIBILITY FOR PLANNING	SP&C EFFICIENCY
Ill. ASSEMBLY LEVEL OPERATIONS (cont.)	2. Concern for the Health and Welfare of the Interrelated trades personnel (mfg. shop people and SP&C people) - Existing or forthcoming facilities must provide for the protection of mfg. shop hazards SP&C generated hazards. 3. Environmental Concerns. Whether SP&C operations are in the manufacturing shop or outside (adjacent to) weathers temperature humidity are of concern for SP&C operations and SP&C personnel.			

SP&C SAFETY PLANNING FOR OPERATIONS
EXERCISE

Worksheet III .A.l.b (cont.)

CONSTRUCTION STAGE	UNIQUE REQUIREMENT/CONCERNS	IN-YARD/B & P HOUSE/ON-SHIP	RESPONSIBILITY FOR PLANNING	SP&C EFFICIENCY
Iv. BLOCK LEVEL OPERATIONS:	- SP&C safety Planning Concerns: - Location of unit in yard. - Size and configuration - Access openings - Staging Condition - Temporary Services (Lights, air, ventilation) - Protection required for personnel - Type and extent of other trades activities - In the general area - In the particular space - In adjacent areas - In adjacent spaces. - When SP&C work is scheduled: - Time of Year, (Weather) - Time of Week, (Regular week or off shift) - Time of day, shift)			
v. ZONE (ON-SHIP OPERATIONS)	- Location of SP&C job on-ship: - Deck-frame-space - Configuration of space - Access routes to space			

SP&C SAFETY PLANNING FOR OPERATIONS
EXERCISE

Worksheet III .A.l.b (cont.)

CONSTRUCTION STAGE	UNIQUE REQUIREMENT/CONCERNS	IN-YARD/B & P HOUSE/ON-SHIP	RESPONSIBILITY FOR PLANNING	SP&C EFFICIENCY
	2. Status of ship construction at time of SP&C job. Temporary openings Temporary services (Lights, vent., compt. air, sanitary systems). Protection required for machines etc. Other trades' level of work Other trades' type of work Other trades' unfinished work 3* Impact on Personnel from SP&C work: - SP&C trades - Support Trades - Other trades - Ship's crew 4. Impact on productivity from SP&C work: - SP&C trades own productivity is reduced on ship - Support trades' productivity is reduced - Other trades' productivity reduced by SP&C application and curing time delays.			

H.O. #2
SP&C Safety Planning

EXERCISE SOLUTION

H.O. #2
III A.1.a Safety

SP&C LONG-TERM SAFETY PLANNING
EXERCISE SOLUTION

CONSTRUCTION STAGE	UNIQUE REQUIREMENT/CONCERNS	RESPONSIBILITY FOR PLANNING (DESCENDING ORDER)	SP&C EFFICIENCY
I. MANAGEMENT PLANNING	1. Concern that prospective contracts may require the use of materials such as paints or chemicals that have not been previously used or approved for use by the shipyard (Your Company). Example - Use of SP&C type anti-fouling paints which contain highly toxic "tin" chemicals - or similar products.	Vice President for Contracts: - Estimators - Bid Task Group - Research and testing department - Contract Planning	Balanced impact on SP&C efficiency as long as approved products are used but SP&C efficiency will fluctuate from positive to negative in relation to the more preferred or less preferred approved products. Example: Water based inorganic zinc paint is more <u>safety efficient</u> to use than <u>solvent</u> based inorganic zinc.
	2. Concern where new, untried, or not previously approved materials, methods, or techniques are a <u>firm</u> part of the prospective contract. Then management planning must provide coverage in the bid for research, development, training, and other compensatory measures.	Vice President for Contracts: - Estimators - Contract Planners - Research and Development - Safety Dept. - SP&C trades	SP&C safety efficiency would generally experience a negative impact. The degree of negative effect would relate to the type and extent of compensatory measures.
	3. Concern that prospective contracts may require the use of products that do not conform to EPA clean water or clean air regulations.	Vice President for Contracts: - Estimators - Contract planners - Bid Task Group - Research Dept. - Safety Dept.	SP&C safety efficiency would generally experience a negative impact. The degree of negative effect would relate to the type and extent of compensatory measures.

H.O. #2
III A.1.a (cont.)

SP&C LONG-TERM SAFETY PLANNING
EXERCISE SOLUTION

CONSTRUCTION STAGE	UNIQUE REQUIREMENT/CONCERNS	RESPONSIBILITY FOR PLANNING (DESCENDING ORDER)	SP&C EFFICIENCY
II. PRECONSTRUCTION A. <u>PLANNING</u> :	1. Concern that existing and projected new facilities be compatible with the basic projected ship construction method and planned processes and work flow. 2. Concern for SP&C trades compliance with the various Government regulatory agency requirements: - EPA - OSHA - Clean Air - Clean Water - Toxic Waste Control	Vice President for Construction: Construction Task Group Project Manager Construction Supt. Purchasing Division Procurement Material control Safety Dept. Steel fabrication Dept. SP&C trades	Assuming sufficient and high quality facilities then SP&C safety efficiency will vary in direct proportion to the quality of preconstruction planning. SP&C Safety effect will, overall, be in direct proportion to the % of construction work accomplished prior to on-ship; i.e., <u>before</u> CS #5, Zone Level work.

SP&C SAFETY PLANNING FOR OPERATIONS
EXERCISE SOLUTION

H.O. #2
III.A.1.b

CONSTRUCTION STAGE	UNIQUE REQUIREMENT/CONCERNS	IN-YARD/B & P HOUSE/ON-SHIP	RESPONSIBILITY FOR PLANNING	SP&C EFFICIENCY
Il. PRECONSTRUCT TION (cont. B. OPER- ATIONS :	B. <u>OPERATIONS</u>: 1. Concern for acceptable facilities to accommodate preconstruction SP&C operations: - Concern for qualified SP&C operators in shop or area that may not be under SP&C trades control. Example - The blasting and coating of steel plates and shapes by steel fab shop when steel first arrives in shipyard. 2. Concern for handling, storage and use of dangerous SP&C materials - paints, solvents, chemicals, cleaners etc. especially when SP&C work is done by personnel not fully trained for this.	In-yard or Blast/Paint house In-Yard or Blast/Paint house or on-ship	Design Purchasing Dept. Facilities Eng. Steel Fab. Dept. SP&C trades Design Purchasing Dept. Mat. Control Dept. Plant Engineers Safety Dept. Shop Users SP&C trades	Preconstruction coating may or may not be applied to SP&C quality standards which could result in negative efficiency by requiring later rework on the part of SP&C trades. SP&C safety effect is directly related to the caliber of planning and follow up on this.
Ill. ASSEMBLY OPERATIONS	1. Concern for the compatibility of SP&C operation in or adjacent to the various manufacturing shop operations: - Pipe shop - Hanger shop - Ventilation shop - Foundation shop - Switchboard shop These shops generate hot work (fire sparks, etc., while SP&C operations must be shielded from such conditions.	Mfg. shops In-Yard or Blast/Paint Houses	Mfg. Shop Supt. Facilities Eng. Safety Dept. SP&C trades	SP&C safety effect is directly related to the quality of planning and follow up here.

H.O. #2
III.A.l.b (cont.)

SP&C SAFETY PLANNING FOR OPERATIONS
EXERCISE SOLUTION

CONSTRUCTION STAGE	UNIQUE REQUIREMENT/CONCERNS	IN-YARD/B & P HOUSE/ON-SHIP	RESPONSIBILITY FOR PLANNING	SP&c EFFICIENCY
Ill. ASSEMBLY LEVEL OPERATIONS (cont.)	2. Concern for the Health and Welfare of the Interrelated trades personnel (mfg. shop people and SP&C people) - Existing or forthcoming facilities must provide for the protection of mfg. shop hazards VS SP&C generated hazards.	Mfg. shop Blast/Paint house In-yard	Facilities Eng. Mfg. shop trades Safety Dept. SP&C trades	SP&C safety effect must be well planned - or it will be overshadowed by manufacturing shop operations.
	3. Environmental Concerns. Whether SP&C operations are in the manufacturing shop or outside (adjacent to) weather, temperature humidity are of concern for SP&C operations and SP&C personnel.	Mfg. shop In-yard On-ship	Facilities Eng. Mfg. shop trades SP&C trades	SP&C safety effect is in proportion to the quality of planning and to nature on outside work.

SP&C SAFETY PLANNING FOR OPERATIONS
EXERCISE SOLUTION

H.O. #2
III .A.l.b (cont.)

CONSTRUCTION STAGE	UNIQUE REQUIREMENT/CONCERNS	IN-YARD/B & P HOUSE/ON-SHIP	RESPONSIBILITY FOR PLANNING	SP&C EFFICIENCY
IV. BLOCK LEVEL OPERATIONS:	SP&C safety Planning Concerns: - Location of unit in yard. - Size and configuration - Access openings - Staging Condition - Temporary Services (Lights, air, ventilation) - Protection required for personnel	In-Yard	Design Project Manager Construction Supt. Support Trades SP&C trades	SP&C effect is directly related to the caliber and degree of planning.
	2. Type and extent of other trades activities - In the general area - In the particular space - In adjacent areas - In adjacent spaces.	In-Yard	Construction - Supv.	SP&C safety efficiency prefer to exclude other trades for max. effect. Next, exclude hot work and limit other trades
	3. When SP&C work is scheduled: - Time of Year, (Weather) - Time of Week, (Regular week or off shift) - Time of day, (shift)	In-Yard	Construction Supv. Schedule project planners SP&C trades	SP&C safety effect can be controlled by planning for: - Best weather - Daytime work (usually) - Off shift where practical.
v. ZONE (ON-SHIP OPERATIONS)	1. Location of SP&C job on-ship: - Deck-frame-space - Configuration of space - Access routes to space	On-Ship	Design Project Planners Construction Supv. Construction Planner: SP&C trades	SP&C safety effect is a function of these planning concerns

SP&C SAFETY PLANNING FOR OPERATIONS
EXERCISE SOLUTION

H.O. #2
III .A.1.b (cont.)

CONSTRUCTION STAGE	UNIQUE REQUIREMENT/CONCERNS	IN-YARD/B &P HOUSE/ON-SHIP	RESPONSIBILITY FOR PLANNING	SP&C EFFICIENCY
	2. Status of ship construction at time of SP&C job. - Temporary openings - Temporary services (Lights, vent. compt. air, sanitary systems). - Protection required for machines etc. - Other trades' level of work - Other trades' type of work - Other trades unfinished work 3. Impact on Personnel from SP&C work: SP&C trades Support Trades Other trades Ship's crew 4. Impact on productivity from SP&C work: SPLC trades own productivity is reduced on ship Support trades' productivity is reduced Other trades' productivity reduced by SP&C application and curing time delays.			In Summary - it is more efficient for SP&C work to be accomplished as much as practical prior to CS #5, on-ship work.

APPENDIX F

APPENDIX F

Exercise 111. A.2, SP&C SHIFT CHANGE COMMUNICATION AND COORDINATION

1. Purpose: Identify and list SP&C Shift Change Communication and Coordination requirements (on-ship and off-ship), and associated planning.
2. Product: A list of SP&C Shift Change Communication and Coordination considerations relevant to this shipyard which may be used by participants as a job aid in future planning team efforts.
3. Instructional Strategy:
 - o Method: Lecture, Instructor - led group discussion
 - o Media: Viewgraphs, or chalk/white board, or easel pad, worksheets.
 - o Participant Assignment: Complete worksheets, participate in discussion
4. Resources Required:

Instructor

Viewgraph Examples III.A.2.a & b
Overhead Projector
Viewgraph pen
Chalk/White board & markers
Exercise III.A.2 (Appendix F)
Instructor Guide, Appendix L
13 SP&C Work Planning Factors
(H. O. #1)

Participants

Pencil
Exercise III.A.2
(Appendix F)
H.O. #1, 13 SP&C Work
Planning Factors
Handout #1, 13 SP&C Work
Planning Factors
(Appendix L)

5. References:

- o I.G. Section III.A.2.
- o I.G. Appendixes B & E
- o I.G., Appendix L. 13 SP&C Work Planning Factors, (H.O. #1)

6. Process:

A. Preparation

1. Review:

- o Instructor Guide, Section III.A.2
- o Exercise III.A.2 (Appendix F)
- o H.O. #1, 13 SP&C Work Planning Factors
- o Presentation methods (Appendix B)

Guided Discussion

Questioning Techniques

2. Identify and relate each part of the exercise and supporting materials
3. Review suggested presentation strategy (below)
4. Prepare viewgraphs of associated worksheet(s) for use in presentation or, predraw easel pad sheets.
5. Personalize introduction, content, summary, and transition.
6. Complete an instructor copy of each worksheet (suggest two items under each heading)
7. Identify and designate a recorder to assist instructor in the exercise.
8. Rehearse with exercise materials in the training environment.
9. Xerox sufficient copies of materials for trainee use.

B. Presentation Strategy

1. Introduce the exercise'
2. Provide following exercise instructions:
 - o General

Continue with same group arrangement used for
III.A.1, Safety Planning Exercise.

Refer to Student Workbook, Section III.A.2

Review worksheets

Refer SWB; Appendix L, (13 SP&C Work Planning Factors) and identify shift change communication and coordination concerns

Complete two exercise worksheets III.A.2.a (on-ship) and III.A.2.b (off-ship)

Be prepared to report findings during group discussion phase

No solution sheet will be handed out

Time: 35"

0 Worksheet Completion

column 1: State the communication/coordination requirement

column 2: indicate when the requirement/responsibility is carried out

Column 3: Indicate who has responsibility to initiate and follow-up

Column 4: State how SP&C shift change communication and coordination efficiency can be improved

0 Ask for questions related to these instructions.

0 Start exercise time by stating "You should be ready to report after 20" from NOW (10" per worksheet).

3. After 20" facilitate and guide discussion to draw out findings.

0 Synthesize each response

0 Recorder lists responses on prepared viewgraph worksheet outlines or other visual aid

SHIFT CHANGE COMMUNICATION
AND COORDINATION
EXERCISE

ON-SHIP

Shift Change C/C Requirement	When Occuring	c/c Responsibility	How SP&C Efficiency can be improved
1. Communication			
2. Coordination			

SHIFT CHANGE COMMUNICATION
AND COORDINATION
EXERCISE

OFF-SHIP

Shift Change C/C Requirement	When Occuring	c/c Responsibility	How SP&C Efficiency can be improved
1. Communication			
2. Coordination			

APPENDIX G

APPENDIX G
EXERCISE III.A.3, SP&C WORKER QUALIFICATIONS

1. **Purpose:** Identify and list SP&C efficiency problems in given categories, which are worker qualification associated.
2. **Product:** A list of SP&C Worker Qualification problems which impact efficiency in given categories and possible solutions relevant to this shipyard. The list to be used by participants as a job aid in future planning team efforts.
3. **Instructional Strategy:** .
 - o Method: Lecture, Instructor-led group discussion
 - o Media: Viewgraph, or chalk/white board, or easel pad, worksheet
 - o Participant Assignment: Complete worksheet, participate in discussion
4. **Resources Required:**

<u>Instructor</u>	<u>Participants</u>
Viewgraph Example Exercise Worksheet III.A.3.b	Pencil
Overhead projector	Exercise III.A.3. (Appendix G)
Chalk/White board & markers	H.O. #1, 13 SP&C Work Planning Factors (Appendix L)
Viewgraph pen	
Exercise IIIA..3 (Appendix F)	
5. **References:**
 - o Instructor Guide, Section 111.A.3
 - o Instructor Guide, Appendix B
 - o Instructor Guide, Appendix G
 - o Instructor Guide, Appendix L, 13 SP&C Work Planning Factors,

6. Process:

A. Preparation

1. Review:
 - o Instructor Guide, Section III.A.3
 - o Appendix L, 13 SP&C Work Planning Factors, (H.O. #1)
 - o Exercise III.A.3 (Appendix G)
 - o Presentation Methods (Appendix B)
 - Guided Discussion
 - Questioning Techniques
2. Identify and relate each part of the exercise and supporting materials
3. Be prepared to answer the questions and provide own shipyard examples.
4. Review suggested presentation strategy (below)
5. Prepare viewgraph of associated worksheet for use in presentation or, predraw easel pad sheets. .
6. Prepare viewgraph listing the discussion questions & answers
7. Personalize introduction, content, summary, and transition.
8. Identify and designate a recorder to assist instructor during the exercise.
9. Rehearse with exercise materials in the training environment.
10. Xerox sufficient copies of materials for trainee use.

B. Presentation

1. Introduce the exercise
2. Provide following exercise instructions:
 - o General
 - Continue with same group arrangement used for III.A.2, (Shift Change Communication and Coordination Exercise)
 - Refer to Student workbook, Section III.A.3
 - Two worksheets , III.A.3.a, Worker Qualification Exercise Requirement and Worksheet

Review worksheet requirement with participants
Acknowledge space limitations on Worksheet. Suggest abbreviated notes.

Be prepared to provide inputs when called upon
Time 30"

0 Worksheet Completion

column 1: Indicate the Construction Stage during which the problem usually occurs

Column 2: Identify the related "WPF elements

Column 3: State the Worker Qualification problems

Column 4: Indicate how SP&C Planning and Scheduling efficiency can be improved

- o Demonstrate completion of-one problem identification
- o Ask for questions related to these instructions

3. Start exercise time by stating "You should be ready to report after 15" from NOW.
4. After a few minutes hand out 3 x 5 cards requiring specific discussion question(s) be answered when called on. All participants to receive one of the discussion questions.
5. Facilitate and guide report and discussion to draw out findings and answers.
 - o Get answers to the discussion questions
 - o Ask if there are "other" areas of SP&C Efficiency in this yard affected by Worker Qualifications?
 - o Synthesize each response
 - o Reorder lists responses on prepared viewgraph worksheet outline

WORKER QUALIFICATION
EXERCISE

REQUIREMENT SHEET

1. Worker qualifications impact SP&C efficiency in several ways:
 - o Production rate
 - Estimated/Actual rates
 - o Inspection Quality
 - o Training
 - o Rework
 - o Safety
 - o Crew skill mix
 - o Others? Which?
2. Consider the following questions and organize your responses to them on the accompanying worksheet.
 - o Do we have any problems w/SP&C efficiency in any of the above areas because of unqualified workers?
 - Which areas?
 - o What type of problem?
 - o What procedures are involved?
 - o What are the supervisor's controls?
 - o Who plans?
 - o Can we realize any of the following efficiencies for our yard?
 - Always have one or more backup people trained or in-training for each spot on your team. An ideal gang would be composed of:
 - 35% long-time reliable
 - 35% experienced mechanics
 - 30% new people in training.

Worksheet
III.A.3.b

WORKER QUALIFICATION
EXERCISE

When Problem Occurs (CS #)	Problem Area (WPF)	Problem Statement	How SP&C Efficiency can be improved

APPENDIX H

APPENDIX H

EXERCISE III.B., ASSEMBLY LEVEL OPERATIONS: WORK PLANNING FACTOR AND ELEMENTS IDENTIFICATION

1. Purpose: Identify the specific elements of SP&C Work Planning Factors that associate them with Construction Stage #3, Assembly Level Operations and identify ways to improve SP&C efficiency.
2. Product: A list of SP&C Work Planning Factors and efficiencies associated specifically with Construction Stage #3, Assembly Level Operations relevant to this shipyard. The list may be used by participants as a job aid in future planning team efforts.
3. Instructional Strategy:
 - o Method: Participant-led small group discussion with report
 - o Media: Viewgraph, or chalk/white board, or easel pad, worksheet
 - o Participant Assignment: Participate in small group discussion and report preparation; complete own worksheet; contribute to overall discussion.
4. Resources Required:

Instructor

Viewgraph example of
Exercise worksheet

Overhead projector

Viewgraph pens

Exercise III.B (Appendix.H)

Guide for Discussion Group
Leaders, Appendix B

Participant

Pencil

Exercise III.B (Appendix H)

H.O. #1, 13 SP&C Work Planning
Factors (Appendix L)

5. References:

- o Instructor Guide, Section III.B.
- o Instructor Guide, Appendix B
- o Instructor Guide, Appendix H
- o Instructor guide, Appendix L, 13 SP&C Work Planning Factors (H.O. #1)

6. Process:

A. Preparation

J

1. Review:
 - o Instructor Guide, Section III.C.
 - o Appendix L, 13 SP&C Work Planning. Factors H.O. #1
 - o Appendix I, Exercise Worksheet III.C.
2. Identify and relate each part of the exercise and supporting materials
3. Review suggested presentation strategy (below)
4. prepare viewgraph of associated worksheet for use in presentation or, predraw easel pad sheets.
5. Personalize introduction, content, summary, and transition.
6. Complete an Instructor copy of the Worksheet (suggest *at least* one element per WPF)
7. Prepare WPF assignments to pass out to each small group (5 x 5 cards)
8. Rehearse with exercise materials in the training environment.
9. Xerox sufficient copies of materials for trainee use.

NOTE: Since some WPFs have more CS #3 related elements than others, care must be taken to ensure balanced distribution among table groups.

B. Presentation Strategy

1. Introduce the exercise
2. Provide following exercise instructions:

o General

Continue with same table groups established for Exercise II, Management Planning

Refer to Student Workbook, Section III.B.

One worksheet, Work Planning Factor and Elements Identification, CS #3, Assembly Level Operations

Review worksheet assigned WPFS & identify CS #3 - specific elements

Refer H.O. #1, analyze pertinent content

Be prepared to report the table group's findings when asked

Will have use of lectern and overhead projector or chalk/white board, easel pad

Time: 20" - 30"

o Worksheet Completion

column 1: Check the WPFs that are CS #3 specific

column 2: List CS #3 - specific elements of the WPF

column 3: Indicate how SP&C near-term planning and scheduling efficiency can be improved

"o Demonstrate completion of one element under one WPF

o Ask for questions related to these instructions

o Start exercise time by stating, "You should be ready to report after 15" from NOW."

3. Pass out WPF assignments
4. After 10" designate one table group to report. Have other groups complete list and prepare to add to the report.
4. Facilitate and guide report and discussion to draw out improvements and additions to the designated report.

APPENDIX B
EXERCISE III. B., ASSEMBLY LEVEL OPERATIONS
SPECIFIC WORK PLANNING
FACTOR/ELEMENT IDENTIFICATION
CONSTRUCTION STAGE #3 ASSEMBLY LEVEL

Work Planning Factor	Cs #3 - Specific Elements	How SP&C Efficiency can be improved
1. Physical Description		
2. Location		
3. Support		
4. Specs		
5. Time / Manpower		
6. Minimizing Rework		
7. Material		
8. Equipment		
9. Handling/ Storage		
10. Inspection		
11. Disruption Interference		
12. Safety		
13. Schedules		

APPENDIX I

APPENDIX I
EXERCISE 111. C., BLOCK LEVEL OPERATIONS: WORK
PLANNING FACTOR AND ELEMENTS IDENTIFICATION

1. Purpose: Identify the specific elements of SP&C Work Planning Factors that associate them with Construction Stage #4, Block Level Operations and identify ways to improve SP&C efficiency.
- 9 Product: A list of SP&C Work Planning Factors and efficiencies associated specifically with Construction Stage #4, Block Level Operations relevant to this shipyard. The list may be used by participants as a job aid in future planning team efforts.
3. Instructional Strategy:
 - o Method: Participant-led small group discussion with report
 - o Media: Viewgraph, or chalk/white board, or easel pad, worksheet
 - o Participant Assignment: Participate in small group discussion; complete own worksheet; contribute to overall discussion.
4. Resources Required:

<u>Instructor</u>	<u>Participant</u>
Viewgraph of Exercise Worksheet	Pencil
Overhead Projector	Exercise III.C. (Appendix I)
Viewgraph pens	H.O. #1, 13 SP&C Work Planning Factors (Appendix L)
Exercise III.C. (Appendix I)	
H.O. #1, 13 SP&C WPFS (Appendix L)	
Guide for Discussion Group Leaders (Appendix B)	

5. References:

- o Instructor guide, Section III.C
- o Instructor guide, Appendix B
- o Instructor Guide, Appendix I
- o Instructor Guide, Appendix L

6. Process:

A. Preparation

1. Review:

- o Instructor Guide, Section III.C.
- o Appendix L, 13 SP&C Work Planning Factors, H.O. #1
- o Appendix I. Exercise Worksheet III.

2. Identify and relate each part of the exercise and supporting materials.
3. Review suggested presentation strategy (below)
4. Prepare viewgraph of associated worksheet for use in presentation or, predraw easel pad sheets.
5. Personalize introduction, content, summary, and transition.
6. Complete an Instructor copy of the Worksheet (suggest at least one element per WPF).
7. Prepare WPF assignments to pass out to each small group (3 x 5 cards)
8. Rehearse with exercise materials in the training environment.
9. Xerox sufficient copies of materials for trainee use.

NOTE: Since some WPFs have more CS #4 related elements than others, care must be taken to ensure balanced distribution of effort among table groups.

B. Presentation Strategy

1. Introduce the exercise

2. Provide following exercise instructions:

o General

Continue with same table groups established for

III.B., Assembly Level Operations

Refer to Student Workbook, Section III.C.

One worksheet, Work Planning Factor and Elements

Identification, Block Level Operations

Review worksheet assigned WPFS & identify CS #3 -
specific elements

Refer H.O. #1, Analyze pertinent content

Be prepared to report the table group's findings when
asked.

Will have use of lectern and overhead projector or
chalk/white board, easle pad

Time: 45"

o Worksheet Completion

Column 1: Check the WPFS that CS #4 specific.

Column 2: List CS #4 specific elements of the WPF

column 3: Indicate how SP&C near-term Planning and
Scheduling efficiency can be improved

o Demonstrate completion of one element under one WPF

o Ask for questions related to these instructions

3. Pass out WPF assignments

o Start exercise time by stating "You should be ready to
report after 30" from NOW.

4. After 25" designate one table group to report. Have other
groups complete lists and prepare to add to the report.

5. Facilitate and guide report and discussion to draw out
improvements and additions to the designated report.

APPEND

Worksheet
III. C.EXERCISE 111. C., BLOCK LEVEL OPERATIONS:
SPECIFIC WORK PLANNING
FACTOR IDENTIFICATION

CONSTRUCTION STAGE #4 BLOCK LEVEL

Work Planning Factor	CS #4 Specific Elements	How SP&C Efficiency can be improved
1. Physical Description		
2. Location		
3. Support		
4. Specs		
5. Time/Manpower		
6. Minimizing Rework		
7. Material		
8. Equipment		
9. Handling/Storage		
10. Inspection		
11. Disruption Interference		
12. Safety		
13. Schedules		

APPENDIX J

APPENDIX J
EXERCISE III.D., ZONE LEVEL OPERATIONS:
WORK PLANNING FACTOR AND ELEMENTS IDENTIFICATION

1. Purpose: Identify the specific elements of SP&C Work Planning Factors that associate them with Construction Stage #5, Zone Level Operations.
2. Product: A list of SP&C Work Planning Factors associated specifically with Construction Stage #5, Zone Level Operations relevant to this shipyard. The list may be used by participants as a job aid in future planning team efforts.
3. Instructional Strategy:
 - o Method: Participant-led small group discussion w/report
 - o Media: Viewgraphs, or chalk/white board, or easel pad, worksheet
 - o Participant Assignment: Participate in small group discussion, complete own worksheet contribute to overall discussion.
4. Resources Required:

<u>Instructor</u>	<u>Participant</u>
Viewgraph example of Exercise Worksheet SWB III.D	Pencil
	Exercise III.D. (Appendix J)
Overhead projector	H.O. #1, 13 SP&C Work Planning Factors (Appendix L)
Viewgraph pens	
Exercise III.D. (Appendix J)	
H.O. #1, 13 SP&C Work Planning Factors (Appendix L)	
Guide for Discussion Group Leaders (Appendix B)	

5. References:

- o Instructor Guide, Section III.D.
- o Instructor Guide, Appendix B
- o Instructor Guide, Appendix J
- o Instructor Guide, Appendix L, 13 SP&C Work Planning Factors, H.O. #1

6. Process:

A. Preparation

1. Review:
 - o Instructor Guide, Section III.D.
 - o Appendix L, 13 SP&C Work Planning Factors, (H.O. #1)
 - o Appendix J, Exercise Worksheet III.D.
2. Identify and relate each part of the exercise and supporting materials
3. Review suggested presentation strategy (below)
4. Prepare viewgraph of associated worksheet for use in presentation or, predraw easel pad sheets.
5. Personalize introduction, content, summary, and transition.
6. Complete an Instructor copy of the Worksheet (suggest at least one element per WPF).
7. Prepare WPF assignments to pass out to each small group (3 x 5 cards).
8. Rehearse with exercise materials in the training environment.
9. Xerox sufficient copies of materials for trainee use.

NOTE : Since some WPFs have more CS #5 related elements than others, care must be taken to ensure balanced distribution among table groups.

B. Presentation Strategy

1. Introduce the exercise

2. Provide following exercise instructions:

o General

Continue with same table groups established for
III.C., Block Level Operations Exercise

Refer to Student workbook, Section III.D.

One worksheet, Work Planning Factor and Elements
Identification, CS #5, Zone Level Operations

Review worksheet assigned WPFS & identify CS #5 -
specific elements

Refer H.O. #1, analyze pertinent content

Be prepared to report the table group's findings when
asked.

Will have use of lectern and overhead projector or
chalk/white board, easel pad.

Time: 45"

o Worksheet Completion

column 1: Check the WPFS that CS #5 specific.

Column 2: List CS #5 specific elements of the WPF

column 3: Indicate how SP&C near-term Planning and
Scheduling efficiency can be improved

o Demonstrate completion of one element under one WPF

o Ask for questions related to these instructions

3. Pass out WPF assignments

o Start exercise time by stating "You should be ready to
report after 25" from NOW.

4. After 20" designate one table group to report. Have other
groups complete lists and prepare to add to the report.

5. Facilitate and guide report and discussion to draw out
improvements and additions to the designated report.

APPENDIX J

Worksheet
III.DEXERCISE III.D., ZONE LEVEL OPERATIONS:
SPECIFIC WORK PLANNING
FACTOR IDENTIFICATION

CONSTRUCTION STAGE #5 ZONE LEVEL

Work Planning Factor	CS #5 Specific Elements	How SP&C Efficiency can be improved
1. Physical Description		
2. Location		
3. Support		
4. Specs		
5. Time/Manpower		
6. Minimizing Rework		
7. Material		
8. Equipment		
9. Handling/Storage		
10. Inspection		
11. Disruption Interference		
12. Safety		
13. Schedules		

APPENDIX K

APPENDIX K
EXERCISE IV, SP&C WORK PLANNING

1. Purpose: Provide a joint planning experience in which both managers and SP&C supervisors apply the 13 SP&C Work Planning Factors to a case incident and develop a plan for accomplishing ship construction work.
2. Product: List of planning considerations and actions related to a ship construction case incident.
3. Instructional Strategy:
 - o Method: Small group discussion with report
 - o Media: Viewgraphs, or chalk/white board, or easel pad, case study
 - o Participant Assignment: Participate in small group planning session, complete own notes, contribute to general discussion session.

4. Resources Required:

Instructor

Viewgraph Examples

Overhead projector

Viewgraph pen

Exercise IV, (Appendix K)

Instruction for Guide Appendix B

Instructor Guide Appendix L, 13
SP&C Work Planning Factors

Participant

Pencil

Eraser

Lined tablet paper

Exercise IV worksheets and
Data Sheet (Appendix K)

H.O. #1, 13 Work Planning
Factors (Appendix L)

5. References

- o Instructor Guide, Section IV
- o Instructor Guide, Appendix B
- o Instructor Guide, Appendix K
- o Instructor Guide, Appendix L
- o Supporting Data Sheet

6. Process

A. Preparation

1. Review:

- o Instructor Guide, Section IV
- o H.O. #1, 13 SP&C Work Planning Factors
- o Exercise IV (Appendix K)
- o Review presentation methods (Appendix B)
 - Guided discussion
 - Question techniques

2. Identify and relate each part of the exercise and supporting materials
3. Review suggested presentation strategy (below)
4. Prepare viewgraphs for use in presentation or, predraw easel pad sheets
5. Personalize the introduction, content, summary, and transition.
6. Identify and designate a recorder to assist instructor in the exercise
7. Rehearse with exercise materials in the training environment
8. Xerox sufficient copies of Solution Handout #3 for participant use.

B. Presentation Strategy

1. Establish discussion groups by integrating returning top management personnel into existing groups, or constitute entirely new groups. Ensure top managers are divided among the groups.

2. Provide each discussion group with the Handout #3, Exercise IV, SP&C Work Planning Exercise.
3. Allow time for the trainees to read through Handout #3
4. State process for completing the requirements.
5. Remain available to answer questions from any table.
6. At appropriate time 5" before discussion group report, designate most advanced group to present its solution.
7. Have designated group leader present findings (product) from lectern.
8. At conclusion of designated presentation, ask for questions/inputs from the entire group.
 - o Have group fill in any blank spots
 - o Remind participants to make notes
 - o Ask if there is a better way
 - o Ask if anyone's solution differs.
9. Go on to second requirement. Repeat system used for first requirement, but 5" before time to report, select a different group to present the report.
10. When appropriate, summarize results of the two exercises:
 - o Mention objectives achieved by group
11. Time: Approximately 2 Hrs.
12. Announce next sequential activity
 - o Complete evaluations
 - o Award certificates
 - o Check out

APPENDIX K
EXERCISE IV, SP&C WORK PLANNING

BACKGROUND

You work for Shipyard 'A.B.C.' located on the Mid-Atlantic seaboard. A.B.C. is building six (6) UNO-99 class ships for an allied Navy. These are your hulls, numbers: 101-102-103-104-105-106. A.B.C. has some subassembly work being performed by a vendor "D.E.F.". These subassemblies include six (6) complete bow units for hulls 101-106. The total interior coatings on the Bow Unit for H-103 have been rejected due to unsatisfactory application during the past winter. A.B.C. has agreed to accept shipment and correct the coating problem after arrival of Bow at A.B.C. yard. D.E.F. Co. will be back charged accordingly.

APPENDIX K
EXERCISE IV. SP&C WORK PLANNING EXERCISE

FIRST REQUIREMENT

Develop complete SP&C Planning to remove all the rejected coating from the interior of Bow Unit H-103; reprepare and recoat all areas to comply with specifications. See supporting Data Sheet.

A. Specifically you should project/list:

1. Planned method to accomplish this (include safety planning)
2. SP&C labor required
 - o People per gang
 - o Gangs per shift
 - o Shifts of work
 - o Total SP&C labor (hours)
3. Support labor required
 - o Identify trades
 - o Number of shifts
 - o Total support labor (Hours)
4. Identify where SP&C work is to be done
 - o In-yard, blast house, on-blocks, on-ship
5. List materials required
 - o Tons abrasive
 - o Gallons paint (by type)
 - o Other (list & estimate quantity)
6. List materials (residuals) and disposition of same

7. List equipment required in relation to your work plan
 - o At the blast house
 - o On-yard
 - o On-blocks
 - o On-ship
8. List personnel equipment required for SP&C operators
9. Identify overhead type support costs such as
 - o Compressed air
 - o Others
10. List Inspection Plan (ref: SP&C)
 - o When
 - o who
 - o why
11. Submit information to cost department to prepare back charge billing to D.E.F. Co.

APPENDIX K
EXERCISE IV. SP&C WORK PLANNING

SECOND REQUIREMENT

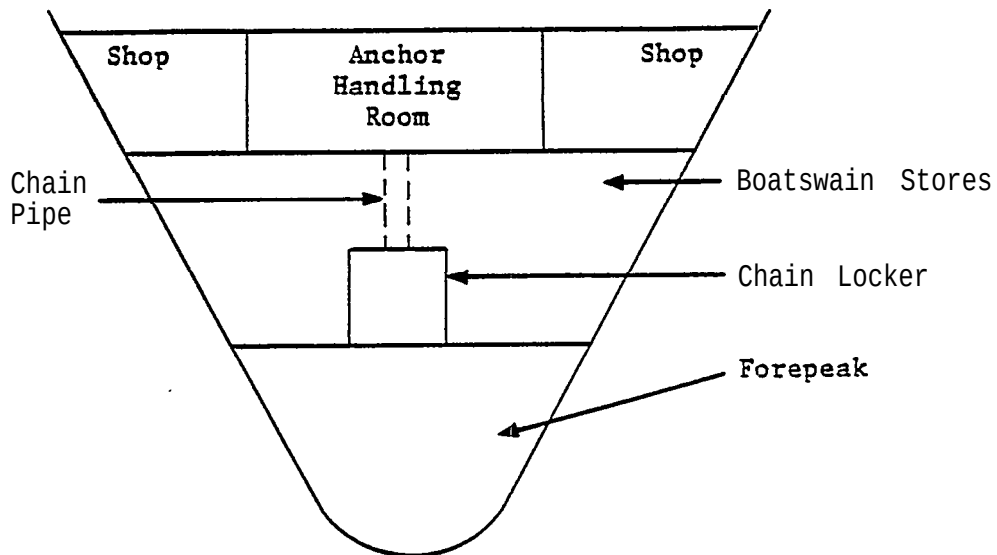
Develop complete SP&C planning to prepare and coat the exterior underwater hull (Keel to D.L.L.) in preparation for launching. Consider a total undewater coating system including anti-fouling paint. See Supporting Data Sheet.

A. Specifically you should project:

1. Method to accomplish this and precautions
2. SP&C labor required
3. Support labor total hours
4. List materials required
 - o Abrasives
 - o Paint
 - o Other
5. List clean up hours
 - o SP&C trades
 - o Others
6. List disposition of residuals
7. List equipment required
8. List inspection plan
 - o who
 - o When
 - o why

APPENDIX K
SP&C WORK PLANNING
SUPPORTING DATA SHEET

1. This bow unit contains 6 compartments.
 - o Windlass and rope handling room @ 10,000 Sq. Ft. area
 - o Paint locker and carpenter shop @ 3,000 Sq. Ft. each
 - o Boatswain stores @ 3,500 Sq. Ft. each
 - o Chain locker @ 2,500 Sq. Ft. each
 - o Fore peak tank @ 6,000 Sq. Ft. each



2. These hulls are 600 Ft. long x 80 Ft. Beam x 60 Ft. Deep. Deep load line (D.L.L.) = 30 Ft. (F.P. to A.p.). The underwater keel to D.L.L. = 110,000 Sq. Ft. (Approx.).
3. Paint specification requirements are:
 - o All steel to be abrasive blasted and coated with one shop coat of inorganic zinc primer at one to two roils (D.F.T.)

- o Salt water tanks to be coated with one coat of epoxy primer @ 2 roils t .5 mil over intact shop primer. Follow this with one finish coat of red epoxy at a D.F.T of 6 roils t 1 mil for a total D.F.T. of 10 roils t 2 roils
 - Use DEV0E 201 primer or equal
 - Use DEV0E 230 red epoxy or equal
- o Storerooms and similar spaces to be coated with one coat DEV0E 201 primer (tie coat) at approximately 2 mil D.F.T. followed by one finish coat of alkyd resin paint (approved quality trade mark)
- o Exterior hull to be coated as follows

Keel to D.L.L.

Blast and apply 2 coats of DEV0E 201 primer @ 2 mil D.F.T. per coat. Apply one top coat of DEV0E 230 epoxy (red) at 8 roils D.F.T. Apply on coat DEV0E 2/3 anti-fouling @ 2 roils D.F.T. total thickness 14 roils + 2 roils

D.L.L. to Rail

Sweepblast existing shop primer. Apply one coat DEV0E 201 primer (tie coat) @ 2 roils D.F.T. followed by two coats silicone alkyd haze gray @ 2 roils each D.F.T. for total film of 7 roils D.F.T+ 1 mil.

Lay off and paint in name - hailing port, draft figures, and water line markings.

4. Schedule (Excerpts)

- o Bow Unit H-130 will arrive at A.B.C. shipyard Saturday 10-4-86 (via barge).
- o Revised erection schedule calls for start erection of Bow Unit H 103 no later than Monday, 10-20-86 and finish erection by Thursday, 10-30-86.

H.O. #3
Data Sheet (cont.)

- o Start SP&C work on underwater hull on Monday, 10-13-86 (erection work finished except the Bow Unit).
- o Launching, on Saturday, 11-8-86
- o No re-docking scheduled after launching.

H.O. #3
Data Collection
Sheet #1

APPENDIX K
EXERCISE IV. SP&C WORK PLANNING EXERCISE
FIRST REQUIREMENT

USE THESE SHEETS TO LIST DATA FOR FIRST REQUIREMENT.

1. Planned method to accomplish this (include safety planning)

APPENDIX K
EXERCISE IV. SP&C WORK PLANNING EXERCISE

FIRST REQUIREMENT

2. SP&C labor required

- ☐ People per gang
- ☐ Gangs per shift
- ☐ Shifts of work
- ☐ Total SP&C labor (hours)

3. Support labor required

- ☐ Identify trades
- ☐ Number of shifts
- ☐ Total support labor (Hours)

4. Identify where SP&C work is to be done

- ☐ In-yard
- ☐ blast house

APPENDIX K
EXERCISE IV. SP&C WORK PLANNING EXERCISE

FIRST REQUIREMENT

4. Identify where SP&C work is to be done (cont.)
 - 0 On-blocks
 - 0 On-ship
5. List materials required
 - 0 Tons abrasive
 - 0 Gallons paint (by type)
 - 0 Other (list & estimate quantity)
6. List materials (residuals) and disposition of same
7. List equipment required in relation to your work plan
 - 0 At the-blast house

APPENDIX K
EXERCISE IV. SP&C WORK PLANNING EXERCISE

FIRST REQUIREMENT

7. List equipment required in relation to your work plan (cont.)

o On-yard

o On-blocks

o On-ship

8. List personnel equipment required for SP&C operators

APPENDIX K
EXERCISE IV. SP&C WORK PUNNING EXERCISE

FIRST REQUIREMENT

9. Identify overhead type support costs such as

o Compressed air

o Others

10. List Inspection **Plan** (ref: SP&C)

o When

o who

o why

APPENDIX K
EXERCISE IV. SP&C WORK PLANNING EXERCISE

FIRST REQUIREMENT

11. Submit information to cost department to prepare back charge billings to D. E.F. C O .

APPENDIX K
EXERCISE IV. SP&C WORK PLANNING

SECOND REQUIREMENT

USE THESE SHEETS TO LIST DATA FOR SECOND REQUIREMENT

1. Method to accomplish this and precautions

2. SP&C labor required

3. Support labor total hours

4. List materials required

o Abrasives

APPENDIX K
EXERCISE IV. SP&C WORK PIANNING

SECOND REQUIREMENT

4. List materials required (cont.)

o Paint

o *Other*

5. List clean up hours

o SP&C trades

o Others

APPENDIX K
EXERCISE IV. SP&C WORK PLANNING

SECOND REQUIREMENT

6. List disposition of residuals

7. List equipment required

8. List inspection plan

o who

o When

o why

APPENDIX L

INSTRUCTOR GUIDE

APPENDIX L

H.O. #1

THIRTEEN SP&C WORK PLANNING FACTORS

H.O. #1

Appendix L
Thirteen SP&C work Planning Factors

1 PHYSICAL DESCRIPTION (of the item to receive SP&C)

SIZE	sq. Ft. Area/Cu." Ft. Area/Quantity Pieces Affects - Handling, transportation - Quantity of labor and material - Schedules and work location	Size data comes from SP&C Spec. Drawings, groups, shop mfg. orders or similar instructions included in work packages. Needs to be considered early in the planning process	For off-ship SP&C work - put primer coat on small pieces/ plates/ baama/ brackete/ foundationa/ pipe hangera/ nuta/ bolta/ washera doors/ hatches, etc.
SHAPE AND APPURTENANCES	Affects - Handling, positioning - Ventilation, Staging, lighting. access	Impacts decision on how and where SP&C is best accomplished and SP&C efficiency	put intermediate coat(s) on intermediate size PCS subassemblies, modules, etc.
WEIGHT	Affects - Handlings (liftings) movings	Important to off-ship work (N.A. to on ship work.)	- put final coats on large pre-erection assemblies and aux. items such as masts/king posts/smokestacks/elevators
OPENINGS	Affects - Ventilation, lighting accessibility/protection/staging/number workers/cleanup/curing	Generally more opening preferred except "In-yard" requires more protection to blank the excess openings	
TYPE MATERIAL	Whether Mild, HY-80 Steel, S.T.S. Aluminum Stainless Steel. other Affects - Selection of SP&C extent of protection type of blast media	Determines the types of SP&C process and length of time to perform it.	put primer on as soon as structural erection is complete in area
CURRENT MATERIAL CONDITION	New steel, w/wo millscale, Rusty old paint, Toxic/non-toxic, Crease, 011, Special contaminations	Impacts type clearing Impacts type personnel protection Impacts cleanup and disposition of residuals Impacts degree of disruption to	put final coats on per compartment completion schedule NOTE - All plate to be blasted and coated 3/4 mil with pre-erection primer

Appendix L
Thirteen SP&C Work Planning Factors

2 LOCATION (where the SP&C work will be performed)

OFF-YARD	Vendor or suppliers items that may arrive already coated - partially coated or not coated at all.	Planners from design or purchasing should have these routed on arrival to provide for in-house SP&C. These items must be receipt inspected and SP&C processed as required.	Require vendor structural items to be primer coated prior to delivery as much as possible. Require vendor outfitting items to be finished coated prior to delivery as much as practical
IN-YARD	Units that are fabricated and SP&C processed - generally outside and exposed to the environments - affects community environment, clean water, fumes and fall out noise - protection - Affects company environment offices/trades/etc.	Exterior environment impacts SP&C efficiency and quality.	Minimize in-yard SP&C work Utilize a combination of preconstruction primer and subassembly units done in Blast Houses. Planners and SP&C Personnel should collaborate on break out size of units for most efficient SP&C work Where to SP&C Primer Where to SP&C Intermediate Where to SP&C final
IN-SHOP	Units that are SP&C coated in a Blast House - metal finishing paint shop or similar in house company facility. This location is ideal for parts, pieces and small to medium size subassemblies or modules.	Generally the preferred SP&C method for total cost control when proficiently planned and processed. There is some trade-off in total quality due to the mandatory rework of structural make-up of component parts.	Employ computers and blast shop coordinators to regulate the short-term work flow - avoid peaks and valleys and provide priority to the most critical units in support of various project schedules, consistent with production line flow schedules.

Appendix L
Thirteen SP&C Work Planning Factors

2 LOCATION (cont.)

ON-SHIP, EXTERNAL	SP&C work performed on the exterior surfaces of ships - superstructure, decks, side shell, bottom Affects - SP methods, & materials coating/methods & materials, cleanup/methods & materials, staging, support functions	The location of the ship at the time of SP&C work must not be overlooked for - in dry dock - on building ways - at pier - in stream impacts - environmental - staging - access	Test Sample existing paint/coatings for toxicity. Check application of power tool cleaning. Apply a test patch of SP&C (recoating) Use portable air compressors for higher air pressure - faster cutting - uses less grit
ON-SHIP, INTERIOR	SP&C work performed on the interior surfaces of: - ships - tanks/voids - machinery/spaces/bilges - storerooms - hotel spaces	Impacts - access - ventilation - lighting - staging - level of Manning - method of SP&C work	Use airless spray paint equipment vs. atomizing or other application tools. Strive for SP&C work packages that schedule a block of work (tanks) (compts) (spaces) or area at one time to minimize support functions and disruption.

3 SUPPORT

HANDLING	Functions usually supplied by in-house service trades other than the SP&C trade personnel.		
	Does the subject SP&C work require lifting/turning/moving/hanging? If so, what service trade support is required?	Size and type of handling equipment. Number of moves required.	Preconstruction primer ● application should include planned facilities for blasting/coating and quick curing of primer applied to steel on receipt at the plant (shipyard). Blast and coat houses generally include provisions for transporting sub-assembly or modules throughout the fabrication and SP&C processes - the Planners Job is to make efficient use of these facilities at all levels of points of SP&C planning. Minimize temporary stage construction - use fixed staging - ● an lifters cranes with personnel floats, etc., whenever you can. Never enter any tank or space that has Just been opened until gas tester or safety rep clears space for entry and designates type of personnel protection require.. Utilize upside down position to minimize scaffolding requirements. Tie staging to drydock NOT ships hull. Consider permanent scaffold clips to remain with ship.
	Does the subject SP&C work require transporting? If so, what type of transportation is required?	To and from blast house To temp. storage before or after SP&C processing To other yard locations for SP&C	
UTILITY SERVICES	Compressed air for power cleaners, blast equipment, paint spray pumps, grinders, etc.	Services readily available for SP&C schedule	
Air		Set up and operation by SP&C personnel	
Water	Gas to heat buildings/units/shops		
Gas	For cleaners, vacuum machines	Set up by support personnel	
Electric	Portable lights		
Power	Fixed lighting to work by		
Lighting			
VENTILATION	For personal health, comfort, safety	Time to perform SP&C	
	For confined space explosion protection	Safety of personnel	
	For coating/drying/curing	Other trade support	
	Natural or forced ventilation		
STAGING	Type and quantity	For access and maneuvering	
	When and how to set up/initiate	Blocking other work	
	When and how to take down/remove	Necessary to SP&C operations and Inspection	

H.O. #1

Appendix L
Thirteen SP&C Work Planning Factors

3 SUPPORT (cont.)

TEMPORARY PROTECTION	what to protect and how?	Service trades required?	Utilize processes, positions, and locations to minimize cleanup
	Who installs protection?	Impacts time For erection and removal	
	Who removes protection - when?	Impacts cleaning/blasting work apace	
		Impacts painting and cure time	
CLEANUP	What type cleanup	Impacts schedule length	
	What area or space and when?		
	What magnitude?	Impacts equipment repaired	
	Toxic or not?		
	What disposal of residuals?		
Chemist Gas Tester	When required - why?	Impacts schedule time for confined spaces, for tanks just opened, and highly flammable coatings.	
	Who calls/alerts?		
	What is the authority level of chemist - of gas tester?		
Safety Engr. Lab Services	When is each required - why?	impacts schedule time and quality	
	Who calls/contacts each - why?		
	Authority/responsibility of each?		
VENDOR REPS. Paint Sup- plier	Involved for quality and safety enhancement of the coating work.	Impacts quality, schedule time, and potential rework.	Communication with vendors, suppliers, and equipment reps.
	who communicates need for either/each		
Equipment Supplier	SP&C operators work with supply rep. Authority/respnnsibility of each		

4 SP&C SPECIFICATIONS

SOURCES OF SPECIFICATIONS OR SP&C INSTRUCTIONS	Customer detail specifications Engineering - SP&C instructions taken from known as "Paint Schedule" (paint blueprint) SP&C work package data taken from above two sources	Unclear, incomplete or incorrect space. result in error. Impacts schedule, rework, material procurement, and manpower.	Specification review by qualified SP&C personnel required in work planning process.
TYPE OF COATING REQUIRED AND ITS IDENTIFICATION	GENERIC FAMILY - Alkyd resin, <u>Vinyl</u> , <u>Epoxy</u> , Inorganic Zinc, Urethane, Latex (water base). coal tar compounds CHARACTERISTICS: <u>Combustible</u> , <u>Flammable</u> , <u>Highly Flammable</u> , <u>Non-Toxic</u> , <u>Toxic</u> , <u>poisonous</u> , <u>Non-Combustible</u> , <u>Non-Flammable</u> Coating characteristics are obtained from: Product Data Sheets Safety Data Sheets Both should be supplied by paint vendor or manufacturer.	The coating characteristics impact where and how job may or may not be done.	Do not start mixing and coating without reviewing product data sheets and safety data sheets. Always check the shelf life date on paint can - use only known good paint to avoid costly problems.
METHOD OF APPLICATION	Brush/roll/spray/dip/flow; combination of above. Spray application is considered the current basic application method - supported by brush touch up and brush coating of welds, etc.	Impacts rate of Production cure time, equipment, and manpower.	Use airless spray coating as the prime equipment supported by atomizing spray; brush/roller touch-up work.
NUMBER OF COATS	Generally two or more coats required. At least one prime coat and one top coat	Two coat systems expand less initial application labor than three coat systems and expedite items thru blast paint rooms. two coat systems are quicker, but usually require more touch-up and more rework so that the three coat system often proves best even at the frame total dry rolls.	Use three coat system where permissible on most off ship work. - This gives flexibility to job - Potential for reduced rework - Overall lower cost and better quality

4 SP&C SPESIFICATIONS (cont.)FILM THICK-
NESS

Recommended wet film thickness is obtained from product data sheet; is important monitor at application to ensure that each coat dries to specified dry film thickness to end up with specificd total dry film

A typical epoxy system may require:
2 Dry Mills of primer
10 Dry Mills of top coat
12 Dry Mills total

Impacts quality, control, application time, potential rework, and equipment required.

Explore your options and apply same thickness on 3 costs:

- 2 Dry Mills of primer
- 6 Dry Mills intermediate coat
- 4 Dry Mills top coat (later)

DRYING/
CURING

Drying generally refers to time between coats before next coat. Curing refers to completion of chemical reactions and/or drying and ready for intended service function.

Drying/curing impact when/ where/how long it takes to do a specific job.

Long dry/cure can bog down blast house operations

Provide accelerated curing environment in blast paint houses - heat, ventilation, humidity control

INSPECTION

WHO/WHEN/WHERE

Inspections may be formal or informal, in-process or upon completion.

Required inspections influence quality and progress of SP&C work. Unnecessary inspections generate confusion, overlap and rework, and contribute to higher costs.

Make maximum use of your In progress inspections.

Minimize formal planned inspections and keep those near end of job.

COATING
OBJECTIVES

Coatings serve a variety of purposes

Purposes - corrosion protection, cosmetic anti-fouling, weather resistance. Sanitation or a combination of these.

The SP&C objective impacts when/ where/how coatings are applied and must be considered in long and short-term planning in relation to the SP&C system and to the service function of the paint/coating.

Use wet and dry film gages

Monitor total film thickness

Too thick is worse than too thin because it consumes excess material and generates re-work thus using more labor - resulting in higher costs overall.

4 SP&C SPECIFICATIONS (cont.)

SURFACE PREPARATION

Method	All surface prep falls under one of these classes: <u>manual cleaning</u> , <u>power cleaning</u> , <u>blasting</u> , <u>chemical cleaning</u> or combinations thereof.	Methods influence when/where/why SP&C work can or cannot be accomplished.	Utilize efficient methods that ■ meet minimum spec. required.
Blast Media	Sand, metal shot, metal grit, Black Beauty resin grit, etc.		
Profile/Anchor Pattern	Dries the spec or paint system require specific profile, anchor pattern?	Media used impacts production rate.	Blast profile should be in accord with product data sheet or as rule of thumb 1/4 to 1/3 of the first coat thickness (dry film).
Options	Does the spec or system allow any options such as use of mechanical needle guns in lieu of blasting on small areas?		<u>Example</u>: If you wish to apply 3 mils dry film of a given primer that is listed at 50% solids, then you need a 1 mil profile (anchor pattern) on which you apply 5 wet mils of paint that will dry to 3 mils for a well bonded primer. Use the needle gun option where permissible to avoid spot blasting on large units and on ship.

H.O. #1

Appendix L
Thirteen SP&C Work Planning Factors

5 TIME/MANPOWER

MANPOWER PLANNING	Objective - accomplish acceptable SP&C in the shortest practical time with minimum manpower used and minimum rework required.	Impacts schedule and cost of job.	Planners and operators must recognize that some short-term sacrifices must occasionally be made in time and manpower to support the team objective of overall shortest time and lowest manpower. These are management decisions and line supervisors/planners should not feel guilty at resulting higher costs.
ALLOTTED TIME PER SCHEDULE	Planners allow target times to process designated sizeable units of work through fixed operations.	Planners should communicate with SP&C reps who attend planning meetings.	
AVAILABLE MAN-POWER	Planners should communicate with each other as well as SP&C operators to look at total target work load and project manpower needs.	Availability of manpower is more a planning problem between SP&C supervisors and dept. heads.	Always have one or more backup people trained or in training for each spot on your team. An ideal gang would be composed of:
SPACE RESTRICTIONS	Affects the type of equipment used and number of workers used at a time, thus controls elapsed time to do job and Influences total manhours.	Impacts SP&C facilities - blast/coat houses - etc. and work planned for inside.	35% long-time reliables 35% experienced mechanics 30% new people in training
LABOR SKILLS LEVEL	Affects the elapsed time of job in relation to the average skill of the operations and impacts the total cost in similar manner.	Impacts production rate Training is a full-time part of SP&C operations. Each foreman should constantly have a percentage of new people blended in	SP&C operators should keep a <u>log</u> of estimated times vs. actual times to complete each SP&C work packages. These should then be made available to and/or discussed with long-term planners, schedulers and estimators.
SP&C OPERATORS ESTIMATED TIME AND LABOR TO COMPLETE	The SP&C operators - foremen and his support elements must recompile all input work from several sources to determine his weekly and daily work plan, thus producing his estimated time on specific tasks/units.	Foreman work plan impacts overall schedule if different from the planner's work estimate.	

H.o. #1

Appendix L
Thirteen SP&C Work Planning Factors

5 TIME/MANPOWER (cont.)

SCHEDULE TIME
vs.
ESTIMATED TIME

Scheduled time is generally a broader target or guide established at earlier planning levels. Estimated time is a short-term detail time estimate that needs to be as accurate as possible and feed back to planning meeting so as to make on course corrections in schedules. both current and future schedules.

If the planners schedule and time coincides with the SP&C operators schedules and time then output should be on schedule. Of course, the above rarely exists because the SP&C operators have to deal with SP&C planning coming from several sources, such as project managers, different fabrication shops, different planners, etc., and the lack of standard units of SP&C work.

Impacts overall SP&C schedule performance when scheduled time and estimated times are significantly different.

The compatibility of scheduled time and estimated time is a measure of the total team experience and ability in many situations.

This compatibility plus a recognized system of SP&C work in any given shipyard will do much to improve production and reduce costs.

6 MINIMIZING SP&C REWORK

WHEN TO APPLY PRIMER	<u>OPTIONS:</u> (1) As preconstruction primer when steel arrives in shipyard (2) Small subassembly units/pieces on the yard (3) Subassembly/modules/pieces in the blast and paint shop (4) Large subassembly units prior to on-ship erection (5) Post-erection/on-ship application	A. The costliest part of SP&C blast work is the removal and disposition of blasting residuals. Therefore, the prime objective is to avoid or at least minimize blasting on ship. B. Application of an accepted preconstruction primer-applied at the time of receipt of steel in the yard is a desired step when it is permissible within the spec. and management system. C. Consider the use of a preconstruction Primer in some cases as a preservative and color assist to other trades even if it must be blasted off to use the spec. (4) primer.	(1) Accomplish as much off-chip SP&C as permissible and practical within the specification and system constraints. (2) Plan each step of SP&C as close a permissible and practical to the completion of other trades work, especially fitting, chipping, cutting, welding, straightening, piping, wiring, etc. (3) Monitor the status of other trade work; see for yourself that other trades work is ready for SP & C coating at the intermediate or final coat level. (4) Use light colors of primer and intermediate coats where the system permits to highlight and help correct unfinished structural/outfitting prior to application of the final coat; and to improve illumination in construction areas and spaces.
WHEN TO APPLY INTER- MEDIATE COAT	<u>OPTIONS:</u> (1) Small subassembly units/pieces on yard (2) Subassembly/modules/pieces in the blast and paint house (3) Large subassembly units prior to on-ship erection (4) Posterection/on-ship application	A. Application of intermediate coat(s) should be considered for small subassemblies done in blast and paint houses or for large subassembly units processed prior to erection on ship.	

H.O. #1

Appendix L
Thirteen SP&C Work Planning Factors

6 MINIMIZING SP&C REWORK (cont.)

WHEN TO APPLY FINAL COAT(S)	<u>OPTIONS:</u>	A. Final coat(s) should be applied to most non-structural components off-ship in paint chop or blast/paint houses.	(5) When "quality" and/or 'coating integrity" is the priority consideration then and only then should on-ship SPEC operations considered as the beat choice for the bulk of SP&C work. (This eliminates patching in of make-up seams, joints, etc. - permits full continuously covered coats of primer, intermediate and final painting.
	(1) Small subassembly units/pieces on yard (2) Subaassembly/modules in blast and paint shop (3) Large subassemblies prior to on-ship erection (4) Post-erection on-chip application	B. Final coat(s) to structural components should be applied off-ship to large subassembly units or on-ship after completion of other work depending on spec. and system requirements. 'This is a foremen's/planner's conaider-ation, but not their decision.	

MATERIALEXAMPLES OF
SP&C
MATERIALS

For Surface Preparation - Part of SP&C: Impacts:

(1) Abrasive steel shot (2) Abrasive steel grit (3) Combination of (1) & (2) above (4) White sand (5) Synthetic abrasive (byproduct of other industrial operations) (6) Aluminum oxide (7) Sandpaper and similar mfg. abrasives (8) Chemical cleaners - citric acid, phosphoric acid, etc; soap type cleaners (9) Masking tape, etc.	(1) Material out of stock delays work (2) Poor quality material results in rework (3) Aged material (coatings) will not meet quality standards

For Painting or Coating Part

- (1) Alkyd resin paints
- (2) Vinyl resin paints
- (3) Inorganic zinc coatings
- (4) Epoxy resin coatings
- (5) Polyurethane paints
- (6) Coatings - coal tar products
- (7) Latex (water base) paints
- (8) Other similar paints, coatings
- (9) Solvent cleaners
- (10) Solvent thinners
- (11) Masking tape

SAFETY

Is this a new material or one I am familiar with/have used before?

Is there a safety data sheet, and who has it?

Now do I check the safety data sheet?

NOTE: Refer to safety heading on sheet () of these considerations

SP&C personnel have limited options to decide on the use of cleaning or coating materials - the choices are locked in earlier. You DO HAVE and MOST USE the option of communicating back through your bosses and/or counter parts relative to materials that do not perform well and the need for better performing materials.

Always insist on ● at. product data and safety sheets. Review these for each SP&C job.

Always check the shelf life date - insist on newly packaged coatings.

Get control of and maintain a 3 to 5 day supply of SP&C materials for your gang.

Who else is using same type material in same or close by area? Watch this for performance clues and for material supply control.

H.O. #1

Appendix L
Thirteen SP&C Work Planning Factors

8 EQUIPMENT

TYPE FOR SP&C SUPPORT OPER- ATIONS (EXAMPLES)	Fork lift Front-end loaders Cranes Conveyors Grit-hoppers Air compressors Air drivers Dehumidifiers Manlifters Rail cars Tractor-trailers Trucks Aux - heaters	Proper equipment use requires trained operators. Appropriate equipment saves time	<u>Minimize</u> Start/stop operation Set up time Repair/breakdown thru effective PM Plan equipment utilization Maintain equipment inventory

TYPE FOR CLEANING	Abrasive blast equipment - Automatic - Manual - Fixed portable - pneumatic/centrifugal types - Vacu/veyors/vacuum cleaners	Other type cleaning - Power wheels - sanders - Power chippers/scalers/ needle guns - Chemical (Dip-wipe-etc.) - Manual/sand blast As a rule of thumb for discussion of equipment: centrifugal abrasive wheels will predominate in small blast machines and small blast grit recycling rooms - manually operated blast nozzles with expendable abrasives (non-recycling) usually prevail for off-ship exterior work and all on-ship blasting work	Portable air compressors ganerally provide cleaner and higher pressure air for blasting, thus they reduce: - elapsed time - labor time - blasting material consumed per unit of work output.

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Appendix L
Thirteen SP&C Work Planning Factors

8 EQUIPMENT (cont.)

TYPE FOR COATING	Spray paint	- Airless spray paint pump type equipment will perform better on viscous coatings and those to be applied in thicker wet films like 6 or more wet film mils per coat.	A combination of airless spray and atomizing spray equipment is the best overall painting equipment; supported by roller/brush, etc.
	- Air/airless - Eletrostatic - (Combination		
	Brush/roll (power or manual)	- A combination of airless and low pressure atomizing spray equipment works better on interior compts. and machine spaces working in and around obstructions, such as, pipes, cable runs, electronic consoles, machinery, furniture, etc.	Insist on spray operators using "wet film" thickness gages - put on the desired thickness at one time without excess and without <u>rework</u> .
	Dip or flow coating		

H.O. #1

Appendix L
Thirteen SP&C Work Planning Factors

9 HANDLING AND STORAGE OF SP&C UNITS/ PIECES OFF-SHIP

HANDLING

Referring to the unit that is to be
SP&C processed

WHAT is to
be handled

Identification of SP&C unit by code
number or by detail description
In case of smaller parts/pieces.

Can be pieces/parts/subassem-
blies/module/machinery. etc.
Impacts equipment and time.

WHY is it to
be handled

For SP&C processing on-yards in-shop
or for movement to storage or on ship
as part of SP&C processing.

Impacts equipment, schedules,
support craft coordination.

Lifting - turning or moving to allow
desired processing of SP&C work.

WHO is to
handle it

Internal SP&C operations or requires
service support assistance.

SP&C schedules depend on items
moving on schedule.

Heavy lifts should be scheduled
by planners.

SP&C supervisors must request
other moves/situations.

SP&C supervisors must be able to
handle units/pieces in their spaces
without other trade assistance.

ROUTING AND
SCHEDULE

From fabrication to SP&C process

Step #1 can be primer or interim
Step #2 can be interim or storage/
Final
Step #1 can be final

Impacts dependent upon
shipyard work process procedures
for number of moves, required
time of travel, number of heavy
lifts, etc.

The routing would be targeted at the
planning level, but detail schedule
would tail to SP&C operations.

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9 HANDLING & STORAGE SP&C UNITS (cont.)STORAGE

Units may be stored at the completion of fabrication with no coating or with residual preconstruction primer.

Units may be SP&C primed after fab. and stored at this point.

Units may be SP&C primed and part top coated - then stored awaiting-add-itional assembly or erection.

This determination is a function of the system and where specific units fit in - the SP&C operations must know the system and fit of the pieces even if they can't change the system.

Length of time in storage should be considered to avoid rust and corrosion of uncoated units and to avoid deterioration of partly

Units should be protected against surface film contaminations during storage or be thoroughly cleaned at end of storage or before additional recoating.

Certain coating systems may not be suspended for storage or other reasons at the primer or intermediate coat level, but at be continued thru final coat application within time constraints. The product data sheets will caution on this and it should always be respected. However, lower temperatures can extend recoat time and higher temperature can reduce recoat time. Judge accordingly. Check with paint lab personnel for added assurances.

Store units or places:

- inside where practical
- in position that allows runoff of water. Drill drain holes if runoff can't be relied on
- away from salt water flooding or salt water spray or mist
- with spacer pieces between flat faces/surfaces

10 INSPECTION

	Inspection of work performed at any of several levels affects the following concerns: Does spec. require specific inspection? What type inspection? Who conducts inspections? What criteria? Who witnesses inspections? What documentation? who accepts/rejects? At what points? NOTE: Spec./owner/customer used interchangeably here. Does the yard management system require inspections? Does the point vendor/representative inspection?	Impacts based upon spec. are: - in process - intermediate - step-by-step - final What type/level? Inspection, or the right to witness In-process operations?	Depend on in-process inspections by experienced inspectors - you or your counterparts Keep formal inspections to the minimum. These disrupt work and and serve no purpose (unless mandatory). The most effective inspection system is composed of: in-process monitoring that includes wet roll thickness reading and dry mil. readings after each coat followed by
SPECIFICATION REQUIREMENTS	Does the dept. supt. require inspections by department-trained inspectors, independent of production personnel?	Impacts the scheduling of inspection services.	one thorough final inspection of each unit/area/tank/compartment, etc. at completion of major coating work
INTERNAL REQUIREMENTS	Do you, the foreman, faithfully inspect and accurately evaluate the production accomplishments of your gang?		This, when faithfully and accurately done, is the best level of SP&C work inspection.
FOREMAN'S LEVEL			

H.O. #1

Appendix L
Thirteen SP&C Work Planning Factors

11 DISRUPTION/INTERFERENCE

GENERATED BY SP&C	Delays/slow downs/cancellation/damage to other trades or other work functions as a result of SP&C operations.	Applicable SP&C operations on- and off-ship.. The most damaging aspects occurring on-ship and on the adjacent dock areas.	
SP&C BLAST OPERATIONS (CLEANING)	Generates hazards to others in form of dust/flying abrasives/noise. Blocks access routes due to masking and closure protective measures. Precludes other to protect the surfaces being processed.	SP&C preparatory operation involve clean up/cover up to area/unit, etc. that generate displacement, - move over disruptions for other trades before and after actual blasting and coating operations.	Plan SP&C operation for off shift times. after normal work hours or on weekends. Utilize blast and coat rooms effectively thru a planned/ agreed system.
SP&C COATING OPERATIONS (PAINTING)	Generates flammable/explosive/toxic/ irritating fumes. Generates wet (painted)/slippery/keep off surfaces that preclude other work even if nonflammable/nontoxic coating is used.	Precludes other work due to personal health/safety/well-being of others Precludes or strictly limits access and movement thru or within the area/shop/bldg./ space/compartment/dry dock or open decks.	<u>Reduce rework. Do it right and once only.</u> Make use of approved accelerated curing techniques heat/humidity/ ventilation control. Utilize approved "fast cure" versions of available coatings.
SP&C CURING OPERATIONS (DRYING TIME)	Coating must cure to be: - back free from dust. etc. - fume free to avoid fire or explosion - dry hard to permit walking on without damage to the coating - dry firm to remove protection/ covering to release surfaces for continuation of other work.	Generates delays that tie up facilities/areas/spaces/ compartments. While waiting for coatings to cure.	

12 SAFETY

General Note:

Safety must be a totally integrated part of any and all SP&C operations. Safety demands and deserves to be a topic unto itself and is mentioned for limited consideration to show that it must never be neglected or left out. This is not an attempt to provide training in SP&C safety.

Impacts of unsafe operations:

- Injury
- Delay
- Liability
- Loss of work
- Claims

The life you **save** has a very high probability of being your own; in SP&C operations more than most other shipbuilding functions.

Your personal safety

- the first line supervisor has the prime responsibility

Put safety first; mixed right in with performance, production, quality control, etc.

Your personnel (your gang)

the planners have associate responsibility

Your fellow employees

Your work area/shop/yard/ship

the safety engineers have joint responsibility

"DO it right for once-only and safely."

Your shipyard/company

- the managers have leadership responsibility

Your community/environment

Your materials

Safety is everybody's business

Your equipment

Dust

- nuisance
- irritating
- toxic

SP&C HAZARDS

Flying Particles

- abrasive grit
- abrasive shot
- abrasive other

12 SAFETY (cont.)SP&C HAZARDS
(cont.).

High pressure air/fluids

- hose rupture
- nozzle exhaust

high pressure air from blast
or paint equipment.High pressure fluid from water
blast or from airless spray
equipments.

Fire (explosion)

Fumes

- nuisance
- irritating
- toxic
- oxygen displacing

Falls

- from staging/ladders
- from personnel lift equipment

Chemicals

Affects

- burns
- blisters
- irritants (eyes)
- irritants (respirator)
- irritants (skin)

From

From chemicals used as cleaners
 From chemicals being blasted off
 From paints/coats containing
 chemicals
 From solvents/thinners

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Appendix L
Thirteen SP&C Work Planning Factors

13 SCHEDULES

CONTRACT SCHEDULES	Management Developed. These target the <u>start</u> and <u>finish</u> of contract	"The beginning and end" of specific jobs No detail concern for SP&C personnel	
MASTER SCHEDULE	<u>A management tool that details :</u> - Key events - Award of contract - Lay keel - Launch - Deliver	This schedule sets the time frames for other more detail/supporting schedules. SP&C personnel can estimate their broad scope of work from this.	
MAIN EVENTS SCHEDULE	Details main events in sequencing order Erection/launching/outfitting/compartment completion/testing/train trail/delivery	Details SP&C of biles in machinery spaces Details SP&C for some tanks Details SP&C completion dates on compts/math. spaces, etc., but leaves details to later planning	Generates iteration of SP&C activity with other craft activity at specified times.
SHOP MFC. SCHEDULE	Details items/units/components/sub-assemblies built in shops or on exterior building plattens, skids/ areas	Targets subassemblies to the <u>blast/coat</u> house or provides means for SP&C operators to estimate when units are ready for SP&C processes	
MODULE BLAST/ COAT SCHEDULE	Short-term composite schedule made up by SP&C personnel to show SP&C loading and work flow from fabrics-ation areas to erection time	This varies widely from yard to yard and from time to time within the same yard.	Points up the need for a SP&C coordinator team to make this a more efficient process in all shipyards.

13 SCHEDULES (cont.)

NULL ERECTION SCHEDULE	Schedules completion of structural work off-ship for erection units and the date of erection of these units on the ship.	Provides the control dates for some SP&C work that is to be done off-ship prior to erection.	60% of all SP&C coating should be completed prior to erection and 90+2 of all blasting for SP&C should be complete.
LAUNCHING SCHEDULE	Shows details of structural completion and proposed staging removal prior to ship launching	Provides SP&C dates for underwater work and for exterior hull painting (dress up) prior to launching.	Underwater SP&C operations may be decided by <u>spec - management</u> or project level. Final economics is a function of proposed system and how long between launch and delivery.
DOCKING SCHEDULE	Proposed redocking times between launching and delivery	Provides one or more optional times for underwater SP&C work in whole or in part.	
OUTFITTING SCHEDULE	Provides target SP&C dates by showing completion of external sections/tanks/compts/machinery spaces	Additional short-term schedules are provided by project/depts. to detail SP&C operation.	
SP&C TANKS	Provides hydro testing of tanks before launch	These are areas where the SP&C foreman can and should make real contributions by direct participation or by indirect representation at or to the planning meetings that schedule and re-schedule these SP&C operation.	Eliminate <u>rework</u> at each opportunity, but <u>do not</u> hesitate to <u>repeat</u> your ideas, suggestions or <u>complaints</u> that may contribute to better performance in SP&C operations.
SP&C MACH. SPACES	SP&C operators have input into these schedules thru planning meetings to detail start and finish times for each compartment/tank/area		
SP&C EXTERIOR	Breaks exterior of ship into sections for SP&C work		
COMPARTMENT COMPLETION SCHEDULE	Targets number of compts. to be completed per week or month and on certain Navy work it targets the compartments/spaces that are turned over to the ship's crew for living and (operational purposes	Instrumental in SP&C supervisors estimating number of workers required to comply with scheduled number of compartments.	Foremen/plannere/mat. supervisors/equipment supervisors and similar SP&C personnel can and should play a significant part in long-term scheduling by feeding their ideas and needs through their superiors and back to the long-term planning sources. This can results in more meaningful schedules across the board and reduce total costs of SP&C operations.
and/or			
COMPARTMENT TURNOVER SCHEDULE			

APPENDIX M

INTRODUCTION VIEWGRAPHS

**WORK PLANNING
FOR
SHIPYARD
SURFACE PREPARATION
AND
COATING
(SP&C)**

INTRODUCTION

WORK PLANNING FOR SHIPYARD SURFACE PREPARATION AND COATING (SP&C)

INTRODUCTION WORKSHEET

Instructions : Please use this worksheet to organize a short self-introduction

NAME:

SHIPYARD

DEPARTMENT:

POSITION/TITLE:

LOCATION:

Shipyards planning experience:

Experience

Types of planning experience

Specific expectations from this Workshop:

Specific Questions you want answered:

COURSE OBJECTIVES

1. The purpose of this course is to provide the background information and skills necessary to improve the general ability of SP&C supervisors to effectively plan and schedule near term Surface Preparation and Coating work on new ship construction.
2. A desired second outcome of this course is to increase the shipyard management's knowledge of the effects of near term detailed surface preparation and coating planning on overall shipyard production efficiency.
3. Therefore, the outcomes of this course will be an improved exchange of SP&C work planning information and ideas between shipyard top management, SP&C supervisors and cognizant craft planners and schedulers.

SCOPE AND OVERVIEW

SECTION I VIEWGRAPHS

HISTORICAL BACKGROUND

SP&C Planning

- I Last on ship's completion list
- I Difficult to manage
 - Inefficient and complex
- I Too much on-board work

U.S. SHIPYARDS NOT COMPETITIVE

- Labor Intensive Workforce
- Low productivity
- Antiquated systems and processes
- Antiquated industrial equipment and facilities
- Potential for in-process changes and alterations

HULL BLOCK CONSTRUCTION SYSTEM

- Japanese lead the world in this system
- Varying degrees of the Hull Block Construction Method now in U.S. shipyards
- Traditional system survives, in whole or in part in the U.S.

NATIONAL SHIPBUILDING RESEARCH PROGRAM

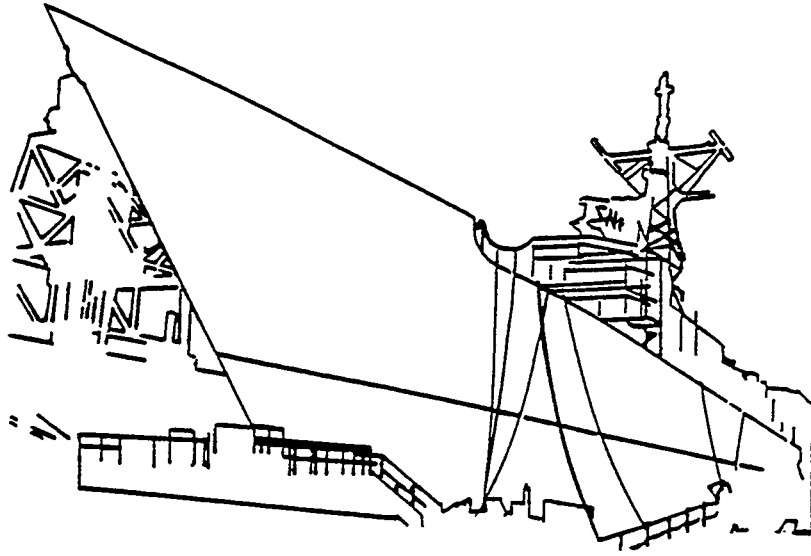
- I Sponsor of the effort to improve the shipyard industry SP&C process
 - Concerned that SP&C now represents 10% - 20% of ship construction costs
 - . Concerned that painter's work still controlled by the design and production methods which are decided by others in the planning process
 - This training package is a result of that concern

APPROACH TO SP&C WORK PLANNING

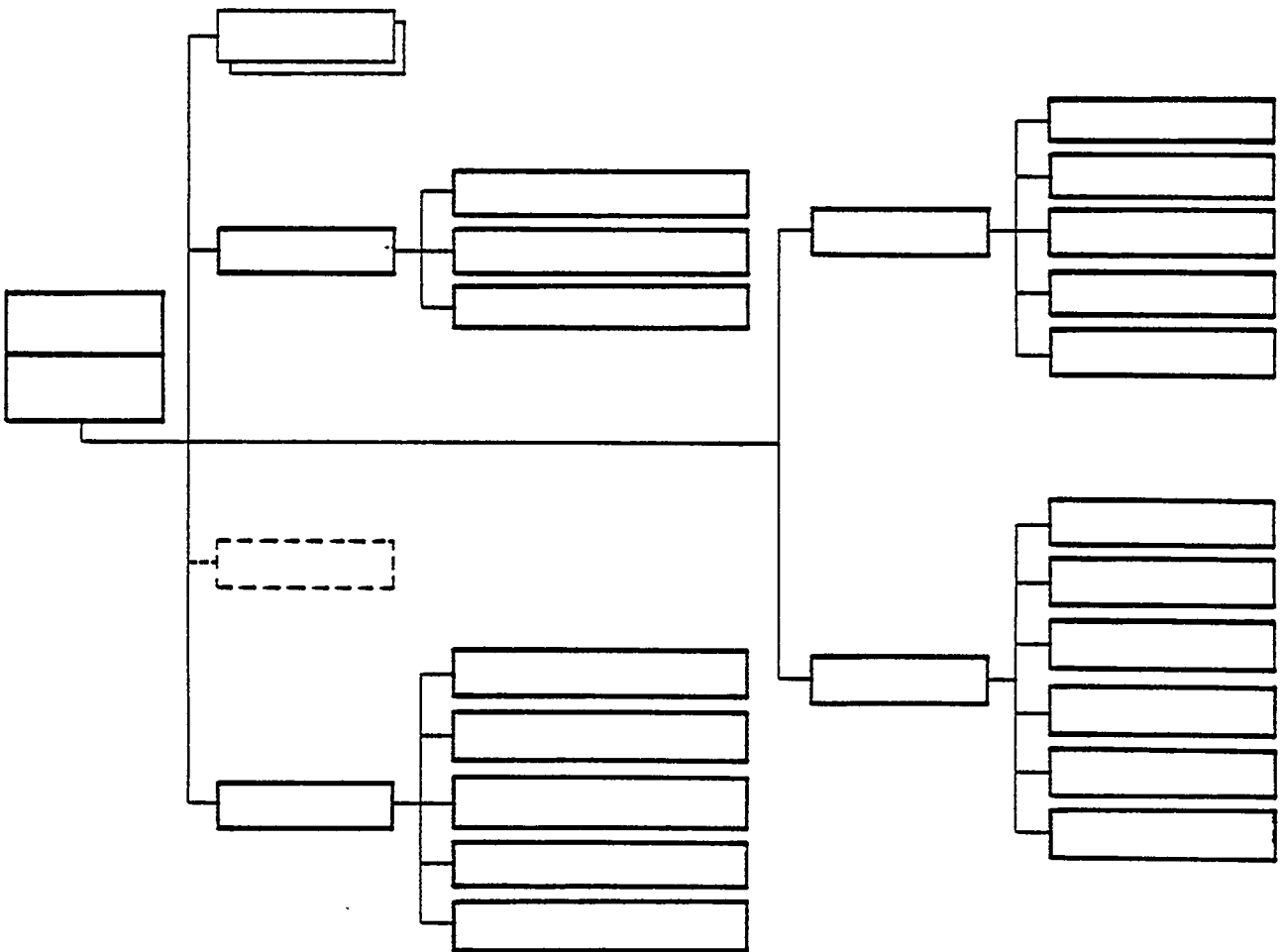
- A. Prepare and paint as early as possible
- B. Do as much under controlled conditions as possible
- C. Use blast and paint houses
- D. Use end of other shops (pipe shop paint section)
- E. Paint final coats only after all other work is done - to preclude rework
- F. Maximum down-hand work
- G. It may be cheaper to move the paint than the item to be painted (cost trade off)
- H. Inspect, before you paint, and after
- I. Plan blasters and painters work in relation to other trades in the construction process
- J. The Zone Approach permits and encourages most outfitting SP&C work to be accomplished earlier under more efficient conditions
 - Safer
 - Cleaner
 - Tools and materials delivered to work sites quickly and economically
- K. Plan early and stick to your plan

BENEFITS DERIVED

- I Reduce blast and paint time
- I Minimize on-board work
- I Simplify SP&C Planning and Scheduling
- I Avoid interferences between trades
- I Achieve greater efficiency of handling equipment and material
- I Improve safety
- I Improve working environment
- I Improve Productivity
- I Improve Quality



SHIPYARD ORGANIZATION



13 WORK PLANNING FACTORS

1. Physical Description
2. Location
3. Support
4. SP&C Specification
5. Time/Manpower
6. Minimizing
7. Material
8. SP&C Equipment
9. Handling and Storage
10. Inspection
11. Disruption/Interference
12. Safety
13. Schedules

(WPF) #1. PHYSICAL DESCRIPTION
(painted item)

- Size
- Shape
- Openings
- Appurtenances
- Materials Types
- Materials Conditions

(WPF) #2. LOCATION
(Where work is to be performed)

. Off-yard

● In-yard

● On-ship

- External

- Interior

(WPF) #3. SUPPORT

- Handling
- Transporting
- Utility Services
- Ventilation
- Staging
- Temporary Protection
- Cleanup
- Chemist
- Gas tester
- Safety
- Lab Services
- Vendor Representatives
 - Paint Supplier
 - Equipment Supplier

(WPF) #4. SP&C SPECIFICATIONS

- Film thickness

- Drying/Curing

- Inspection

- Ž Coating Objectives

- Sources of Specifications or SP&C Instructions

- Type of Coating required and Coating Identification

- Method of Application

- Number of Coats

- Surface Preparation

(WPF) #5. TIME/MANPOWER

- Manpower Planning
- Allotted Time Per Schedule
- Available Manpower
- Space Restrictions
- Labor Skills Level
- SP&C Operators Estimated Time and Labor to Complete
- Schedule Time vs. Estimated Time

(WPF) #6. MINIMIZING SP&C REWORK

- When to Apply Primer
- When to Apply Intermediate Coat
- When to Apply Final Coats

(WPF) #7. MATERIAL

- Materials for Surface Preparation
- Materials for Painting or Coating
- Material Safety

(WPF) #8. SP&C EQUIPMENT

- Support Operations

- Forklift
- Air Compressors

- Cleaning

- Abrasive blast equipment
- Pneumatic/Centrifugal
- Vacuum cleaners

- Coating

- Sprayers
- Brush/Roll (power/manual)

(WPF) #9. HANDLING AND STORAGE

- Handling Units to be Processed
- . Routing and Scheduling
- Storage

(WPF) #10. INSPECTION

- . Routine Inspection Requirements
- Specification Inspection Requirements
- Foreman's Inspections

(WPF) #11. DISRUPTION/INTERFERENCE
 (By SP&C)

- Generated by SP&C
- Generated by other trades
- SP&C Blast Operations
- SP&C Coating Operations
- SP&C Curing (Drying time)

(WPF) #12. SAFETY

- What
- Who
- SP&C Hazards
 - Dust
 - Flying particles
 - High Pressure
 - Fire
 - Fumes
 - Falls
 - Chemicals

(WPF) #13 SCHEDULES

- Contract Schedules
- Master Schedule
- Main Events Schedule
 - Shop Manufacturing Schedule
- Module Blast/Coat Schedule
- Hull Erectors Schedule
- Launching Schedule
 - Docking Schedule
- Outfitting Schedule
- Trials Schedule
- Delivery Schedule
 - Most Important but least significant amount of work

FIVE STAGES OF NEW SHIP CONSTRUCTION

1. Management Planning (Design Plan)
2. Pre-Construction Planning and Operations
3. Assembly
4. Block Level Operations
5. Zone Level Operations

CONSTRUCTION STAGE #: MANAGEMENT- PLANNING

- Initiated by opportunity to bid (RFP)
 - New Ship Construction
 - Repair Package
- . Involves
 - Developing a Bid Work Plan
 - Determining Specifications
 - Developing the cost
 - Determining the methods for construction
 - Make/Buy decisions
- Results in
 - Cost-effective competitive bid
 - Hull erection plan providing known efficiency opportunity parameters
 - Work plan to follow when contract awarded

CONSTRUCTION STAGE #2: PRE-CONSTRUCTION PIANNING AND OPERATIONS

- Initiated by contract award
- Involves
 - Work Planning refinements
 - Schedules (master through detail)
 - Project Planning
- Results in
 - Work Packages
 - Schedules detailed
 - Manpower planning
 - Material ordering & receipt
 - Raw materials preparation, coat, and storage
 - Accurate/Appropriate SP&C specifications
 - Optimum integration of trades and schedules to minimize interference requirements
 - Yard ready to operate
 - Shop fabrication of raw materials
 - Work commenced on schedule

CONSTRUCTION STAGE #3: ASSEMBLY LEVEL OPERATIONS

- Initiated by work package and short term schedules
- Involves
 - Off-ship environment
 - Yard/Shop joining fabricated parts
 - Joining parts assemblies into subassemblies
 - Meeting two week schedules
 - Least handling
 - Larger surfaces
 - Use cost-effective Blast/Paint houses
 - Easier access
 - Most down hand painting
- Results in
 - SP&C Assemblies ready for block level
 - Surfaces protected to intermediate holding
 - Some final materials coating
 - Feedback to top management on meeting production rates and schedules

CONSTRUCTION STAGE #4: BLOCK LEVEL OPERATIONS

- Initiated by: Work packages and short term schedules

. Involves

- Off ship environment
- Yard/Shop fabrication
- Joining assemblies into blocks
- Less easy access to SP&C work
- More disruption/interference
- More safety and equipment concerns by supervision
- Less down hand work
- Greater coordination between trades planners

. Results

- Greater percentage final outfitting and painting
- Greater potential for rework
- Feedback to top management on production rate and schedule performance

CONSTRUCTION STAGE #5: ZONE
LEVEL OPERATIONS

- Initiated by: Work packages and short-term schedules

- Involves

- On ship SP&C environment
 - Max disruption/interference
 - Max space preparation/cleanup
 - Max safety requirements
 - Max equipment handling manually
 - Max restricted access
 - Max coordination
 - Final Coats
 - Touch up (Cosmetics)
 - Testing -
 - Inspecting
 - Bottom wet
 - Trial schedules
 - Most rework intensive
 - Most costly SP&C work environment

- . Results

- Ship ready for trials
 - Ship ready for delivery
 - Ship delivery area ready

SECTION II VIEWGRAPHS

MANAGEMENT PLANNING

- Purpose

- Ž Characteristics

- Inputs

- outputs

PIANNING CONSIDERATIONS

- In-Yard
 - Primer coat
 - Intermediate coat
 - Final coat
- On-Ship
 - Final coat

APPLICABLE WORK PLANNING FACTORS

1. Physical Description
4. SP&C Specifications
5. Time/Manpower
6. Minimizing SP&C Rework
7. Material
8. SP&C Equipment
9. Handling and Storage
10. Inspection
13. Schedules

PLANNING CORE FIVE

- . Main Event schedule
 - Shop Manufacturing schedule
 - Hull Erection schedule
 - Outfitting schedule
- . Compartment Completion schedule
 - 60% of SP&C completed prior to erection
 - 90% of blasting should be complete

MANAGEMENT PLANNING

WORKSHOP

PRECONSTRUCTION
PLANNING AND OPERATIONS

APPLICABLE WORK PLANNING FACTORS

1. Physical Description
2. Location
3. Support
4. SP&C Specifications
5. Time/Manpower
6. Minimizing SP&C Rework
7. Material
8. SP&C Equipment
9. Handling and Storage
10. Inspection
11. Disruption/Interference
13. Schedules

SECTION III VIEWGRAPHS

THREE SPECIAL CONSIDERATIONS

L SAFETY CONDITIONS AND GAS CHEMISTRY

SAFETY PLANNING

EXERCISE

THREE SPECIAL CONSIDERATIONS

II. SHIFT CHANGE COMMUNICATION AND COORDINATION

**SHIFT CHANGE COMMUNICATION
AND
COORDINATION EXERCISE**

THREE SPECIAL CONSIDERATIONS

III. WORKER QUALIFICATIONS

WORKER QUALIFICATIONS
EXERCISE

CONSTRUCTION #3

ASSEMBLY LEVEL OPERATIONS

CONSTRUCTION STAGE #3

ASSEMBLY LEVEL OPERATIONS

EXERCISE

CONSTRUCTION STAGE #4

BLOCK LEVEL OPERATIONS

CONSTRUCTION STAGE #4

BLOCK LEVEL OPERATIONS

EXERCISE

CONSTRUCTION STAGE #5

ZONE LEVEL OPERATIONS

CONSTRUCTION STAGE #5

ZONE LEVEL OPERATIONS

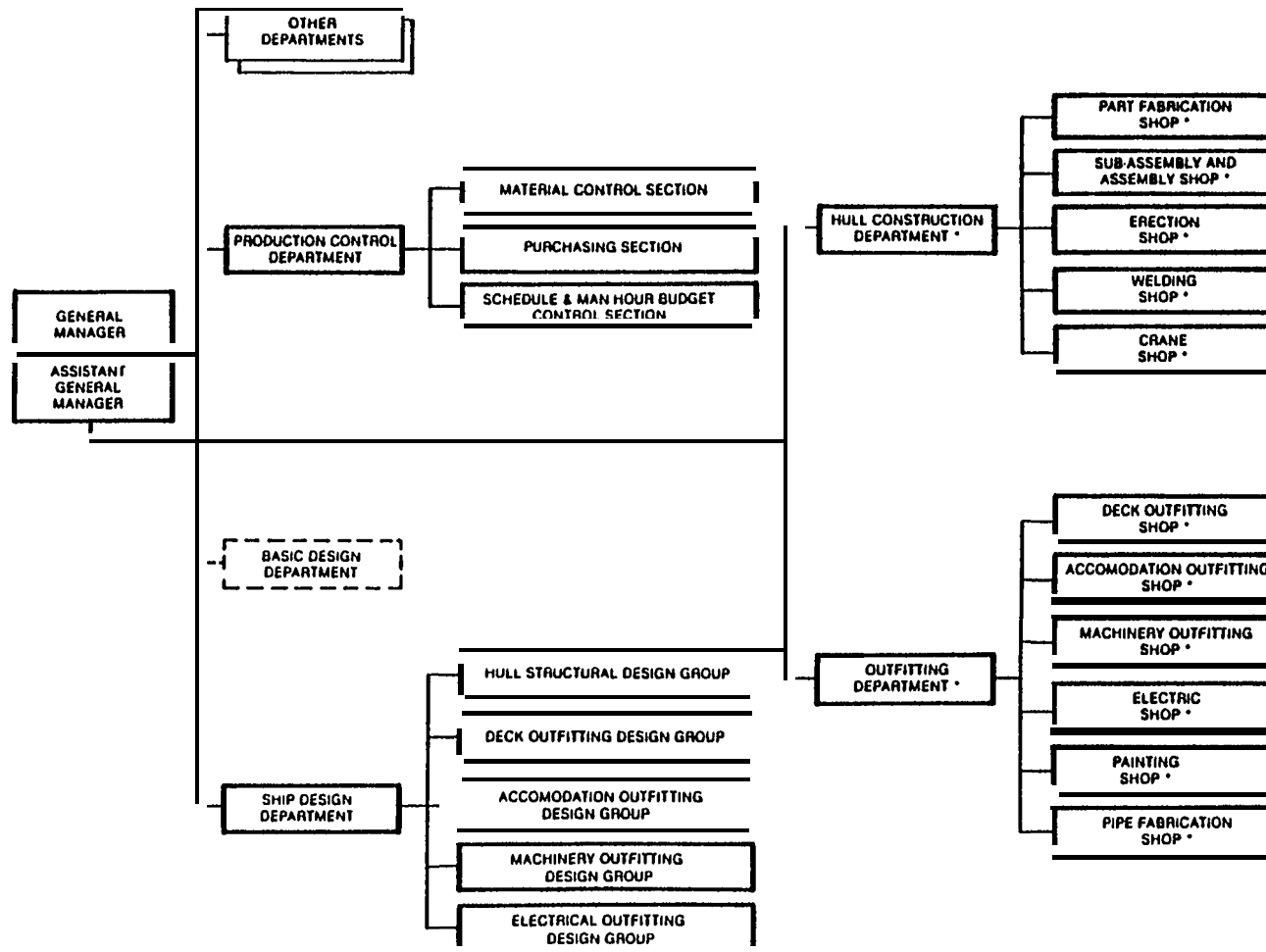
EXERCISE

SECTION IV VIEWGRAPHS

SP&C WORK PLANNING

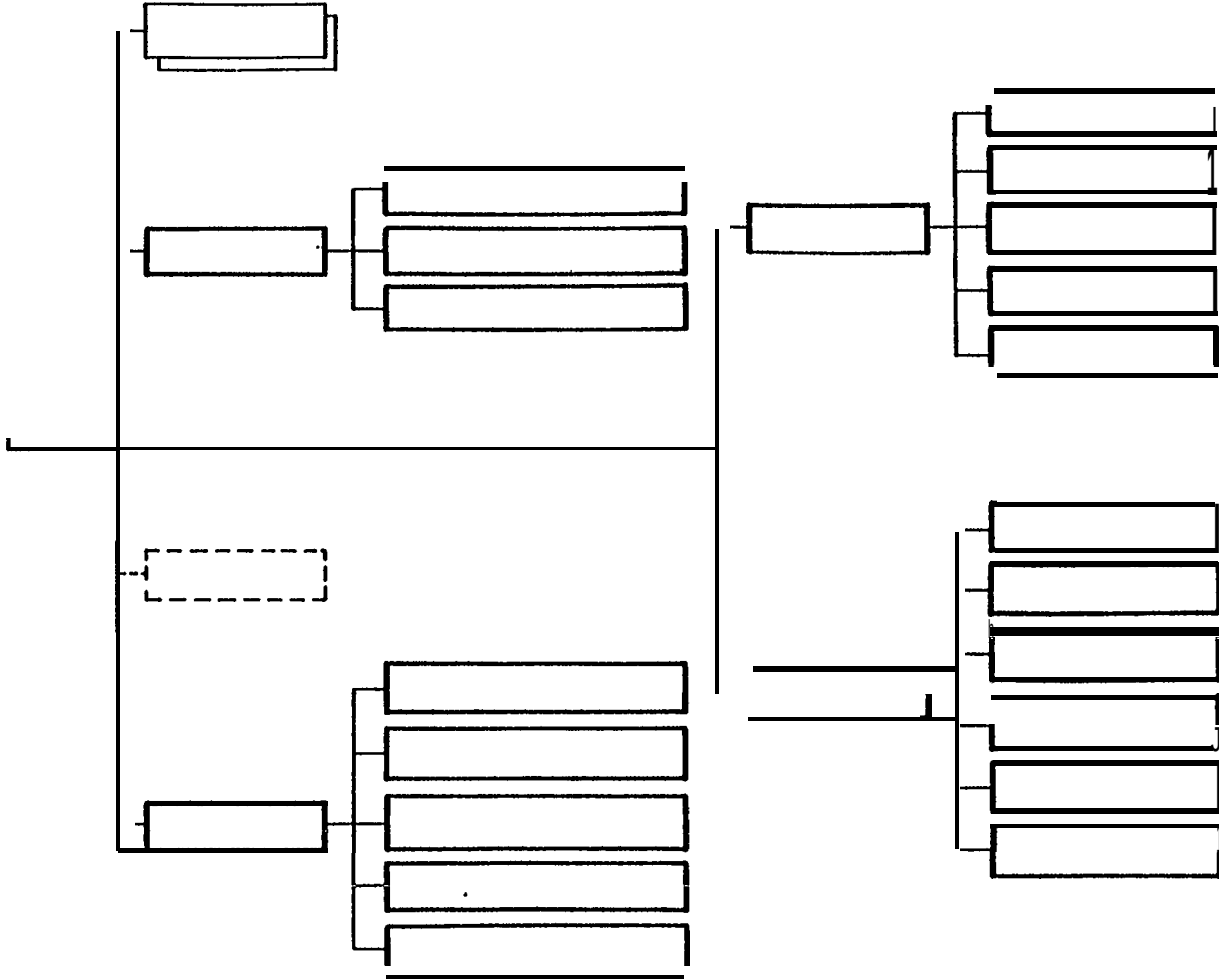
EXERCISE

EXAMPLE SHIPYARD ORGANIZATION



SOURCE: Integrated Hull Construction. Outfitting and Painting (IHOP), p.6;
U.S. Department of Transportation, Maritime Administration, May, 1983.

SHIPYARD ORGANIZATION CHART FOR ADAPTATION



SOURCE: Integrated Hull Construction, Outfitting and painting (IHOP) P.6;
U.S. Department of Transportation, Maritime Administration, May, 1983.

APPENDIX N

APPENDIX N

APPENDIX N

FOREMAN WORK PLANNING CHECKLIST

1. Purpose: To develop a personalized checklist for use by the SP&C supervisor
2. Product: Detailed notes and actions for the SP&C Supervisor which he can use in his yard during the work planning process.
3. Instructional Strategy:
 - o Method: Instructor lead discussion of all items listed in Appendix N
 - o Media: Viewgraphs (as applicable to topics), easel pad, Appendix N
 - o Participant Assignment: Participate in group discussion, write down applicable actions in Student Notes Column
4. Resources Required:

<u>Instructor</u>	<u>Participant</u>
Viewgraphs (as applicable)	Pencil
Overhead projector	Appendix N
Appendix N	Appendix L
Appendix L	
5. References:
 - o Instructor Guide, Section III.E.
 - o Instructor Guide, Appendix L
 - o Instructor Guide, Appendix N

6. Process:

A. Preparation

1. Review:
 - o Instructor Guide, Section III.E.
 - o Appendix L
 - o Appendix N
2. Relate each item of Appendix N to Appendix L WPF'S
3. Review suggested presentation strategy (below)
4. Personalize the checklist to the yard terminologies
5. Develop prompting questions to draw out detailed action items
6. Xerox sufficient copies of materials for trainee use.

B. Presentation Strategy

1. Introduce the discussion objectives and emphasize the importance of each supervisor having a good checklist
2. Discuss the first item and take notes on specific actions which develop from discussion. Use the easel to write down a synopsis of the action items to demonstrate a sample of the student notes
3. Briefly summarize the checklist importance at the end of the discussions.

APPENDIX N

FOREMAN WORK PLANNING CHECKLIST

Checklist

Student Notes

General - For each work assignment:

- A. Make sure all work package documentation is complete and the work to be accomplished is understood.
 - 1. Are specifications complete?
 - 2. Are there special safety considerations?
 - a. Gas chemistry for confined spaces?
 - b. Flammable materials?
 - c. High or dangerous places for men to work?
 - 3. What is the schedule for work?

FOREMAN WORK PLANNING CHECKLIST (Continued)

Checklist

Student Notes

4. What other trade assistance is required?

5. Walk the job down.

B. Evaluate the work to be done using the 13 work planning factors.

1. WPF-1 - Physical Description

a. What size and shape?

b. What type material?

c. What condition is it in?

2. WPF-2 - Location

FOREMAN WORK PLANNING CHECKLIST (Continued)

Checklist

Student Notes

a. Where is the work to be done?

(1) In-yard

(2) In-shop or Blast and Paint
House

(3) On Board Ship

(4) Internal Space

(5) External Space

What problems are created by
location?

FOREMAN WORK PLANNING CHECKLIST (Continued)

Checklist

Student Notes

c. Special Considerations

(1) Tanks

(2) Voids

(3) Machinery Space

(4) Bilge

(5) Hotel Spaces

(6) Underwater Bottoms

FOREMAN WORK PLANNING CHECKLIST (Continued)

Checklist

Student Notes

3. WPF-3 - SUPPORT

a. What Support Services/Trades are required?

(1) Handling -Riggers

(2) Transporting

(3) Utility Services

(4) Air, electricity, Lights,
Water, Heat

(5) Ventilation

(6) Staging

FOREMAN WORK PLANNING CHECKLIST (Continued)

Checklist

Student Notes

(7) Temporary Protection

(8) Clean-up

(9) Waste removal

(10) Chemist/Gas Tester

(11) Safety Engineer/Lab Semites

(12) Vendor Reps

(13) Paint Supplier

(14) Equipment Supplier

FOREMAN WORK PLANNING CHECKLIST (Continued)

Checklist

Student Notes

b. When are these services required?

4. WPF-4 SP&C - Specifications

a. What Surface Preparation
Specification is the work to
conform to?

(1) Method

(2) Blast media

(3) Profile/Pattern

(4) Optimal methods

FOREMAN WORK PLANNING CHECKLIST (Continued)

Checklist

Student Notes

b. What Paint Specification is the work to conform to?

(1) Type of coating system

(2) Method of application

(3) Number of coats

(4) Thickness of each coat

(5) Cure and dry time

(6) Method of quality inspection

(7) Objective of the coating

FOREMAN WORK PLANNING CHECKLIST (Continued)

Checklist

Student Notes

5. WPF-5 - Time/Manpower

a. What size crew is required to meet schedule?

(1) Special skills

(2) Crew skill mix

(3) Alternative work plan

b. Any space restrictions for crew?

c. Can the work be done on time?

FOREMAN WORK PLANNING CHECKLIST (Continued)

Checklist

Student Notes

- d. Will the space be ready for the crew on time?

6. WPF-6 - Minimizing Rework

- a. Will other trades be out of the way?
- b. Is there work below, above, or on adjoining bulkheads?
- c. Are primer, intermediate, and final coats being applied correctly and on time?

7. WPF-7 - Material

- 3. Is the material called for the correct SP&C material?

FOREMAN WORK PLANNING CHECKLIST (Continued)

Checklist

Student Notes

- b. Check self-life dates

- c. Is the quantity of material enough
for your job?

- d. Is the material new and you need
instruction is proper use?

8. WPF-8 - Equipment

- a. Is the equipment available?

- b. Is it well maintained?

- c. Is it safe?

FOREMAN WORK PLANNING CHECKLIST (Continued)

<u>Checklist</u>	<u>Student Notes</u>
d. Are there enough pieces, or feet of hose?	
e. Is there power or air for equipment?	
f. Are operators trained for equipment use?	
9. WPF-9 - Handling and Storage	
a. What items need to be handled because of size, weight, shape, etc.?	
b. What support services are required?	
c. When must it be handled?	

FOREMAN WORK PLANNING CHECKLIST (Continued)

Checklist

Student Notes

- d. Who coordinates heavy lifts?
- e. When SP&C for storage what specs are called out?
- f. Can you coat over the storage coat with intermediate or finish coats without removing the storage coats?

10. WPF-10 - Inspection

- a. What specs are being inspected?
- b. Who, when, where, and how will the inspection be done?
- c. The foreman should inspect first?

FOREMAN WORK PLANNING CHECKLIST (Continued)

<u>Checklist</u>	<u>Student Notes</u>
11. WPF-11 - Disruption/Interference	
a. Does your work plan have the potential for being disrupted?	
b. Are other workers going to interfere?	
c. Talk to other foremen around the space you are to work in.	
d. Do you have an alternative work plan?	
e. What is the weather? Rain, cold, wind, humidity, heat?	

FOREMAN WORK PLANNING CHECKLIST (Continued)

Checklist

Student Notes

12. WPF-12 - Safety

- a. Are your materials and equipment safe to work with?
- b. Is your work area safe to work in?
- c. Will others be in danger because of your work?
- d. Do you need to call a safety inspector to approve a procedure, structure, or material?
- e. Is protective clothing called for?

FOREMAN WORK PLANNING CHECKLIST (Continued)

Checklist

Student Notes

13• WPF-13 - Schedules

- a. Can you meet the schedule called for?
- b. What is the impact if you cannot meet the schedule?
- c. Procedures for overtime, extra shift work, extra crews?

SECTION V

January 1987

SHIP PRODUCTION *COMMITTEE*
FACILITIES IMPROVEMENTS
OUTFITTING AND PRODUCTION AIDS
INDUSTRIAL ENGINEERING **FOR SHIPBUILDERS**
SHIPBUILDING STANDARDS THE NATIONAL
DESIGN/PRODUCTION INTEGRATION SHIPBUILDING
COMPUTER AIDS FOR SHIPBUILDING RESEARCH
SURFACE PREPARATION AND COATINGS PROGRAM
FLEXIBLE AUTOMATION
TECHNOLOGY TRANSFER
EDUCATION AND TRAINING
WELDING
REAPS

**WORK PLANNING FOR SHIPYARD SURFACE
PREPARATION AND COATING (SP&C)**

STUDENT WORKBOOK

U.S.. DEPARTMENT OF TRANSPORTATION
Maritime Administration

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

STUDENT WORKBOOK
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STUDENT WORKBOOK
SCOPE AND OVERVIEW

Topic	<u>Suggested Hours of Concentration</u>
INTRODUCTION	1/2
SECTION I	
A. Historical Background	1/2
B. Approach to SP&C Work Planning	1/2
C. Shipyard Planning Organization	3/4
D. Thirteen SP&C Work Planning Factors - An Overview	3/4
E. The Five Stages of Work Planning in the Ship Construction Process	1/2
SECTION II	
A. Pre-Award Management Planning and SP&C Planning Factor Utilization	3/4
B. Management Planning Workshop	1
c. Preconstruction Planning and Operations	3/4
SECTION III	
A. Special Considerations for Basic Planning	3/4
1. Safety Conditions and Gas Chemistry (w/exercise)	3/4
2. Shift Change Communication/Coordination (w/exercise)	1/2
3. Worker Qualifications (w/exercise)	1/2
B. Assembly level operations (w/exercise)	1/2
c. Block level operations (w/exercise)	1/2
D. Zone level operations (w/exercise)	1/2
E. Foreman Work Planning Checklist	1
SECTION IV	
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SECTION V	
A. Closing Administration	1/2
Total Hours	13 1/2

STUDENT WORKBOOK
Course Objectives

1. The purpose of this course is to provide the background information and skills necessary to improve the general ability of SP&C supervisors to effectively plan and schedule near-term surface preparation and coating work on ship construction.
2. A desired second outcome of this course is to increase the shipyard management's knowledge of the effects of near-term detailed surface preparation and coating planning on overall shipyard production efficiency.
3. A third outcome of this course is to increase the SP&C planner's knowledge and awareness of the safety implications and practices, and personnel needs necessary to carry through SP&C operations.
4. Lastly, a desired outcome is an improved exchange of SP&C work planning information and ideas between shipyard top management, SP&C supervisors and cognizant craft planners and schedulers.

A NOTE TO THE STUDENT

This student workbook provides all the information needed for participation in the course, with the exception of some materials that will be provided to you as handouts as the course progresses. There is a large amount of material to be covered in a short period of time.

The basic material of this course has been developed by persons with career experience in shipyard SP&C and management planning. This should be especially evident as you work with the Thirteen SP&C Work Planning Factors. You are encouraged to participate to the fullest throughout the course. Ask questions of the instructor to clarify any point not understood and contribute to the products of the large and small group discussion sessions. It is very important that you add your expertise to that of the group, and that you consider the expertise provided by others. This course is directed toward the exchange of ideas that will help your ship construction planning process toward the development and execution of competitively priced bids built on the yard's identifiable potential for more efficient operations. Efficiency can mean more work for your shipyard, and the continuation and enhancement of your career path.

Certainly, all trades - not Surface Preparation and Coating alone - have much to contribute to the shipyard's productivity. This course focuses on SP&C. Now is the opportunity for your contribution.

Please refer to Appendix A, "How to Use The Student Workbook", and familiarize yourself with the remainder of the workbook.

STUDENT WORKBOOK
DEFINITIONS

SURFACE PREPARATION AND COATING (SP&C): The surface preparation of all materials for a ship and their coating for preservation, appearance, and other functions (e.g., anti-fouling).

NEAR-TERM PLANNING: Generally, the lowest level of planning and scheduling (two week schedule) or to the first level of trades supervision (Foreman).

WORK PLANNING: The means of performing the necessary steps to prepare for and accomplish SP&C tasks, it includes:

1. Determining where, when, and who will perform the work (planning and scheduling)
2. Acquisition of the required materials and equipment to perform the work
3. Scheduling SP&C craftsmen to perform the work
4. Integrating SP&C trades work with work planned for other trades

ASSEMBLY: The second level of construction (the first level is parts fabrication). The joining of two or more component parts to make up a system or an assembly (i.e., deck, sides, and ribs, etc.)

BLOCK: A group of assemblies jointed to form an independent section of the vessel (bow, stern, deck house, etc.). Blocks are completed as far as practical (piping, ventilation, electrical, surface preparation and coating) and then joined (or via grand blocks) to form the complete vessel.

GRAND BLOCK: A relatively large block assembly made from 2 or more blocks.

ZONE: An identifiable space or group of spaces of the assembled vessel, providing for work and control purposes.

PLANNERS: Individuals whose primary job function is to plan work accomplishment through equipment, processes, or manpower applications.

SCHEDULERS : Individuals whose primary job function is to schedule work accomplishment through the various planned processes in the most efficient manner.

SP&C SUPERVISORS: Trades foremen and higher supervisors who are responsible for planning and scheduling SP&C work.

SP&C OPERATIONS: Trades performance of surface preparation and coating work tasks, e.g.; blasting, cleaning, painting, etc.

Reference: NSRP, Integrated Hull Construction Outfitting and Painting, May, 1983.

SCHEDULERS : Individuals whose primary job function is to schedule work accomplishment through the various planned processes in the most efficient manner.

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Reference: NSRP, Integrated Hull Construction Outfitting and Painting, May, 1983.

STUDENT WORKBOOK
BIBLIOGRAPHY

1. Integrated Hull Construction, Outfitting and Painting (IHOP), U.S. Department of Transportation, Maritime Administration, May, 1983.
2. Outfit Planning, U.S. Department of Commerce, Maritime Administration, December, 1979.
3. Paint and Surface Preparation: A Training Program for Shipyard Personnel, U.S. Department of Commerce, Maritime Administration, 1979.
4. J.W. Peart, L.L. Jaekel, M. Noma, N.K. Kobuhe, and I. Hirota, "Shipyard Design and-Planning for-a Zone-Oriented Painting System." Journal of Ship Production (3) Aug. 1985 pp 192-210

INTRODUCTION

STUDENT WORKBOOK
INTRODUCTION

Please review and complete the accompanying self-introduction form. The instructor will ask you to hand it in on completion of the introductions.

STUDENT WORKBOOK

WORK PLANNING FOR SHIPYARD SURFACE
PREPARATION AND COATING (SP&C)

INTRODUCTION WORKSHEET

Instructions: Please use this worksheet to organize a short self-introduction

NAME : _____
SHIPYARD _____
DEPARTMENT : _____

POSITION/TITLE: _____

LOCATION: _____

Shipyard planning experience:

Experience

Types of planning experience

Specific expectations from this Workshop:

Specific Questions you want answered:

Section I

STUDENT WORKBOOK
SECTION I
OBJECTIVES

OBJECTIVE

The purpose of this section of the course is to provide the background information and skills necessary to improve the general ability of SP&C supervisors to effectively plan and schedule near-term surface preparation and coating work on ship construction.

In order to meet this objective, the following enabling objectives have been formulated to provide guidance.

Enabling Objectives:

1. Given the necessary background information, be able to state and describe the importance of the 13 SP&C work planning factors.
2. Given information on the practical application of SP&C be able to discuss the benefits derived for work planning in SP&C.
3. Given the 13 SP&C work planning factors, be able to associate the appropriate work planning factor(s) with each of the five stages of construction.
4. Given information on SP&C work planning, be able to describe the advantages of long range planning of SP&C work to overall yard efficiency.
5. Given information on SP&C work planning, be able to analyze the impact of shipyard practices on SP&C work planning.

STUDENT WORKBOOK

SECTION I

- A. This section is comprised of a background lecture, an exercise in which the shipyard's organization is defined, a discussion of the Thirteen SP&C Work Planning Factors, and the five stages of work planning in the ship construction process.
- B. Participants require only paper, pencil and eraser.
- c. During the exercise, the instructor will provide handout materials for participant use.
- D. Use this section to collect Section I related notes and materials.
- E. For the exercise, see Appendix C (Shipyard Organization Exercise). Appendix L, 13 SP&C Work Planning Factors applies.

STUDENT WORKBOOK
SECTION I

Use this workbook space to retain your lined tablet notes related to Section I.

Section II

STUDENT WORKBOOK

SECTION II

OBJECTIVES

OBJECTIVE

The purpose of this section is to increase the shipyard management's knowledge of the effects of near-term detailed surface preparation and coating planning on overall shipyard production efficiency.

In order to meet this objective, the following enabling objectives have been formulated to provide guidance.

Enabling Objectives:

1. Given information about planning factors, be able to discuss and describe the SP&C off-ship and shipboard work schedule and production impacts related to management planning.
2. Given inputs on work planning factor information about manpower and schedules describe and discuss how SP&C planning will minimize rework requirements.
3. Given information about preconstruction planning and operations be able to describe and discuss the overall impacts of applicable work planning factors to preconstruction and planning operations.

STUDENT WORKBOOK

SECTION II

- A. This section is comprised of a discussion of pre-award management planning, a management planning exercise, and a discussion of preconstruction planning and operations. On completion of the exercise> management level participants will break away temporarily from the workshop. They will return to participate in the Section IV exercise.
- B. Participants require paper, pencil and eraser.
- c. Use this section to collect Section II related notes and materials.
- D. For the exercise, see Appendix D, (Management Planning Workshop).

STUDENT WORKBOOK
SECTION II

Use this workbook space to retain your lined tablet notes related to Section II.

Section III

STUDENT WORKBOOK

SECTION III

OBJECTIVES

OBJECTIVE

The purpose of this section of the course is to enable participants to discuss and describe the safety implications and practices and personnel needs necessary to carry through SP&C operations.

To accomplish this objective the following enabling objectives have been formulated.

Enabling Objectives

1. Be able to discuss and describe SP&C safety implications including gas chemistry.
2. Be able to discuss and describe SP&C shift change communication and coordination considerations.
3. Be able to discuss and describe the implications of worker qualifications to SP&C work planning.
4. Be able to discuss the planning factors involved in assembly level operations.
5. Be able to discuss the planning factors involved in block level operations.
6. Be able to discuss the planning factors involved in zone level operations.

STUDENT WORKBOOK

SECTION III

- A. This section is comprised of several lecture/discussions and exercises.
- B. Participants require paper, pencil and eraser.
- c. During the exercises, the instructor may provide handout materials for participant use.
- D. Use this section to collect Section III related notes and materials.
- E. For the exercises, see the following appendixes:
 - E SP&C Safety Planning (H.O. #2 issued by instructor during discussion).
 - F SP&C Shift Change Communication and Coordination
 - G SP&C Worker Qualifications
 - H Assembly Level Operations: Work Planning Factor and Elements Identification
 - I Block Level Operations: Work Planning Factor and Elements Identification
 - J Zone Level Operations: Work Planning Factor and Elements Identification
 - N Foreman Work Planning Checklist
- F. Appendix L, 13 SP&C Work Planning Factors, applies

STUDENT WORKBOOK
SECTION III

Use this workbook space to retain your lined tablet notes related to Section III.

Section IV

STUDENT WORKBOOK

SECTION IV

- A. This case incident exercise provides opportunity for management level planners and SP&C supervisors, and planners to work together in the application of the 13 SP&C Work Planning Factors to two ship construction cases.
- B. Participants require paper, pencil, and eraser.
- c. During the exercise, the instructor will provide the case incident and associated materials (H.O. #3) to participants.
- D. Use this Section and Appendix K to collect exercise related notes and materials.
- E. For the exercise, Appendix L, 13 SP&C Work Planning Factors, applies.

STUDENT WORKBOOK
SECTION IV

Use this workbook space to retain your lined tablet notes related to Section IV.

Section IV

STUDENT WORKBOOK
SECTION V

Use **this workbook** space to retain your lined tablet notes related to Section V.

WORK PLANNING FOR SHIPYARD SURFACE
PREPARATION AND COATING (SP&C)

EVALUATION

Name _____ Date _____

Shipyards _____ Position _____

INSTRUCTIONS:

COMMENTS: Space is provided for your comments, suggestions, and explanations of ratings following each section.

SCALE RATINGS: Please evaluate each aspect of the Course listed below by marking the 5 point scale to the right of each item. Mark the box to indicate your evaluation. Please do not split ratings.

PARTICIPANT'S OBJECTIVES

Indicate your objectives in attending this course

1. _____
2. _____
3. _____

a. To what degree were your objectives satisfied?

_____ Outstanding _____ Excellent _____ Good _____ Fair _____ Poor

COURSE CONTENT

Indicate how useful each item of content was to you.

	low 1	2	med 3	4	high 5
1. Shipyards Organization Exercise					
2. Management Planning Exercise					
3. SP&C Safety Planning (H.O. #2 issued by instructor during discussion).					
4. SP&C Shift Change Communication and Coordination					
5. SP&C Worker Qualifications					
6. Assembly Level Operations: Work Planning Factor and Elements Identification					
7. Block Level Operations: Work Planning Factor and Elements Identification					

COURSE CONTENT (cont.)

Indicate how useful each item of content was to you.

	low	med	high		
	1	2	3	4	5
8. Zone Level Operations: Work Planning Factor and Elements Identification					
9. SP&C Planning Exercise					
10. Appendix L, 13 SP&C Work Planning Factors					
11. Instructor-led discussions					
12. Participant-led discussions					

TOPIC COVERAGE

Which topics should have received more time? Please cite.

1. _____
2. _____
3. _____

Which topics should have received less time? Please cite.

1. _____
2. _____
3. _____

	low		med		high	
COURSE DEVELOPMENT	1	2	3	4	5	
1. Student Workbook						
2. Learning Environment						
3. Feedback Instrument (this form)						

OVERALL RATING:

low		med		high	
1	2	3	4	5	

How would you rate the course as a whole?

Comments:

What was the most effective part of the course for you? my?

What was the least effective part of the course for you? why?

APPENDIX A

STUDENT WORKBOOK
APPENDIX A

This student workbook provides all the information needed for participation in the course, with the exception of some materials that will be provided to you as handouts as the course progresses.

Composition of the Student Workbook:

1. The Student Workbook is divided into Front Matter, Sections, and Appendices.
 - a. Important in the Front Matter are the Course Objectives, Definitions, and the Bibliography.
 - b. The sections contain the Section Objectives. These divided spaces should be used also for accumulating your section-related course notes.
 - c. Appendix B provides space to collect a Discussion Group Leader's Guide. The Guide will be issued to those selected to guide a small group through the exercises.
 - d. Appendices C through K contain the exercises, their instructions and worksheets.
 - e. Appendix L. Please familiarize yourself with the contents of this workbook especially Appendix L, 13 SP&C Work Planning Factors. These Factors are the heart of this course. You will be asked to study it closely in order to facilitate quality inputs and the pace of the course.
 - f. Equipment. The only equipment you need for this course is a pencil and paper for your notes, and perhaps a ruler. Other materials will be provided by the instructor.

2. Now scan the workbook materials to get an idea of the course/section objectives, and general direction of the course. You will no doubt see a number of points at which your own expertise will come into play.

APPENDIX B

STUDENT WORKBOOK
APPENDIX B

Use this space to retain the Discussion Group Leader's Guide if it is issued to you.

APPENDIX C

STUDENT WORKBOOK
APPENDIX C
EXERCISE I, SHIPYARD PLANNING ORGANIZATION REVIEW

Purpose:

1. Provides all participants with a functional description of the Shipyard's planning organization.

2. Product:

Annotated shipyard functional organization chart.

3. Instructional Strategy:

- o Method: Lecture, Instructor-led group discussion
- o Media: Viewgraphs, or chalk/white board, or easel pad, worksheets, solution handout.
- o Participant Assignment: Review organization chart, identify omissions, inaccuracies. Contribute to general discussion session. Complete own notes.

4. Resources Required:

Participant

Pencil

Eraser

Shipyard organization chart handout

5. References:

- o Shipyard organization manual.
- o Departmental Standard Operating Procedures (SOP'S)

6. Instructions:

- o Review shipyard organization chart handout
- o Identify discrepancies
 - Inaccuracies
 - Omissions
- o Provide inputs to general group discussion
- o Annotate own organization chart handout

APPENDIX D

STUDENT WORKBOOK

APPENDIX D

EXERCISE II., MANAGEMENT PLANNING WORKSHOP : (RESPONDING TO SHIP CONSTRUCTION RFP)

1. Purpose: Provide top management and SP&C supervisors opportunity to work together to identify the SP&C Work Planning Factors that apply in Construction Stage #1 Management Planning, and to develop a planning aid for their shipyard.
2. Product: List of SP&C Construction Stage #1, Management Planning, input requirements to assist design planners.
3. Instructional Strategy:
 - o Method: Participant-led small group discussion with report
 - o Media: Viewgraphs, or chalk/white board, or easel pad; worksheet
 - o Participant Assignment: Participate in small group discussion and report preparation; complete own worksheet; contribute to overall discussion.
4. Resources Required:
 - Participant
 - o Pencil
 - o Exercise II (Appendix D)
 - o H.O. #1, 13 SP&C Work Planning Factors (Appendix L)
5. References:
 - o Supporting Data Sheet 1
 - o Student Workbook, Appendix L, 13 SP&C Work Planning Factors (H.O. #1)

6. Instructions:

- o Review assignment
- o Complete Worksheet

Column 1: Completed.

column 2: List the WPF elements which generate SP&C recommendations or information inputs to the Design Plan

Column 3: Indicate who has responsibility to provide required input /

Column 4: Indicate the recommendation or information required.

APPENDIX D
EXERCISE II., MANAGEMENT PLANNING:
SPECIFIC WORK PLANNING
FACTOR/ELEMENT IDENTIFICATION

Worksheet #1

BACKGROUND

Your yard has received a Request for Proposal (RFP) which seeks bidders for the construction of 118 foot cutters for the U.S. Coast Guard. These new cutters are required to replace the Coast Guard's current fleet of 82 and 95 footers by the 1990s.

REQUIREMENTS

Given the information in Data Sheet #1, and Appendix L, 13 SP&C Work Planning Factors, complete the Exercise Worksheet #2 as instructed. The result should be a listing of SP&C Design Plan input requirements and information which incorporates all known and achievable efficiencies of which your yard is capable with respect to SP&C ship construction operations.

APPENDIX D
EXERCISE II., MANAGEMENT PLANNING:
SPECIFIC WORK PLANNING
FACTOR/ELEMENT IDENTIFICATION

Data Sheet #1

SUPPORTING DATA SHEET

Multi-Mission U.S. Coast Guard Cutter for 1990's

1. Design Requirements

- o Length: 118 foot
- o Displacement: 157 tons
- o Beam: 22 foot
- o Sustained. Speed: 30 knots
- o Manning: 16

2. Proposed Cost \$10,000,000 each.

- o Begin prototype construction 1990
- o Test prototype 1991
- o Begin production 1992

3. Other Characteristics:

- o Conventional Steel Monohull
- o Convertible to armed patrol craft in wartime
 - The main deck aft of the deck house to be flat for easy outfitting w/missile or gun mounts
- o Galley and crew compartments consolidated below amidships
- o Deck house of aluminum (single component) attached to steel deck

Worksheet
#2

APPENDIX D
EXERCISE II., MANAGEMENT PLANNING:
SPECIFIC WORK PLANNING
FACTOR/ELEMENT IDENTIFICATION

CONSTRUCTION STAGE #1 MANAGEMENT PLANNING			
Work Planning Factor	CS #1 - Specific Elements	Responsibility	Recommendation/ Information
1. Physical Description			
2. Location			
3. Support			
4. Specs			
5. Time/ Manpower			
6. Minimizing Rework			
7. Material			
8. Equipment			
9. Handling/ Storage			
10. Inspection			
11. Disruption Interference			
12. Safety			
13. Schedules			

APPENDIX E

STUDENT WORKBOOK

APPENDIX E

Exercise III. A. 1., SP&C SAFETY PLANNING

1. **Purpose:** Identify and list SP&C safety long-term planning requirements, operations requirements, associated planning responsibilities, and SP&C efficiencies.
2. **Product:** Lists of SP&C safety planning requirements, operations requirements, responsibilities, associated planning responsibilities and SP&C efficiencies. The resulting lists to be used by participants as job aids in future planning team efforts.
3. **Instructional Strategy:**
 - o Method: Lecture, Instructor-led group discussion
 - o Media: Viewgraphs, or chalk/white board, or easel pad, worksheets, solution sheets.
 - o Participant Assignment: Complete worksheets, participate in discussion.
4. **Resources Required:**
Participants
 - o Pencil
 - o Exercise III.A.1 (Appendix E (-))
 - o H.O. #1, 13 Work Planning Factors (Appendix L)
5. **References:**
 - o Student Workbook, Appendix L, 13 SP&C Work Planning Factors (H.O. #1)

6. Instructions:

- o Review assignment
- o Complete Worksheet - III.A.l.a.
 - Column 1: Already complete
 - Column 2: Already complete
 - Column 3: Indicate which position holder(s)/ department(s) in the yard has responsibility for planning
 - Indicate Planning and Scheduling requirement and process.
 - Column 4: Indicate how SP&C efficiency can be achieved
- o Complete Worksheet - III.A.l.b.
 - column 1: Already completed
 - column 2: Already completed
 - Column 3: Indicate location(s) of the work
 - column 4: Indicate which position holder(s)/ department(s) in the yard have responsibility for planning
 - Column 5: Indicate how SP&C efficiency can be achieved

**SP&C LONG-TERM SAFETY PLANNING
EXERCISE**

Worksheet I .1.a

CONSTRUCTION STAGE	RESPONSIBILITY FOR PLANNING (DESCENDING ORDER)	SP&C EFFICIENCY
1. MANAGEMENT PLANNING 1. Concern that prospective contracts may require the use of materials such as paints or chemicals that have not been previously used or approved for use by the shipyard (Your Company). Example - Use of SP&C type anti-fouling paints which contain highly toxic "tin" chemicals - or similar products. 2. Concern where new, untried, or not previously approved materials, methods, or techniques are a <u>firm</u> part of the prospective contract. Then management planning must provide coverage in the bid for research, development, training, and other compensatory measures. 3. Concern that prospective contracts may require the use of products that do not conform to EPA clean water or clean air regulations.		

SP&C LONG-TERM SAFETY PLANNING
EXERCISE

Worksheet III A.1.a (cont.)

CONSTRUCTION STAGE	UNIQUE REQUIREMENT/CONCERNS	RESPONSIBILITY FOR PLANNING (DESCENDING ORDER)	SP&C EFFICIENCY
II. PRECONSTRUCTION A. <u>PLANNING</u> :	1. Concern that existing and projected new facilities be compatible with the basic projected ship construction method and planned processes and work flow. 2. Concern for SP&C trades compliance with the various Government regulatory agency requirements: - EPA - O S H A - Clean Air - Clean Water - Toxic Waste Control		

SP&C SAFETY PLANNING FOR OPERATIONS
EXERCISE

CONSTRUCTION STAGE	UNIQUE REQUIREMENT/CONCERNS	IN-YARD/D & F HOUSE/ON-SHIP	RESPONSIBILITY FOR PLANNING	SP&C EFFICIENCY
II. PRECONSTRUCTION (cont.) B. OPERATIONS: 1. Concern for acceptable facilities to accommodate preconstruction SP&C operations: - Concern for qualified SP&C operators in shop or area that may not be under SP&C trades control. Example - The blasting and coating of steel plates and shapes by steel fab shop when steel first arrives in shipyard. 2. Concern for handling, storage and use of dangerous SP&C materials - paints, solvents, chemicals, cleaners etc. - especially when SP&C work is done by personnel not fully trained for this.				
III. ASSEMBLY OPERATIONS 1. Concern for the compatibility of SP&C operation in or adjacent to the various manufacturing shop operations: - Pipe shop - Hanger shop - Ventilation shop - Foundation shop - Switchboard shop These shops generate hot work (fire sparks, etc., while SP&C operations must be shielded from such conditions				

SP&C SAFETY PLANNING FOR OPERATIONS

EXERCISE

Worksheet III.A.I.b (cont.)

CONSTRUCTION STAGE	UNIQUE REQUIREMENT/CONCERNS	IN-YARD/B & P HOUSE/ON-SHIP	RESPONSIBILITY FOR PLANNING	SP&C EFFICIENCY
III. ASSEMBLY LEVEL OPERATIONS (cont.)	2. Concern for the Health and Welfare of the Interrelated trades personnel (mfg. shop people and SP&C people) - Existing or forthcoming facilities must provide for the protection of mfg. shop hazards vs SP&C generated hazards. 3. Environmental Concerns. Whether SP&C operations are in the manufacturing shop or outside (adjacent to) weather, temperature humidity are of concern for SP&C operations and SP&C personnel.			

SP&C SAFETY PLANNING FOR OPERATIONS

EXERCISE

Worksheet III.A.I.b (cont.)

CONSTRUCTION STAGE	UNIQUE REQUIREMENT/CONCERNS	IN-YARD/B & P HOUSE/ON-SHIP	RESPONSIBILITY FOR PLANNING	SP&C EFFICIENCY
Iv. BLOCK LEVEL OPERATIONS:	1. SP&C safety Planning Concerns: - Location of unit in yard. - Size and configuration Access openings Staging Condition Temporary Services (Lights, air, ventilation) Protection required for personnel 2. Type and extent of other trades activities - In the general area - In the particular space - In adjacent areas - In adjacent spaces. 3. When SP&C work is scheduled: - Time of Year, (Weather) - Time of Week, (Regular week or off shift - Time of day, (shift)			
v. ZONE (ON-SHIP OPERATIONS)	1. Location of SP&C job on-ship: - Deck-frame-space - Configuration of space - Access routes to space			

SP&C SAFETY PLANNING FOR OPERATIONS

EXERCISE

Worksheet III.A.1.b (cont.)

CONSTRUCTION STAGE	UNIQUE REQUIREMENT/CONCERNS	IN-YARD/B & P HOUSE/ON-SHIP	RESPONSIBILITY FOR PLANNING	SP&C EFFICIENCY
	2. Status of ship construction at time of SP&C job. - Temporary openings - Temporary services (Lights, vent., compt. air, sanitary systems). - Protection required for machines etc. - Other trades' level of work - Other trades' type of work - Other trades' unfinished work 3. Impact on Personnel from SP&C work: - SP&C trades - Support Trades - Other trades - Ship's crew 4. Impact on productivity from SP&C work: - SP&C trades own productivity is reduced on ship - Support trades' productivity is reduced - Other trades' productivity reduced by SP&C application and curing time delays.			

APPENDIX F

STUDENT WORKBOOK

APPENDIX F

Exercise 111. A.2, SP&C SHIFT CHANGE COMMUNICATION AND COORDINATION

1. **Purpose:** Identify and list SP&C Shift Change Communication and Coordination requirements (on-ship and off-ship), and associated planning.
2. **Product:** A list of SP&C Shift Change Communication and Coordination considerations relevant to this shipyard which may be used by participants as a job aid in future planning team efforts.
3. **Instructional Strategy:**
 - o Method: Lecture, Instructor - led group discussion
 - o Media: Viewgraphs, or chalk/white board, or easel pad, worksheets.
 - o Participant Assignment: Complete worksheets; participate in discussion
4. **Resources Required:**
 - Participant**
 - o Pencil
 - o Exercise III.A.2 (Appendix F)
 - o H.O. #1, 13 SP&C Work Planning Factors (Appendix L)
5. **References:**
 - o Student Workbook, Appendix F
 - o Student Workbook, Appendix L. 13 SP&C Work Planning Factors, (H. O. #1)

6. Instructions:

- o Review Assignment
- o Worksheet Completion
 - Column 1: State the communication/coordination requirement
 - column 2: indicate when the requirement/ responsibility is carried out
 - Column 3: Indicate who has responsibility to initiate and follow-up
 - Column 4: State how SP&C shift change communication and coordination efficiency can be improved

Worksheet
III. A.2. a

SHIFT CHANGE COMMUNICATION
AND COORDINATION
EXERCISE

ON-SHIP

Shift Change C/C Requirement	When Occuring	c/c Responsibility	How SP&C Efficiency can be improved
1. Communication			
2. Coordination			

Worksheet
III.A.2.b

SHIFT CHANGE COMMUNICATION
AND COORDINATION
EXERCISE

OFF-SHIP

Shift Change C/C Requirement.	When Occuring	c/c Responsibility	How SP&C Efficiency can be improved
1. Communication			
2. Coordination			

APPENDIX G

STUDENT WORKBOOK
APPENDIX G
EXERCISE III.A.3, SP&C WORKER QUALIFICATIONS

1. Purpose: Identify and list SP&C efficiency problems in given categories, which are worker qualification associated.
2. Product: A list of SP&C Worker Qualification problems which impact efficiency in given categories and possible solutions relevant to this shipyard. The list to be used by participants as a job aid in future planning team efforts.
3. Instructional Strategy:
 - o Method: Lecture, Instructor-led group discussion
 - o Media: Viewgraph, or chalk/white board, or easel pad, worksheet
 - o Participant Assignment: Complete worksheet, participate in discussion
4. Resources Required:
 - Participants
 - o Pencil
 - o Exercise III.A.3. (Appendix G)
 - o H.O. #1, 13 SP&C Work Planning Factors (Appendix L)
5. References:
 - o Appendix G
 - o Student Workbook, Appendix L, 13 SP&C Work Planning Factors, (H.O. #1)

6. **Instructions:**

- 0 Review assignment
- 0 Complete Worksheet

column 1:. Indicate the Construction Stage during which the problem usually occurs

Column 2: Identify the related WPF elements

Column 3: State the Worker Qualification problems

Column 4: Indicate how SP&C Planning and Scheduling efficiency can be improved

WORKER QUALIFICATION
EXERCISE

REQUIREMENT SHEET

1. Worker qualifications impact SP&C efficiency in several ways:

- 0 Production rate
 - Estimated/Actual rates
- 0 Inspection Quality
- 0 Training
- 0 Rework
- 0 Safety
- 0 Crew skill mix
- 0 Others? Which?

2. Consider the following questions and organize your responses to them on the accompanying worksheet.

- 0 Do we have any problems w/SP&C efficiency in any of the above areas because of unqualified workers?

Which areas?

- 0 What type of problem?
- 0 What procedures are involved?
- 0 What are the supervisor's controls?
- 0 Who plans?
- 0 Can we realize any of the following efficiencies for our yard?

Always have one or more backup people trained or in-training for each spot on your team. An ideal gang would be composed of:

35% long-time reliable
35% experienced mechanics
30% new people in training.

WORKER QUALIFICATION
EXERCISE

When Problem Occurs (CS #)	Problem Area (WPF)	Problem Statement	How SP&C Efficiency can be improved

APPENDIX H

STUDENT WORKBOOK

APPENDIX H

EXERCISE III. B., ASSEMBLY LEVEL OPERATIONS: WORK PLANNING FACTOR AND ELEMENTS IDENTIFICATION

1. Purpose: Identify the specific elements of SP&C Work Planning Factors that associate them with Construction Stage #3, Assembly Level Operations and identify ways to improve SP&C efficiency.
2. Product: A list of SP&C Work Planning Factors and efficiencies associated specifically with Construction Stage #3, Assembly Level Operations relevant to this shipyard. The list may be used by participants as a job aid in future planning team efforts.
3. Instructional Strategy:
 - o Method: Participant-led small group discussion with report
 - o Media: Viewgraph, or chalk/white board, or easel pad, worksheet
 - o Participant Assignment: Participate in small group discussion and report preparation; complete own worksheet; contribute to overall discussion.
4. Resources Required:
 - Participant
 - o Pencil
 - o Exercise III.B (Appendix H)
 - o H.O. #1, 13 SP&C Work Planning Factors (Appendix L)

5. References:

- o Student Workbook, Appendix H
- o Student Workbook, Appendix L, 13 SP&C Work Planning Factors (H. O. #1)

6. Instructions for:

- o Review assignment
- o Complete Worksheet
 - column1: Check the WPFS that are CS #3 specific
 - column 2: List CS #3 specific elements of the WPF
 - column 3: Indicate how SP&C near-term planning and scheduling efficiency can be improved

APPENDIX H
EXERCISE III. B., ASSEMBLY LEVEL OPERATIONS
SPECIFIC WORK PLANNING
FACTOR/ELEMENT IDENTIFICATION

CONSTRUCTION STAGE #3 ASSEMBLY LEVEL

Work Planning Factor	CS #3 - Specific Elements	How SP&C Efficiency can be improved
1. Physical Description		
2. Location		
3. Support		
4. Specs		
5. Time / Manpower		
6. Minimizing Rework		
7. Material		
8. Equipment		
9. Handling/ Storage		
10. Inspection		
11. Disruption Interference		
12. Safety		
13. Schedules		

APPENDIX I

STUDENT WORKBOOK
APPENDIX I
EXERCISE III. C., BLOCK LEVEL OPERATIONS: WORK
PLANNING FACTOR AND ELEMENTS IDENTIFICATION

1. Purpose: Identify the specific elements of SP&C Work Planning Factors that associate them with Construction Stage #4, Block Level Operations and identify ways to improve SP&C efficiency.
2. Product: A list of SP&C Work Planning Factors and efficiencies associated specifically with Construction Stage #4, Block Level Operations relevant to this shipyard. The list may be used by participants as a job aid in future planning team efforts.
3. Instructional Strategy:
 - o Method: Participant-led small group discussion with report
 - o Media: Viewgraph, or chalk/white board, or easel pad, worksheet
 - o Participant Assignment: Participate in small group discussion; complete own worksheet; contribute to overall discussion.
4. Resources Required:
 - Participant
 - o Pencil
 - o Exercise III.C. (Appendix I)
 - o H.O. #1, 13 SP&C Work Planning Factors (Appendix L)

5. References:

- ° Student Workbook, Appendix I
- ° Student Workbook, Appendix L, 13 SP&C Work Planning Factors, (H.0, #1)

6. Instructions

- ° Review Requirement
- ° Complete Worksheet

- Column 1: Check the WPFs that CS #4 specific.
- Column 2: List CS #4 specific elements of the WPF
- Column 3: Indicate how SP&C near-term Planning and Scheduling efficiency can be improved

APPENDIX I

SWB Worksheet
III.C.

EXERCISE 111. C., BLOCK LEVEL OPERATIONS:
SPECIFIC WORK PLANNING
FACTOR IDENTIFICATION

CONSTRUCTION STAGE #4. BLOCK LEVEL

Work Planning Factor	CS #4 Specific Elements	How SP&C Efficiency can be improved
1. Physical Description		
2. Location		
3. Support		
4. Specs		
5. Time/Manpower		
6. Minimizing Rework		
7. Material		
8. Equipment		
9. Handling/Storage		
10. Inspection		
11. Disruption Interference		
12. Safety		
13. Schedules		

APPENDIX J

STUDENT WORKBOOK

APPENDIX J

EXERCISE III. D., ZONE LEVEL OPERATIONS:
WORK PLANNING FACTOR AND ELEMENTS IDENTIFICATION

1. Purpose: Identify the specific elements of SP&C Work Planning Factors that associate them with Construction Stage #5, Zone Level Operations.
2. Product: A list of SP&C Work Planning Factors associated specifically with Construction Stage #5, Zone Level Operations relevant to this shipyard. The list may be used by participants as a job aid in future planning team efforts.
3. Instructional Strategy:
 - o Method: Participant-led small group discussion w/report
 - o Media: Viewgraphs, or chalk/white board, or easel pad, worksheet
 - o Participant Assignment: Participate in small group discussion, complete own worksheet, contribute to overall discussion.
4. Resources Required:
 - Participant
 - o Pencil
 - o Exercise III.D. (Appendix J)
 - o H.O. #1, 13 SP&C Work Planning Factors (Appendix L)
5. References:
 - o Student Workbook, Appendix L, 13 SP&C Work Planning Factors, (H. O. #1)

6. Instructions:

- Review assignments
- Complete Worksheet

- column 1: Check the WPFs that are CS #5 specific.
- column 2: List CS #5 specific elements of the WPF
- column 3: Indicate how SP&C near-term Planning and Scheduling efficiency can be improved

SUB Worksheet
III.DEXERCISE III.D., ZONE LEVEL OPERATIONS:
SPECIFIC WORK PLANNING
FACTOR IDENTIFICATION

CONSTRUCTION STAGE #5 ZONE LEVEL

Work Planning Factor	CS #5 Specific Elements	How SP&C Efficiency can be improved
1. Physical Description		
2. Location		
3. Support		
4. Specs		
5. Time/Manpower		
6. Minimizing Rework		
7. Material		
8. Equipment		
9. Handling/Storage		
10. Inspection		
11. Disruption Interference		
12. Safety		
13. Schedules		

APPENDIX K

STUDENT WORKBOOK
APPENDIX K
EXERCISE IV, SP&C WORK PLANNING

1. Purpose: Provide a joint planning experience in which both managers and SP&C supervisors apply the 13 SP&C Work Planning Factors to a case incident and develop a plan for accomplishing ship construction work.
2. Product: List of planning considerations and actions related to a ship construction case incident.
3. Instructional Strategy:
 - o Method: Participant-led small group discussion w/report
 - o Media: Viewgraphs, or chalk/white board, or easel pad, case incident
 - o Participant Assignment: Participate in small group planning session, complete own notes, contribute to general discussion session.
4. Resources Required:
 - Participant
 - Pencil
 - Eraser
 - Lined tablet paper
 - Exercise IV worksheets and Data Sheet, Data Collection Sheets (Appendix K)
 - H.O. #1, 13 SP&C Work Planning Factors (Appendix L)
 - H.O. #3, Exercise IV Requirements, Worksheets, Data Collection Sheets
 - Sheets

5. References

- Student Workbook, Appendix K
- Student Workbook, Appendix L, 13 SP&C Work Planning Factors (H.O. #1)
- Supporting Data Sheet

6. Instructions:

- Review Handout #3
- Contribute planning inputs during small group discussion
- Complete Data Collection Sheets
- Participate in general group discussion
- Complete notes during general group discussion

APPENDIX L

STUDENT WORKBOOK

APPENDIX L

H.O. #1

THIRTEEN SP&C WORK PLANNING FACTORS

Appendix L
Thirteen SP&C Work Planning Factors

1 PHYSICAL (!)ES-
SCRIPTION (of the item to receive sp&c)

SIZE	Sq. Ft. Area/Cu." Ft. Area/Quantity Pieces Affects - Handling, transportation - Quantity of labor and material Schedules and work location	Size data comes from SP&C Spec. Drawings, groups, shop mfg. orders or similar instructions included in work packages. Needs to be considered early in the planning process.	For off-ship SP&C work - put primer coat on small pieces plates/beams/brackets/foundations/pipe hangers/nuts/bolts/washers doors/hatches, etc.
SHAPE AND APPURTENANCES	Affects - Handling, positioning - Ventilation, Staging, lighting, access	Impacts decision on how and where SP/C is best accomplished and SP/C efficiency	- put intermediate coat(s) on intermediate size PCS subassemblies, modules, etc.
WEIGHT	Affects - Handlings (liftings) movings	Important to off-ship work (N.A. to on ship work.)	- put final coats on large pre-erection assemblies and aux. items such as masts/king posts/smokestacks/elevators
OPENINGS	Affects - Ventilation, lighting accessibility/protection/staging/number workers/cleanup/curing	Generally more opening preferred except "In-yard" requires more protection to blank the excess openings	
TYPE MATERIAL	whether Mild, HY-80 Steel, S.T.S. Aluminum Stainless Steel, other Affects - Selection of SP&C extent of protection type of blast media	Determines the types of SP&C process and length of time to perform it.	- put primer on as soon as structural erection is complete in area
CURRENT MATERIAL CONDITION	New steel, w/o millscale, Rusty old paint, Toxic/non-toxic, Crease, oil, Special contaminations	Impacts type cleaning Impacts type personnel protection Impacts cleanup and disposition of residuals Impacts degree of disruption to	- put final coats on per compartment completion schedule * NOTE - All plate to be blasted and coated 3/4 mil with pre-erection primer

Appendix L
Thirteen SP&C Work Planning Factors

2 LOCATION (where the SP&C work will be performed)

OFF-YARD	Vendor or suppliers items that may arrive already coated - partially coated or not coated at all.	Planners from design or purchasing should have these routed on arrival to provide for in-house SP&C. These items must be receipt inspected and SP&C processed as required.	Require vendor structural items to be primer coated prior to delivery as much as possible. Require vendor outfitting items to be finished coated prior to delivery as much as practical
IN-YARD	Units that are fabricated and SP&C processed - generally outside and exposed to the environments - affects community environment, clean water, fumes and fall out noise - protection - Affects company environment offices/trades/etc.	Exterior environment impacts SP&C efficiency and quality.	Minimize in-yard SP&C work Utilize a combination of preconstruction primer and subassembly units done in Blast Houses. Planners and SP&C Personnel should collaborate on break out size of units for most efficient SP&C work Where to SP&C Primer Where to SP&C Intermediate Where to SP&C final
IN-SHOP	Units that are SP&C coated in a Blast House - metal finishing paint shop or similar in house company facility. This location is ideal for parts, pieces and small to medium size subassemblies or modules.	Generally the preferred SP&C method for total cost control when proficiently planned and processed. There is some trade-off in total quality due to the mandatory rework of structural make-up of component parts.	Employ computers and blast shop coordinators to regulate the short-term work flow - avoid peaks and valleys and provide priority to the most critical units in support of various project schedules, consistent with production line flow schedules.

Appendix L
Thirteen SP&C Work Planning Factors

2 LOCATION (cont.)

ON-SHIP, EXTERNAL	SP&C work performed on the exterior surfaces of ships - superstructure, decks, side shell, bottom Affects - SP methods, & materials coating/methods & materials, cleanup/methods & materials, staging, support functions	The location of the ship at the time of SP&C work must not be overlooked - in dry dock - on building ways - at pier - in stream Impacts - environmental - staging - access	Test Sample existing paint/coatings for toxicity. Check application of power tool cleaning. Apply a test patch of SP&C (recoating) Use portable air compressors for higher air pressure - faster cutting - uses less grit
ON-SHIP, INTERIOR	SP&C work performed on the interior surfaces of: - ships - tanks/voids - machinery/spaces/bilges - storerooms - hotel spaces	Impacts - access - ventilation - lighting - staging - level of Manning - method of SP&C work	Use airless spray paint equipment vs. atomizing or other application tools. Strive for SP&C work packages that schedule a block of work (tanks) (compts) (spaces) or area at one time to minimize support functions and disruption.

3 SUPPORT

Functions usually supplied by in-house service trades other than the SP&C trade personnel.			
HANDLING	Does the subject SP&C work require lifting/turning/moving/hanging? If so, what service trade support is required?	Size and type of handling equipment. Number of moves required.	Preconstruction primer application should include planned facilities for blasting/coating and quick curing of primer applied to steel on receipt at the plant (shipyard).
	Does the subject SP&C work require transporting? If so, what type of transportation is required?	To and from blast house To temp. storage before or after SP&C processing To other yard locations for SP&C	
UTILITY SERVICES	Compressed air for power cleaners, blast equipment, paint spray pumps, grinders, etc.	Services readily available for SP&C schedule	Blast and coat houses generally include provisions for transporting sub-assem. or modules throughout the fabrication and SP&C processes - the Planners Job is to make efficient use of these facilities at all levels of points of SP&C planning.
Air		Set up and operation by SP&C personnel	
Water	Gas to heat buildings/units/shops	Set up by support personnel	
Gas	For cleaners, vacuum machines		Minimize temporary stage construction - use fixed staging - man lifters cranes with personnel floats, etc., whenever you can.
Electric	Portable lights		
Power	Fixed lighting to work by		
Lighting			
VENTILATION	For personal health, comfort, safety	Time to perform SP&C	Never enter any tank or space that has Just been opened until gas tester or safety rep clears space for entry and designates type of personnel protection require.
	For confined space explosion protection	Safety of personnel	
	For coating/drying/curing	Other trade support	
	Natural or forced ventilation		
STAGING	Type and quantity	For access and maneuvering	Utilize upside down position to minimize scaffolding requirements.
	When and how to set up/initiate	Blocking other work	
	When and how to take down/remove	Necessary to SP&C operations and inspection	
			Tie staging to drydock NOT ships hull. Consider permanent scaffold clips to remain with ship.

Appendix L
Thirteen SP&C Work Planning Factors

3 SUPPORT (cont.)

TEMPORARY PROTECTION	What to protect and how?	Service trades required?	
	Who installs protection?	Impacts time for erection and removal	
	Who removes protection - when?	Impacts cleaning/blasting work space	
		Impacts painting and cure time	
CLEANUP	What type cleanup	Impacts schedule length	Utilize processes, positions, and locations to minimize cleanup
	What area or space and when?		
	What magnitude?	Impacts equipment repaired	
	Toxic or not?		
	What disposal of residuals?		
Chemist Gas Tester	When required - why?	Impacts schedule time for confined spaces, for tanks just opened, and highly flammable coatings.	
	Who calls/alerts?		
	What is the authority level of chemist - of gas tester?		
Safety Engr. Lab Services	When is each required - why?	Impacts schedule time and quality	
	Who calls/contacts each - why?		
	Authority/responsibility of each?		
VENDOR REPS. Paint Supplier	Involved for quality and safety enhancement of the coating work.	Impacts quality, schedule time, and potential rework.	Communication with vendors, suppliers, and equipment reps.
	Who communicates need for either/each		
Equipment Supplier	SP&C operators work with supply rep. Authority/responsibility of each		

4 SP&C SPECIFICATIONS

SOURCES OF SPECIFICATIONS OR SP&C INSTRUCTIONS	Customer detail specifications Engineering - SP&C instructions taken from known as "Paint Schedule" (paint blueprint) SP&C work package data taken from above two sources	Unclear, incomplete or incorrect specs. result in error. Impacts schedule, rework, material procurement, and manpower.	Specification review by qualified SP&C personnel required in work planning process.
TYPE OF COATING REQUIRED AND ITS IDENTIFICATION	GENERIC FAMILY - Alkyd resin, Vinyl, Epoxy, Inorganic Zinc, Urethane, Latex (water base), coal tar compounds CHARACTERISTICS: <u>Combustible</u>, <u>Flammable</u>, <u>Highly Flammable</u>, <u>Non-Toxic</u>, <u>Toxic</u>, <u>Poisonous</u>, <u>Non-Combustible</u>, <u>Non-Flammable</u> Coating characteristics are obtained from: Product Data Sheets Safety Data Sheets Both should be supplied by paint vendor or manufacturer.	The coating characteristics impact where and how job may or may not be done.	Do not start mixing and coating without reviewing product data sheets and safety data sheets. Always check the shelf life date on paint can - use only known good paint to avoid costly problems.
METHOD OF APPLICATION	Brush/roll/spray/dip/flow; combination of above. Spray application is considered the current basic application method - supported by brush touch up and brush coating of welds, etc.	Impacts rate of production, cure time, equipment, and manpower.	Use airless spray coating as the prime equipment supported by atomizing spray; brush/roller touch-up work.
NUMBER OF COATS	Generally two or more coats required. - At least one prime coat and one top coat	Two coat systems expend less initial application labor than three coat systems and expedite items thru blast paint rooms. Two coat systems are quicker, but usually require more touch-up and more rework so that the three coat system often proves best even at the same total dry mils.	Use three coat system where permissible on most off ship work. - This gives flexibility to job - Potential for reduced rework - Overall lower cost and better quality

Appendix L
Thirteen SP&C Work Planning Factors

4 SP&C SPECIFICATIONS (cont.)

FILM THICK- NESS	Recommended wet film thickness is obtained from product data sheet; is important monitor at application to ensure that each coat dries to specified dry film thickness to end up with specified total dry film A typical epoxy system may require: 2 Dry Mils of primer 10 Dry Mils of top coat 12 Dry Mils total	Impacts quality, control, application time, potential rework, and equipment required.	Explore your options and apply same thickness on 3 coats: - 2 Dry Mils of primer - 6 Dry Mils intermediate coat - 4 Dry Mils top coat (later)
DRYING/ CURING	Drying generally refers to time between coats before next coat. Curing refers to completion of chemical reactions and/or drying and ready for intended service function.	Drying/curing impact when/where/how long it takes to do a specific job. Long dry/cure can bog down blast house operations	Provide accelerated curing environment in blast paint houses - <u>heat</u>, <u>ventilation</u>, <u>humidity control</u>
INSPECTION	<u>WHO/WHEN/WHERE</u> Inspections may be formal or informal, in-process or upon completion.	Required inspections influence quality and progress of SP&C work. Unnecessary inspections generate confusion, overlap and rework, and contribute to higher costs.	Make maximum use of <u>your</u> in progress inspections. Minimize formal planned inspections and keep those near end of job.
COATING OBJECTIVES	Coatings serve a variety of purposes Purposes - <u>corrosion protection</u>, <u>cosmetic anti-fouling</u>, weather resistance. Sanitation or a combination of these.	The SP&C objective impacts when/where/how coatings are applied and must be considered in long and short-term planning in relation to the SP&C system and to the service function of the paint/coating.	Use wet and dry film gages Monitor total film thickness Too thick is worse than too thin because it consumes excess material and generates <u>re-work</u> thus using more labor - resulting in higher costs overall.

4 SP&C SPECIFICATIONS (cont.)

SURFACE PREPARATION

Method	All surface prep falls under one of these classes: <u>manual cleaning</u> , <u>power cleaning</u> , <u>blasting</u> , <u>chemical cleaning</u> or combinations thereof.	Methods influence when/where/why SP&C work can or cannot be accomplished.	Utilize efficient methods that meet minimum spec. required.
Blast Media	Sand, metal shot, metal grit, Black Beauty resin grit, etc.		
Profile/Anchor Pattern	Does the spec or paint system require specific profile, anchor pattern?	Media used impacts production rate.	Blast profile should be in accord with product data sheet or as rule of thumb 1/4 to 1/3 of the first coat thickness (dry film).
Options	Does the spec or system allow any options such as use of mechanical needle guns in lieu of blasting on small areas?		<u>Example:</u> If you wish to apply 3 mils dry film of a given primer that is listed at 50% solids, then you need a 1 mil profile (anchor pattern) on which you apply 5 wet mils of paint that will dry to 3 mils for a well bonded primer. Use the needle gun option where permissible to avoid spot blasting on large units and on ship.

Appendix L
Thirteen SP&C Work Planning Factors

5 TIME/MANPOWER

MANPOWER PLANNING	Objective - accomplish acceptable SP&C in the shortest practical time with minimum manpower used and minimum rework required.	Impacts schedule and cost of job.	Planners and operators must recognize that some short-term sacrifices must occasionally be made in time and manpower to support the team objective of overall shortest time and lowest manpower. These are management decisions and line supervisors/planners should not feel guilty at resulting higher costs.
ALLOTTED TIME PER SCHEDULE	Planners allow target times to process designated sizeable units of work through fixed operations.	Planners should communicate with SP&C reps who attend planning meetings.	
AVAILABLE MAN-POWER	Planners should communicate with each other as well as SP&C operators to look at total target work load and project manpower needs.	Availability of manpower is more a planning problem between SP&C supervisors and dept. heads.	Always have one or more backup people trained or in training for each spot on your team. An ideal gang would be composed of:
SPACE RESTRICTIONS	Affects the type of equipment used and number of workers used at a time, thus controls elapsed time to do job and influences total manhours.	Impacts SP&C facilities - blast/coat houses - etc. and work planned for inside.	35% long-time reliables 35% experienced mechanics 30% new people in training
LABOR SKILLS LEVEL	Affects the elapsed time of job in relation to the average skill of the operations and impacts the total cost in similar manner.	Impacts production rate Training is a full-time part of SP&C operations. Each foreman should constantly have a percentage of new people blended in	SP&C operators should keep a log of estimated times vs. actual times to complete each SP&C work packages. These should then be made available to and/or discussed with long-term planners, schedulers and estimators.
SP&C OPERATORS ESTIMATED TIME AND LABOR TO COMPLETE	The SP&C operators - foremen and his support elements must recompile all input work from several sources to determine his weekly and daily work plan, thus producing his estimated time on specific tasks/units.	Foreman work plan impacts overall schedule if different from the planner's work estimate.	

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Appendix L
Thirteen SP&C Work Planning Factors

5 TIME/MANPOWER (cont.)

SCHEDULE TIME
vs.
ESTIMATED TIME

Scheduled time is generally a broader target or guide established at earlier planning levels. Estimated time is short-term detail time estimate that needs to be as accurate as possible and feed back to planning meeting so as to make on course corrections in schedules, both current and future schedules.

If the planners schedule and time coincides with the SP&C operators schedules and time then output should be on schedule. Of course, the above rarely exists because the SP&C operators have to deal with SP&C planning coming from several sources, such as project managers, different fabrication shops, different planners, etc., and the lack of standard units of SP&C work.

Impacts overall SP&C schedule performance when scheduled time and estimated times are significantly different.

The compatibility of scheduled time and estimated time is a measure of the total team experience and ability in many situations.

This compatibility plus a recognized system of SP&C work in any given shipyard will do much to improve production and reduce costs.

Appendix L
Thirteen SP&C Work Planning Factors

6 MINIMIZING SP&C REWORK

WHEN TO APPLY PRIMER	<u>OPTIONS:</u>	A. The costliest part of SP&C blast work is the removal and disposition of blasting residuals. Therefore, the prime objective is to avoid or at least minimize blasting on ship.	(1) Accomplish as much off-ship SP&C as permissible and practical within the specification and system constraints.
	(1) As preconstruction primer when steel arrives in shipyard (2) Small subassembly units/pieces on the yard (3) Subassembly/modules/pieces in the blast and paint shop (4) Large subassembly units prior to on-ship erection (5) Post-erection/on-ship application	B. Application of an accepted preconstruction primer applied at the time of receipt of steel in the yard is a desired step when it is permissible within the spec. and management system. C. Consider the use of a preconstruction primer in some cases as a preservative and color assist to other trades even if it must be blasted off to use the spec. primer.	(2) Plan each step of SP&C as close as permissible and practical to the completion of other trades work, especially fitting, chipping, cutting, welding, straightening, piping, wiring, etc. (3) Monitor the status of other trades work; see for yourself that other trades work is ready for SP&C coating at the intermediate or final coat level.
WHEN TO APPLY INTER- MEDIATE COAT	<u>OPTIONS:</u>	A. Application of intermediate coat(s) should be considered for small subassemblies done in blast and paint houses or for large subassembly units processed prior to erection on ship.	(4) Use light colors of primer and intermediate coats where the system permits to highlight and help correct unfinished structural/outfitting prior to application of the final coat; and to improve illumination in construction areas and spaces.
	(1) Small subassembly units/pieces on yard (2) Subassembly/modules/pieces in the blast and paint house (3) Large subassembly units prior to on-ship erection (4) Posterection/on-ship application		

Appendix L
Thirteen SP&C Work Planning Factors

6 MINIMIZING SP&C REWORK (cont.)

WHEN TO APPLY FINAL COAT(S)	<u>OPTIONS:</u>	A. Final coat(s) should be applied to most non-structural components off-ship in paint shop or blast/paint houses.	(5) When "quality" and/or "coating integrity" is the priority consideration <u>then</u> and only <u>then</u> should on-ship SP&C operations be considered as the best choice for the bulk of SP&C work. (This eliminates patching in of make-up seams, joints, etc. - permits full continuously covered coats of primer, intermediate and final painting.
	(1) Small subassembly units/pieces on yard (2) Subassembly/modules in blast and paint shop (3) Large subassemblies prior to on-ship erection (4) Post-erection on-ship application	B. Final coat(s) to structural components should be applied off-ship to large subassembly units or on-ship after completion of other work depending on spec. and system requirements. This is a foreman's/planner's consideration, but not their decision.	

7 MATERIAL.EXAMPLES OF
SP&C
MATERIALS

For Surface Preparation - Part of SP&C: Impacts:

(1) Abrasive steel shot (2) Abrasive steel grit (3) Combination of (1) & (2) above (4) White sand (5) Synthetic abrasive (byproduct of other industrial operations) (6) Aluminum oxide (7) Sandpaper and similar mfg. abrasives (8) Chemical cleaners - citric acid, phosphoric acid, etc; soap type cleaners (9) Masking tape, etc.	(1) Material out of stock delays work (2) Poor quality material results in rework (3) Aged material (coatings) will not meet quality standards

For Painting or Coating Part

- (1) Alkyd resin paints
- (2) Vinyl resin paints
- (3) Inorganic zinc coatings
- (4) Epoxy resin coatings
- (5) Polyurethane paints
- (6) Coatings - coal tar products
- (7) Latex (water base) paints
- (8) Other similar paints, coatings
- (9) Solvent cleaners
- (10) Solvent thinners
- (11) Masking tape

SP&C personnel have limited options to decide on the use of cleaning or coating materials - the choices are locked in earlier. You DO HAVE and MUST USE the option of communicating back through your bosses and/or counter parts relative to materials that do not perform well and the need for better performing materials.

Always insist on mat. product data and safety sheets. Review these for each SP&C job.

Always check the shelf life date - insist on newly packaged coatings.

Get control of and maintain a 3 to 5 day supply of SP&C materials for your gang.

Who else is using same type material in same or close by area? Watch this for performance clues and for material supply control.

SAFETY

Is this a new material or one I am familiar with/have used before?

Is there a safety data sheet, and who has it?

How do I check the safety data sheet?

NOTE: Refer to safety heading on sheet () of these considerations

Appendix I.
Thirteen SP&C Work Planning Factors

8 **EQUIPMENT**

TYPE FOR SP&C SUPPORT OPER- ATIONS (EXAMPLES)	Fork lift	Proper equipment use requires trained operators.	<u>Minimize</u>
	Front-end loaders		Start/stop operations
	Cranes	Appropriate equipment saves time	Set up time
	Conveyors		Repair/breakdown thru
	Grit-hoppers		effective PM
	Air compressors		Plan equipment utilization
	Air drivers		Maintain equipment inventory
	Dehumidifiers		
	Manlifters		
	Rail cars		
	Tractor-trailers		
Trucks			
Aux - heaters			

TYPE FOR CLEANING	Abrasive blast equipment	Other type cleaning	
	- Automatic	- Power wheels - sanders	Portable air compressors generally provide cleaner and higher pressure air for blasting, thus they reduce:
	- Manual		
	- Fixed portable		
	- Pneumatic/centrifugal types	- Power chippers/scalers/ needle guns	
	- Vacu/veyors/vacuum cleaners	- Chemical (Dip-wipe-etc.)	
		- Manual/sand blast	- elapsed time - labor time - blasting material consumed per unit of work output.
		As a rule of thumb for discussion of equipment:	
		- centrifugal abrasive wheels will predominate in small blast machines and small blast grit recycling rooms	
		- manually operated blast nozzles with expendable abrasives (non-recycling) usually prevail for off-ship exterior work and all on-ship blasting work	

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Appendix L
Thirteen SP&C Work Planning Factors

8 EQUIPMENT (cont.)

TYPE FOR COATING	Spray paint	- Airless spray paint pump type equipment will perform better on viscous coatings and those to be applied in thicker wet films like 6 or more wet film mils per coat.	A combination of airless spray and atomizing spray equipment is the best overall painting equipment; supported by roller/brush, etc.
	- Air/airless - Electrostatic - Combination		
	Brush/roll (power or manual) Dip or flow coating	- A combination of airless and low pressure atomizing spray equipment works better on interior compts. and machine spaces working in and around obstructions, such as, pipes, cable runs, electronic consoles, machinery, furniture, etc.	Insist on spray operators using "wet film" thickness gages - put on the desired thickness at one time without excess and without <u>rework</u> .

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Appendix L
Thirteen SP&C Work Planning Factors

9 HANDLING AND STORAGE OF SP&C UNITS/ PIECES OFF-SHIP

HANDLING

Referring to the unit that is to be SP&C processed

WHAT is to be handled

Identification of SP&C unit by code number or by detail description in case of smaller parts/pieces.

Can be pieces/parts/subassemblies/module/machinery, etc. Impacts equipment and time.

WHY is it to be handled

For SP&C processing on-yards in-shop or for movement to storage or on ship as part of SP&C processing.

Impacts equipment, schedules, support craft coordination.

Lifting - turning or moving to allow desired processing of SP&C work.

WHO is to handle it

Internal SP&C operations or requires service support assistance.

SP&C schedules depend on items moving on schedule.

Heavy lifts should be scheduled by planners.

SP&C supervisors must request other moves/situations.

SP&C supervisors must be able to handle units/pieces in their spaces without other trade assistance.

ROUTING AND SCHEDULE

From fabrication to SP&C process

Step #1 can be primer or interim
Step #2 can be interim or storage/
final
Step #3 can be final

Impacts dependent upon shipyard work process procedures for number of moves, required time of travel, number of heavy lifts, etc.

The routing would be targeted at the planning level, but detail schedule would fall to SP&C operations.

9 HANDLING & STORAGE SP&C UNITS (cont.)

STORAGE

Units may be stored at the completion of fabrication with no coating or with residual preconstruction primer.

Units may be SP&C primed after fab. and stored at this point.

Units may be SP&C primed and part top coated - then stored awaiting additional assembly or erection.

This determination is a function of the system and where specific units fit in - the SP&C operations must know the system and fit of the pieces even if they can't change the system.

Length of time in storage should be considered to avoid rust and corrosion of uncoated units and to avoid deterioration of partly

Units should be protected against surface film contaminations during storage or be thoroughly cleaned at end of storage or before additional recoating.

Certain coating systems may not be suspended for storage or other reasons at the primer or intermediate coat level, but must be continued thru final coat application within time constraints. The product data sheets will caution on this and it should always be respected. However, lower temperatures can extend recoat time and higher temperature can reduce recoat time. Judge accordingly. Check with paint lab personnel for added assurances.

Store units or pieces:

- inside where practical
 - in position that allows runoff of water. Drill drain holes if runoff can't be relied on
 - away from salt water flooding or salt water spray or mist
 - with spacer pieces between flat faces/surfaces
-

Appendix L
Thirteen SP&C Work Planning Factors

10 INSPECTION

	Inspection of work performed at any of several levels affects the following concerns: Does spec. require specific inspection? What type inspection? Who conducts inspections? Who witnesses inspections? Who accepts/rejects? NOTE: Spec./owner/customer used interchangeably here. Does the yard management system require inspections? Does the paint vendor/representative inspection?	Impacts based upon spec. are: What criteria? What documentation? At what points? - in process - intermediate - step-by-step - final What type/level? Inspection, or the right to witness in-process operations?	Depend on in-process inspections by experienced inspectors - you or your counterparts Keep formal inspections to the minimum. These disrupt work and and serve no purpose (unless mandatory). The most effective inspection system is composed of: - in-process monitoring that includes wet mil. thickness reading and dry mil. readings after each coat followed by - one thorough final inspection of each unit/area/tank/compartment, etc. at completion of major coating work
SPECIFICATION REQUIREMENTS	Does the dept. supt. require inspections by department-trained inspectors, independent of production personnel?	Impacts the scheduling of inspection services.	
INTERNAL REQUIREMENTS			
FOREMAN'S LEVEL	Do you, the foreman, faithfully inspect and accurately evaluate the production accomplishments of your gang?		This, when faithfully and accurately done, is the best level of SP&C work inspection.

11 DISRUPTION/INTERFERENCE**GENERATED
BY SP&C**

Delays/slow downs/cancellation/damage to other trades or other work functions as a result of SP&C operations.

Applicable SP&C operations on- and off-ship.. The most damaging aspects occurring on-ship and on the adjacent dock areas.

**SP&C BLAST
OPERATIONS
(CLEANING)**

Generates hazards to others in form of dust/flying abrasives/noise.

Blocks access routes due to masking and closure protective measures.

Precludes other to protect the surfaces being processed.

SP&C preparatory operations involve clean up/cover up to area/unit, etc. that generate displacement, - move over disruptions for other trades before and after actual blasting and coating operations.

Plan SP&C operations for off shift times, after normal work hours or on weekends.

Utilize blast and coat rooms effectively thru a planned/agreed system.

**SP&C COATING
OPERATIONS
(PAINTING)**

Generates flammable/explosive/toxic/irritating fumes.

Generates wet (painted)/slippery/keep off surfaces that preclude other work even if nonflammable/nontoxic coating is used.

Precludes other work due to personal health/safety/well-being of others.

Precludes or strictly limits access and movement thru or within the area/shop/bldg./space/compartment/dry dock or open decks.

Reduce rework. Do it right and once only.

Make use of approved accelerated curing techniques heat/humidity/ventilation control.

Utilize approved "fast cure" versions of available coatings.

**SP&C CURING
OPERATIONS
(DRYING TIME)**

Coating must cure to be:

- tack free from dust, etc.
- fume free to avoid fire or explosion
- dry hard to permit walking on without damage to the coating
- dry firm to remove protection/covering to release surfaces for continuation of other work.

Generates delays that tie up facilities/areas/spaces/ compartments. While waiting for coatings to cure.

Appendix L
Thirteen SP&C Work Planning Factors

12 SAFETY

General Note:

Safety must be a totally integrated part of any and all SP&C operations. Safety demands and deserves to be a topic unto itself and is mentioned for limited consideration to show that it must never be neglected or left out. This is not an attempt to provide training in SP&C safety.

Your personal safety

Your personnel (your gang)

Your fellow employees

Your work area/shop/yard/ship

Your shipyard/company

Your community/environment

Your materials

Your equipment

Impacts of unsafe operations:

- Injury
- Delay
- Liability
- Loss of work
- Claims

- the first line supervisor has the prime responsibility

- the planners have associate responsibility

- the safety engineers have joint responsibility

- the managers have leadership responsibility

Safety is everybody's business

The life you save has a very high probability of being your own; in SP&C operations more than most other shipbuilding functions.

Put safety first; mixed right in with performance, production, quality control, etc.

"Do it right for once-only and safely."

WHAT/WHO

SP&C HAZARDS

Dust

- nuisance
- irritating
- toxic

Flying Particles

- abrasive grit
- abrasive shot
- abrasive other

Appendix L
Thirteen SP&C Work Planning Factors

12 SAFETY (cont.)

L-21
SP&C HAZARDS
(cont.).

High pressure air/fluids

- hose rupture
- nozzle exhaust

High pressure air from blast
or paint equipment.

High pressure fluid from water
blast or from airless spray
equipments.

Fire (explosion)

Fumes

- nuisance
- irritating
- toxic
- oxygen displacing

Falls

- from staging/ladders
- from personnel lift equipment

Chemicals

Affects

- burns
- blisters
- irritants (eyes)
- irritants (respirator)
- irritants (skin)

From

From chemicals used as cleaners
From chemicals being blasted off
From paints/coats containing
chemicals
From solvents/thinners

Appendix L
Thirteen SP&C Work Planning Factors

13 SCHEDULES

CONTRACT SCHEDULES	Management Developed. These target the <u>start</u> and <u>finish</u> of contract	"The beginning and end" of specific jobs	
		No detail concern for SP&C personnel	
MASTER SCHEDULE	A management tool that details : - Key events - Award of contract - Lay keel - Launch - Deliver	This schedule sets the time frames for other more detail/supporting schedules. SP&C personnel can estimate their broad scope of work from this.	
MAIN EVENTS SCHEDULE	Details main events in sequencing order Erection/launching/outfitting/compartment completion/testing/train trail/delivery	Details SP&C of biles in machinery spaces Details SP&C for some tanks Details SP&C completion dates on compts/mach. spaces, etc., but leaves details to later planning	Generates iteration of SP&C activity with other craft activity at specified times.
SHOP MFG. SCHEDULE	Details items/units/components/sub-assemblies built in shops or on exterior building plattens, skids/areas	Targets subassemblies to the <u>blast/coat house</u> or provides means for SP&C operators to estimate when units are ready for SP&C processes	
MODULE BLAST/COAT SCHEDULE	Short-term composite schedule made up by SP&C personnel to show SP&C loading and work flow from fabrication areas to erection time	This varies widely from yard to yard and from time to time within the same yard.	Points up the need for a SP&C coordinator team to make this a more efficient process in all shipyards.

Appendix L
Thirteen SP&C Work Planning Factors

13 SCHEDULES (cont.)

HULL ERECTION SCHEDULE	Schedules completion of structural work off-ship for erection units and the date of erection of these units on the ship.	Provides the control dates for some SP&C work that is to be done off-ship prior to erection.	60% of all SP&C coating should be completed prior to erection and 90+% of all blasting for SP&C should be complete.
LAUNCHING SCHEDULE	Shows details of structural completion and proposed staging removal prior to ship launching	Provides SP&C dates for underwater work and for exterior hull painting (dress up) prior to launching.	Underwater SP&C operations may be decided by <u>spec - management</u> or project level. Final economics is a function of proposed system and how long between launch and delivery.
DOCKING SCHEDULE	Proposed redocking times between launching and delivery	Provides one or more optional times for underwater SP&C work in whole or in part.	
OUTFITTING SCHEDULE	Provides target SP&C dates by showing completion of external sections/tanks/compts/machinery spaces	Additional short-term schedules are provided by project/depts. to detail SP&C operations.	
o SP&C TANKS	Provides hydro testing of tanks before launch	These are areas where the SP&C foreman can and should make real contributions by direct participation or by indirect representation at or to the planning meetings that schedule and re-schedule these SP&C operations.	Eliminate <u>rework</u> at each opportunity, but <u>do not hesitate to repeat</u> your ideas, suggestions or complaints that may contribute to better performance in SP&C operations.
o SP&C MACH. SPACES	SP&C operators have input into these schedules thru planning meetings to detail start and finish times for each compartment/tank/area		
o SP&C EXTERIOR	Breaks exterior of ship into sections for SP&C work		
o COMPARTMENT COMPLETION SCHEDULE	Targets number of compts. to be completed per week or month and on certain Navy work it targets the compartments/spaces that are turned over to the ship's crew for living and operational purposes	Instrumental in SP&C supervisors estimating number of workers required to comply with scheduled number of compartments.	Foremen/planners/mat. supervisors/equipment supervisors and similar SP&C personnel can and should play a significant part in long-term scheduling by feeding their ideas and needs through their superiors and back to the long-term planning sources. This can results in more meaningful schedules across the board and reduce total costs of SP&C operations.
and/or			
o COMPARTMENT TURNOVER SCHEDULE			

APPENDIX N

APPENDIX N

STUDENT WORKBOOK
APPENDIX N
FOREMAN WORK PLANNING CHECKLIST

1. Purpose: To develop a personalized checklist for use by the SP&C supervisor
2. Product: Detailed notes and actions for the SP&C Supervisor which he can use in his yard during the work planning process.
3. Instructional Strategy:
 - o Method: Instructor lead discussion of all items listed in Appendix N
 - o Media: Viewgraphs (as applicable to topics), easel pad, Appendix N
 - o Participant Assignment: Participate in group discussion, write down applicable actions in Student Notes Column
4. Resources Required:

<u>Instructor</u>	<u>Participant</u>
Viewgraphs (as applicable)	Pencil
Overhead projector	Appendix N
Appendix N	Appendix L
Appendix L	
5. References:
 - o Instructor Guide, Section III.E.
 - o Instructor Guide, Appendix L
 - o Instructor Guide, Appendix N

6. Process:

A. Preparation

1. Review:
 - o Instructor Guide, Section III.E.
 - o Appendix L
 - o Appendix N
2. Relate each item of Appendix N to Appendix L WPF'S
3. Review suggested presentation strategy (below)
4. Personalize the checklist to the yard terminologies
5. Develop prompting questions to draw out detailed action items
6. Xerox sufficient copies of materials for trainee use.

B. Presentation Strategy

1. Introduce the discussion objectives and emphasize the importance of each supervisor having a good checklist
2. Discuss the first item and take notes on specific actions which develop from discussion. Use the easel to write down a synopsis of the action items to demonstrate a sample of the student notes
3. Briefly summarize the checklist importance at the end of the discussions.

APPENDIX N

FOREMAN WORK PLANNING CHECKLIST

Checklist

Student Notes

General - For each work assignment:

- A. Make sure all work package documentation is complete and the work to be accomplished is understood.
1. Are specifications complete?
 2. Are there special safety considerations?
 - a. Gas chemistry for confined spaces?
 - b. Flammable materials?
 - c. High or dangerous places for men to work?
 3. What is the schedule for work?

FOREMAN WORK PLANNING CHECKLIST (Continued)

<u>Checklist</u>	<u>Student Notes</u>
4. What other trade assistance is required?	
5. Walk the job down.	
B. Evaluate the work to be done using the 13 work planning factors.	
1. WPF-1 - Physical Description	
a. What size and shape?	
b. What type material?	
c. What condition is it in?	
2. WPF-2 - Location	

FOREMAN WORK PLANNING CHECKLIST (Continued)

Checklist

Student Notes

a. Where is the work to be done?

(1) In-yard

(2) In-shop or Blast and Paint
House

(3) On Board Ship

(4) Internal Space

(5) External Space

b. What problems are created by
location?

FOREMAN WORK PLANNING CHECKLIST (Continued)

Checklist

Student Notes

c. Special Considerations

(1) Tanks

(2) Voids

(3) Machinery Space

(4) Bilge

(5) Hotel Spaces

(6) Underwater Bottoms

FOREMAN WORK PLANNING CHECKLIST (Continued)

<u>Checklist</u>	<u>Student Notes</u>
3. WPF-3 - SUPPORT	
a. What Support Services/Trades are required?	
(1) Handling -Riggers	
(2) Transporting	
(3) Utility Services	
(4) Air, electricity, Lights, Water, Heat	
(5) Ventilation	
(6) Staging	

FOREMAN WORK PLANNING CHECKLIST (Continued)

Checklist

Student Notes

(7) Temporary Protection

(8) Clean-up

(9) Waste removal

(10) Chemist/Gas Tester

(11) Safety Engineer/Lab Services

(12) Vendor Reps

(13) Paint Supplier

(14) Equipment Supplier

FOREMAN WORK PLANNING CHECKLIST (Continued)

Checklist

Student Notes

b. When are these services required?

4. WPF-4 SP&C - Specifications

a. What Surface Preparation
Specification is the work to
conform to?

(1) Method

(2) Blast media

(3) Profile/Pattern

(4) Optimal methods

FOREMAN WORK PLANNING CHECKLIST (Continued)

Checklist

Student Notes

b. What Paint Specification is the work to conform to?

(1) Type of coating system

(2) Method of application

(3) Number of coats

(4) Thickness of each coat

(5) Cure and dry time

(6) Method of quality inspection

(7) Objective of the coating

FOREMAN WORK PLANNING CHECKLIST (Continued)

Checklist

Student Notes

5. WPF-5 - Time/Manpower

a. What size crew is required to meet schedule?

(1) Special skills

(2) Crew skill mix

(3) Alternative work plan

b. Any space restrictions for crew?

c. Can the work be done on time?

FOREMAN WORK PLANNING CHECKLIST (Continued)

Checklist

Student Notes"

- d. Will the space be ready for the crew on time?

6. WPF-6 - Minimizing Rework

- a. Will other trades be out of the way?
- b. Is there work below, above, or on adjoining bulkheads?
- c. Are primer, intermediate, and final coats being applied correctly and on time?

7. WPF-7 - Material

- a. Is the material called for the correct SP&C material?

FOREMAN WORK PLANNING CHECKLIST (Continued)

Checklist

Student Notes

- b. Check self-life dates

- c. Is the quantity of material enough
for your job?

- d. Is the material new and you need
instruction is proper use?

8. WPF-8 - Equipment

- a. Is the equipment available?

- b. Is it well maintained?

- c. Is it safe?

FOREMAN WORK PLANNING CHECKLIST (Continued)

<u>Checklist</u>	<u>Student Notes</u>
d. Are there enough pieces, or feet of hose?	
e. Is there power or air for equipment?	
f. Are operators trained for equipment use?	
9. WPF-9 - Handling and Storage	
a. What items need to be handled because of size, weight, shape, etc.?	
b. What support services are required?	
c. When must it be handled?	

FOREMAN WORK PLANNING CHECKLIST (Continued)

<u>Checklist</u>	<u>Student Notes</u>
d. Who coordinates heavy lifts?	
e. When SP&C for storage what specs are called out?	
f. Can you coat over the storage coat with intermediate or finish coats without removing the storage coats?	
10. WPF-10 - Inspection	
a. What specs are being inspected?	
b. Who, when, where, and how will the inspection be done?	
c. The foreman should inspect first?	

FOREMAN WORK PLANNING CHECKLIST (Continued)

<u>Checklist</u>	<u>Student Notes</u>
11. WPF-11 - Disruption/Interference	
a. Does your work plan have the potential for being disrupted?	
b. Are other workers going to interfere?	
c. Talk to other foremen around the space you are to work in.	
d. Do you have an alternative work plan?	
e. What is the weather? Rain, cold, wind, humidity, heat?	

FOREMAN WORK PLANNING CHECKLIST (Continued)

Checklist

Student Notes

12. WPF-12 - Safety

- a. Are your materials and equipment safe to work with?
- b. Is your work area safe to work in?
- c. Will others be in danger because of your work?
- d. Do you need to call a safety inspector to approve a procedure, structure, or material?
- e. Is protective clothing called for?

FOREMAN WORK PLANNING CHECKLIST (Continued)

Checklist

Student Notes

13. WPF-13 - Schedules
- a. Can you meet the schedule called for?
 - b. What is the impact if you cannot meet the schedule?
 - c. Procedures for overtime, extra shift work, extra crews?

WORK PLANNING
FOR
SHIPYARD
SURFACE PREPARATION
AND
COATING
(SP&c)

INTRODUCTION

WORK PLANNING FOR SHIPYARD SURFACE PREPARATION AND COATING (SP&C)

INTRODUCTION WORKSHEET

Instructions: Please use this worksheet to organize a short self-introduction

NAME:

SHIPYARD

DEPARTMENT:

POSITION/TITLE:

LOCATION:

Shipyards planning experience:

Experience

Types of planning experience

Specific expectations from this Workshop:

Specific Questions you want answered:

COURSE OBJECTIVES

- ① The purpose of this course is to provide the background information and skills necessary to improve the general ability of SP&C supervisors to effectively plan and schedule near term Surface Preparation and Coating work on new ship construction.
- ② A desired second outcome of this course is to increase the shipyard management's knowledge of the effects of near term detailed surface preparation and coating planning on overall shipyard production efficiency.
- ③ Therefore, the outcomes of this course will be an improved exchange of SP&C work planning information and ideas between shipyard top management, SP&C supervisors and cognizant craft planners and schedulers.

SCOPE AND OVERVIEW

I

HISTORICAL BACKGROUND

SP&C Planning

- Last on ship's completion list

Ž Difficult to manage

Ž Inefficient and complex

Ž Too much on-board work

U.S. SHIPYARDS NOT COMPETITIVE

- Labor Intensive Workforce

- Low productivity

- Ž Antiquated systems and processes

- Ž Antiquated industrial equipment and facilities

- Ž Potential for in-process changes and alterations

HULL BLOCK CONSTRUCTION SYSTEM

- Japanese lead the world in this system
- Varying degrees of the Hull Block Construction Method now in U.S. shipyards
- Traditional system survives, in whole or in part in the U.S.

NATIONAL SHIPBUILDING RESEARCH PROGRAM

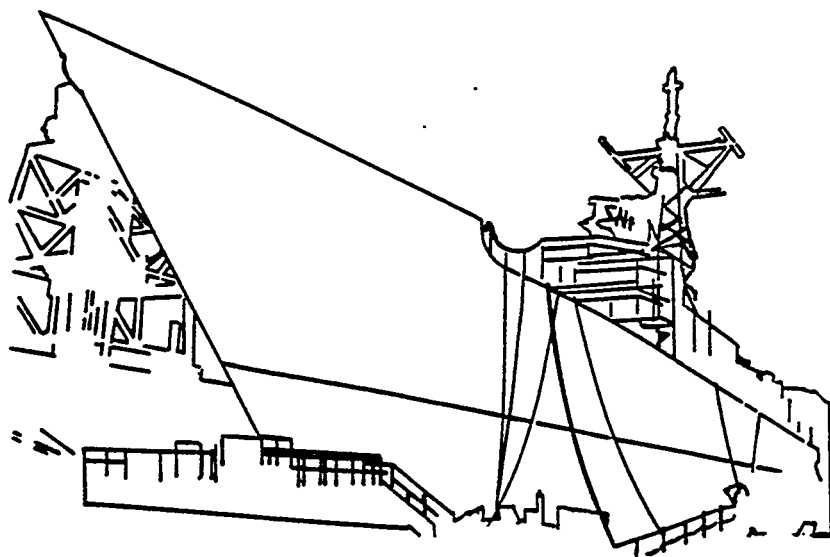
- Sponsor of the effort to improve the shipyard industry SP&C process
- **Concerned that SP&C now represents 10% - 20% of ship construction costs**
- **Concerned that painter's work still control led by the design and production methods which are decided by others in the planning process**
- **This training package is a result of that concern**

APPROACH TO SP&C WORK PLANNING

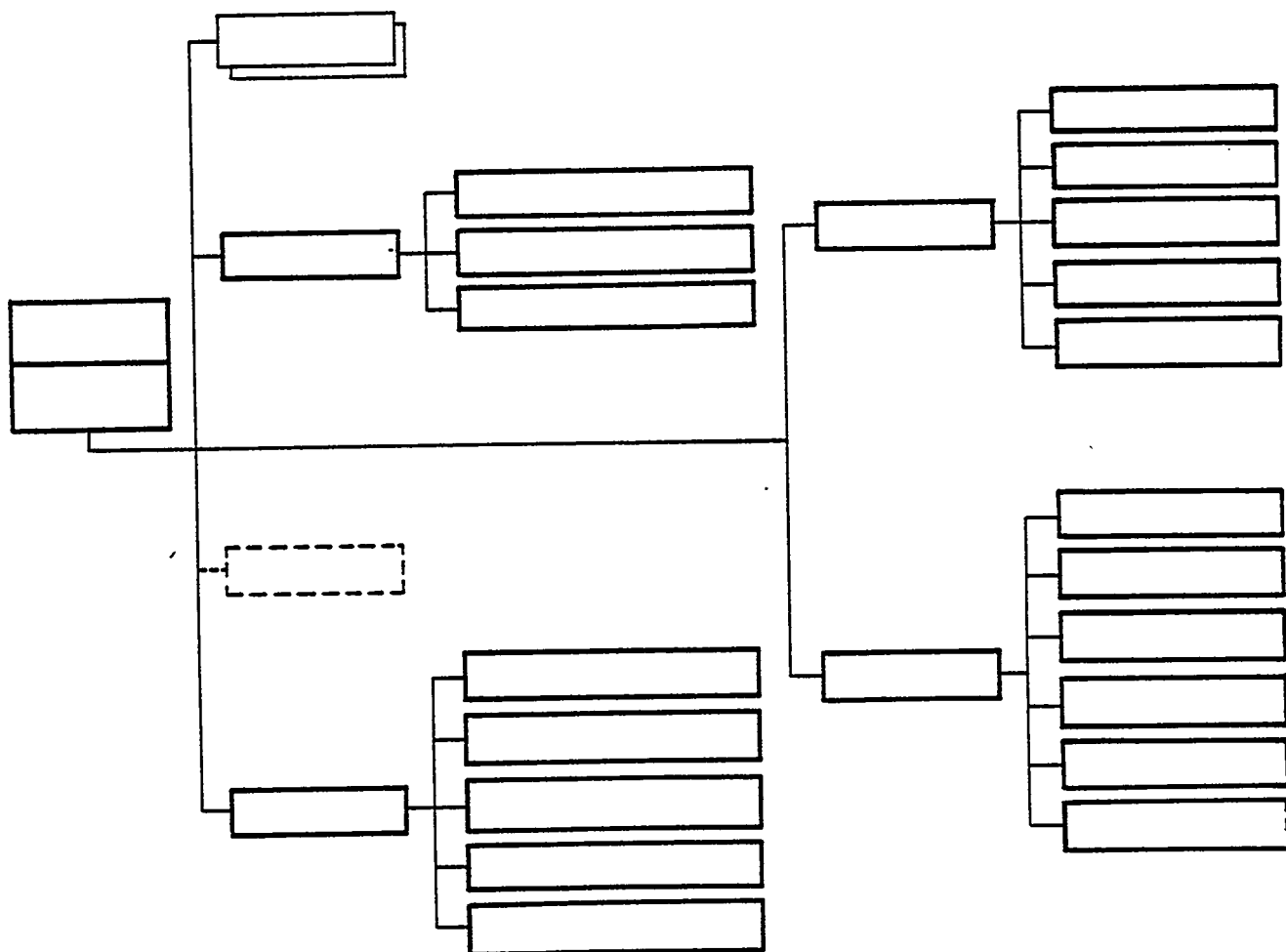
- A. Prepare and paint as early as possible
- B. Do as much under controlled conditions as possible
- c. Use blast and paint houses
- D. Use end of other shops (pipe shop paint section)
- E. Paint final coats only after all other work is done - to preclude rework
- F. Maximum down hand work
- G. It may be cheaper to move the paint than the item to be painted (cost trade off)
- H. Inspect, before you paint and after
- I. Plan blasters and painters work in relation to other trades in the construction process
- J. The Zone Approach permits and encourages most outfitting SP&C work to be accomplished earlier under more efficient conditions
 - **Safer**
 - **Cleaner**
 - Tools and materials delivered to work sites quickly and economically.
- K. Plan early and stick to your plan

BENEFITS DERIVED

- Reduce blast and paint time
- Minimize on-board work
- Simplify SP&C Planning and Scheduling
- Avoid interferences between trades
- Achieve greater efficiency of handling equipment and material
- Improve safety
- Improve working environment
- Improve Productivity
- Improve Quality



SHIPYARD ORGANIZATION



13 WORK PLANNING FACTORS

1. Physical Description
2. Location
3. Support .
4. SP&C Specification
5. Time/Manpower
- 6 Minimizing
- 7: Material
8. SP&C Equipment
9. Handling and Storage
10. Inspection
11. Disruption/Interference
12. Safety
13. Schedules

**(WPF) #1. PHYSICAL DESCRIPTION
(painted item)**

- Size
- Shape
- Openings
- Appurtenances
- Materials Types
- Materials Conditions

(WPF) #2. LOCATION
(Where work is to be performed)

- Off-yard
- In-yard
- On-ship
 - External
 - Interior

(WPF) #3. **SUPPORT**

- Handling
- Transporting.
- Utility Services
- Ventilation
- Staging
- Temporary Protection
- Cleanup
- Chemist
- Gas tester
- S a f e t y
- Lab Services
- Vendor Representatives
 - Paint Supplier
 - Equipment Supplier

(WPF) #4. SP&C SPECIFICATIONS

- **Film thickness**
- **Drying/Curing**
- **Inspection**
- **Coating Objectives**
- **Sources of Specifications or SP&C Instructions**
- **Type of Coating required and Coating Identification**
- **Method of Application**
- **Number of Coats**
- **Surface Preparation**

(WPF) #5. TIME/POWER

.Ž Manpower Planning .

Ž.Allotted Time Per Schedule

- Available Manpower
- Space Restrictions
- Labor Skills Level

Ž SP&C Operators Estimated Time and Labor to Complete

- Schedule Time vs. Estimated Time

(WPF) #6. MINIMIZING SP&C REWORK

Ž When to Apply Primer

Ž When to Apply Intermediate Coat

Ž When to Apply Final Coats

(WPF) #7. MATERIAL

- Materials for Surface Preparation
- Materials for Painting or Coating
- Material Safety

(WPF) #8. SP&C EQUIPMENT

Ž Support Operations

- Forklift
- Air Compressors

● Cleaning

- Abrasive blast equipment
- Pneumatic/Centrifugal
- Vacuum cleaners

● Coating

- Sprayers
- Brush/Roll (power/manual)

(WPF) #9. HANDLING AND STORAGE

- Handling Units to be Processed
- Routing and Scheduling
- Storage

(WPF) #10. INSPECTION

- Routine Inspection Requirements
 - Ž Specification Inspection Requirements
 - Ž Foreman's Inspections

**(WPF) #11. DISRUPTION/INTERFERENCE
 (By SP&C)**

- Generated by SP&C
- Generated by other trades
- SP&C Blast Operations
- SP&C Coating Operations
- SP&C Curing (Drying time)

(WPF) #12. SAFETY

- What
- Who
- SP&C Hazards
 - Dust
 - **Flying particles**
 - High Pressure
 - Fire
 - Fumes
 - Falls
 - Chemicals

(WPF) #13 SCHEDULES

- **Contract Schedules**

- Ž Master Schedule

- Ž Main Events Schedule

- Ž Shop Manufacturing Schedule

- Ž Module Blast/Coat Schedule

- **Hull Erectors Schedule**

- Ž Launching Schedule

- Docking Schedule

- Ž Outfitting Schedule

- Ž Trials Schedule

- Delivery Schedule

- Most Important but least significant amount of work

FIVE STAGES OF NEW SHIP CONSTRUCTION

1. Management Planning (Design Plan)
2. Pre-Construction Planning and Operations
3. Assembly
4. Block Level Operations
5. Zone Level Operations

CONSTRUCTION STAGE #1: MANAGEMENT PLANNING

- **Initiated by opportunity to bid (RFP)**
 - New Ship Construction
 - Repair Package
- **Involves**
 - Developing a Bid Work Plan
 - Determining Specifications
 - **Developing the cost**
 - Determining the methods for construction
 - Make/Buy decisions
- **Results in**
 - Cost-effective competitive bid
 - Hull erection plan providing known efficiency opportunity parameters
 - Work plan to follow when contract awarded

CONSTRUCTION STAGE #2: PRE-CONSTRUCTION PLANNING AND OPERATIONS

- Initiated by contract award
- Involves
 - Work Planning refinements
 - Schedules (master through detail)
 - Project Planning
- Results in
 - Work Packages
 - Schedules detailed
 - Manpower planning
 - Material ordering & receipt
 - Raw materials preparation, coat, and storage
 - Accurate/Appropriate SP&C specifications
 - Optimum integration of trades and schedules to minimize interference requirements
 - Yard ready to operate
 - Shop fabrication of raw materials
 - Work commenced on schedule

CONSTRUCTION STAGE #3: ASSEMBLY LEVEL OPERATIONS

Ž Initiated by work package and short term schedules

Ž Involves

- Off-ship environment
- Yard/Shop joining fabricated parts
- Joining parts assemblies into subassemblies
- Meeting two week schedules
- Least handling
- Larger surfaces
- Use cost-effective Blast/Paint houses
- Easier access
- Most down hand painting

● Results in

- SP&C Assemblies ready for block level
- Surfaces protected to intermediate holding levels
- Some final materials coating
- Feedback to top management on meeting production rates and schedules

CONSTRUCTION STAGE #4: BLOCK LEVEL OPERATIONS

ŽInitiated by: Work packages and short term
schedules

•Involves

- Off ship environment
- Yard/Shop fabrication
- Joining assemblies into blocks
- Less easy access to SP&C work
- More disruption/interference
- More safety and equipment concerns by supervision
- Less down hand work
- Greater coordination between trades planners

ŽResults

- Greater percentage final outfitting and painting
- Greater potential for rework
- Feedback to top management on production rate and schedule performance

CONSTRUCTION STAGE #5: ZONE LEVEL OPERATIONS

- **Initiated by:** Work packages and short-term schedules
- **Involves**
 - On ship SP&C environment
 - Max disruption/interference
 - Max space preparation/cleanup
 - Max safety-requirements
 - Max equipment handling manually
 - Max restricted access
 - Max coordination
 - Final Coats
 - Touch up (Cosmetics)
 - Testing
 - Inspecting
 - Bottom wet
 - Trial schedules
 - Most rework intensive
 - Most costly SP&C work environment

R e s u l t s

- Ship ready for trials
- Ship ready for delivery
- Ship delivery area ready

MANAGEMENT PLANNING

- Purpose

- Ž Character sties

- Inputs

- Ž outputs

PLANNING CONSIDERATIONS

- In-Yard

- Primer coat
- Intermediate coat
- Final coat

- Ž On-Ship

- Final coat

APPLICABLE WORK PLANNING FACTORS

- 1.** Physical Description
- 4.** SP&C Specifications
- 5.** Time/Manpower
- 6.** Minimizing SP&C Rework
- 7.** Material
- 8.** SP&C Equipment
- 9.** Handling and Storage
- 10.** Inspection
- 13.** Schedules

PLANNING CORE FIVE

Ž Main Event schedule

Ž Shop Manufacturing schedule

- Hull Erection schedule

- Outfitting schedule

Ž Compartment Completion schedule

- 60% of SP&C completed prior to erection
- 90% of blasting should be complete

MANAGEMENT PLANNING

WORKSHOP

**PRECONSTRUCTION
PLANNING AND OPERATIONS**

APPLICABLE WORK PLANNING FACTORS

1. Physical Description
2. Location
3. support
4. SP&C Specifications
5. Time/Manpower
6. Minimizing SP&C Rework
7. Material
8. SP&C Equipment
9. Handling and Storage
10. Inspection
11. Disruption/Interference
13. Schedules

THREE SPECIAL CONSIDERATIONS

I. SAFETY CONDITIONS AND GAS CHEMISTRY

SAFETY PLANNING

EXERCISE

THREE SPECIAL CONSIDERATIONS

II. SHIFT CHANGE COMMUNICATION AND COORDINATION

**SHIFT CHANGE COMMUNICATION
AND
COORDINATION EXERCISE**

THREE SPECIAL CONSIDERATIONS

III. WORKER QUALIFICATIONS

WORKER QUALIFICATIONS
EXERCISE

CONSTRUCTION #3

ASSEMBLY LEVEL OPERATIONS

CONSTRUCTION STAGE #3

ASSEMBLY LEVEL OPERATIONS

EXERCISE

CONSTRUCTION STAGE #4

BLOCK LEVEL OPERATIONS

CONSTRUCTION STAGE #4

BLOCK LEVEL OPERATIONS

EXERCISE

CONSTRUCTION STAGE #5

ZONE LEVEL OPERATIONS

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CONSTRUCTION STAGE #5

ZONE LEVEL OPERATIONS

EXERCISE

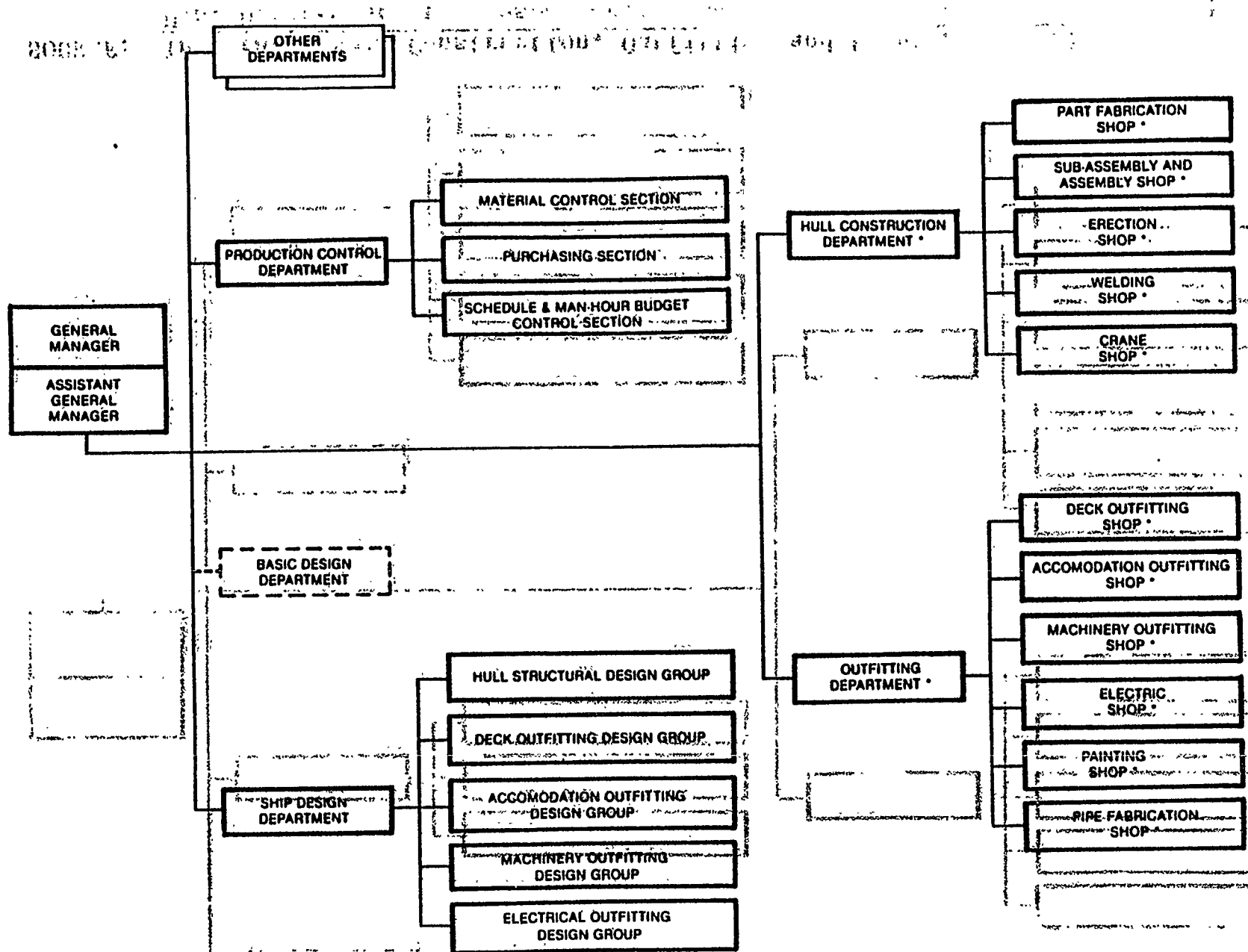
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SP&C WORK PLANNING

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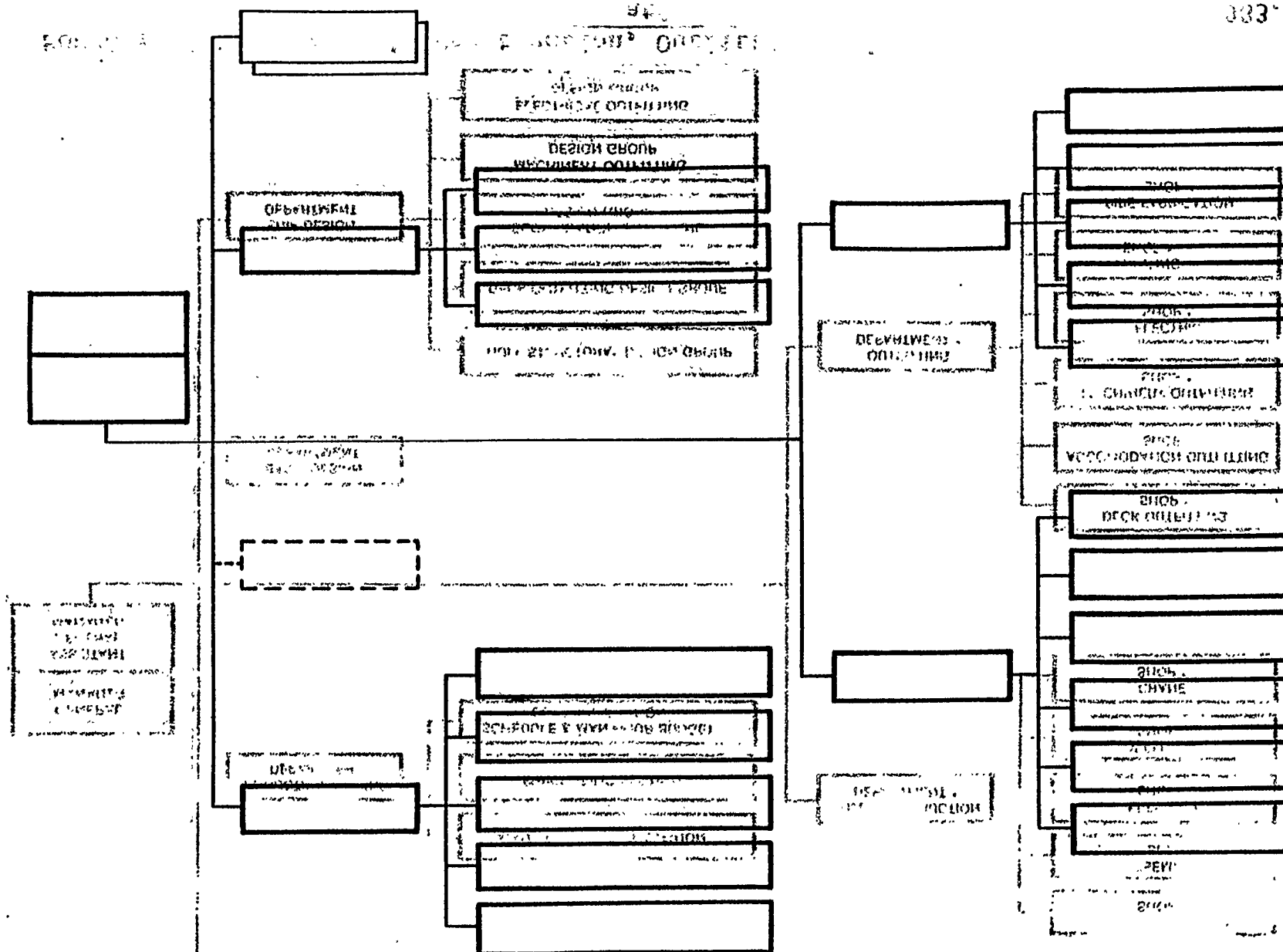
EXAMPLE SHIPYARD ORGANIZATION



SOURCE: Integrated Hull Construction, Outfitting and Painting (IHOP), p.6;
U.S. Department of Transportation, Maritime Administration, May, 1983.

SHIPYARD ORGANIZATION CHART FOR ADAPTATION

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