



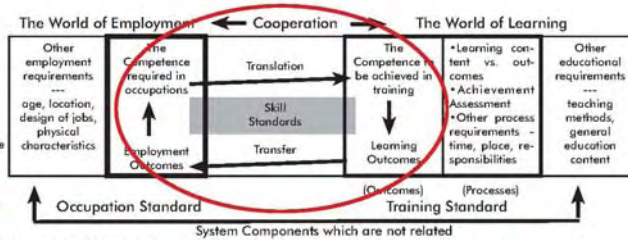
Project on Workforce Preparation Improvement

October 2006 Update
Crosscut Initiatives Panel Project
April-Dec 2006

Workforce Preparation Improvements

A National Shipbuilding Research Program project (www.nsrp.org). Project work is focused on tools and improved cooperation between the worlds of employment and learning shown in the figure.

Skill Standards Conceptual Framework: Bridge between learning and employment



STEP 1: RESEARCH AND TEAM WITH WEB-BASED SKILL INVENTORY AND MANAGEMENT FIRM(S)

- Step 1 Goal: find a system(s) to house:
- shipbuilding core/basic skill inventory
 - individual's assessments to skill standards
 - skill gap closure tools catalog
 - individual and team skill management tools



STEP 2: ADAPT NSRP AND MSSC CORE SKILL STANDARDS TO THE WEB-BASED SYSTEM

- Step 2 Goal: extract representative core or entry level skill standards from NSRP & MSSC databases
- description of work required
 - knowledge, skill, ability required to do the work
 - criteria for proper completion of work
 - recommended written and/or practical assessment procedures



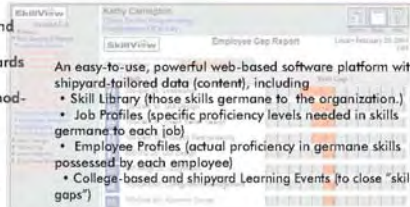
STEP 3: RECRUIT & SURVEY SHIPYARD-COMMUNITY COLLEGE TEAMS INTERESTED IN IMPROVING ENTRY AND INCUMBENT WORKER SKILLS.

- Step 3 Goal: Identify needs and resources
- Shipyards validate basic/core skill standards
 - Shipyards share entry level expectations and reveal incumbent worker skill gaps
 - Colleges identify courses or modules that may help close skill gaps
 - Shipyards identify learning examples to make college courses more relevant
 - Colleges identify educational and learning tools to help in-company training

- Possible teams:
- Electric Boat Quonset/ SENESCO - CCRI
 - NG Newport News - Tidewater CC
 - Alaska Ship & Drydock - UofA Ketchikan
 - Gulf Coast Team(s)
 - San Diego or Seattle Teams
 - Others to be identified

STEP 4: INTEGRATE NEEDS, RESOURCES AND SKILL INVENTORY & MANAGEMENT TOOLS INTO A PILOT SYSTEM THAT SERVES ONE OR MORE SHIPYARD-COLLEGE TEAMS.

- Step 4 Goal: Design workforce preparation improvement system model using web-based enabling technology.
- Representative inventory of employees and their core skills
 - Skill assessment to NSRP or MSSC standards
 - Management visibility of skill gaps
 - Menu of community college courses or modules to close skill gaps
 - Menu of shipyard courses or modules to close skill gaps
 - Best practices for college and shipyard instructors and for structured on-the-job learning



STEP 5: DEMONSTRATION AND REFINEMENT OF MODEL AT A SHIPYARD-COLLEGE SITE.

- Step 5 Goal: Demonstrate and optimize
- Web-based and other tools for shipyard-college cooperation
 - Methods and tools to determine what shipyards and shipyard workers need to know
 - Methods and tools to assess current skill levels and determine gaps
 - Methods and tools to close skill gaps for entry-level job seekers and incumbent shipyard workers.



Workforce Preparation Improvements: web-based tools and cooperation between shipyard and colleges to identify required skills, evaluate people to identify gaps, close gaps in learning events such as classrooms, learning labs, self study, and on-the-job training.

Invitation

- Team with web-based skill inventory & management firm – SkillsNET Corporation
- Adapt NSRP & MSSC core skill standards
- Shipyard-college teams
- Integrate needs, resources, skill inventory & management tools into a pilot project
- Demonstrate and refine model at a shipyard-college site

SkillsNET[®]

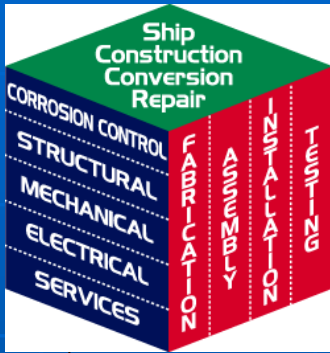
*“Standardizing the
Language of Work”[™]*



Shipyard-College Teams

- Team East:
 - Northrop Grumman Newport News, Bob Leber Robert.Leber@ngc.com ; Tidewater Community College, Barbara Murray, tcmurrb@tcc.edu
 - Atlantic Marine, Larry Hickey, LHickey@atlanticmarine.com (please invite key college contacts)
 - Electric Boat: Pat Bullard, pbullard@ebmail.gdeb.com, Fred Pendlebury, fpendleb@ebmail.gdeb.com (please invite key college contacts)
- Team Gulf:
 - Northrop Grumman Ship Systems: Larry Crane larry.crane@NGC.COM, Mark Scott, Mark.Scott@ngc.com , Dave Cobb, d.cobb@ngc.com (please invite key college contacts)
 - Bender Shipbuilding: Dale Jermyn (has two e-mails), Jerm@bendership.com, wdjermyn@newhorizonfinancial.net; Dawn Wilson, DAWN@bendership.com (please invite key college colleagues)
- Team West
 - Alaska Ship & Drydock, Doug Ward, dward@akship.com; University of Alaska Southeast Ketchikan, Cathy Lecompte, cathy.lecompte@uas.alaska.edu; Alaska Dept. of Labor and Workforce Development, AVTEC, Fred Esposito, fred_esposito@labor.state.ak.us
 - Todd Pacific Shipyard, Chris Marletti, Chris.Marletti@toddpacific.com , John Nelson, John.Nelson@toddpacific.com; Renton Technical College, Beth Arman, barman@rtc.ctc.edu
 - BAE Ship Repair, Donn Yover, YoverD@swmarine.com
 - NASSCO, Valerie Houlihan, vhouliha@nassco.com
- Crosscut Panel Team
 - SENESCO Marine – Larry Gebhardt (and Crosscut Chair), lpgbhardt@cablone.net
 - Tradesmen International Don Bewley, (and Crosscut Vice Chair) don.bewley@tradesmeninternational.com
 - Crosscut consultant – Les Hansen LHansen119@aol.com
 - MSSC colleagues – Cathy Clayton, Indiana LIFT (to be submitted), ; Leo Reddy, MSSC, Leoreddy@aol.com

Matrix of Shipbuilding & Repair Skill Standards



	FABRICATION	ASSEMBLY	INSTALLATION	TESTING
Structural				
	Cutting, Bending and Flanging Pipe	Assembling a Structure on the Panel Line	Installing Outfitting Items on Modules	Testing Piping Systems
	Marking, Cutting, Beveling Plates and Profiles		Installing Pipe Assemblies on Block/Module	Testing Tank/Compartment Tightness Testing
	Bending and Shaping Plates and Profiles	Joining Pipe/Assemblies	Installing Pipe Assemblies on Ship	
			Erecting a Module on Board	
Mechanical				
	Machining Precision Parts	Fitting Machinery to Foundations	Installing Machinery/Equipment on Ship	Testing Ship's Systems
Electrical				
	Calibrating Instruments	Assembling Connector Plugs to Cables	Wiring and Connecting on Block/Module	Testing Circuit/Component and Systems
			Pulling Cable and Connecting on Ship	
			Installing Wave Guides	

Matrix of Skill Standards

	FABRICATION	ASSEMBLY	INSTALLATION	TESTING
Services				
		Aligning Blocks Using Accuracy Control Measures	Moving an Onboard Load	Conducting Non-Destructive Testing
		Erecting Staging in Assembly Areas	Erecting Staging on a Ship Interior/Exterior	Testing On-Board Hoisting Equipment
		Constructing Blocking and Shoring Support		
		Mooring a Ship to a Pier		
		Constructing Keel Blocks		
		Moving a Structural Assembly by Crane		
Corrosion Control				
	Applying Pre-Construction Primer on Plates and Shapes	Prepping and Painting a Unit/Block/Module	Prepping and Painting an Exterior Hull	Inspecting Paint Coatings
		Prepping and Painting Pipe	Prepping and Painting Tanks	
		Prepping and Painting Anchor Chain		

Focus for pilot

- Shipfitter and related jobs
 - Work in fabrication, assembly, repair
 - Synthesizes multiple skills
 - Pathway to supervision & leadership

Bridge: Work-Learning

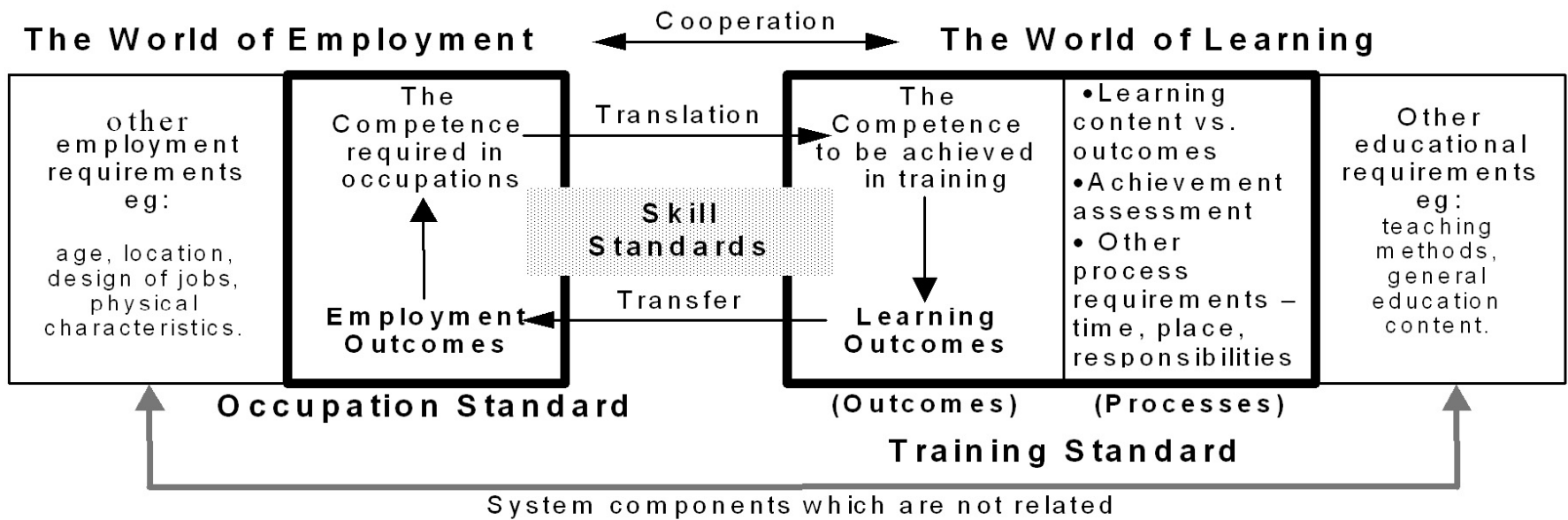


Figure : Skills Standards Conceptual Framework

MSSC & Work Keys



MSSC Assessment

MSSC certification is designed to validate that any individual with the certification has both the technical as well as employability and academic skills needed to work in modern manufacturing. Rigorous assessment is part of the fabric of MSSC to ensure the integrity of the certification. Certification covers MSSC's four core competency areas: Manufacturing Processes and Production, Maintenance Awareness, Quality and Continuous Improvement, and Safety. Each area is addressed with a separate assessment.



MSSC training and assessment address the need for employability and academic skills as well as technical skills. The assessments require mastery of core knowledge and skills that are essential for high performance manufacturing:

Employability Skills

- Problem Solving
- Decision Making
- Teamwork
- Organization and Planning
- Social Interaction
- Adaptability
- Leadership
- Consensus Building
- Career Awareness and Self-Development

Academic Skills

- Math
- Science
- Reading
- Writing
- Listening
- Speaking
- Computer
- Gathering and Analyzing Information

Once training is completed, participants may take the assessment for that topic. Following assessment, a Certificate of Recognition is provided. All four key assessments must be passed in order to achieve the Production Technician certification. Should a participant not pass one of the assessments, they may re-take the assessment.



MSSC Assessments

Manufacturing Processes and Production

- Awareness of customer needs
- Resources for production processes
- Equipment modes & set up
- Equipment monitoring
- Inspection to meet specs
- Product / process documentation
- Product preparation for shipping
- Machine automation
- Electrical principles
- Mechanical principles
- Pneumatic pressure and flow
- Bearings & couplings
- Belt and chain drives

Maintenance Awareness

- Preventive maintenance
- Routine repair
- Indicator monitoring
- Equipment maintenance training
- Maintenance of production schedule
- Analysis of breakdowns
- Alignment checks
- Lubrications and coolants
- Blueprint reading
- Circuit analysis
- Tool maintenance
- Preventive actions
- Corrective actions
- Verification and documentations

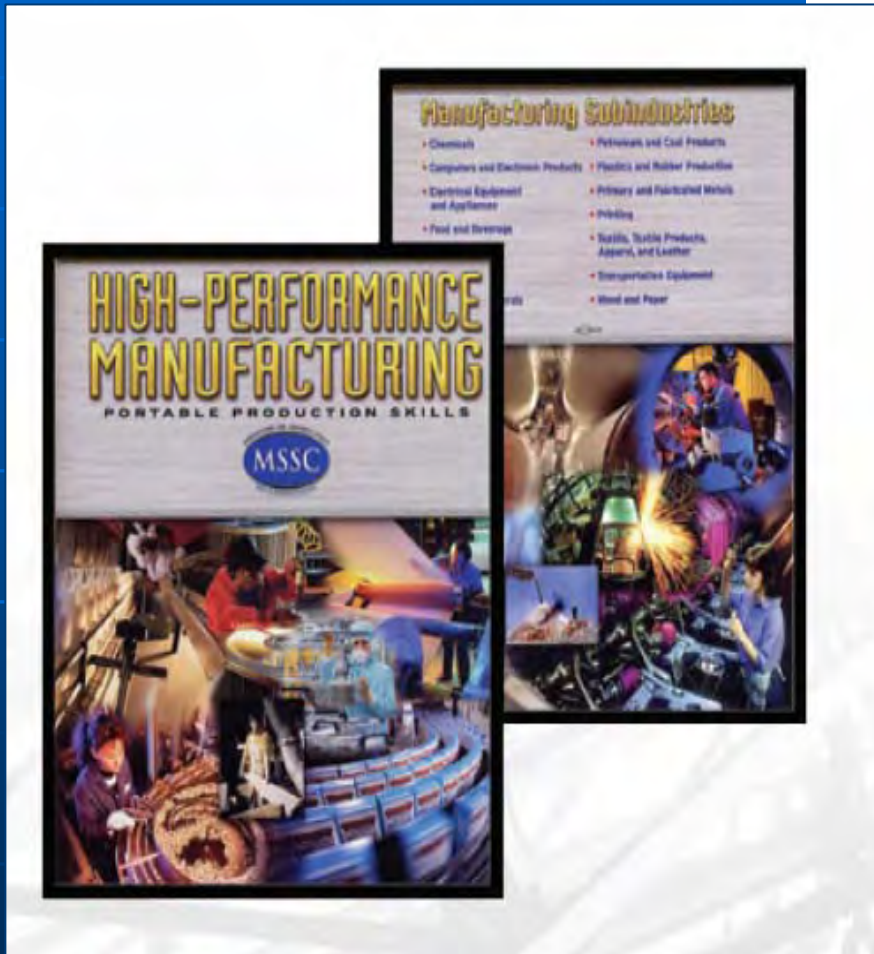
Quality and Continuous Improvement

- Internal quality audits
- Calibration of data collection equipment
- Continuous improvement
- Quality test documentation
- Quality maintenance adjustments
- Communication of quality problems
- Corrective actions
- Recording of process outcomes
- Quality training
- Closed-loop correction action
- Introduction to SPC

Safety

- Creation of a safe workplace
- Environmental safety inspections
- Emergency drills
- Correction of unsafe conditions
- Safety orientation training
- Safety equipment use
- Work environment safety
- Safety-related maintenance
- Equipment monitoring for safety
- Operator safety
- Communication of safety problems

Curriculum Samples



Shipfitter Student Guide

Compiled by:

Larry Gebhardt & Bruce Cresser

This booklet contains

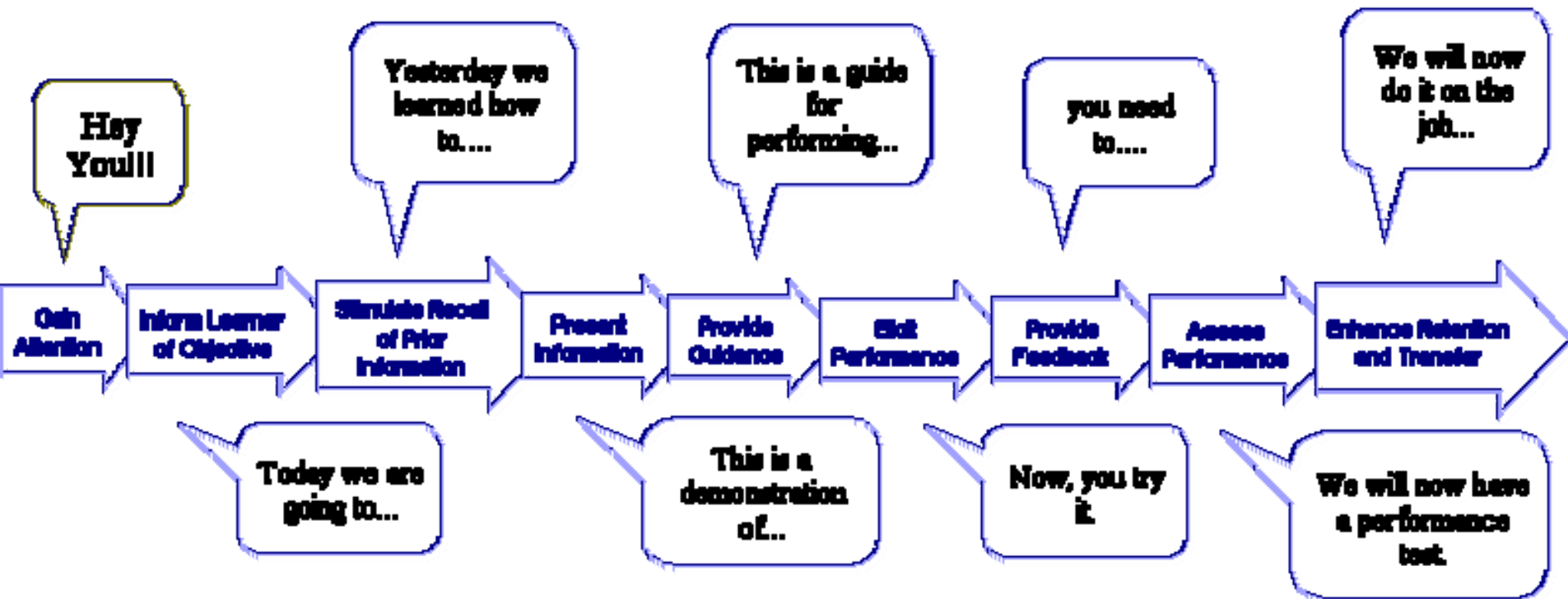
Introduction to shipfitting
Safety
T-1 Tack Welding
Burning for the shipfitter
Ship nomenclature
Using shipfitting aids
Learning guides and practice outlines
Shipfitter math

Shipfitting Technology

- Understand work orders, part marking & careful layout
- Assemble precision cut parts and subassemblies
- Attach outfitting items in specific locations
- Manual and laser measurement
- Trimming and adjustment techniques for fit-up
- Jigs and fixtures
- Careful handling
- Result: accurate 3-dimensional structure



Instruction Delivery



Theory & Principles ... Practice ... Competent Application

What part best delivered in classroom

What part best delivered in learning lab

What part best delivered in structured on-the-job learning

Step 2 Goal: extract representative core or entry level skill standards from NSRP & MSSC databases

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- criteria for proper completion of work
- recommended written and/or practical assessment procedures

SkillObject Definitions

Components/Parts of the SkillObject

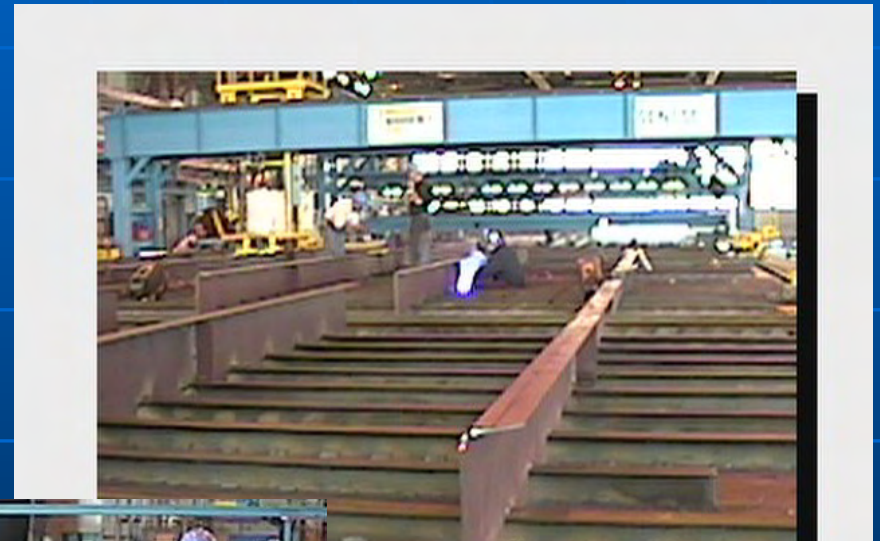
- A label or name
- Tasks
- Enabling Skills/Abilities
- Tools/software/equipment/devices
- Unique Knowledge
- Resources
- Performance Standards



SkillObject's are legally defensible, precise work descriptors that meet specific business needs

Panel Line - Subassemblies

- Panel line station
- Make panel blanket
- Add stiffeners
- Add flange frames or webs
- Begin modular outfitting
- Accuracy & quality throughout



Knowledge, Skills and Abilities I

Job/Work Orders

- 1 Ability to read and interpret Job Orders*
- 2 Ability to determine references*
- 3 Ability to determine assist crafts and codes*
- 4 Ability to read and interpret job material lists*
- 5 Knowledge of approved abbreviations/acronyms*
- 6 Ability to determine personnel requirements*
- 7 Ability to read and interpret schedules and related references*

Knowledge, Skills and Abilities II

Blue Prints, Sketches, Schematics, and Diagrams

- 1 Knowledge of the content of different types of blue prints*
- 2 Knowledge of blue print layout*
- 3 Knowledge of different views*
- 4 Knowledge of blue print symbols*
- 5 Knowledge of terminology*
- 6 Knowledge of different line values*
- 7 Ability to read scales*
- 8 Ability to identify dimensions*
- 9 Ability to identify finishes, tolerances and allowances*
- 10 Ability to cross reference drawings*
- 11 Ability to identify material requirements*
- 12 Ability to identify parts by name and number*
- 13 Ability to make working sketches*

Knowledge, Skills and Abilities III

Technical Manuals

- 1 Ability to determine operating parameters*
- 2 Ability to determine assembly and disassembly procedures*
- 3 Ability to determine operating sequences*
- 4 Ability to determine equipment specifications*

Ship construction, compartmentation, and terminology

- 1 Knowledge of the shipboard terms for direction and location*
- 2 Knowledge of the designations for decks and platforms*
- 3 Knowledge of the system for compartment identification*
- 4 Knowledge of ship reference lines and reference points*
- 5 Ability to find designated locations on ships*
- 6 Knowledge of names for major features and spaces*

Knowledge, Skills and Abilities IV

Mathematics

- 1 Ability to add, subtract, multiply and divide whole numbers fractions and decimals*
- 2 Ability to convert between whole numbers, decimals, and fractions*
- 3 Ability to solve linear equations in one unknown*
- 4 Ability to use geometry/trigonometry to solve for sides, area, angles and volumes*
- 5 Ability to identify the parts of a circle (radius, diameter, arcs, chords, center, circumference)*
- 6 Ability to calculate dimensions by using a combination of partial measurements*
- 7 Ability to calculate weight using dimensions and unit mass*
- 8 Ability to convert between English and metric measurement*
- 9 Ability to apply trade related formulas*

Linear Measurement

- 1 Knowledge of the accuracy of linear measurement instruments*
- 2 Knowledge of the applications of linear measurement instruments*
- 3 Knowledge of allowable substitutions*
- 4 Knowledge of instrument handling and storage*
- 5 Knowledge of calibration requirements*
- 6 Knowledge of environmental effects on instruments*
- 7 Ability to take measurements properly*
- 8 Ability to read scales*

Knowledge, Skills and Abilities V

Angular Measurement

- 1 Knowledge of the accuracy of angular measurement instruments*
- 2 Knowledge of the applications of angular measurement instruments*
- 3 Knowledge of allowable substitutions*
- 4 Knowledge of instrument handling and storage*
- 5 Knowledge of calibration requirements*
- 6 Knowledge of environmental effects on instruments*
- 7 Ability to take measurements properly*
- 8 Ability to read scales*

Level, Vertical, Position Measurement

- 1 Knowledge of the accuracy of devices for level, vertical, and platform position determination*
- 2 Knowledge of the application of devices for level, vertical, and platform position determination*
- 3 Knowledge of allowable substitutions*
- 4 Knowledge of instrument handling and storage*
- 5 Knowledge of calibration requirements*
- 6 Knowledge of environmental effects on instruments*
- 7 Ability to take measurements properly*
- 8 Ability to read scales*

Knowledge, Skills and Abilities VI

Safe Working Environment

- 1 Knowledge of shipyard policies and regulations to maintain a safe working environment*
- 2 Knowledge of the shipyard safety organization*
- 3 Knowledge of to whom to report unsafe working conditions*
- 4 Ability to recognize potential hazards/unsafe working conditions*
- 5 Ability to maintain a clean working environment*
- 6 Ability to dispose of scrap materials other than hazardous materials*
- 7 Ability to correct unsafe working conditions*

Personal Protective Equipment (other than respirators)

- 1 Knowledge of shipyard policies and regulations concerning the use of PPE*
- 2 Knowledge of the functions of PPE*
- 3 Knowledge of the limitations of different types of PPE*
- 4 Knowledge of where and when specific PPE is required*
- 5 Ability to select the appropriate PPE for the job*
- 6 Ability to properly use and maintain PPE*

Knowledge, Skills and Abilities VII

Gas Free and Hot work

- 1 Knowledge of shipyard policy and regulations relating to gas free certification and performing hot work*
- 2 Knowledge of the requirements for gas free certification of spaces*
- 3 Knowledge of the requirements relating to performing hot work aboard ship*
- 4 Knowledge of what activities constitute "hot work"*
- 5 Knowledge of the potential hazards associated with confined spaces*
- 6 Knowledge of the requirements for posting fire watches*
- 7 Knowledge of the responsibilities of fire watches*
- 8 Knowledge of the safety related responsibilities of the person performing hot work*
- 9 Knowledge of the posting requirements for gas free and hot work certification*
- 10 Knowledge of combustible and flammable material*
- 11 Ability to read and understand a gas free/hot work certificate*
- 12 Ability to determine ventilation requirements for confined spaces*

Manual Lifting & Ergonomics

- 1 Knowledge of the dangers associated with improper lifting techniques*
- 2 Knowledge of the shipyard limitations on manual lifting*
- 3 Ability to properly lift an object*
- 4 Ability to perform stretch/flex exercises and lifting technique*

Knowledge, Skills and Abilities VIII

Welding and Burning

- 1 *Knowledge of symbols used to describe weld joints and brazed joints*
- 2 *Knowledge of weld limitations and procedures associated with different metals*
- 3 *Knowledge of the distortion of metals which may result from welding.*
- 4 *Knowledge of the sequences used in welding joints, pipes and structures.*
- 5 *Ability to perform tack-welding*
- 6 *Knowledge of oxy-fuel cutting procedures*

Welding (welders)

- 1 *Ability to weld using various welding processes and welding machines*
- 2 *Ability to perform preventive maintenance on welding equipment*
- 3 *Also see KSAs 10500.18000-18600 , and 63100-63650*

Rigging

- 1 *Knowledge of crane/rigging terminology.*
- 2 *Knowledge of weights and measures*
- 3 *Knowledge of the manner in which weight lifting equipments operate*
- 4 *Knowledge of the types and functions of rigging gear*
- 5 *Knowledge of appropriate lifting procedures and techniques*
- 6 *Ability to calculate weights*
- 7 *Ability to determine the load capacity of rigging equipment.*
- 8 *Knowledge of rigging equipment inspection requirements*
- 9 *Knowledge of shipboard padeyes (std), capabilities and configurations*
- 10 *Knowledge of the appropriate hand signals when directing crane operators to correct location and orientation of work pieces*

Knowledge, Skills and Abilities IX

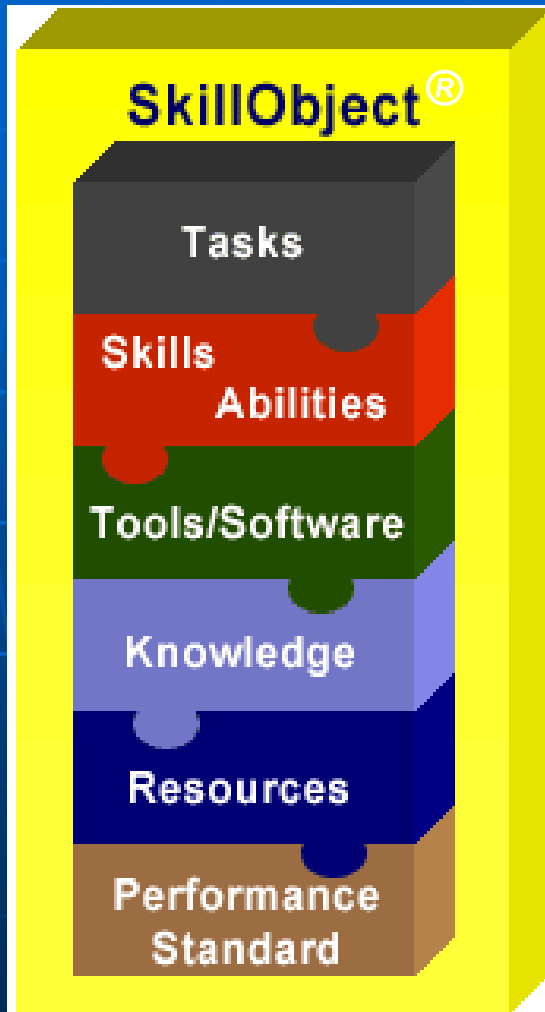
Location and Orientation (Structural)

- 1 Knowledge of ship's framing*
- 2 Ability to locate ship's reference lines and points*
- 3 Ability to use sketches, blueprints and other technical information to determine the correct location for a structure*
- 4 Ability to accurately translate positions between the reference point and desired location*
- 5 Ability to achieve structure orientation relative to hull and deck contour, e.g., sheer, camber*
- 6 Ability to scribe structures for orientation of hull and deck contour camber*
- 7 Ability to compensate structure orientation for ship orientation, e.g., list, trim*

Workplace Skills

- 1 Ability to listen and comprehend the job assignment*
- 2 Ability to express oneself technically*
- 3 Ability to perform with minimum supervision*
- 4 Ability to share information and please the customer*
- 5 Ability to read and follow written directions*

SkillObject Example



Example SkillObject Data

Shipfitter - Fabrication

Build Panel on Panel Line

S=Management of Material Resources
A=Measurement

Rigging, Welding Equipment

Measurement instrument accuracy

Panel Line Technical manuals

Accurate placement of all parts

-- Also includes normative survey data (not shown)

Advantages of Linking to O*NET

Enabling Skill Categories	Enabling Ability Categories
<p>Content Skills</p> <p>Process Skills</p> <p>Social Skills</p> <p>Complex Problem Solving Skills</p> <p>Technical Skills</p> <p>Systems Skills</p> <p>Resource Management Skills</p>	<p>Verbal Abilities</p> <p>Idea Generation and Reasoning Abilities</p> <p>Quantitative Abilities</p> <p>Memory Abilities</p> <p>Perceptual Abilities</p> <p>Spatial Abilities</p> <p>Attentiveness Abilities</p> <p>Fine Manipulative Abilities</p> <p>Control Movement Abilities</p> <p>Reaction Time Abilities</p> <p>Physical Strength Abilities</p> <p>Endurance Abilities</p> <p>Flexibility, Balance, and Coordination Abilities</p> <p>Visual Abilities</p> <p>Auditory and Speech Abilities</p>

SkillsNET Access

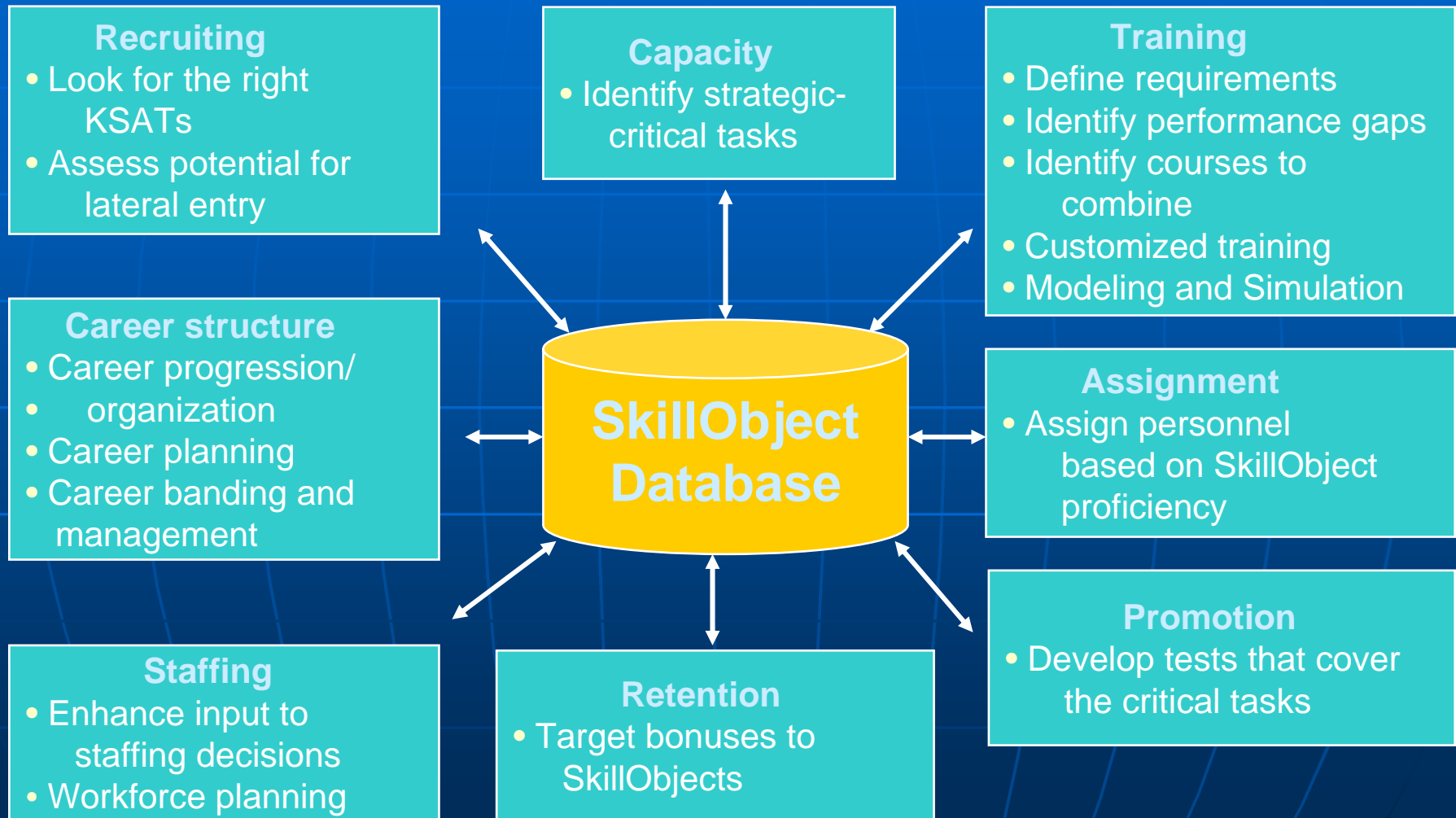
- Strategic Task Analysis Representative (STAR) assignment:
- Your talent is requested for profiling your job utilizing an innovative job profiling system. This assignment requires your knowledge and expertise on the work you perform. As the STAR you`ll review an existing job task list provided from the SkillObject(tm) Library and:
 - - Select appropriate Generalized Work Activities (GWA`s)
 - - Add new tasks that you know are missing from the list.
 -
- This process requires about four to six (4-6) hours. This profile provides a job description for screening new employees and career development. Your contribution will significantly impact workforce development.
- The job profiling system automatically generated the following User ID and Password:
 - User ID: lgebhardt
 - Password: lg8393
 -
- Access the job profiling system at: <http://www.SkillsProfiler.com/user/>
- Thank you for sharing your expertise.

- SkillsNET Code: L316699

SkillObjects make up the *DNA* of your organization



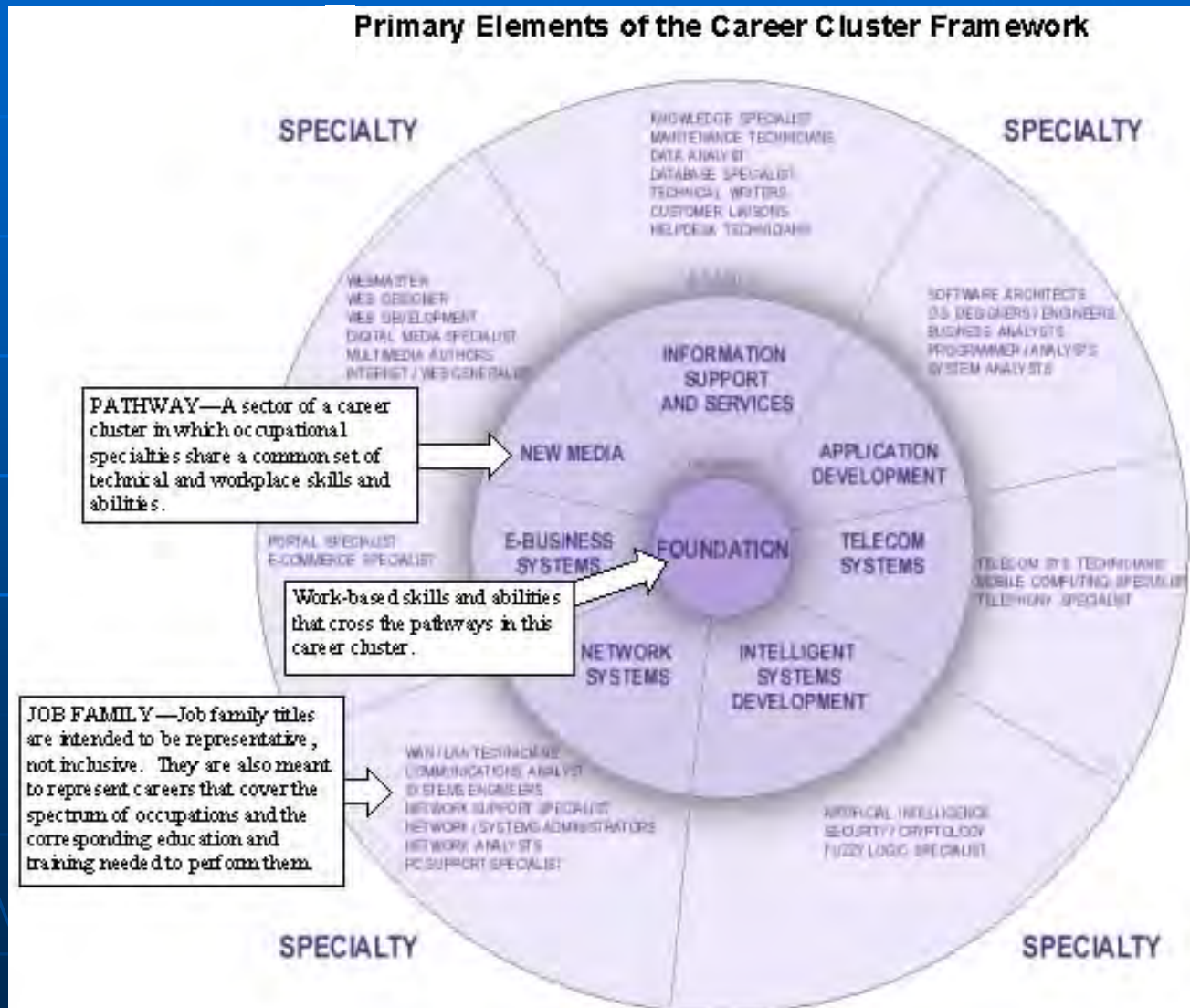
Strategic Applications of the Data



- **Competency based pay;**
- **Employee empowered development through IDPs**

Strategic Applications of the Data

Primary Elements of the Career Cluster Framework



Step 3 Goal: Identify needs and resources

- Shipyards validate basic/core skill standards
- Shipyards share entry level expectations and reveal incumbent worker skill gaps
- Colleges identify courses or modules that may help close skill gaps
- Shipyards identify learning examples to make college courses more relevant
- Colleges identify educational and learning tools to help in-company training



Work & Training Aids

	Document Type: STANDARD SERVICE MODULE	Document No.: 134-106-001	Date: 12/05/05	Location: J:\Lean\SSM library
Centrifugal Pump Overhaul		Replaces: N/A	Revision Date: N/A	134
Repair Department	Trade Manager	Production Manager		
	Jon Nygard	George Robertson		

II. DISASSEMBLY	No. of Personnel: One or two depending on pump size	Est. Hours
<p>SAFETY ISSUES: If at any time during the performance of these operations, it is deemed that the safety of any individual is at risk, or there is a possibility of damaging property or equipment, the operation will be stopped until corrective safety measures have been taken.</p> <ul style="list-style-type: none"> Emergencies may be reported via channel two on a two-way radio or by dialing extension 292 from any yard phone. IAW Todd Pacific Shipyards, "Safetygrams", dated 10/27/2005, hearing protection shall be worn whenever the noise level exceeds 85 decibels. Rule of thumb: If you have to speak above your normal tone of voice, hearing protection is required for yourself as well as for those working in the area around you. For information regarding hazardous chemicals, refer to the web site of the product in question. In accordance with OSHA regulations, manufacturers of hazardous chemicals are required to furnish a MSDS for each hazardous product they produce. 		

Qty.	Nomenclature	Qty.	Nomenclature	Qty.
1	Dial indicator	1	Screwdriver, flat tip	Var. sizes
1	Micrometer, inside	1	Punch, pin	1 roll
1	Micrometer, outside	1	Hammer, ball peen	1
1	Feeler gauge set, standard	1	Brass drift, 1" diameter	1
1	Scribe	1	Flashlight	1/2 bundle
1	Tape measure	1	Gear puller	3 cans
1	Pliers, 440 channel locks	1	Press, hydraulic	1 can
1	Pliers, snap ring	2	Shaft stands	1
1	Ratchet, 1/2" drive	1	Crow bar	1 roll
1	Socket set, standard 1/2" drive	1	Eyebolt	1
1	Socket set, standard deep	2	Wedges, wooden	1
1	Wrench, 1" drive impact	2	Straps, nylon	2 sheets
1	Wrenches, 3/4" - 1-5/8" combo	4	Tags, metal parts	1
1	Wrench, crescent	1	Tags, Transportation move	1
1	Wrench set, standard allen	1 yd.	Plastic, sheets of	

	Document Type: STANDARD SERVICE MODULE	Document No.: 134-106-001	Date: 12/05/05	Location: J:\Lean\SSM library
Centrifugal Pump Overhaul		Replaces: N/A	Revision Date: N/A	134
Repair Department	Trade Manager	Production Manager		
	Jon Nygard	George Robertson		



Prior to disassembly of the pump, match mark the parts in different areas so the correct reassembly may be accomplished. Do not place match marks on critical surfaces such as machined surfaces. IAW SLP 7.5-2, Identification and Traceability, as the pump is being disassembled, tag each part, or place them in a bag or tote box affixed with an identification tag. At a minimum, each tag shall contain the vessel name, job and item number and part nomenclature.



Wipe the casings free from sludge, oil and dirt. Remove the bolts, except the two jacking bolts (circled) on each side, that fasten the upper and lower casing (Fig. 6A)

To split the casings, after the bolts are removed, simultaneously tighten both jacking bolts. An eyebolt may be installed on the cover to lift it off the case (Fig. 6B).

Caution: Do not attempt to lift the entire unit using an eyebolt.

Step # 2: REACTOR PREPARATION

Reactors are the apparatus we use to mix batches in. Before a new batch can be mixed, we need to make sure there is nothing left in the reactor such as residue from the previous batch that will contaminate the batch you are preparing to make.



OVERVIEW

1. Make a visual check of the reactor and agitator to look for grit and residual film from the previous batch. Then thoroughly rinse out the reactor with deionized (DI) water until the water is clear.
2. After the reactor and agitator are cleaned:
 - Check the sample valve to confirm the line is clear and that you have flow.
 - Position the temperature probe in the thermowell.
 - Set the cooling water valves and close the product drain valve.
 - Make sure the reactor manway is closed.
 - Open the reactor to the scrubber
 - Charge to the reactor based on the amount provided on the Batch Document
 - Start the agitator and set the specified speed
 - Turn on the nitrogen purge and heat the batch to the specified temperature.

SAFETY

1. Make sure the reactor is sealed properly with a pressure test after the reactor manway is closed.
2. Be sure to follow the documented Standard Operating Procedure (SOP) whenever you test the pressure in a reactor.

QUALITY

1. If the reactor water is not clear in the beginning, you risk contaminating the new batch with an incorrect particle size from residue from the previous batch.
2. Temperature is a critical element of the process. The temperature probe needs to be correctly positioned in the thermowell to get an accurate reading.
3. For some batches we produce we will purge the reactor with Nitrogen to remove all the air. If air is not removed from the reactor it will inhibit the process.

COMMUNICATIONS

1. Be sure to acknowledge completion of each step on the Batch Document.
2. Do not hesitate to ask your supervisor when you have questions. When people start guessing, we frequently end up ruining a batch.

Work & Training Aids



Step 4 Goal: Design workforce preparation improvement system model using web-based enabling technology.

- Representative inventory of employees and their core skills
- Skill assessment to NSRP or MSSC standards
- Management visibility of skill gaps
- Menu of community college courses or modules to close skill gaps
- Menu of shipyard courses or modules to close skill gaps
- Best practices for college and shipyard instructors and for structured on-the-job learning

Step 5 Goal: Demonstrate and optimize

- Web-based and other tools for shipyard-college cooperation
- Methods and tools to determine what shipyards and shipyard workers need to know
- Methods and tools to assess current skill levels and determine gaps
- Methods and tools to close skill gaps for entry-level job seekers and incumbent shipyard workers.