



Portable Weld Inspection Management System

Project No. S2059

**NSRP Welding
Technology Panel
Meeting**

April 5, 2006



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PWIMS will provide a quantitative, non-subjective weld inspection tool.



Project Number: S2059
Title: Portable Weld Inspection Management System (PWIMS)
Performing Activity: Center for Naval Shipbuilding Technology
Objective: Eliminate redundant inspections and unnecessary repair cycles; Enable recording of actual weld size to identify/reduce over-welding, and develop new weld size and inspection criteria based on fitness-for-service
Start / End Dates: Nov 04 – Jul 06
Project Cost:
ManTech Investment: \$369K
Cost Share: \$20K – Servo Robot providing WISC unit to BIW
Weapon System: DDG-51 and DD(X)

Performing Activities:

List the team members and their roles. Include:

- CNST
- PEO Ships
- Bath Iron Works–Project Lead/Implementing Organization
- ServoRobot – Manufacturer of Inspection Unit
- Edison Welding Institute – SPC Software Integrator

Technical Achievements:

- PWIMS Functional Specification Completed
- BIW Chief Welding Engineer and Level III VT Examiner Trained on WISC operation
- Prototype System Developed and in Field Trials
- Analysis Software Developed and Incorporated

Implementation:

System: DDG-51 and DD(X)
Site: Bath Iron Works
Schedule: Initial testing to begin in May/June 2005
Status: Slightly behind due to contracting issues, but starting to make up ground. Under budget at this point, no major technical issues noted.

Payoff:

- Elimination of redundant inspection – Done is done
- Elimination of “interpretation differences”
- Data could be used for fitness for purpose decisions

PWIMS Presentation Outline

- **Project Overview**

- Team Members, Issues, Objectives, Proposed Solution
- Funding, Budget/Expense, Milestones, Schedule

- **Project Tasks**

- 1.1 Functional Specification Development
- 1.2 System Integration and Testing
- 1.3 SPC Software Development
- 2.1 Field Trials
- 2.2 Demonstration
- 2.3 Final Report



PWIMS Presentation Outline

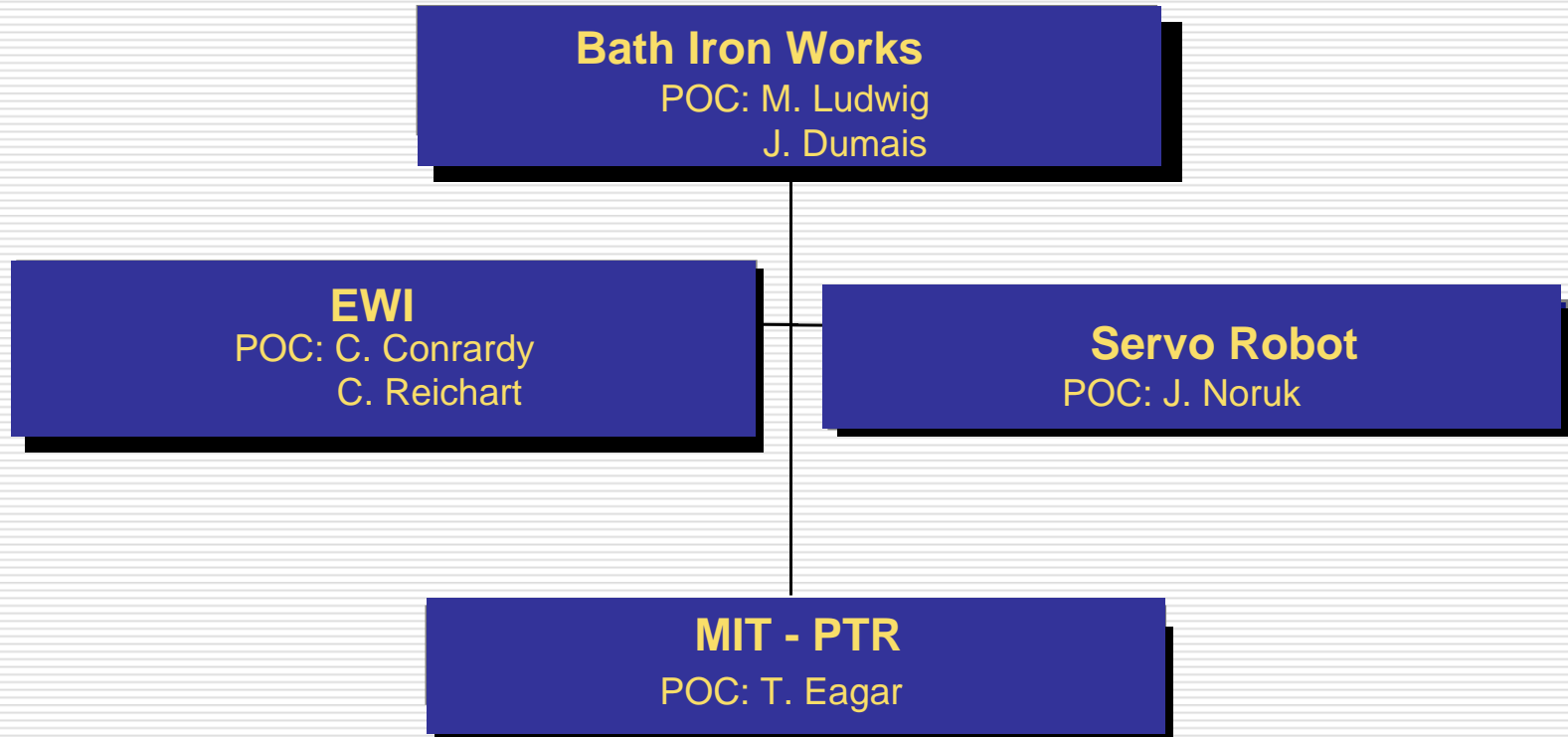
- **Tech Transfer Activity**
 - Presentations
 - NJC Teaching Factory
- **Potential Issues**
 - Software/Hardware
 - Size
 - Costs
- **Wrap Up**

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Project Team Members



Issue - Visual Inspection

- ❑ Visual inspection is tedious task. The inspector broadly evaluates the visual quality of a structure and then investigates areas which look suspicious.
- ❑ Each inspector has to 'interpret' what they see and evaluate it against a criteria.
- ❑ Human nature leads to different 'interpretations' of acceptability - which cause disruptions and delays.

Issue - Visual Inspection

- ❑ Arguing with a welding inspector is like wrestling with a pig in a mud hole
- ❑ Soon you realize the pig likes wrestling in the mud.

Issue Visual Inspection

- Analysis of Data:
 - Current manually created visual inspection forms not easily analyzed
 - Data manually entered into computer by clerk
 - Analysis done by QC Engineer later
 - No timely method to assess the health of either the welding processes or the inspection processes

PWIMS Objectives

- Project proposed to eliminate:
 - Conflicting interpretations of acceptability between BIW Trades and Inspectors and between BIW and SUPSHIP
 - Performance of redundant inspections based on new people performing inspections and finding something not found before
 - Inaccurate and manually processed SPC
 - No accurate method to assess the health of either the welding processes or the inspection processes

Proposed Solution

- Start with Servo Robot's WISC system
- Project will evaluate the effectiveness of this system in shipyard environment and modify system where possible



Proposed Solution

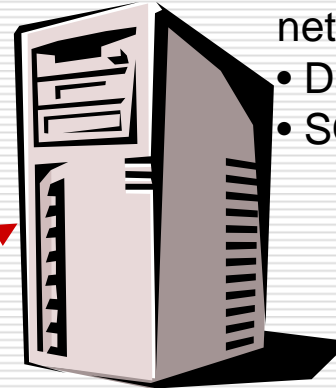


Desktop Computer:
(in WE or QC department)

- Set-up joint templates

Server Computer:
(anywhere on the network)

- Data repository
- SQL Server database



WISC - Palm
(used by the inspector)

- Select joint type, scan joint
- Enter location info



Tablet Computer:
(used by the inspector)

- Transfer inspection data
- Add additional info
- Add comments
- Upload to database

Desktop Computers:
(anywhere in the yard)

- Analyze results
- MS Access software





Project Funding



Funding	FY05	FY06	TOTAL
BIW	\$95.5K	\$52K	\$147K
EWI (Sub-Contract)	\$93.5K	\$51K	\$144K
Servo Robot (Sub-Contract)	\$50K	\$27K	\$77K
Total Man Tech Funding	\$239K	\$130K	\$369K
Industry Investment/Cost Share	\$20K	\$0K	\$20K
Total Project Value	\$259K	\$130K	\$389K

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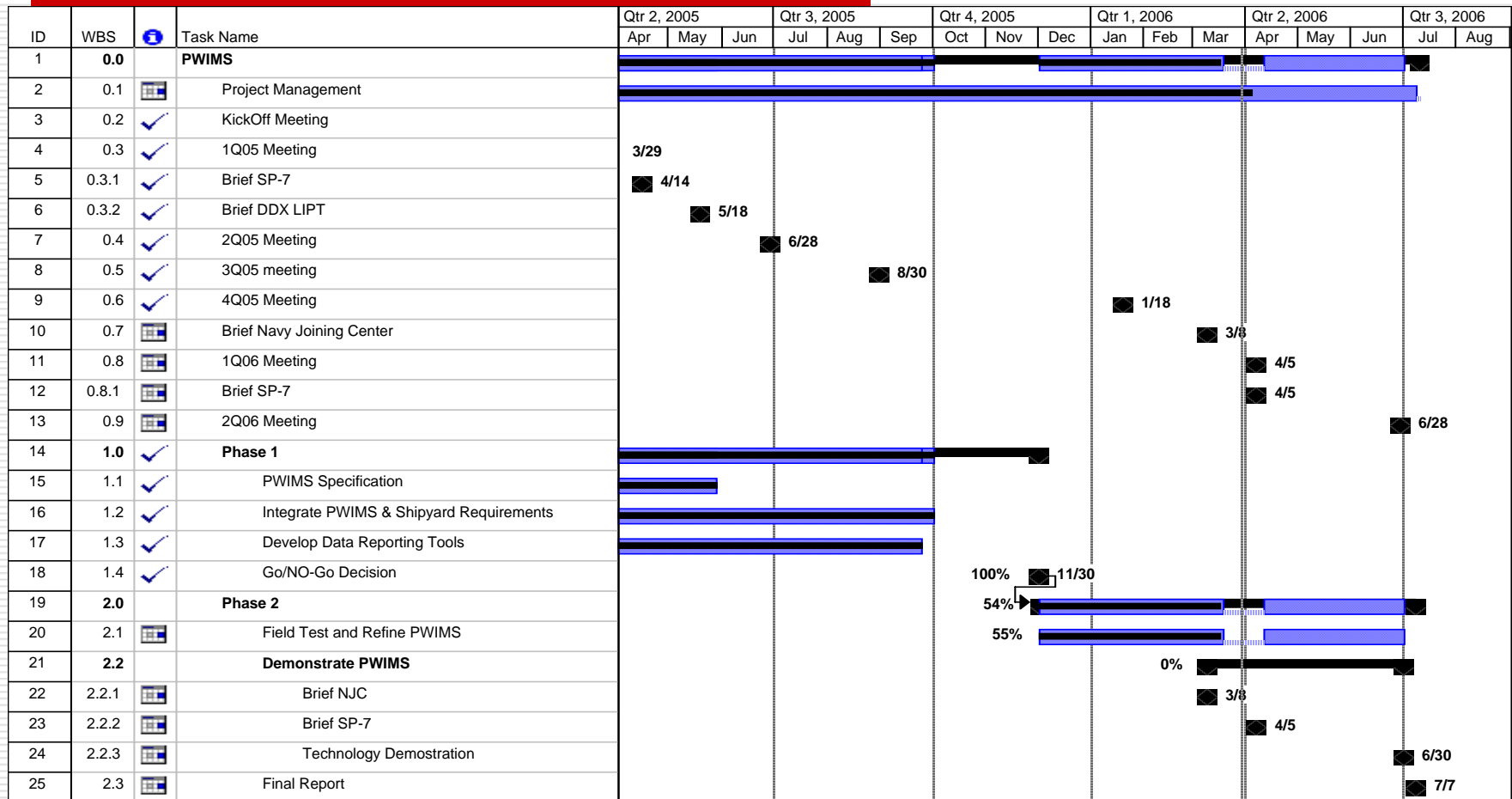
Milestones and Completion Criteria



	Milestone #	Completion Criteria	Metric for Go/No Go
Phase 1	Task 1.1	Specification Issued	Prototype PWIMS system meets Task 1.1
	Task 1.2	Prototype data collection subsystem complete	
	Task 1.3	Prototype analysis software complete	
Phase 2	Task 2.1	Field Test of PWIMS complete	On Hold pending repairs to unit
	Task 2.2	Hold Demo	
	Final Report	Report Issued	



Project Schedule



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PWIMS: Tasks Status

- Task 0
 - Project Kick Off Meeting held 1/19/05
 - 1st Quarter 05 Project Meeting held 3/29/05
 - 2nd Quarter 05 Project Meeting held
 - 3rd Quarter 05 Project Meeting held 3/29/05
 - 4th Quarter 05 Project Meeting held 3/29/05
 - 1st Quarter 06 Project Meeting held 04/04/06
- Task 1.1 Functional Specification
 - Complete
- Task 1.2 Integrate PWIMS
 - Servo Robot delivered initial WISC unit to BIW
 - BIW Level III VT Examiner trained in operation of WISC

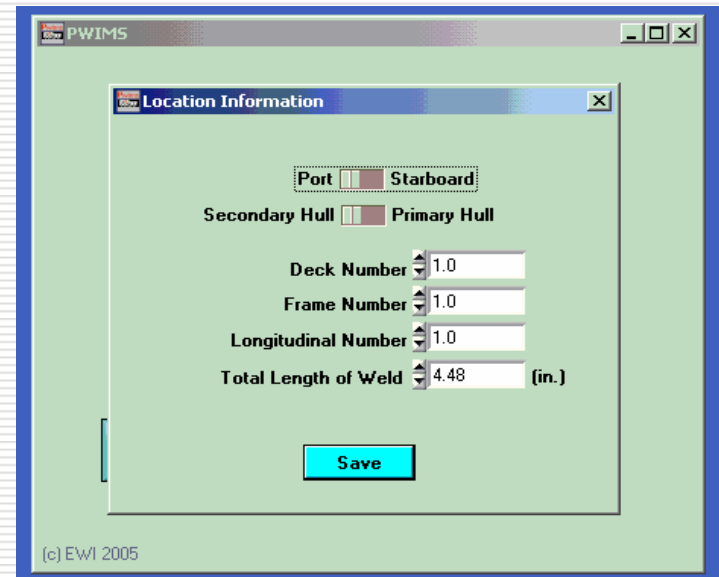
PWIMS: Tasks Status

- Task 1.3 Develop Data Analysis Tools
 - EWI developed data tools
 - Tablet PC



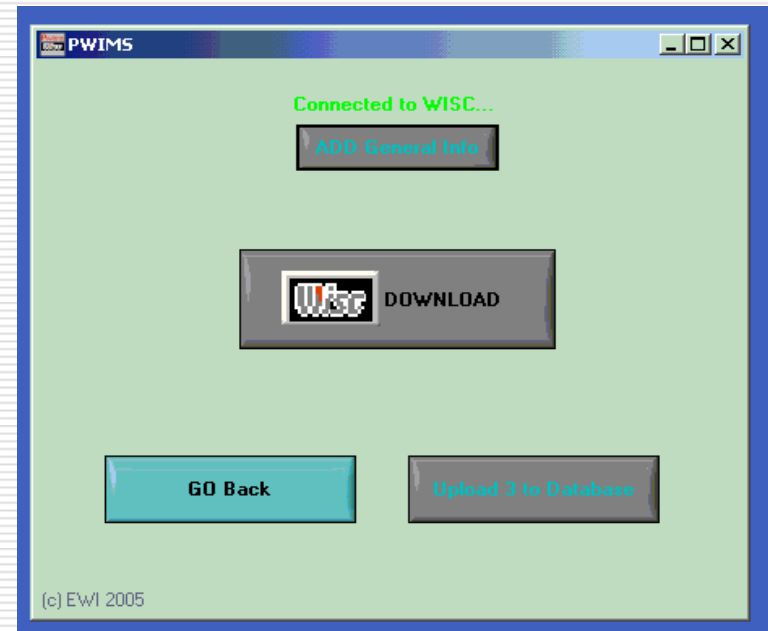
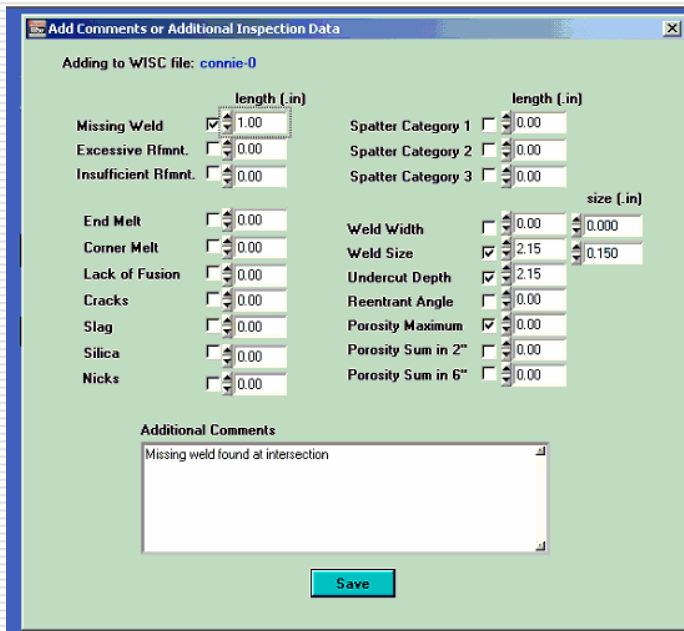
PWIMS: Tasks Status

- Task 1.3 Develop Data Analysis Tools
 - Interface Screens



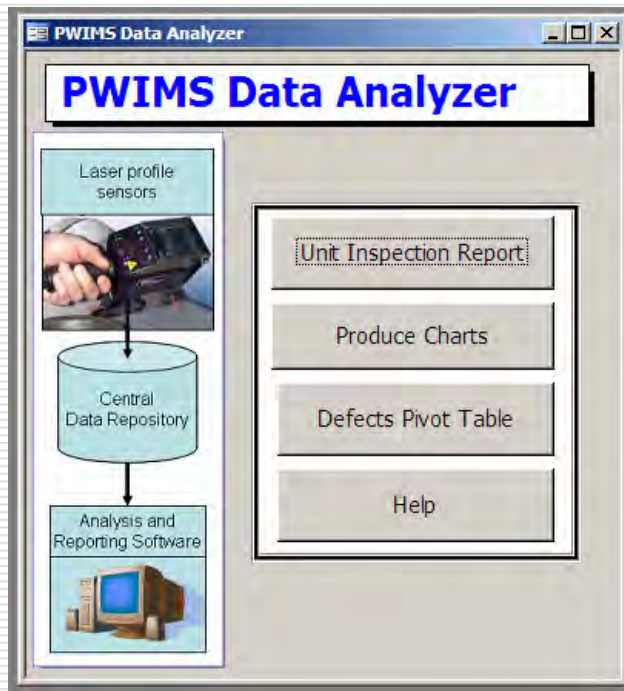
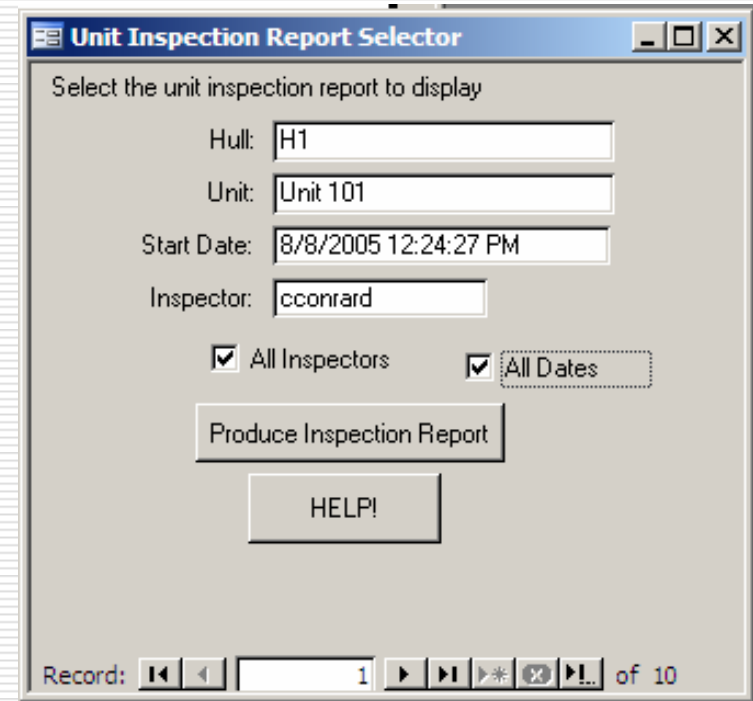
PWIMS: Tasks Status

- Task 1.3 Develop Data Analysis Tools
 - Interface Screens




PWIMS: Tasks Status

- Task 1.3 Develop Data Analysis Tools
 - Data Analysis Software

PWIMS: Tasks Status

- Task 1.3 Develop Data Analysis Tools
 - Sample Report

 Bath Iron Works Unit Inspection Report				HULL	UNIT	INSPECTOR	DATE
				102	5304	All	All
Deck	Long.	Frame	Comments				
1	1	1	Third location	Missing weld, End Melt, Corner melt, Crack			
1	3	2	CC 1	End Melt, Convex, LOF, Silica, Spatter			
1	4	2	CC 2	Missing weld, End Melt, Concave, Silica, Nicks			
1	4	3	JS was here	Missing weld, Concave, Silica, Spatter			
1	7	5	CC 3	Convex, Concave, Corner melt, LOF, Silica, Nicks, Spatter			
1	12	8	no comment	Convex, LOF, Slag, Spatter			
2	5	3		Missing weld			

PWIMS: Tasks Status

- Task 1.3 Develop Data Analysis Tools
 - Chart Builder

Generate Filtered PWIMS Reports

FILTER OPTIONS:

Hull No.
 Inspector

Unit No.
 Location

Component
 Shift

Structure
 Deck

Date Range

Start Date

Jan 2005 Jan 2005

Sun	Mon	Tue	Wed	Thu	Fri	Sat
26	27	28	29	30	31	1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31	1	2	3	4	5

End Date

Jan 2006 Jan 2006

Sun	Mon	Tue	Wed	Thu	Fri	Sat
25	26	27	28	29	30	31
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	1	2	3	4

Weld Size Report Options

GROUP BY: None Date Hull Unit Component Location Structure Deck

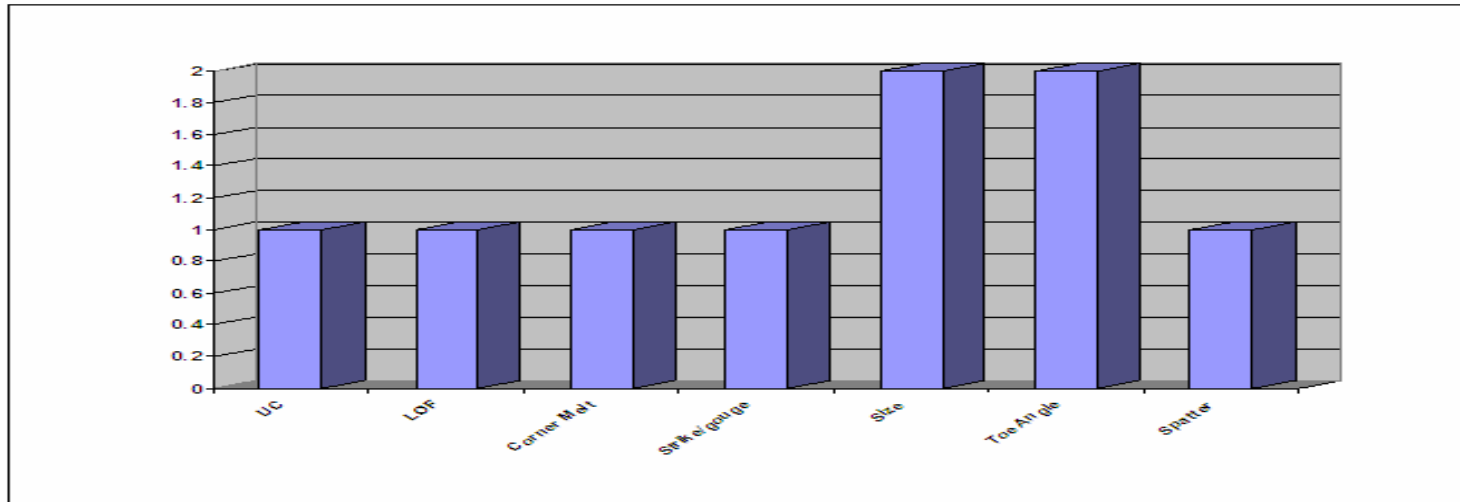
PWIMS: Tasks Status

- Task 1.3 Develop Data Analysis Tools
 - Chart Builder



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Count of Defects by Type



Date Range: 1/1/2005 to 1/1/2006 Hull: DDG111 Unit: 3506 Component: PNL768-W
 Structure: SECONDARY Inspector: cconrard Location: Station 1 Deck: 2

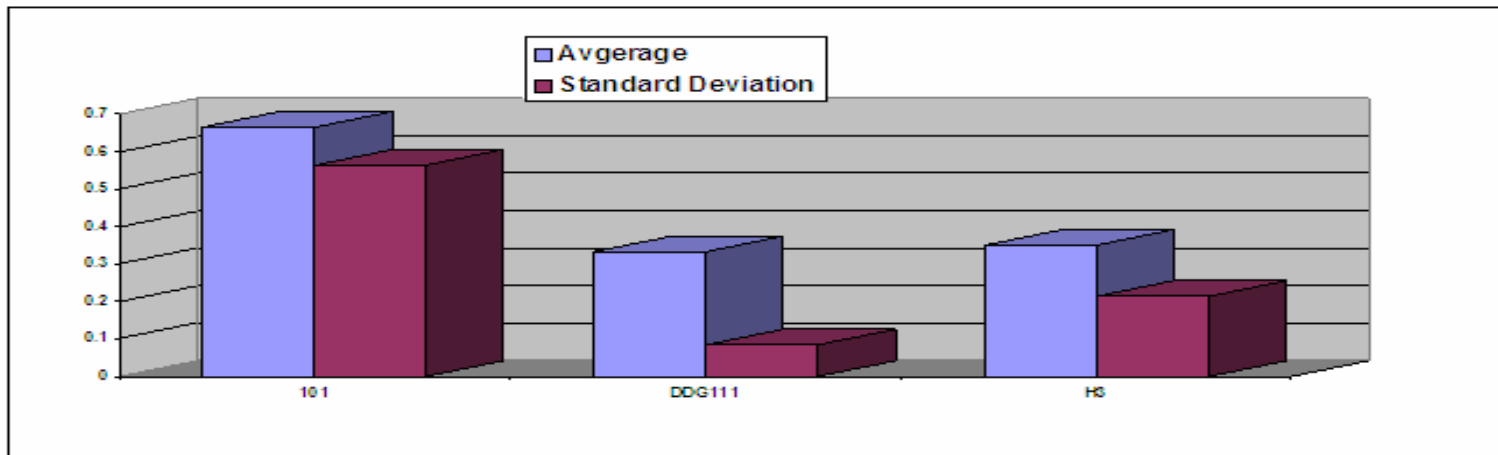
PWIMS: Tasks Status

- Task 1.3 Develop Data Analysis Tools
 - SPC Data



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PWIMS Weld Size Measurements Group By: Hull



Structure: SECONDARY Inspector: cconrard

PWIMS: Tasks Status

- Task 2.1 Field Test and Refine PWIMS
 - Field Testing Underway – On HOLD
 - Have discovered a hardware problem
- Task 2.2 Demonstrate PWIMS
 - Tentatively Scheduled for June 2006
- Task 2.3 Final Report

PWIMS: Tech Transfer Activity

- 04-13-05
 - Briefed NSRP Welding Technology Panel
- 05-18-05
 - Briefed DD(X) LIPT
- 03-08-06
 - Briefed Navy Joining Center
- 04-05-06
 - Briefed NSRP Welding Technology Panel

PWIMS: Tech Transfer Activity

- NJC Teaching Factory
 - In a collaborative agreement between CNST and NJC, a unit will be provided to the NJC's Teaching Factory
 - Allow large number of potential users to experience unit
 - Allow for single point collection of comments in order to facilitate next generation design

PWIMS Potential Issues

Hardware Issues

- Unit is back at Servo for repair

Size

- In current configuration unit is cumbersome
- Team will make recommendations for follow on project to reduce size and make unit wireless

PWIMS Potential Issues

Cost

- At \$20K per unit need to realize savings to justify if want to expand use in yards

PWIMS

Wrap Up

- The greatest potential is for use as an audit tool.
 - Can document inspector performance and creates a permanent record
- Needs to be made more portable
 - Based on old technology
 - Use of new computer technology could shrink size and reduce costs enabling consideration as a daily inspection tool



PWIMS

□ Questions/Discussions

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