

# Optimized Weld Records

RAP Project No. 59083GTH

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Megan Brinker, TRU Solutions



# Related Background

## *Past Digitalization Solutions in Shipbuilding and Ship Repair*

**Vigor Marine:** Environmental, Health and Safety, Paint Quality (since 2015)

**Bath Iron Works:** Safety and Paint Quality (since 2015)

**Newport News Shipbuilding:** Replacing old Paint Quality System E4749 (since 2020)

**BAE Systems:** Paint Quality 009-32 (since 2019)

**NAVSEA:** Tie-downs + Non-skid (exploratory phase)



### **NSRP – Surface Preparation and Coatings Panel**

- Project 1: Digitalizing 009-32, 2013, complete
- Project 2: Out of Spec Flagging for 009-32, 2015, complete
- Project 3: Implementing 009-32 on the deck plate, 2017, complete
- Project 4: Standardization and Digitalization of Visual Inspection for Shipbuilding and Ship Repair, 2020, complete

### **NRL**

- Phase I: Digital Paint/Preservation Quality Assurance Records as a Data Source for Improved Decision Making in partnership with Rampart LLC and sponsored by the Navy Corrosion Executive, Ted Lemieux
- Phase II: Optimized Blast and Paint Quality Assurance Data for Improved Operational Availability

# Project Participants



# Project Introduction

**NAVSEA welding and non-destructive testing (NDT) practices related to Navy Standard Item 009-12 require the acquisition of requirements and procedures, the recording of data, and the reporting of QA data related to the work. This data is compiled following the completion of various critical inspections.**

## Problem Statement

- Current inspections produce multiple paper records, creating a considerable amount of data typically encompassing several hundred pages.
- Proper evaluation of welding quality requires a trained individual to observe and measure elements of the process at various stages of welding and in turn communicate the findings.
- Today's quality assurance techniques are costly, inefficient, and difficult to implement.

## Project Thesis

- Similar to prior NSRP SPC Panel Projects, modify a commercial-off-the-shelf (COTS) technology from TruQC to digitally manage, output and distribute data in accordance with NAVSEA 009-12.
- The Navy community will be able to improve efficiency of managing and collecting QA/QC data related to critical weld activity and ultimately better manage availability.
- Process benefits will include enhanced inspection efficiency and transparency, immediate access to data records, and standardized historical data to feed process improvements.

# Results Summary: Optimized Weld Records (OWR)

## Proof of Concept

- Digitalization was successfully applied to the OWR QA/QC processes
- Value was clearly demonstrated throughout the process and across roles
- The solution met the requirements of the partner shipyards and proved effective for everyday use

**Proven  
Effective**

## Process Impact

- Improved efficiency within the inspection process
- Transmission of inspection data to decision makers quickly and easily
- Minimized, in some cases eliminated, delays associated with adjudicating unsatisfactory items
- Elimination of 'report writing' activity allows engineers and inspectors to maximize time on value-added activity
- Incorporation of 'digital hold points' prevented mistakes before they occurred

**Met the  
Digitalization  
Promise**

## Quality and Cost Impact

- Increased transparency within the welding process, in real-time
- Prevention of costly rework
- Reduced cost of inspection via elimination of 'report writing', non-value-added activity
- Archived inspection and quality data for future improvements and failure analysis
- Eliminate need to 're-create' historical data for assessments

**Yielded Real  
Benefits**

# Practical Benefits

## Save Time

Save 15 minutes per inspection. With an average 30 inspections per ship per day this adds up to 7.5 hours per day!

## Audit Savors

Documentation instantly available through a digital interface.

## Reduce Rework

Data transparency available in real time & user error minimized with drop-down menus.



- **Streamlined document management** makes the most current specification immediately available to everyone in every role.
- **Built-in controls** prevent mistakes before they happen, reducing rework and ultimately enabling contractors to more closely follow the build or repair schedule.
- The Navy has increased visibility into timeframes, **availability is maximized**, and quality is markedly improved.

# Digitalization of Full 009-12 Specifications

Standard	Paragraph	Upload/Attach	Form	Database	Library	Location
MIL-STD-1689	5.2.1	x				Employees
MIL-STD-1689	5.2.2	x				Employees
MIL-STD-1689	5.2.3	x				Employees
MIL-STD-1689	5.2.4	x				Employees
MIL-STD-1689	5.2.5	x				Employees
MIL-STD-1689	5.2.6	x	x			In-Process Weld Surveillance Form 71
MIL-STD-1689	5.2.7	x				Filler Metal Identification Log 70
MIL-STD-1689	5.2.8		x			In-Process Weld Surveillance Form 71
MIL-STD-1689	5.2.9		x			Repair 75 & NDE Forms 66-69
MIL-STD-1689	5.2.9.1		x			Visual Inspection Checklist Report 73
MIL-STD-1689	5.2.10	x				In-Process Weld Surveillance Form 71
MIL-STD-1689	5.2.11		x			In-Process Weld Surveillance Form 71
MIL-STD-1689	5.2.12			x		Database
S9074-AQ-GIB-010/248	4-6.2			x		Database
S9074-AQ-GIB-010/248	5-5.1	x				Employees
S9074-AQ-GIB-010/248	6-3.5			x		Database
S9074-AQ-GIB-010/248	6-4.10	x		x		Employees
S9074-AQ-GIB-010/248	6-4.10.1	x				Employees
S9074-AQ-GIB-010/248	6-4.10.2	x				Employees
S9074-AQ-GIB-010/248	6-4.10.3	x				Employees
S9074-AQ-GIB-010/248	A-4.5.1	x				Employees
S9074-AQ-GIB-010/248	A-4.5.2			x		Database
S9074-AQ-GIB-010/248	C-2.2	x				Employees
S9074-AQ-GIB-010/248	C-2.3			x		Database
S9074-AR-GIB-010/278	4.1.3		x			In-Process Weld Surveillance Form 71
S9074-AR-GIB-010/278	4.1.3.2			x		Database
S9074-AR-GIB-010/278	13.2.10		x	x		Visual Inspection and Repair Report 72
S9074-AR-GIB-010/278	13.2.10.1			x		Database
MIL-STD-22	All				x	Library
MIL-STD-2035	All				x	Library
T9074-AS-GIB-010/271	1.6.8	x				Employees
T9074-AS-GIB-010/271	1.8		x	x		Weld Record Card
T9074-AS-GIB-010/271	3.4.9			x		Database
T9074-AS-GIB-010/271	3.4.15	x				Weld Record Card
T9074-AS-GIB-010/271	4.3.1.9		x			Magnetic Particle Inspection Report 69
T9074-AS-GIB-010/271	5.4.1.2		x			Liquid Penetrant Test 66
T9074-AS-GIB-010/271	6.5.4		x			Ultrasonic Test Report 68
T9074-AS-GIB-010/271	6.6.4.5		x			Ultrasonic Test Report 68
T9074-AS-GIB-010/271	7.3.3		x			Eddy Current Test Report
T9074-AS-GIB-010/271	8.5		x			Visual Test Inspection Report 67
T9074-AS-GIB-010/271	A.7	x				Weld Record Card
T9074-AS-GIB-010/271	B.8		x			Ultrasonic Test Report 68
T9074-AS-GIB-010/271	Fig. 6-12		x			Ultrasonic Test Report 68
DOD-STD-2185	4.1	x				In Record
DOD-STD-2185	4.2.3	x				In Record
MIL-STD-2191	6	x				Employees
S9CGO-BP-SRM-010/CG-47C	All				x	Library
S9086-RK-STM-010/CH-505	All				x	Library

## Four Methods to Digitalize Specifications

- **Upload/Attach:** add spec via typical document attachment process.
- **Form:** use the digital interface to complete questions and add data, with a form auto-generated upon completion.
- **Database:** use data contributed to the database, potentially from multiple forms, to create a standard document.
- **Library:** documents uploaded to the library to be managed and assigned to activity by an admin.



# DEMONSTRATION

## Optimized Weld Records

RAP Project No. 59083GTH



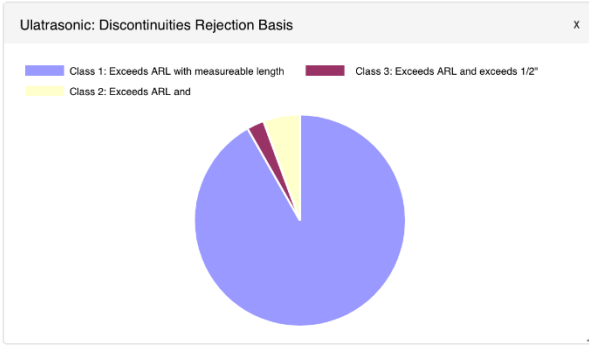
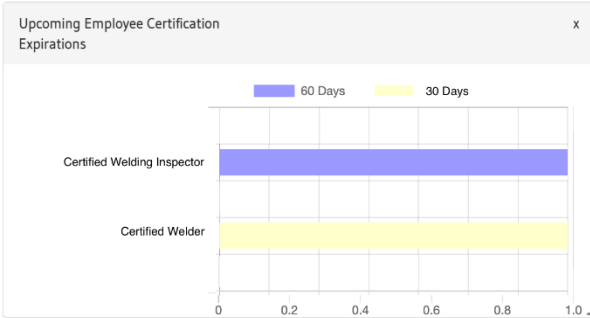
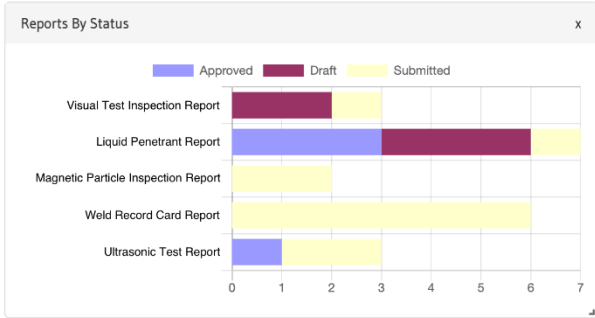
# Web Dashboard

Available charts... | v

Add

Dates: 02/22/2023 - 03/01/2023  
Jobs: All

Filters



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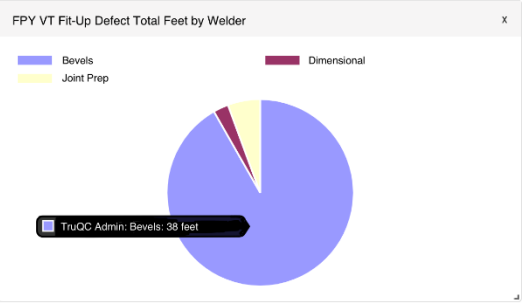
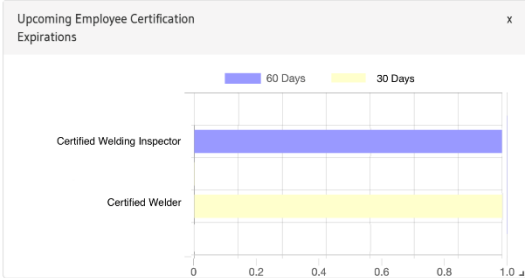
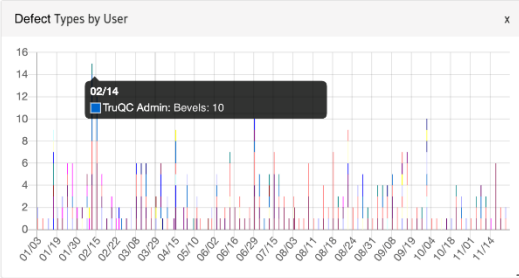
Web 4.30.3, Server 5.30.3

Available charts... | v

Add

Dates: 02/03/2023 - 03/01/2023  
Jobs: All

Filters



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Web 4.30.3, Server 5.30.3

# Solution Approach

*Like the digitalization solution itself, TruQC's commercial-off-the-shelf approach to design and implementation was used to ensure project success.*

## 1 Discovery

- TruQC met with FMM and Vigor to understand the current weld process, workflow, reporting and requirements.
- TruQC compiled and organized findings, solicited input from partner yards, and put together a development plan.

## 2 Wireframes & Testing

- Created draft versions of data presentation and collection interfaces ('wireframes') for review and comment by partner yards.
- Implemented those wireframes in a test environment for more detailed feedback.

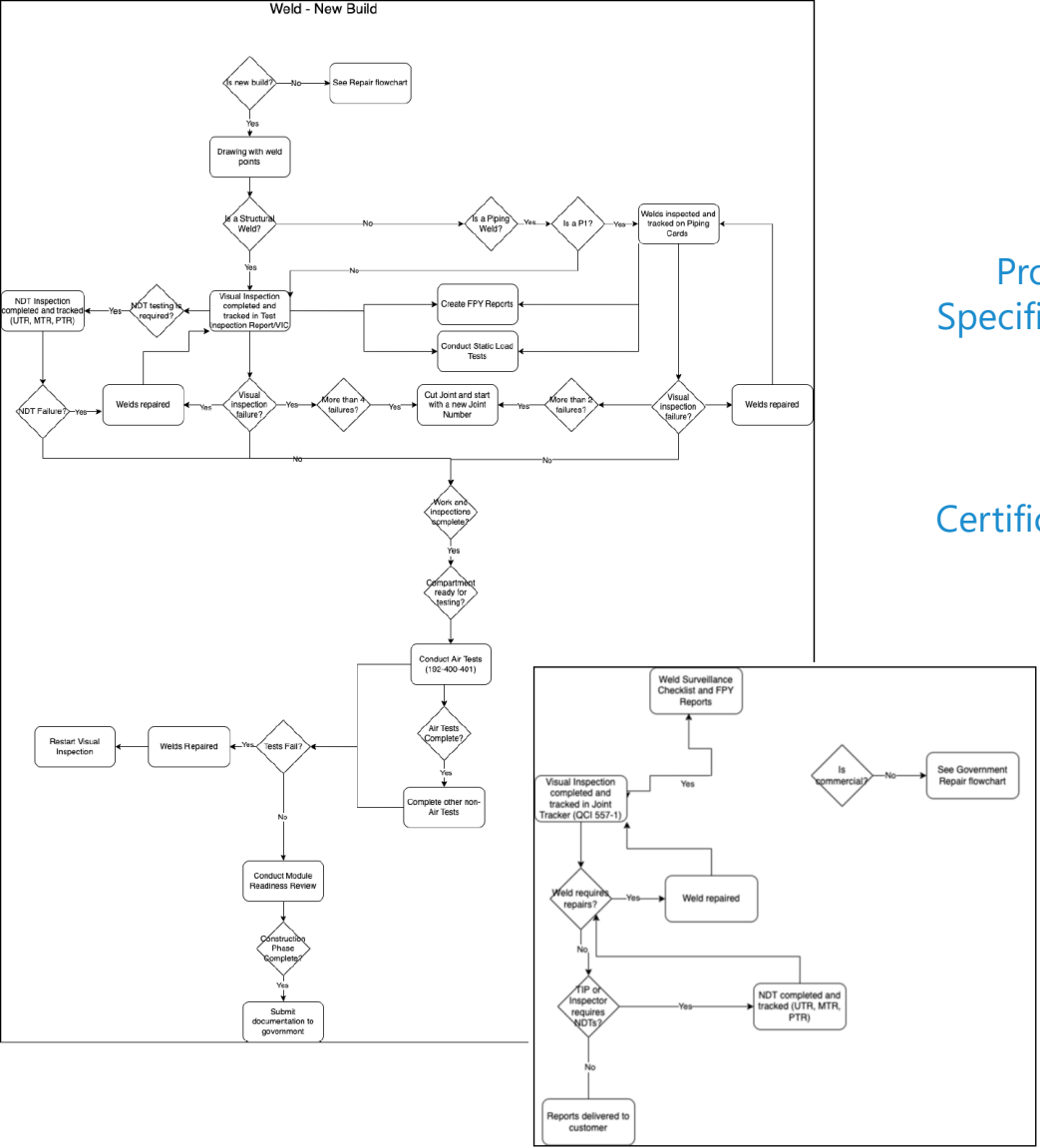
## 3 Project Implementation

- A production version of OWR was deployed at FMM and Vigor, with training and support provided by TruQC.
- During the project, inspections were collected using the traditional paper method as well as the digitalized OWR solution for comparison.

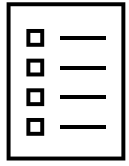
## 4 Project Reporting

- All parties reviewed the results and compiled information for EWI-authored report.

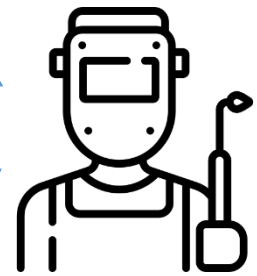
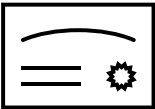
# Full Process Mapping for New Build and Repair



Weld Procedure Specifications



Certifications



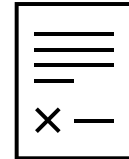
NDT Results



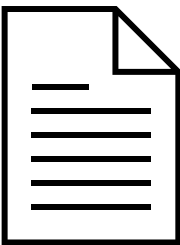
Inspections



Signoffs



Weld Record & Supporting Objective Quality Evidence (OQE)



# Project Summary

**Proven  
Effective**

**Met the  
Digitalization  
Promise**

**Yielded Real  
Benefits**

## Example COTS Capabilities

- Embedded standards/Acceptance Criteria automate out-of-spec flagging
- Barcode scanning & device integration for assured data integrity
- Data transparency and real-time review across RMC, sub and prime contractor
- Faster, cleaner OQE bundling and sign-off
- Real-time view of current state and CFR status
- Results visible via dashboard for KPI tracking

## Potential Enhancements

- Out of Spec Flagging
- Inspector Certification Flagging and tracking for different weld types
- Gauge Integration
- Integration with NMD and other legacy systems
- Defect tracking to resolution
- Importing of Welding standards and specifications

# Q&A

**Megan Brinker**

EVP Business Development

TRU Solutions

megan@trusolutions.com

Mobile: 314-324-7469

