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# Optimization of Abrasive Blasting and Associated Processes

**Erik Oller**

**Navy Metalworking Center**

**Concurrent Technologies Corporation**

**(for the Integrated Project Team)**

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- Introduction
- Pipe Wrapping Improvements
- Grit Blasting Improvements
- Summary

# Issue Description

- Grit blasting is one of the most common processes in shipbuilding
- There are opportunities to make grit blasting and the processes that support grit blasting much more efficient.



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# Integrated Project Team

<b>ONR ManTech</b>	<b>Project Funding and Support</b>	<b>Greg Woods</b>
<b>PMS 450</b>	<b>Stakeholder</b>	<b>Charlie McNamara</b>
<b>NAVSEA 05P23</b>	<b>Technical Warrant Holder</b>	<b>Mark Ingle</b>
<b>NSWCCD</b>	<b>Technical Assistant</b>	<b>Jeffrey Duckworth</b>
<b>NGSB-NN</b>	<b>Implementing Shipyard Information Support Process Optimization Testing</b>	<b>Vannia Willis Darius Windley Wayne Boone</b>
<b>GDEB</b>	<b>Implementing Shipyard Information Support Process Verification Testing</b>	<b>Barry Espeseth Mark Toscano Gil Bissett</b>
<b>NMC</b>	<b>Project Management Wrapping Test and Evaluation Technical Oversight</b>	<b>Erik Oller Paul Schultz</b>



# Current Process Description

- A large amount of piping is installed into submarine hull sections before they are painted
- The sequence for preparing piping for painting is as follows:
  - Piping is wrapped to protect it during blasting
  - Structural steel is blasted to prepare it for painting
  - Piping is unwrapped and cleaned to remove grit
  - Piping is wrapped to protect it during painting
  - Structural steel is painted
  - Piping is unwrapped
- All submarine construction or maintenance shipyards use similar processes.



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# Grit Blasting Labor Cost Drivers

- **Blasting: 40%**
- **Cleaning: 40%**
- **Wrapping: 20%**

# Project Objective

- **Project will identify more efficient grit blasting parameters in order to reduce grit blasting labor.**
- **Parameters may include variations of:**
  - **blast media type**
  - **blast media size**
  - **nozzle angle**
  - **nozzle type**
  - **nozzle velocity**
  - **other parameters**
- **Project will also examine the pipe wrapping methods to determine if they can be improved.**

# Pipe Wrapping Current State

- Pipe wrapping materials must meet NFPA 701 Test Method 2 requirements for being flame retardant.
- Current materials are flame retardant neoprene or untreated neoprene with flame retardant canvas covering. Materials are held in place with duct tape and metal strips.

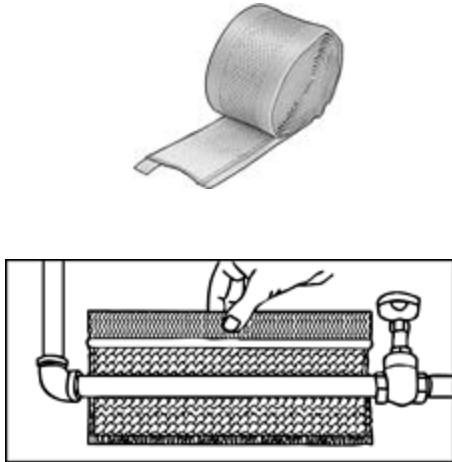


- Wrapping is required to prevent the cosmetically unacceptable effect of grit blasting on unpainted piping.

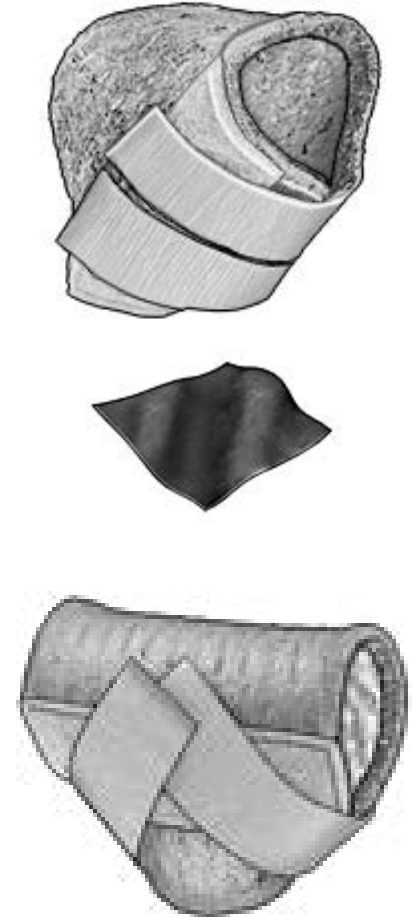


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# Possible Alternative Pipe Wrapping Processes



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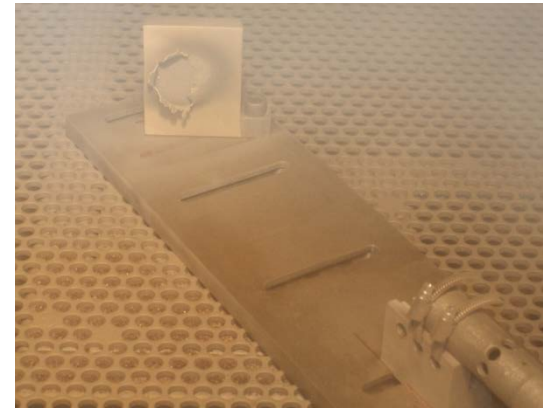
Illustrations courtesy of McMaster-Carr.

# Possible Alternative Pipe Wrapping Materials

- **Potential alternative materials include:**
  - **Neoprene rubber**
  - **Natural gum rubber**
  - **EPDM rubber**
  - **Polyurethane rubber**
  - **8979 Performance Plus Duct Tape**
    - **Low residue (clean removal) conformable, abrasion resistant duct tape**
  - **1367 Blast-Off Tape**
    - **Used for abrasion and thermal protection in gantry areas during rocket launches**
    - **Also recommended for low intensity grit blast and thermal spray operations**
  - **520 Sandblast Stencil tape**
    - **Used to protect surfaces during sandblasting operations**
  - **528 Impact Stripping Tape**
    - **Used to protect aircraft during plastic media blasting**
  - **362 Plasma Spray Masking Tape**
    - **Used to protect surfaces during flame spraying**
  - **8730 HT Polyurethane Protective Tape**
    - **Used to protect surfaces from corrosion, erosion and minor impact damage**

# Pipe Wrapping Material Evaluation

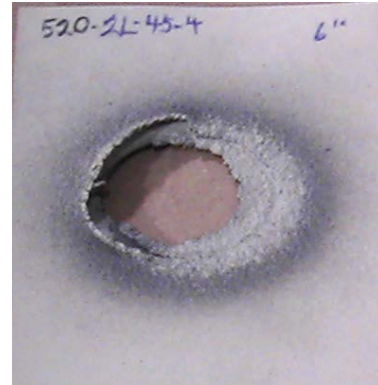
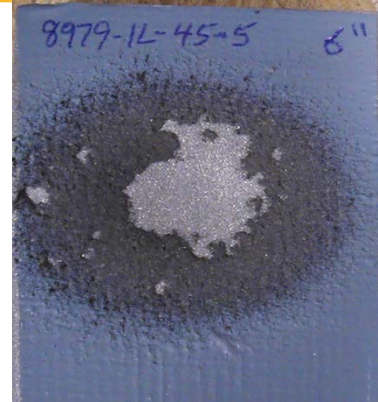
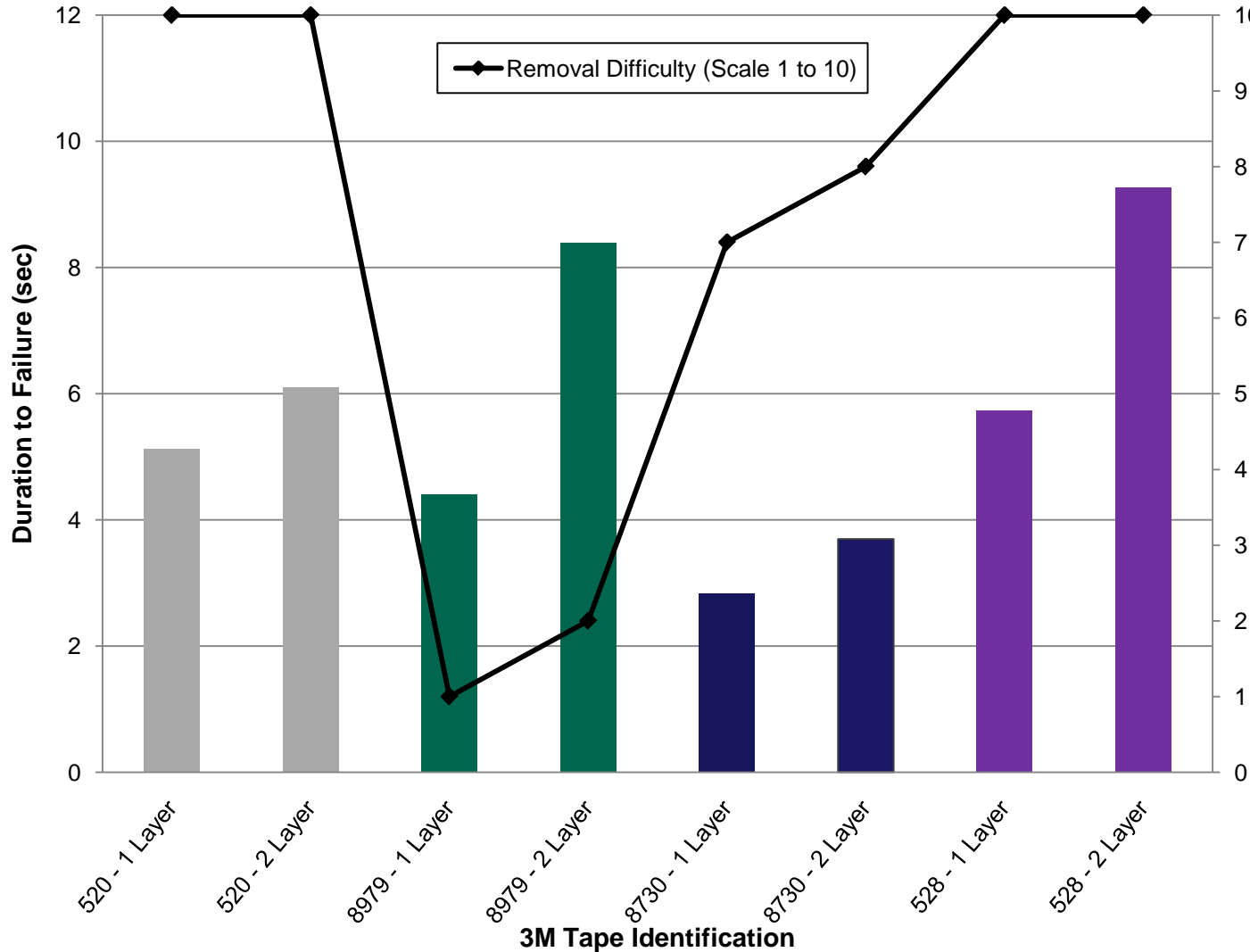
- All materials were evaluated by grit blasting on a flat plate using:
  - 3/8-inch double venturi nozzle
  - 45 degree blasting angle
  - 90 psig constant flow air pressure (120 PSI static pressure)
  - Aluminum oxide 24 grit blasting media
- Initial trials had a 12-inch standoff distance
- Second round trials had a 6-inch standoff distance.



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# Tape Evaluation Summary Chart

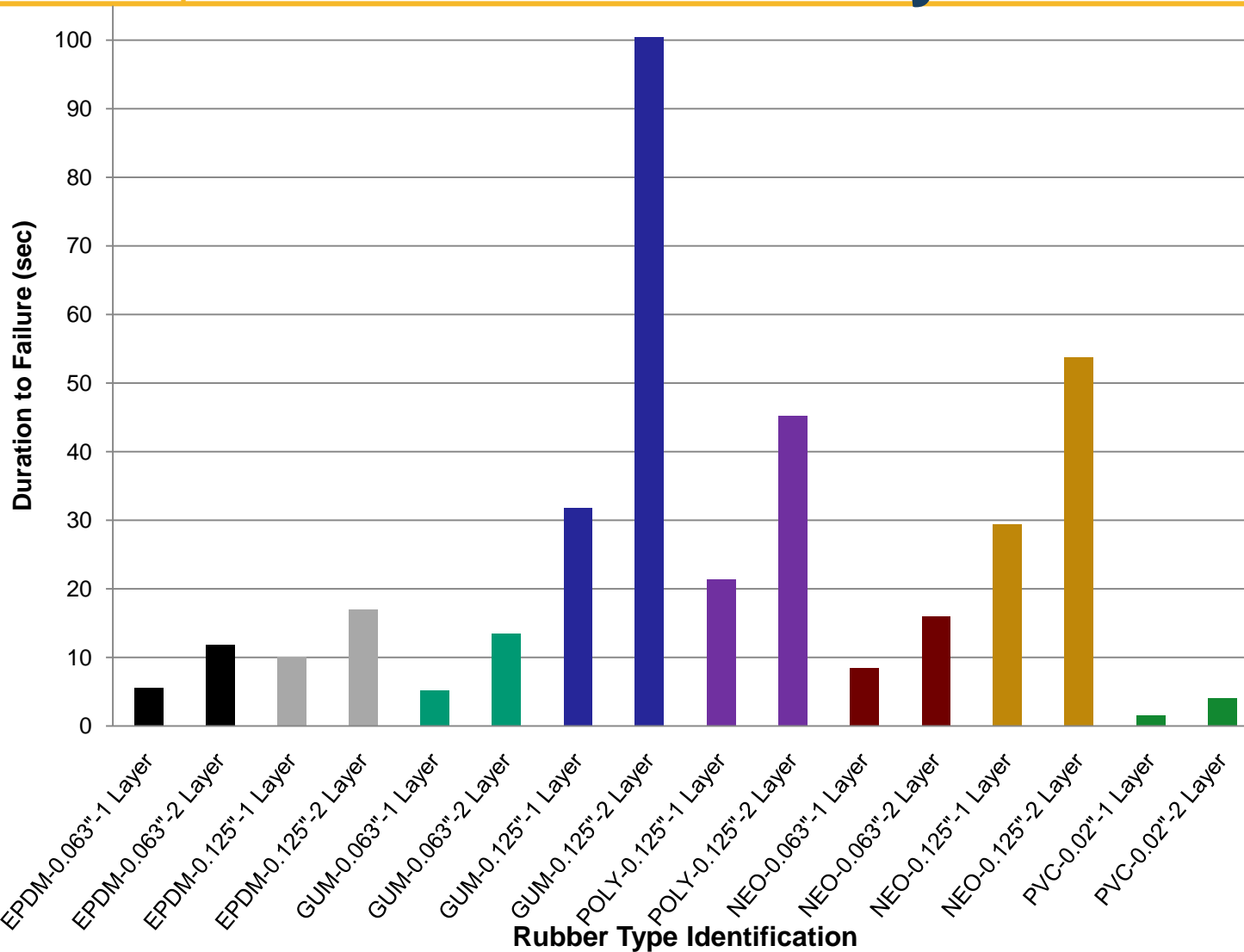
## 6-Inch Nozzle Stand-Off



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**Test Parameters:**  
 \* Aluminum Oxide (24 Grit)  
 \* 45° Blast Approach Angle  
 \* 6-inch Nozzle Standoff  
 \* 90 PSI Constant Flow

# Flat Plate Rubber Evaluation Summary Chart

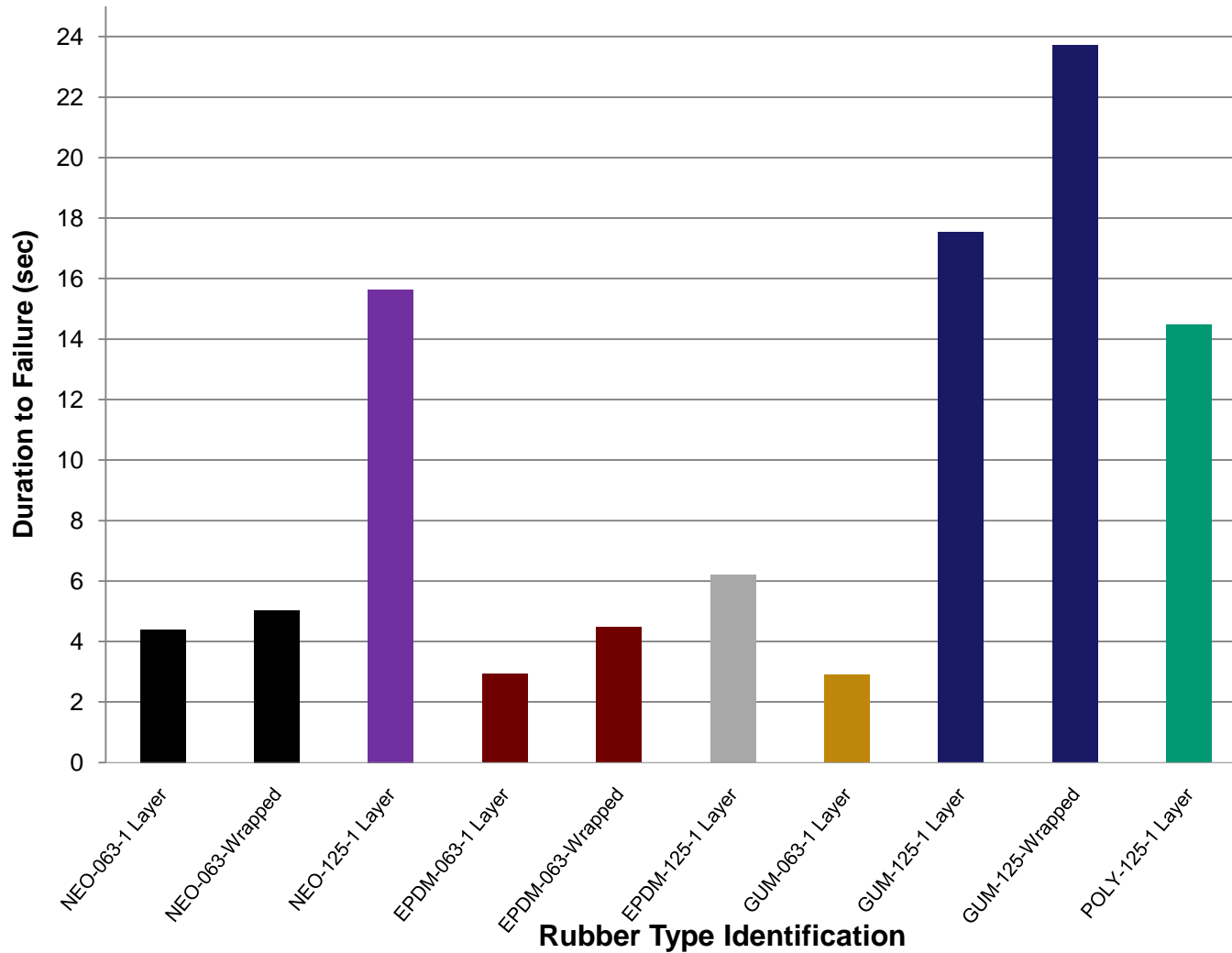


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**Test Parameters:**

- \* Aluminum Oxide (24 Grit)
- \* 45 Blast Approach Angle
- \* 6-inch Nozzle Standoff
- \* 90 PSI Constant Flow

# Direct Blast Pipe Rubber Evaluation Summary Chart



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**Test Parameters:**

- \* Aluminum Oxide (24 Grit)
- \* Direct Blast on Pipe
- \* 6-inch Nozzle Standoff
- \* 90 PSI Constant Flow

# Grit Blasting Optimization

- **Grit blasting optimization will include evaluation of various combinations of parameters to find the best parameter setting to achieve a 2-4 mil profile and near white SSPC-10 finish on structural steel.**
- **Baseline process:**
  - **Nozzle: 1/2-inch internal diameter straight bore nozzle 6 inches long**
  - **Standoff: 18-24 inches**
  - **Blast Angle: 90 degrees**
  - **Grit Material: Steel**
  - **Grit Size: G-25**

# Optimization Test Plan

- **Full factorial experiment will include 36 test conditions**
  - 4 nozzle designs x 4 grit materials x 2 impact angles
  - 3 nozzle bore diameters (for one nozzle design / grit material)
- **Input Variables**
  - **Abrasive Blast System**
  - **Blast Nozzle Design**
    - Long venturi style
    - Double venturi style
    - Bazooka style
    - Extra long venturi style
  - **Blast Nozzle Bore Diameter**
    - $\frac{3}{8}$ -inch,  $\frac{1}{2}$ -inch, and  $\frac{3}{4}$ -inch
  - **Abrasive Media Size**
    - Selected for each material based on a required 3-mil anchor pattern

# Optimization Test Plan

- **Input Variables, continued:**
  - **Abrasive Material**
    - Steel Grit
    - Aluminum Oxide
    - Garnet
    - Copper Slag
  - **Abrasive Mass Flow Rate**
    - Least quantifiable component in the blast system
    - Critical for efficient operation
    - Adjustment of the metering valve must be optimized for each combination of nozzle design and abrasive grit material.
  - **Stand-off Distance**
    - Based on nozzle design
  - **Impact Angle**
    - 90 degrees
    - 45 degrees

# Future Plans

- The project team will finish the Optimization Test Plan in June 2011 and will use the results to identify the best combination of parameters.
- The project team will verify the best combination of parameters in another round of testing to be conducted in Fall 2011.
- The project will complete in March 2012.

# Summary

- The project will identify more efficient grit blasting parameters in order to reduce grit blasting labor.
- The project will also examine the pipe wrapping methods to determine if they can be improved.

# Contact Information

- Erik Oller
- **CTC/Navy Metalworking Center**
- **ollere@ctc.com**
- **(814) 269-2731**