Electrical Technologies Panel

Project Idea Presentations Meeting

Program Update

Electrical Technologies Panel Project Idea Presentation Meeting

July 24th, 2020

Virtual

NSRP Mission

The mission of the National Shipbuilding Research Program is to reduce the total ownership cost and improve the capabilities of both United States Government and U. S.-flag commercial ships.

The Program accomplishes this mission by providing a collaborative framework to manage, focus, develop and share research & development, and leverage best practices in shipbuilding and ship repair.

NSRP Collaboration

Anti-Trust Rules

- Regarding your company's and/or your competitor's **product & services**:
  - Do not discuss current or future prices.
  - Do not discuss any increase or decrease in price.
  - Do not discuss pricing procedures.
  - Do not discuss standardizing or stabilizing prices.
  - Do not discuss controlling sales or allocating markets for any product.
  - Do not discuss future design or marketing strategies.

Anti-Trust Rules

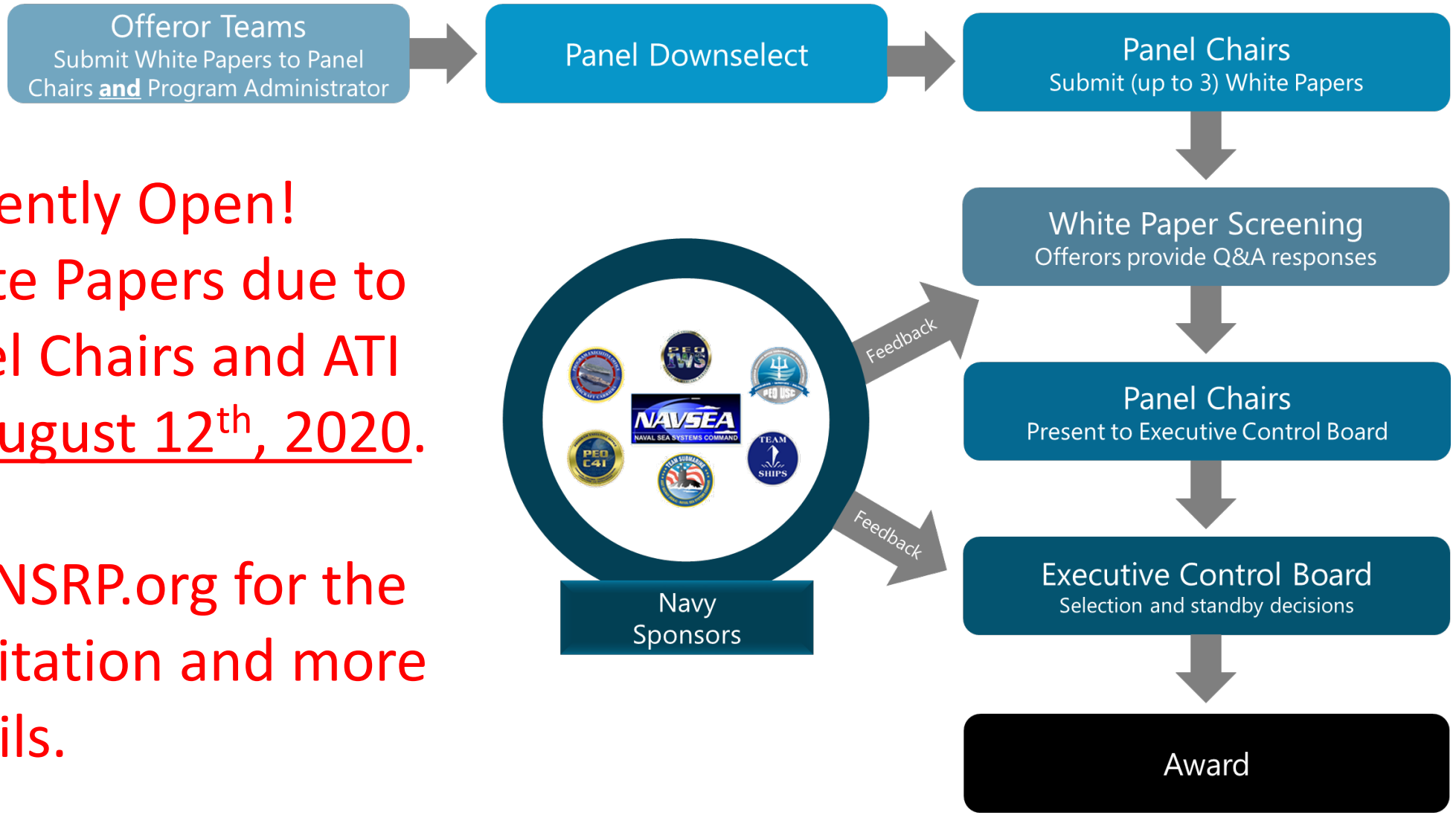
- Regarding your company's and/or your competitors' selection of their **supplier companies**:
  - Do not discuss refusing to deal with a company because of its pricing or distribution practices.
  - Do not discuss strategies or plans to award business to remove business from a specific company.

- Regarding your company's and/or competitors' **trade secrets**:
  - Do not discuss trade secrets or confidential information of your company or any other participant.

Panel Project Proposal Process

Currently Open!
White Papers due to Panel Chairs and ATI by August 12th, 2020.

See NSRP.org for the solicitation and more details.



Panel Project Requirements

- Official requirements can be found in the Panel Project Solicitation and the Panel Project Guide Vol 1 located at https://www.nsrp.org/resource-library/:
- Deadline for Offerors to submit white papers to Panel Chairs ***and*** ATI is 12:00 p.m. (noon) ET on **August 12, 2020**.
- Deadline for Panel Chairs to submit top three white papers and any joint panel papers to ATI is 12:00 p.m. (noon) ET on **September 9, 2020.** Panel Chairs shall submit white paper(s), using the White Paper Submission Module.
- Deadline for Offerors whose white paper is one of the panel's top three to submit to ATI the Supporting Cost Data Table, required by the Panel Project Guide Vol 1 – Offerors Rev. T, is **September 9, 2020**.
- **NOTE: White paper submitters are reminded that each Panel Chair will have interim due dates to accommodate their panel's down-select process prior to submission to ATI. Please regularly check the NSRP website for those dates.**
- *Any questions can be directed to Ryan Schneider (ryan.schneider@ati.org) or Sarah H. Swain (sarah.swain@ati.org).*

Panel Project Requirements

- NSRP Executive Control Board member shipyards and panel members (as defined by individual panel membership by-laws) may submit white papers.
- No more than $150K in program-funded costs (Note: Fee or profit is not allowed)
- No more than 12 months in duration
- At least one member shipyard should be a project participant – ***multiple shipyard participation is strongly encouraged.*** An endorsement email for each participating member shipyard, specifically, an email from that yard's NSRP Shipyard Delegate (NSD) must be attached. These endorsement pages do not count toward the three page limit.
- If a Government organization will participate in the project, provide the name and contact information for the government point of contact who agreed to participate. If there is any issue with obtaining this information, offerors should contact the NAVSEA NSRP Program Engineer, Mr. Howard Franklin, at howard.l.franklin@navy.mil or (202) 781-2171 for early coordination.

Panel Project Requirements

- Offerors shall submit white papers directly to the appropriate Panel Chair and ATI (nsrp@ati.org).
- Any proposed prime contractor shall ensure all subcontractors will agree to the terms and conditions of NSRP's standard Base Task Order Agreement prior to submission of a white paper.

Panel Universal By-laws

- At minimum, panel voting membership will include all of the member shipyards.
- Each organization gets only ONE vote. If an organization has a qualified voting member in a NSRP leadership position (Panel Chair, Panel Vice Chair, or Major Initiative Team Leader) the organization will have an additional vote (not to exceed two votes).
- Except for member shipyards, organizations must meet panel membership requirements, as defined in the individual panel by-laws, to propose a panel project or vote in panel voting activities.

Panel Project Presentations

Topics Received

1. DTS Integration into Ship-wide Controls (Gio Tomasi)
2. Shipboard Fiber Optic Cables Design Enhancements (Gio Tomasi)
3. COTS Power Cable Terminations (Greg Stevens)
4. Shock Mounting Panel for Electrical Panels (Greg Stevens)
5. Electrical Installation Safety Assessment (Greg Stevens)
6. Multi Ship Class Heavy Weather Event Evaluation (Greg Stevens)
7. Stand-By Power Options During Construction & Maintenance Activities (Jason Farmer)
8. Splice-On Fiber Optic Connectors/Termini (Jason Farmer)
9. Temporary Firestop During Construction (Terry Mannion)
10. Fiber Optic Pressure Sensor (John Mazurowski, Maurissa D'Angelo)
11. Arc Stud Welding of Copper Power Cables (Paul Blomquist)
12. Improved Methods for Corrosion Prevention when Bonding and Grounding Dissimilar Metals (John Walks, John Hurley)
13. Laser LED Searchlight (Ryan Hertel)
14. Navy UV Disinfection Fixture (Ryan Hertel)

NSRP 2021 Panel Project
DTS Integration into Ship-wide Controls

Giovanni Tomasi
Chief Technology Officer
RSL Fiber Systems, LLC

NSRP Electrical Technologies Panel Meeting – July 24, 2020

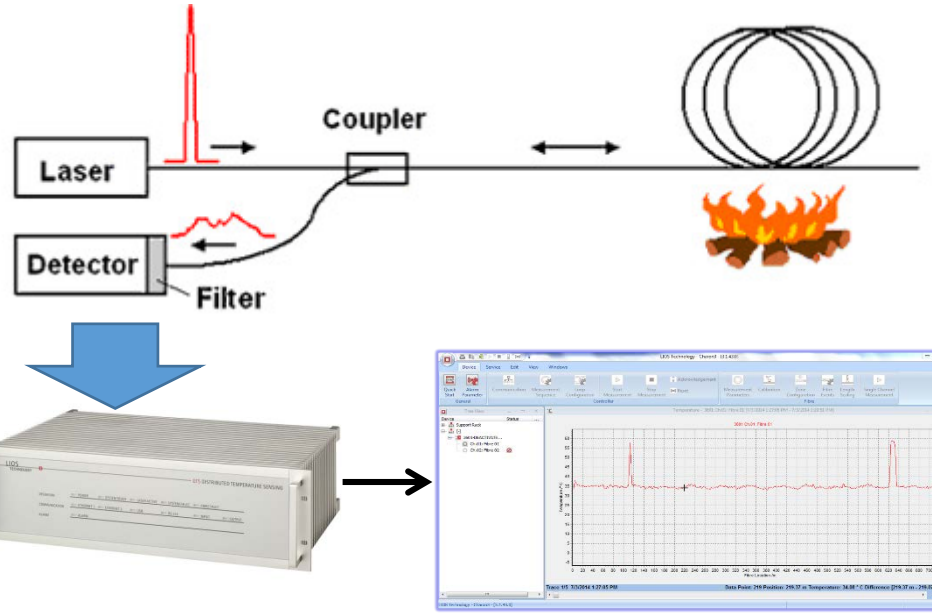
U.S. NAVY DISTRIBUTED TEMPERATURE SENSING (DTS) PROJECTS AND APPLICATIONS

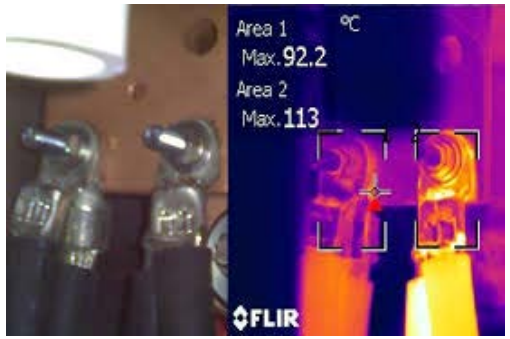
DTS - NSRP PROJECTS

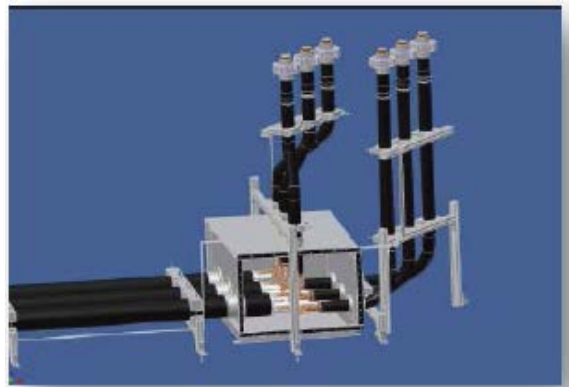
- Distributed Temperature Sensing for Inspection of Electrical Panels on Navy Ships (NSRP 2017-422)
- Qualification Testing of Insulated Bus Pipe (IBP) for Shipboard Introduction (NSRP RA 2019-376)
- Research & Develop Insulated Bus Pipe (IBP) Standard Interface to Naval Electrical Equipment (NSRP RA 20-01)

DTS - OTHER SHIPBOARD APPLICATIONS

- Fire detection
- Machinery health monitoring
- Temperature monitoring of refrigeration units, control room, living spaces…
- Water depth temperature







DTS SHIPBOARD IMPLEMENTATION

Fiber Cable Routing to Electrical Device

→

Integration into Device Connection Points

→

Sensing Zones Configuration

→

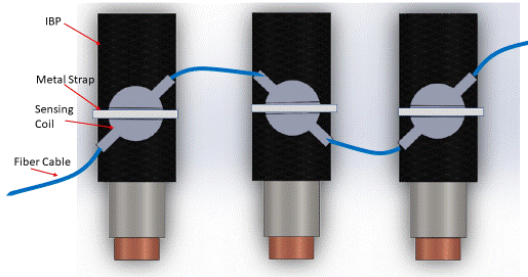
Set Alarm Parameters

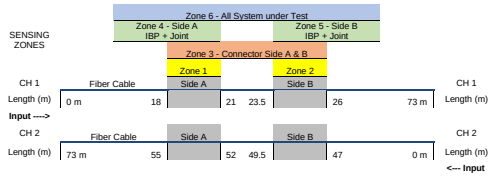
→

Integration Into ship control & monitoring system

→

<u>Real Time Monitoring</u> for early warning to loose connections, fire, and potentially dangerous situations





ZONE	START	END	Alarm @ Temp (°C)
1	47	49.5	Start + 2
2	52	55	Start + 2
3	47	55	Δ2
4	33	49.5	Start + 2
5	52	68	Start + 2
6	33	68	Start + 2, Δ2

Shipboard Fiber Optic Cables Design Enhancements

2019 ELECTRICAL PANEL PROJECT 2019-477

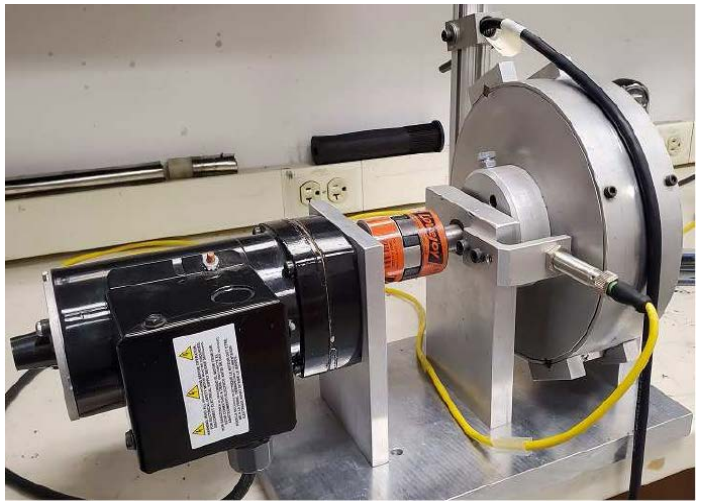
Cable Jacket Scrape Abrasion - Project Follow On

Giovanni Tomasi

NSRP Electrical Technologies Panel Meeting

OUTER JACKET SCRAPE ABRASION

- Jacket abrasion described as a cause of damage at installation.
- MIL-PRF-85045 specifies use of 454 grams (1 lb.) weight, 500 cycles.
- Actual conditions at installation are likely:
  - **Higher force / Less cycles.**
- Test performed at Intertek to failure point of jacket:
  - 4.45 Kg (10 lbs.)
  - Up to 250 cycles
- Three (3) Cables Tested:
  1. M85045/18 with Thermoset Jacket by Irradiation
  2. M85045/18 with Thermoset Jacket by Mold Cure
  3. RSL 118052 with Thermoplastic Jacket
- **Results indicate that Irradiation x-linking is not fully curing jacket**



Sample	Type	Jacket Type	Cable Outer Dia. (mm)	Avg. Wall Thick. (mm)	Results (Scrapes to Failure per mm thickness)
1	M85045/18	Tset (Radiation)	8.0	1.165	**40%**
2	M85045/18	Tset (Mold Cure)	8.2	1.39	**94%**
3	RSL 118052	Tplastic	10.2	1.77	**100%**

PROPOSED FOLLOW-ON PROJECT

OBJECTIVE

- Determine if U.S. Navy is paying a premium for perceived vs. actual performance of cross-linked outer jackets
- Identify cost savings AND performance improvements
- Recommend revision to MIL-PRF-85045 shipboard documents

TEST PLAN

- Repeat test on a minimum of 50 samples
- Include all three (3) QPL'd suppliers
  - Prysmian / Draka
  - Prysmian / General
  - RSCC Aerospace
- Obtain samples from shipyards
  - 6 ft ea. Sample
  - Different production lots
- Cost of Test Program: **$ 26,300**
- Project duration: ~ 3 months

ESTIMATED ROI

a) Savings from Thermoset to Thermoplastic: **$ 6.3M /year**
b) Thermoplastic w/50% reduction in damage: **$ 11.6M / year**

NSRP ETP Panel Project Ideas GDBIW

Presented by: Greg Stevens
Rickey DeLoge
7/24/20

Project Idea 1: COTS Power Cable Terminations

- Idea
  - Find COTS solutions for unique power terminations, reducing the unique characteristics currently used in ship design
- Goals and Objectives
  - Determine candidates for common termination components (i.e., standard lug terminations)
  - Choose applications to demonstrate how COTS solutions will meet requirements
  - Build a demonstration unit that will reflect the usability of the products chosen
  - Possibly perform certain testing, such as shock testing on the demonstration units

Project Idea 2: Shock Mounting Panel for Electrical Panels

- Idea
  - Design a shock mounting panel for electrical panels to mount to so COTS panels and components can be used
- Goals and Objectives
  - Determine what components may be candidates for COTS solutions
  - Design shock mounting units that enable the use of COTS products
  - Shock test the chosen arrangements
  - Analyze the data and make recommendations on design changes

Project Idea 3: Electrical Installation Safety Assessment

- Idea
  - Evaluate safety exposure related to electrical installation tasks such as cable pulling, equipment installation
- Goals and Objectives
  - Determine what activities represent highest risk
  - Generate possible mitigation strategies and solutions to reduce safety exposure

Project Idea 4: Multi Ship Class Heavy Weather Event Evaluation

- Idea
  - Determine the minimal required electrical loads to be supported by a temporary diesel generator during heavy weather events for multiple ship classes.
- Goals and Objectives
  - Target multiple ship classes
  - Create an array of scenario definitions to reflect operational conditions aboard the ship, e.g. Shore or Anchor, Crew onboard, etc.
  - Provide a detailed evaluation of what is considered required electrical loads per the scenario definitions, including load factors and equipment usage factors
  - Provide recommendations for generator sizing and selection
  - Provide recommendations for specification language

Evaluation of Stand-By Power Options for Ships During Construction and Maintenance Activities

Project Lead Organization: Ingalls Shipbuilding
Project Team members: Shipyard A, NAVSEA

Concept/Idea

Issue: Failure at shore power connections result in significant damage to shipboard equipment and impact safety of the crew. If an electrical failure occurs at the shore power connection prior to standby generator power availability, emergency shipboard services such as onboard fire-fighting systems are not available. A method to maintain vital services during construction and maintenance activities is needed to avoid potential damage to shipboard equipment and personnel.

Proposed Solution(s): This project will identify and evaluate options to maintain stand-by power during shore power transfer procedures – especially before generator power is available.

Benefits/Justification

Benefits of the project

- Develop common process to maintain (and provide back up for) vital services for ships during construction and maintenance activities
- Decrease potential for significant damage to shipboard equipment

Project Approach

High level statement of work

- Evaluate current methods of stand-by power at various shore facilities
- Develop recommendations to mitigate impact to emergency services upon failure of shore power service
- Review list of recommendations with NAVSEA and repair facilities
- Develop transition plan for selected approach

Metric(s) of Success

- Development of process to address Gaps identified

Cost/Images/Relevant Information

- **Project Estimated Cost:** $150,000
- **Project Duration:** 12 Months

Splice-On Fiber Optic Connectors/Termini

Project Lead Organization: Ingalls Shipbuilding
Project Team members: Shipyard A, Manufacturer A, NAVSEA

Concept/Idea

Issue: Fiber optic connectors are typically installed shipboard during the construction process – a harsh environment not ideal for connector quality. Splice on connectors are made in a shop environment. The connectors are fusion spliced to the shipboard cable, and provide better optical performance and installation efficiency. Previous Navy efforts identified a splice on option; however additional work is needed for implementation. Recently a supplier has expressed interest in pursuing Navy qualification of their M29504 splice on termini concept.

Proposed Solution(s): Work with supplier and NAVSEA to qualify a splice-on fiber optic termini. The termini will be installed onto shipboard cable via fusion splicing. This connector option will decrease installation time, improve performance, and eliminate the need for polishing fiber optic connectors onboard ships during the construction process.

Benefits/Justification

Benefits of the project

- Eliminate need to fabricate and polish fiber optic connectors shipboard
- Improved optical performance
- Reduced installation time

Project Approach

High level statement of work

- Develop list of candidate connectors
- Review test requirements with Manufacturer
- Establish development/testing plan with Manufacturer
- Work with NAVSEA on qualification requirements
- Conduct lab testing on selected connector
- Develop transition plan for selected approach

Metric(s) of Success

- Develop transition plan for selected connector type
- Identify Gaps that need to be addressed for Navy/Ship Program approval

Cost/Images/Relevant Information

- **Project Estimated Cost:** $150,000
- **Project Duration:** 12 Months

Temporary Firestop During Construction

Project Lead Organization: **STI Marine Firestop**
Project Team members: STI Marine Firestop, Yard A, Yard B

Concept/Idea

Issue: **Is Temporary Firestop to protect vessels under repair / construction in the drydock or dockside a viable requirement ?**

Proposed Solution: **Provide a temporary, re-useable, fire stop access port in way of existing fire doors**

Benefits/Justification

Benefits of the project

- **Allow existing fire doors to be closed when necessary**
- **Allow temporary cables, air and water lines to freely pass thru the bulkhead**
- **Provide a temporary firestop to adjacent compartments**
- **Possible access for AFFF and firehose without opening the fire door**
- **A re-useable firestop solution**

Project Approach

High level statement of work

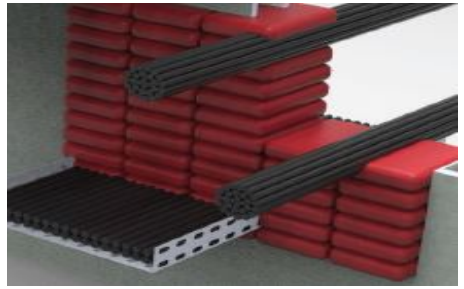
- **With Yard input, compile lists of all temporary services normally routed thru open doors during repair / construction**
- **Develop solution(s) and test plan**
- **Conduct small scale test(s) at STI Marine Fire Lab in Somerville, NJ**

Metric of Success

- **Document results of Fire Lab tests and report comments of Yard stakeholders**

Cost/Images/Relevant Information

- **Project Estimated Cost: $150,000**



FY20 NSRP ETP Panel Project – Topic Proposal Fiber Optic Pressure Sensor

D'Angelo Technologies (D5T)
3182 Rodenbeck Road, Suite D
Beavercreek, OH 45434

Joseph D'Angelo
D'Angelo Technologies, LLC
maurissa@dangelotechnologies.com

John Mazurowski
Penn State Electro-Optics Center
jsm23@arl.psu.edu

Problem Statement

- Shipboard Sensing
  - Pressure Sensing
    - Ultrasonic Vibrations
    - Fuel Chambers
    - Hydraulic Systems
  - Temperature Sensing

Technology

- Fiber Optic Sensor
  - Fiber Brag Grating (FBG)
  - Beat Signal Measurement
- Advantages
  - EMI Immunity
  - Robust to Harsh Environments

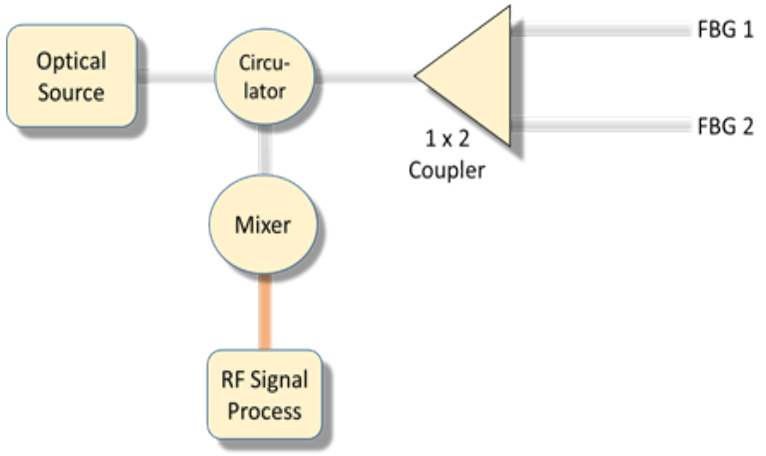


Fig. 1: Parallel Configuration

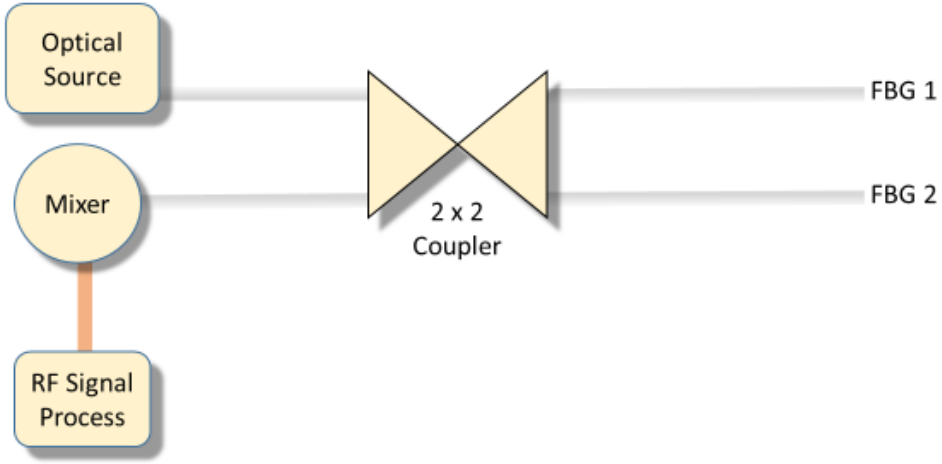


Fig. 2: Parallel Configuration with 2x2 coupler

Arc Stud Welding of Copper Power Cables

Project Lead Organization: EWI, Inc.
Project Team members: TBD

Concept/Idea

Issue:

- Provide better attachment of cables to termination tabs. Current methods of connecting cables to terminals can have reduced reliability, increased resistance, potential for cathodic corrosion.

Proposed Solution(s):

- EWI has developed and patented a method for joining copper cable to bar based on drawn arc stud welding. Each strand of the cable is metallurgically bonded to the copper plate or tab.

Benefits/Justification

Benefits of the project

- Compared to other means of attachment, Arc stud welding of cables to tabs have better conductivity, resistance to thermal sheer and corrosion.
- Arc stud welded cables can have 100% cable-to-tab fusion.
- Cables can be stud welded using equipment already in use in shipyards with only minor modifications, avoiding major capital investment
- By virtue of being all-copper, galvanic corrosion issues are avoided

Project Approach

High level statement of work

- Determine tests required for implementation; create test plan
- Refine the tooling for portable arc stud welding of cables to tabs.
- With input from the IPT, select a set of candidate applications,
- Verify that ABS/NAVSEA qualification requirements can be achieved
- Support implementation at a participating shipyard.

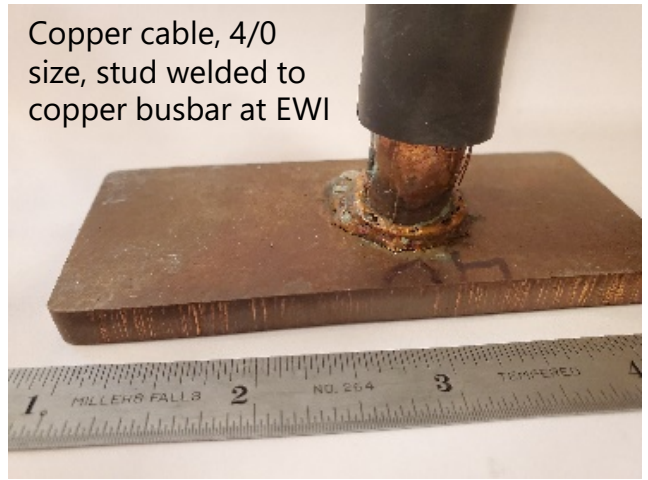
Metric(s) of Success

- Agreement by shipyards and warrant holders that method can be approved
- Validate business case for implementation at a participating yard.

Cost/Images/Relevant Information

Project Estimated Cost:

- $150,000



Copper cable, 4/0 size, stud welded to copper busbar at EWI

Improved Methods for Corrosion Prevention when Bonding and Grounding Dissimilar Metals

Project Lead Organization: Ingalls Shipbuilding (John Hurley)
Project Team members: TBD

Concept/Idea

Issue: Requirements and processes have been fully developed for Corrosion prevention and Bonding and Grounding, however they conflict with each other. Current requirements sidestep the issue by giving precedence to bonding and grounding requirements when necessary, resulting in inadequate corrosion protection that results in maintenance burdens for the shipyard and the Navy.

Proposed Solution(s): Interact with NAVSEA to develop approved methods that cost effectively provide long-term corrosion protection while still meeting bonding and grounding requirements.

Benefits/Justification

Benefits of the project

- Defined processes with NAVSEA TWH input on corrosion prevention and bonding and grounding of electrolytically dissimilar metals.
- Universal process for Class B bonds on dissimilar metal joints.
- Decrease shipbuilding cost due to installation and rework reduction.

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Project Approach

High level statement of work

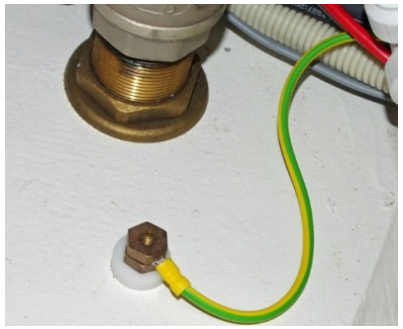
- Develop recommendations for processes to prevent corrosion of dissimilar metals while maintaining the effectiveness of bonding and grounding process.
- Discuss and gain agreement with the NAVSEA TWHs on the recommended processes
- Test the processes and determine the best solution for corrosion prevent and grounding and bonding

Metric(s) of Success

- Demo of process which achieves the benefits described

Cost/Images/Relevant Information

- **Project Estimated Cost:** $150,000
- **Project Duration:** 12 Months



Contacting Metals	Aluminium alloy	Calcium plate	Zinc plate	Carbon and alloy steels	Lead	Tin coating	Copper and alloys	Nickel and alloys	Titanium and alloys	Chromium plate	Corrosion resisting steel	Magnesium alloys
Aluminium alloy												
Calcium plate												
Zinc plate												
Carbon and alloy steels												
Lead												
Tin coating												
Copper and alloys												
Nickel and alloys												
Titanium and alloys												
Chromium plate												
Corrosion resisting steel												
Magnesium alloys												

Green areas indicate dissimilar metal contact

Technology Development – Laser LED Searchlight

Project Lead Organization: Phoenix Products, LLC
Project Team members: Ryan Hertel, Patrick Peczerski

Concept/Idea

Issues:

- **Outdated Technology.** Traditional halogen/xenon arc lamps are becoming discontinued.
- **High Operational Cost.** Short life span (approx. 200-700 hr for halogen, 500-1200hr for xenon arc) affects product fidelity.
- **Reliability.** Sensitive to vibration and shock.
- **Large Footprint**. Traditional and LED search lights require a large fixture profile to create narrow beam.
- **Performance.** Commercial LED marine searchlights offer a beam angle of approx. 8 degrees.

Existing
Marine Searchlight

Proposed Solution(s):

- White-light laser LED technology presents potential for **initial and operational cost savings** along with **operational advantages** to traditional halogen, HID and LED searchlights.
- A team led by Phoenix Products would conduct a thorough review of Navy and Shipyard considerations, present the **capabilities of white-light laser technology** to meet those considerations.
- Build a working laser **LED searchlight prototype** with modular design approach.
- Investigate feasibility of IoT capabilities for controls and predictive maintenance.
- Existing military specifications (MIL-S-19551, MIL-S-16938, NAVSEA 0901-422-0000 and others as needed) will be reviewed, and analysis provided on modifications to those specifications necessary as a result of the new technology

Benefits/Justification

Benefits of the project

- Evaluation of an innovative new commercial technology which shows promise in long-distance searchlight. Potential application of Laser LED technology as applied to Navy searchlights.
- Identify the potential benefits of:
  - **Improved Performance.** Laser LED technology may improve light beam control and distance compared to existing technology which could allow earlier visual detection of obstacles, threats to the ship and signaling.
  - **Improved Efficiency & Control.** Laser LEDs offer narrower beam angles of 2 degrees or less without the need of optics. Tighter beam angle may result in further light reach (3000+ meters).
  - **Reduced Footprint.** Laser LED would allow a decrease in fixture size.
  - **Versatility.** Smaller optic requirements opens the possibility of various optic options incorporated in one searchlight (e.g. searchlight beam, flood, elliptical). Laser LED is available in both white and infrared.
  - **Reduced Operational Costs**. Laser LED technology should reduce the operational costs of onboard lighting as they deliver a longer life span and lower initial purchase cost.
  - **Reliability.** Laser LED chips are significantly more durable in terms of vibration and shock compared to traditional halogen and xenon arc lamps.

Feasibility - Navy UV Disinfection Fixture

Project Lead Organization: Phoenix Products, LLC
Project Team members: Ryan Hertel, Patrick Peczerski

Concept/Idea

Issue: Covid-19 epidemic continues to pose a risk to mission readiness and sailor health on navy vessels. Contaminated interior surfaces and aerosolized coronavirus contaminates in the air increase transmission risks. **Commercially available US disinfectant fixtures may not be suitable for Naval use.** Additional low cost, high benefit measures can be taken to further reduce the risk of transmission on vessels through the use of UV-C and far-UV-C wavelengths. To date, no known pathogens are resistant to UV-C emissions.

Proposed Solution(s):

- Phoenix Products, in partnership with a university health department and shipyard, will **identify best practices for traditional UV-C disinfection lights to maximize disinfection** and create zero harm to crewmen.
- Through research, interviews and investigation, understand and **report on the feasibility of using UV disinfectant fixtures in Naval applications**. Provide commentary and analysis on technical and specification considerations.
- Consider development of an initial concept design

Benefits/Justification

Benefits of the project

- Develop an understanding on the **feasibility of UV disinfection lights within Naval vessels**. Identify primary considerations to lay groundwork for future development.
- Provide evidence of **quantifiable disinfection measures or advantages** that a Navy focused UV disinfection fixture brings.
- Compare and contrast wavelength disinfection technologies to determine appropriate Naval applications.
- Produce a **working concept design** of UV disinfection fixture considering the feasibility findings.

Questions & Discussion