#### NSRP National Shipbuilding Research Program

# SHIPBOARD CABLE TRAYS

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GENERAL DYNAMICS

Bath Iron Works



## AGENDA

- Mission Statement
- Project Participants
- Completion Summary
- Advantages/Challenges
- Task Descriptions
- Task Updates
- Schedule
- Second Quarter Status
- Next Steps



## MISSION STATEMENT

Determine and demonstrate how cable tray technologies can be integrated into ship design to expedite cable installation, reduce safety incidents, and improve first time quality



# PROJECT PARTICIPANTS

- BIW
  - Dave Breton Project Technical Lead
  - Andrew Trueworthy
- ATI
  - Nick Laney Business Manager
- NASSCO
  - Paul Hengst TPOC
- HII
  - Jason Farmer PTR
- Laboratory
  - TBD
- NAVSEA
  - Christopher Nemarich

#### PRIMARY ACTIVITY LIST COMPLETION SUMMARY

- Collect cable installation data 80% complete
- Assess cable tray products **100% complete**
- Design demonstrator units **100% complete**
- Construct demonstrator units 60% complete
- Conduct a pilot demonstration of a cable tray installation and corresponding cable installation 0% complete
- Conduct time study by measuring the performance of a cable installation 0% complete
- Conduct demonstrator shock testing 0% complete
- Perform a cost benefit assessment 0% complete
- Recommend a technology transition plan 0% complete

# ADVANTAGES / CHALLENGES

- Advantages
  - Install cable tray with other infrastructure; come back to install cable (minimal access issue)
  - Easier to make changes to cable install
  - May offer protection to cables
- Challenges
  - Weight
  - Space
  - Product qualification (needs to be defined)
  - Watertight bulkhead interfaces may take the place of traditional transit block systems
  - Increases options for cables and conductor installation (may not need water blocked cable)





https://www.google.com/search?q=shipboard+composite+cable+tray&tbm=isch&tbo=u&source=univ&s a=X&ved=2ahUKEwjk4rfFpITfAhUvw1kKHQjtDWMQsAR6BAgAEAE&biw=1347&bih=900#imgrc=QVqBYtKU dtpldM:&spf=1543861988628

## PRIMARY ACTIVITY LIST DESCRIPTION

- Collect cable installation data, including
  - Time charged to cable installation per ship zone and cable category
  - Types and number of injuries associated with cable pulling
  - Hours and types of rework associated with cable pulling
- Assess cable tray products that are immediately available for use, or products that may require certain levels of qualification for use
- Design and construct demonstrator units
- Conduct a pilot demonstration of a cable tray installation and corresponding cable installation









https://www.google.com/search?q=composite+electrical+duct& tbm=isch&tbo=u&source=univ&sa=X&ved=0a hUKE wj80qSSiZjUA hVL6IMKHSbfA R8QsAQIQw& biw=1280& bih=855

https://www.google.com/search?q=composite+conduit&tbm=isch&tbo=u&source=univ&sa=X&ved=0ahUKEwiG656Th5jUAhV174MKHRKXBUEQsAQIZA&biw=1280&bih=855&dpr=1

## PRIMARY ACTIVITY LIST DESCRIPTION

- Conduct time study by measuring the performance of a cable installation with respect to
  - Hours required for installation
  - Reduction of safety exposures
  - Assisting devices that can be used
  - Cable damage that is incurred
- Perform a cost benefit assessment comparing current process versus proposed uses of cable tray installations
- Recommend a technology transition plan, where deemed feasible, to introduce cable tray products to ship designs





From MP Husky Catalog

## TASK UPDATES

#### • Collect cable installation data – 80% complete

- Assess cable tray products 100% complete
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## COLLECT CABLE INSTALLATION DATA

- Cable hangar, cable pulling injury data
  - BIW Shipyard Electrician related injury & ergonomic data
    - Injury data has been reviewed and summarized into major categories
    - Researching industry averages for comparison
    - NASSCO data collection in process using various cable tray systems
- Cable installation data
  - Shipyard data has been collected, and is being organized for review
  - Shipyard data being reviewed
    - Navy Standard cable hanging systems
    - Commercial cable hanging systems
  - Differences in installation being considered to support data analysis and comparison
    - Complexity of installation
    - Performance needs

# TASK UPDATES

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## ASSESS CABLE TRAY PRODUCTS

- We have chosen & purchased three products from:
  - MP Husky
    - I-Beam Configuration
    - C-Flange Configuration
  - Research Tool & Die
    - Rack-Style Configuration



### **MP HUSKY I-BEAM**



Photo: MP HUSKY Cable Tray & Cable BUS Catalog

## MP HUSKY C-FLANGE



Photo: MP HUSKY Cable Tray & Cable BUS Catalog

## RESEARCH TOOL & DIE RACK-STYLE



Photo: Research Tool & Die Works CABLE RACK ASSEMBLY drawing

### **BIW STANDARD TRAPEZE HANGERS**



## TASK UPDATES

- Collect cable installation data 80% complete
- Assess cable tray products 100% complete

#### • Design demonstrator units – 100% complete

- Construct demonstrator units 60% complete
- Conduct a pilot demonstration of a cable tray installation and corresponding cable installation 0% complete
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# DESIGN DEMONSTRATOR UNITS

#### Design Finalized

- Using expertise from Mechanical Engineers and input from our build facility personnel, a final design has been selected and is being built
- In an effort to obtain more realistic assessment data the assessment and withstand demonstrators have been combined into a common two-piece unit.
  - Larger assessment demonstrator = more realistic shipboard condition
  - Shock demonstrator portion to be separated after assessment testing and shipped
  - Budget savings realized
- This varies from the original two demonstrator proposal

## TASK UPDATES

- Collect cable installation data 80% complete
- Assess cable tray products 100% complete
- Design demonstrator units 100% complete

#### • Construct demonstrator units – 60% complete

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## CONSTRUCT DEMONSTRATOR UNITS

- Build In-Process
  - The Unit #1 'Short' vertical section is nearly complete
  - The Unit #2 'Long' section not started





## **PROJECT SCHEDULE – OVERVIEW**

				Qtr 2, 2019			Qtr 3, 2019			Qtr 4, 2019			Qtr 1, 2020		
Task Name 🗸	Start 👻	Finish 👻	Duration	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr N
NASSCO Initial SOW Meeting and ISA	Thu 5/16/19	Fri 5/24/19	7 days	П											
Project Kickoff meeting	Mon 5/20/19	Mon 5/20/19	0 days	•	5/20										
▶ Initial Plan Development	Wed 5/29/19	Mon 6/3/19	3 days		П										
Internal Project kickoff	Mon 5/20/19	Mon 5/20/19	1 day												
▶ NASSCO tasking	Mon 5/20/19	Mon 5/20/19	1 day												
<ul> <li>Gather and Analyze Installation Data on Muliple Ship</li> <li>Programs - TASK #1</li> </ul>	Sat 6/1/19	Wed 7/3/19	23 days		[										
Research Industry Cable Tray Products - Task #2	Mon 7/1/19	Mon 8/26/19	40 days												
<ul> <li>Design and Build Demonstrator for Installation Assessment - Task #3</li> </ul>	Mon 7/1/19	Tue 10/1/19	65 days						1						
<ul> <li>Design and Build Demonstrator for Withstand Assessments - Task #4</li> </ul>	Sun 9/1/19	Fri 11/1/19	44 days												
Analyze Install and Testing Data - Task #5	Mon 12/2/19	Thu 12/19/19	14 days												
▶ Cost Benefit Analysis - Task #6	Wed 1/1/20	Tue 1/21/20	14 days												
▶ Create Report - Task #8	Wed 7/10/19	Wed 3/18/20	172 days												
▶ Communications - Task #9	Sat 6/1/19	Fri 1/3/20	145 days									1			
▶ Panel Meetings - Task #10	Fri 11/1/19	Tue 3/31/20	100 days						Г						

## PROJECT SCHEDULE – TASKS 3, 4

				Qtr 2, 2019		Qtr 3, 2019			Qtr 4, 2019			Qtr 1, 2020
Task Name 🗸	Start 🚽	Finish 🚽	Duratic 🖣	Jun Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
△ Design and Build Demonstrator for Installation Assessment - Task #3	Mon 7/1/19	Tue 10/1/19	65 days				1					
Design demonstrator to evaluate the installation performance for cable trays versus standard practice using hangers; generate performance metrics and evaluation sheets	Mon 7/1/19	Mon 7/15/19	10 days									
Create installation drawings, representing the demonstrator, the general practice cable and hanger installation, and the proposed cable tray installation	Tue 7/16/19	Mon 7/29/19	10 days									
Installation Demonstrator Materials	Tue 7/30/19	Fri 8/23/19	19 days			٦						
Develop materials list for purchase	Tue 7/30/19	Wed 8/7/19	7 days		<b>1</b>							
Purchase Materials	Thu 8/8/19	Fri 8/16/19	7 days		- <b>1</b>							
Materials Shipping	Mon 8/19/19	Fri 8/23/19	5 days		+	h						
Materials Received	Fri 8/23/19	Fri 8/23/19	0 days			<b>8/23</b>						
Build / Modify installation demonstrator	Mon 8/26/19	Mon 9/9/19	10 days									
Use existing cable and hanger installation practices; measure performance	Tue 9/10/19	Thu 9/19/19	8 days			i i i i i i i i i i i i i i i i i i i						
Use proposed cable tray and methods; measure performance	Fri 9/20/19	Tue 10/1/19	8 days			*						
${\scriptstyle  extsf{ }}$ Design and Build Demonstrator for Withstand Assessments - Task #4	Sun 9/1/19	Fri 11/1/19	44 days									
Modify demonstrator for withstand testing, including up to 3 cable tray product lines of materials, straight tray, 90 degree, T sections; include a ladder hanger arrangement for testing comparison; include in the design cable installed in the trays replic	Sun 9/1/19	Fri 10/4/19	25 days									
Develop shock testing procedure with SN&V and Lab IAW 901D	Mon 10/7/19	Fri 10/11/19	5 days				1					
Package and ship demonstrator to testing facility	Mon 10/7/19	Fri 10/11/19	5 days				<b>1</b>					
Test Demonstrator	Mon 10/14/1	Fri 10/18/19	5 days				<b>1</b>					
Test Report Developed by LAB	Mon 10/21/1	Fri 11/1/19	10 days				+					

## SECOND QUARTER STATUS

- Project is about 45 days behind due to a late start and demonstrator build delays
- The second quarter predominantly involved finalizing demonstrator design, defining, and ordering material for:
  - Building the demonstrator
  - Purchasing the cable tray systems
- Materials costs for the project are expected to run below the original estimated costs
- Finalizing the assessment criterion for the cable tray installation and cable pull time studies

# NEXT STEPS

- Complete construction on the demonstrator units
- Complete the assessment documentation for the time studies
- Organize and stage the cable tray systems for time study
- Conduct time study
- Establish contract with shock test lab (in process; specs and procedures used for competitive bid process, quotes received)



Demonstrator Facility (BIW Orion Training Building)

#### **GENERAL DYNAMICS**

### SHIPBOARD CABLE TRAYS

NSRP ETP

