

Composite Materials Components for Reduced Maintenance and Total Ownership Cost

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- **Introduction**
- **Methodology for New Component Development**
- **Legacy Components**
 - Grating, Vent Screens, Electrical Enclosures
- **Components in Transition**
 - Deck Drain Inserts, MIL-PRF-24758A End Fittings, Trough Cover Plates (DDG51 class)
- **Components in Development**
 - Composite Stowage Boxes, Sunshield, Cover Plates (LPD 17/LHD 1/DDG51 and CG47 classes)
- **Summary**

Introduction

- **Corrosion of metallic components in topside, well deck and catwalk areas requires significant sailor labor and maintenance funding to repair and/or replace corroded components.**
- **Components made out of composite materials offer the potential to be more resistant to environmental effects, lighter weight and in some cases, lower cost than the legacy metallic components.**
- **The goal of this presentation is make the fleet aware of the components that are currently available as well as those in development so that they can be utilized across the fleet to reduce total ownership cost.**

Examples of Corroded Components



Stowage Box



Sound Powered
Phone Jack Box

MIL-PRF-24758A Connector



Deck Drain

Electrical Enclosure



LHD well deck
grating



Vent Screen

Methodology for New Component Development



1. Identification of Target Components

- Input from maintenance personnel, ships' forces, port engineers, and program office used to identify specific components which require frequent maintenance.

2. Requirements Definition

- Analysis to determine the current requirements of the component.
- Interactions with cognizant technical warrant holders.

3. Prototype Fabrication, Evaluation and Demonstration

- Prototype of composite components fabricated and evaluated per the requirements defined during the Requirements Definition Phase.
- Prototype iterated as necessary and Ship Change Document (SCD) generated to allow for fleet demonstrations.

4. Trial Inspection and Institutionalization

- Inspections performed of the fielded component dependent on ship availability.
- Installations documented and ships' forces queried for feedback on success of installation and any lessons learned documented.
- SCD's, Temporary Alteration Installation (TEMPALTS), NAVSEA Drawing packages, and National Stock Numbers (NSN) established as part of the Institutionalization process depending on the component. Preferred transition path determined through interactions with program office and stakeholders.

Composite Deck Grating (Approved for Use)

Installed Composite Deck Grating



LSD Wing Wall



CVN Catwalk

Benefits

- 45% weight by reduction on CVN class catwalk (14 ton reduction)
- Will not corrode like the legacy steel grating

Material

- New phenolic resin based composite material
- NAVSEA 803-6983499B, Deck Grating, GRP Installation and Details.

Approved Suppliers

- Fibergrate Composite Structures Inc.
- Strongwell Corporation

Logistics

- NSN for M-clip
 - 5340-01-529-4180
- NSNs for grating panel
 - 2540-01-654-4472 (3ft x 20ft)
 - 2040-01-660-9865 (4ft x 12ft)
 - 2540-01-654-4473 (4ft x 6ft)
- Updated MRC 2HZ0 (Inspect GRP Grating) to include M-clip and nut NSN.

Composite Vent Screens (Approved for Use)



- Will not corrode like the legacy steel vent screen
- Widely installed across the fleet on CVN, L-ships and DDG classes

Material

- Modified Acrylic (MODAR) based composite material
- NAVSEA DWG 803-6983500 Vent Screen, GRP, Installation and Details

Approved Supplier

- Fibergrate Composite Structures Inc

Logistics

- Screen
 - NSN 5670-01-529-4266
 - Updating NSN
 - Fibergrate P/N 269470
- M-Clip
 - Fibergrate P/N 734250
 - NSN – 5340-01-502-8426
- Developing MRC for inspection of vent screens that will reference M-Clip and Nut NSN.

Composite Electrical Enclosures (Approved for Use)



CVN Aircraft Elevator Station

Approved Supplier

- Glenair

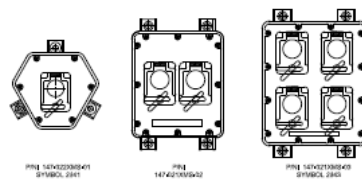
Logistics

- NSNs assigned for various enclosures and replacement parts



- **NAVSEA DWG 803-6983506 Electrical Enclosure, Rev B.**
- **SCD 6922 All Surface Ships**
- **Still looking to transition to CVN fleet on a more wide scale basis.**
 - Initial CVN specific SCD never completed
- **Developing MRCs to be able to note replacement parts that are available (flop lids & covers)**

FAMILY OF SOUND POWERED PHONE ENCLOSURES

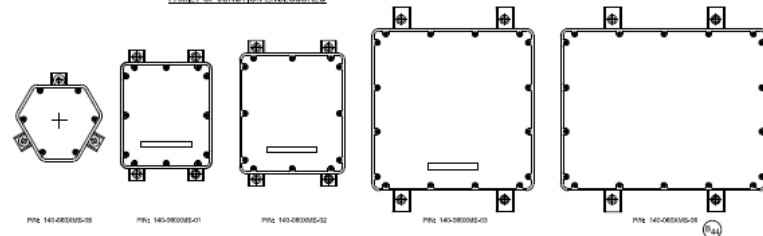


PN: 147-223084-01
SYMBOL 2841

PN: 147-223084-02
SYMBOL 2842

PN: 147-223084-03
SYMBOL 2843

FAMILY OF JUNCTION ENCLOSURES



PN: 147-223085-05

PN: 147-223085-01

PN: 147-223085-02

PN: 147-223085-03

PN: 147-223085-04

FAMILY OF STANDARD NAVY RECEPTACLES



PN: 147-223085-01

PN: 147-223085-02
SYMBOL 10951

PN: 147-223085-03
SYMBOL 175A1

PN: 147-223085-003
SYMBOL 10951

PN: 147-223085-008G
SYMBOL 1101

PN: 147-223085-02

PN: 147-223085-05

PN: 147-223085-005G
SYMBOL 919

Composite Electrical Enclosures (Approved for Use)

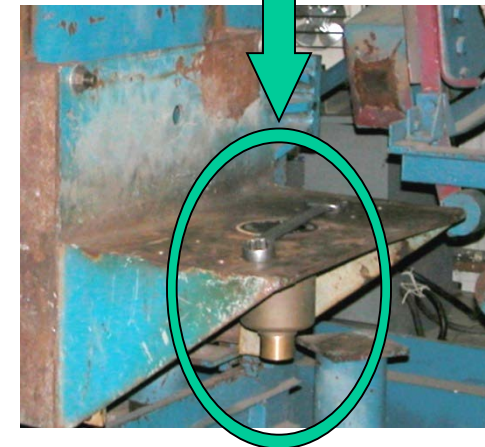
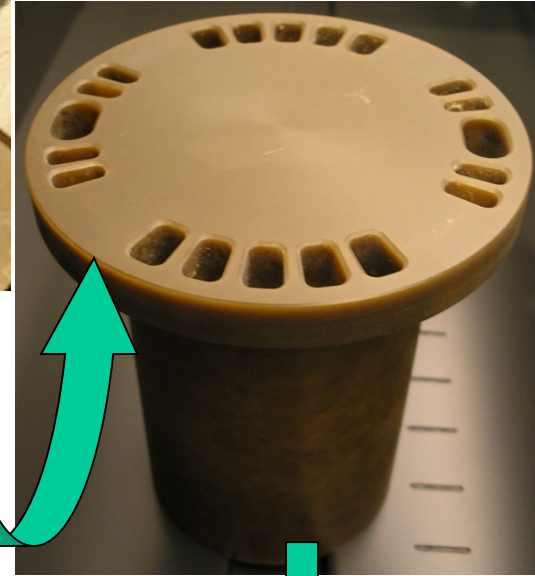
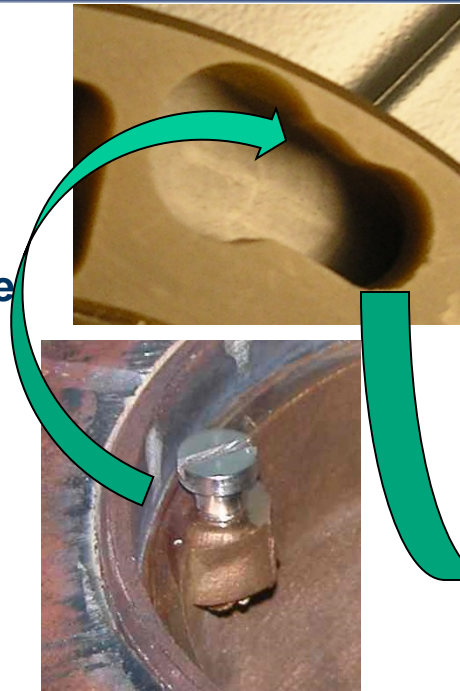
- Composite Electrical Enclosures have been added to the Navy Virtual shelf, Ordering information provided in NAVSEA Drawing.

Type of Box	Glenair P/N	NSN	Sym bol # MIL- HDBK- 290	Replacement Parts	
				Cover NSN	Flop Lid NSN
Junction					
Small Round Enclosure	140-060XMS-05	5975-01-556-7948	-	5940-01-557-2622	-
Small Enclosure	140-060XMS-01	5975-01-556-7957	-	5940-01-557-2612	-
Medium Enclosure	140-060XMS-02	5975-01-557-2672	-	5940-01-557-2616	-
Large Enclosure	140-060XMS-03	5975-01-557-2679	-	5940-01-557-2626	-
Extra Large Enclosure	140-060XMS-06	5975-01-658-2999	-	Glenair P/N avail	-
Sound Powered Telephone					
Single Jackbox	147-022XMS-01	5935-01-572-5487	2841	5935-01-572-5485	5975-01-556-9582
Double Jackbox	147-021XMS-02	5935-01-572-6657	2842	5940-01-572-5480	5975-01-556-9582
Four-Gang Jackbox	147-021XMS-03	5935-01-572-5631	2843	5940-01-572-5483	5975-01-556-9582
Electrical Receptacle					
Single Receptacle (15A, 125V Blade)	147-023XMS-01	5940-01-557-2645	-	5940-01-557-2585	5940-01-556-9621
Single Receptacle (15A, 125V Blade w/threaded collar)	147-023XMS-02	5940-01-557-2667	1099.1	Glenair P/N avail	5940-01-556-9627
Single Receptacle (15A, 125V 2-pole grounded)	147-023XMS-03	-	735.3	Glenair P/N avail	5940-01-556-9627
Single Receptacle (15A, 125V MS3402)	147-033XMS-0003	5940-01-557-2725	1098.1	5940-01-557-2585	5940-01-556-9627
Single Receptacle (15A, 125V, 400 Hz Blade w/threaded collar)	147-032XMS-0005G	5940-01-557-2719	1101	Glenair P/N avail	5940-01-556-9627
Dual Receptacle (15A, 125V Blade)	147-020XMS-02	5940-01-556-9504	-	5975-01-556-9522	5940-01-556-9621
Dual Receptacle (15A, 125V Blade w/threaded collars)	147-020XMS-05	5940-01-557-2634	-	5940-01-557-2587	5940-01-556-9627
Single Receptacle with switch (15A, 125V Blade w/threaded collar)	147-038XMS-0008	6110-01-658-1317	919	-	5940-01-556-9627
Junction Box with Terminals					
Small Round Enclosure (six terminal, A-A-59125/12, 6TB6)	140-060XMS-05T2	5940-01-557-2579	520.1	5940-01-557-2622	-
Small Round Enclosure (six terminal, A-A-59125/15, 9TB)	140-060XMS-05T4	5940-01-557-2712	-	5940-01-557-2622	-
Small Round Enclosure (four terminal, A-A-59125/18, 13TB4)	140-060XMS-05T5	-	400.2	5940-01-557-2622	-
Small Enclosure (eight terminal, A-A-59125/10, 4TB8)	140-060XMS-01T3	5940-01-556-7967	435.1	5940-01-557-2612	-
Small Enclosure (ten terminal, A-A-59125/12, 6TB10)	140-060XMS-01T4	5940-01-556-9434	528	5940-01-557-2612	-
Small Enclosure (four terminal, A-A-59125/20, 16TB4)	140-060XMS-01T6	5940-01-556-9443	444	5940-01-557-2612	-
Large Enclosure (twenty terminal, A-A-59125/10, 4TB20)	140-060XMS-03T1	5940-01-556-9489	432.1	5940-01-557-2626	-
Large Enclosure (thirty terminal, A-A-59125/12, 6TB6/6TB24)	140-060XMS-03T2	5940-01-557-2564	434	5940-01-557-2626	-
Large Enclosure (ten terminal, A-A-59125/20, 16TB10)	140-060XMS-03T5	5940-01-557-2578	529	5940-01-557-2626	-
Large Enclosure (forty terminal, A-A-59125/10, 4TB20)	140-060XMS-03T9	5940-01-557-2582	433.1	5940-01-557-2626	-
Large Enclosure (forty eight terminal, A-A-59125/12, 6TB24)	140-060XMS-03T10	5940-01-556-9494	522.1	5940-01-557-2626	-
Large Enclosure (sixty terminal, A-A-59125/10, 4TB20)	140-060XMS-03T11	5940-01-557-2563	446	5940-01-557-2626	-
Large Enclosure (seventy two terminal, A-A-59125/12, 6TB24)	140-060XMS-03T12	5940-01-556-9499	525	5940-01-557-2626	-
Extra Large Enclosure (forty eight terminal, A-A-59125/12, 6TB24) *	140-060XMS-06T1	-	522.1	Glenair P/N avail	-
Extra Large Enclosure (sixty terminal, A-A-59125/10, 4TB20)*	140-060XMS-06T2	-	446	Glenair P/N avail	-
Extra Large Enclosure (seventy two terminal, A-A-59125/12, 6TB24)*	140-060XMS-06T3	-	525	Glenair P/N avail	-

Composite Deck Drains

(Approved for Use/Transitioning via APL Updates)

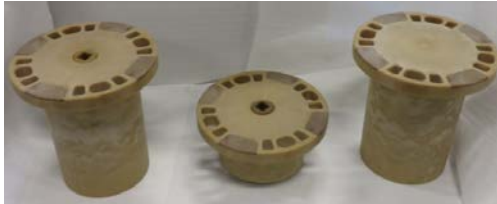
- **Purpose:** Ease of service, no tools, low/no maintenance.
- **Problem:** Fasteners corrode into drain preventing service.
- **Solution:** Make drain insert from composite with twist lock and install fasteners permanently. Finger holes provided to remove and service without tools.
- **Material:** GE ULTEM 2300 with 30% glass fiber reinforcement chosen for mechanical properties and fire performance.
- Non-valved passed Grade B shock test
- Valved passed Grade A shock test
- Evaluation on LHA5 (2004), CG61 (2012), DDG84 (2013), CVN71 and CVN75 (2014)
- NAVSEA DWG 803-6983511 Deck Drain Insert, Composite, 1.5 & 2.0 inch
- Valved versions compatible with legacy T-wrench



Deck drain mounted in shock test machine

Composite Deck Drains

(Approved for Use/Transitioning via APL Updates)



2 inch Type A 2 inch Type B 2 inch Type D
2 inch seal/trap 2 inch seal/trap



2 inch Type A 2 inch Type A
2 inch seal/trap 4 inch seal/trap



1.5 inch Type D 2 inch Type D
2 inch seal/trap 2 inch seal/trap
(unfinished)



2 inch Type D 2 inch Type D
2 inch seal/trap 4 inch seal/trap



2 inch Type C

Material

- Ultem 2300 (30% chopped glass Polyetherimide (PEI))
- NAVSEA DWG 803-6983511 Deck Drain Insert, Composite, 1.5 & 2.0 inch

Approved Supplier

- BAE Systems San Diego Ship Repair

Logistics

- NSN for all configurations
- NSN for shoulder bolts
- Updated 2 MRCs (A1JU/C4QV) one MRC to update (G6GQ) and U-MRC (J2NP)

Corrosion Control APLs

DDG 51 CLASS – APL 990990673
CG 47 CLASS – APL 990990588
LPD 17 CLASS – APL 99A150207
LHA 1 CLASS – APL 99A150206
LHD 1 CLASS – APL 99A150205
LSD 41/49 CLASS – APL 990990701
PC 1 CLASS – APL 99A160059
LCS 1 CLASS – APL 99A160090
LCC 19 CLASS - APL 99A160023

Ships can use corrosion control APL to initially purchase the composite deck drain insert and then update the ship configuration with composite deck drain APLs to reflect which and how many deck drain inserts were installed.

Deck Drains APLs (most common)

2-INCH TYPE A – 2-INCH SEAL – APL 67A090013
2-INCH TYPE B – APL 67A140007
2-INCH TYPE C – APL 67A150009
2-INCH TYPE D – 2-INCH SEAL – APL 67A090011

Deck Drains NSNs (5 shoulder bolts inc.)

2-INCH TYPE A – 2-INCH SEAL – NSN 4510-01-578-1143
2-INCH TYPE B – NSN 4510-01-633-0924
2-INCH TYPE C – NSN 4510-01-649-3042
2-INCH TYPE D – 2-INCH SEAL – NSN 4510-01-578-1209

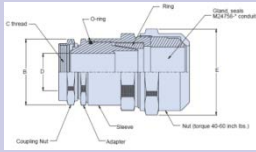
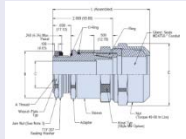
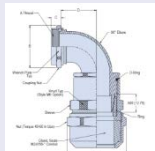
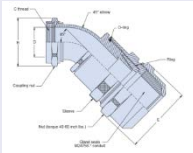
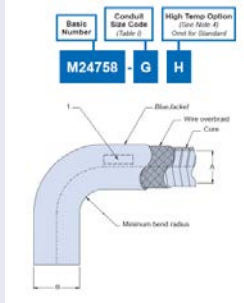
1.5-INCH TYPE A – 2-INCH SEAL – NSN 4510-01-578-1029
1.5-INCH TYPE A – 4-INCH SEAL – NSN 4510-01-578-1022
2-INCH TYPE A – 4-INCH SEAL – NSN 4510-01-578-0844
1.5-INCH TYPE B – NSN 4510-01-632-7573
1.5-INCH TYPE D – 2-INCH SEAL – NSN 4510-01-578-0834
1.5-INCH TYPE D – 4-INCH SEAL – NSN 4510-01-593-9171
2-INCH TYPE D – 4-INCH SEAL – NSN 4510-01-578-1109

MIL-PRF-24758A Conduit End Fitting (Approved For Use/Transitioning)

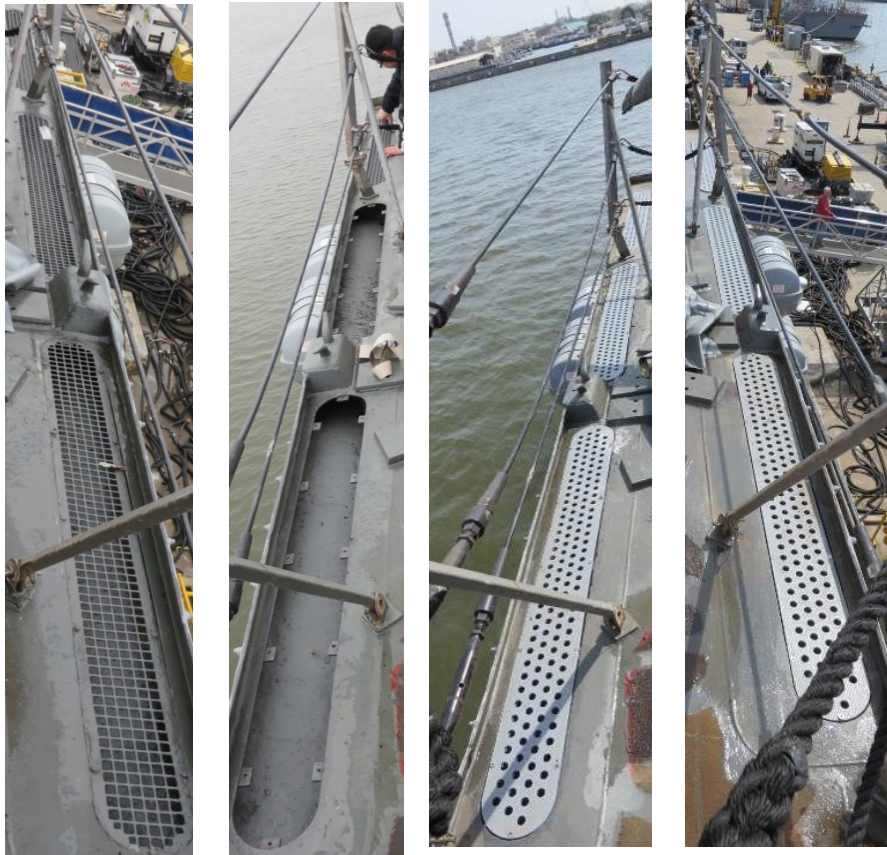
- **Glenair, an approved vendor of MIL-PRF-24758A conduit, has replaced the legacy stainless steel nut and sleeve on the MIL-PRF-24758A end connectors with a composite material to come up with a lightweight, environmentally durable, lower cost, hybrid end connector.**



MIL-PRF-24758A Conduit End Fitting (Approved For Use/Transitioning)

P/N	NSN	Comments	Glenair Drawing
M24758-2BL	5975-01-657-4304	Electrical Adapter - Straight Conduit Size B	
M24758-2CL	5975-01-657-4296	Electrical Adapter - Straight Conduit Size C	
M24758-2DL	5975-01-657-4303	Electrical Adapter - Straight Conduit Size D	
M24758-5BL	5975-01-657-4340	Electrical Adapter - Straight Conduit to Panel - Size B	
M24758-5CL	5975-01-657-4335	Electrical Adapter - Straight Conduit to Panel - Size C	
M24758-4BL	5975-01-657-4473	Electrical Adapter - 90 degree Conduit Size B	
M24758-4CL	5975-01-657-4466	Electrical Adapter - 90 degree Conduit Size C	
M24758-3BL	5975-01-657-4456	Electrical Adapter - 45 Degree Conduit Size B	
M24758-3CL	5975-01-657-4452	Electrical Adapter - 45 Degree Conduit Size C	
M24758-B	5975-01-584-5182	EMI/EMP Shielded Conduit Size B	
M24758-C	LL-H0C-2617	EMI/EMP Shielded Conduit Size C	
M24758-D	5975-01-643-3481	EMI/EMP Shielded Conduit Size D	

Composite Trough Cover Plate (Transitioning via APL Updates)



Demonstration on USS NITZE

Summary – 03 Level Plates

- Port Engineer identified problem components.
- Prototype parts fabricated at NSWC Carderock.
- Glass fiber reinforced vinyl ester composite material coated with Formula 150 and MIL-PRF-24635 Polysiloxane, Deck gray.
- Matched Drilled shipboard to meet mounting hole locations.
- Initial 2 cover plate demonstration on USS BULKELEY April 2013.
- Full ship sets installed USS NITZE (April 2015), USS MAHAN (June 2016), and USS BULKELEY (April 2017).
- Moving forward with NSN generation.

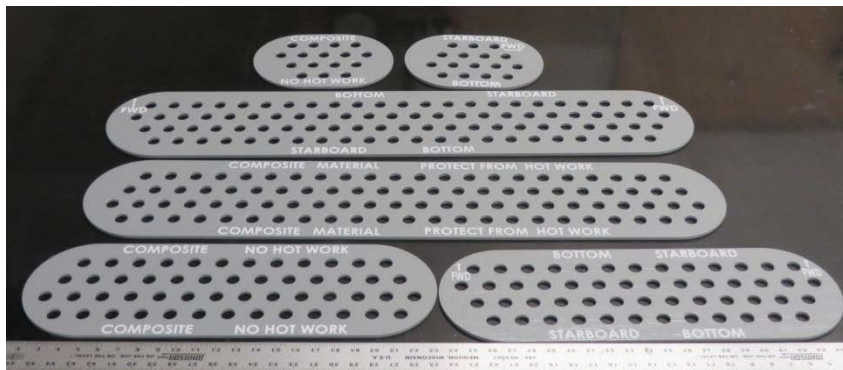
Composite Trough Cover Plate (Transitioning via APL Updates)



- **As each location on the ship is different, the plates have to be match drilled to the mounting tabs.**
- **Each plate in the shipset is marked:**
 - Port/Starboard
 - Forward/Middle/Aft
 - Arrow FWD
- **NSN will be generated based on first articles received from Seemann Composites and a shipset (6) will be added to the Corrosion Control APL to complete transition.**

DDG51 Class – Bridge Wing

- Similar trough cover plates have been developed for bridge wing troughs.
- Similar transition path in process for in-service ships.
- ECP for DDG128AF new construction.



Composite Cover Plates (In Development)

- **FY17/FY18 Development of Internal Strainer Plates in Sump and Bilge Areas. – Looking for examples**



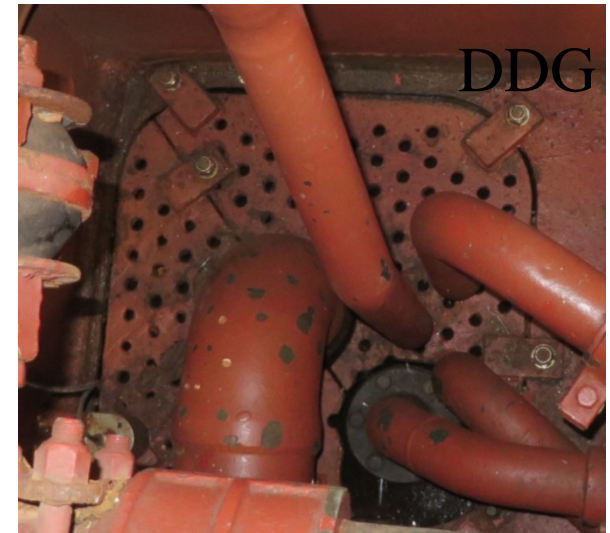
LHD



LPD



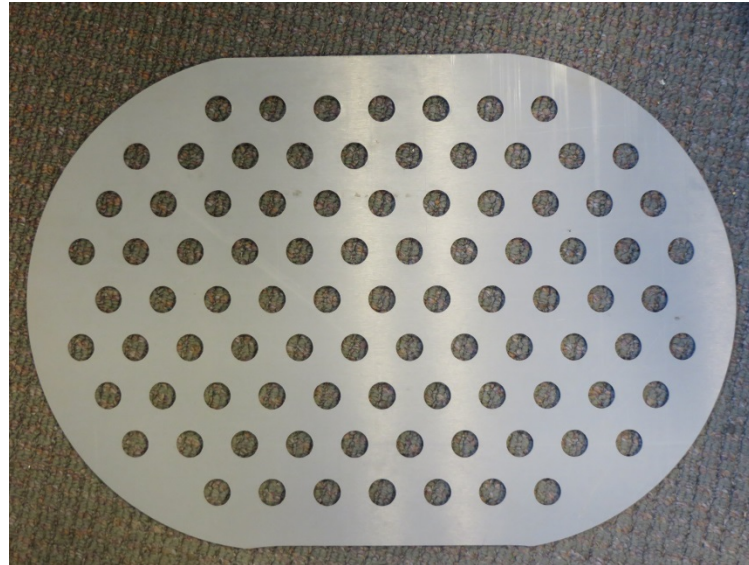
CG



DDG

Composite Cover Plates (In Development)

- **Prototype Composite Bilge/Educator Strainer Plate Developed. FY18 demonstrations planned.**



Ready Service Locker Sunshield (FY16-18) (In Development)



- **NAVSEA 05PF Painting Center of Excellence has selected the Composite Munition Sunshield for funding in FY16-FY18.**
- **Legacy steel sunshields are rust formers and require frequent maintenance.**
- **This project will develop a composite material based sunshield.**
- **Initial material selection is a COTS product that is a white colored glass fabric reinforced polyetherimide (PEI) composite material.**
 - Material is currently used in aircraft applications and has very low flame spread, smoke density and toxicity properties.

Ready Service Locker Sunshield (FY16-18) (In Development)

- **Planning a shipboard demonstration on 25 mm ammo RSL onboard USS Zephyr (PC 8) at Mayport in mid-June 2018**
- **Planning a shipboard demonstration on .50 cal RSL onboard USS Whidbey Island (LSD-41) and USS Gunston Hall (LSD-44) at Norfolk in August 2018 timeframe**
- **Working with Office of Naval Research Manufacturing Technology Program to develop reconfigurable machine to fabricate any shape from flat sheet stock.**



Composite Stowage Boxes (In Development)



USS BULKELEY
(over 2 years installation)



USS NITZE
(over 4 years installation)

Initial Stowage Box Projects

- Brow Chain Rail Stowage Box (DDG 51 class)
- Telephone Headset Stowage Box (fleet wide)
- Rescue and Assist Box (fleet wide)

Summary

- Ultem 2300 (30% chopped glass PEI)
- Ultem (7781 glass fabric reinforced)
- Composite version of sheet metal processing.
 - Locally heat area and then bend material to form box.
 - Use thermoplastic welder tool to join seams.
- Larger stowage boxes will use bonded angles of same material to provide strengthening at corners.

Composite Drip Pans (Potential Future Program)

- **Looking for examples of Corrosion Prone Drip Pans in the Fleet**



- **ONR Mantech effort currently underway to develop a replacement panel for the current Nomex Core false deck panels**
 - Reduce cost of material and installation and improve durability of material
- **NSWCCD is investigating improved fasteners, alternative mounting methods and basic repair methods for legacy materials to improve readiness of the electrical spaces.**



Components for Demonstration



- **NSWCCD is always looking for components that could be converted to composite materials to reduce the maintenance burden.**
- **NSWCCD is currently soliciting for points of contacts within the surface ship community for future trial demonstrations of composite deck drain inserts as these components transition to the fleet.**

Summary

- **Composite materials based components have been shown to reduce the required maintenance due to corrosion in topside applications.**
- **A standard methodology has been established to take new ideas from the fleet through the development process.**
- **The preferred path to Institutionalization for new components is developed through interactions with Technical Warrant Holders (TWH), In-Service Engineering Agents (ISEA), fleet and program office.**
- **It is imperative that all logistics development, Allowance Parts List (APL), Coordinated Ship Allowance List (COSAL), NSN, Planned Maintenance System (PMS), occurs during development to ensure a smooth transition to the fleet.**

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