Advances and Evolution in Shipboard Cable Applications, Designs, and Manufacturing

August 13, 2025
NSRP Meeting
Manchester, NH

Marmon Aerospace & Defense Group
A Berkshire Hathaway Company

Agenda

Marmon Aerospace & Defense Group

MARMON HOLDINGS INC: A BERKSHIRE HATHAWAY COMPANY

DURACELL · FRUIT OF THE LOOM · Benjamin Moore · GEICO · DQ · NETJETS · Justin BOOTS · McLANE · BERKSHIRE HATHAWAY ENERGY · MARMON · IMC · Lubrizol · BNSF RAILWAY

Medical | Water | Food | Retail | Transportation | Electrical | Rail | Metals | Plumbing | Industrial | Crane

Electrical

Components /Compounds

- CABLE COMPONENTS GROUP
- GENDON POLYMER SERVICES INC

Connectivity

- KITCO fiber optics
- TEW&C
- CCPI Europe

Aerospace & Defense

- MARMON Aerospace & Defense
- Harbour INDUSTRIES
- MARINE TECH WIRE AND CABLE, INC.

Industrial Energy & Infrastructure

- RSCC World Class Engineered Cable
- cerrowire
- COMTRAN
- DEKORON Unitherm
- TRILOGY Communications
- Dekoron Wire & Cable LLC
- RADIANT-RSCC Specialty Cable

Utility

- Hendrix
- kerite

Marine Tech is Now Part of Marmon A&D

Marmon Aerospace & Defense Group

- Addition of Lightweight Circuit Integrity Cable
- Overlapping capabilities for better capacity management
  - York PA
  - Naples FL
  - Manchester NH
  - Hooksett NH
- Similar raw material supply chains
- Combined QA/Lab Testing Capabilities
- Highly experienced workforce and management team
- Expanded distribution network
- Combined market and competitive knowledge

MARINE TECH
WIRE AND CABLE, INC.

Manufacturing Facility – Hooksett, NH

US Navy / Marmon A&D joint investment

Marmon Aerospace & Defense Group

Manufacturing Facility designed exclusively for production of large silicone rubber insulated 1kV to 5kV NAVSEA specified power cables with circuit integrity.

Power Feeder Cable adds:

- All-inclusive Shipyard requirements
- Increases our Navy product portfolio

Marmon A&D Advantages:

- Shortest Lead-times
- Proven Quality Assurance
- Robust Naval product portfolio
- Financial Stability

NAVSEA Priorities:

- Improved Quality Assurance
- Improved Program Timelines

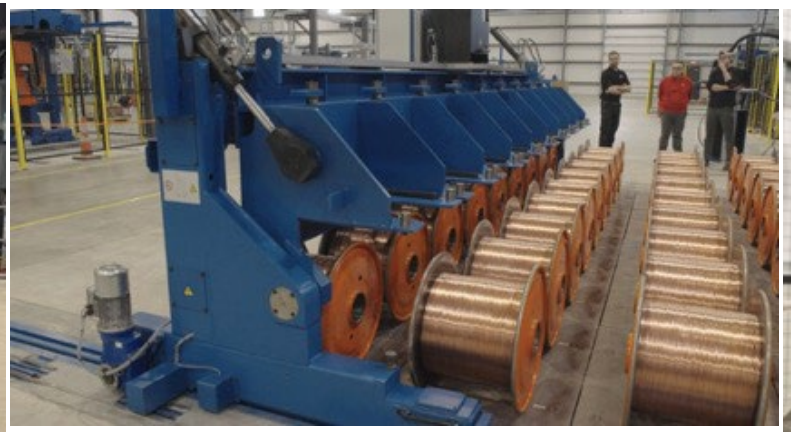
New Manufacturing Facility – Hooksett, NH

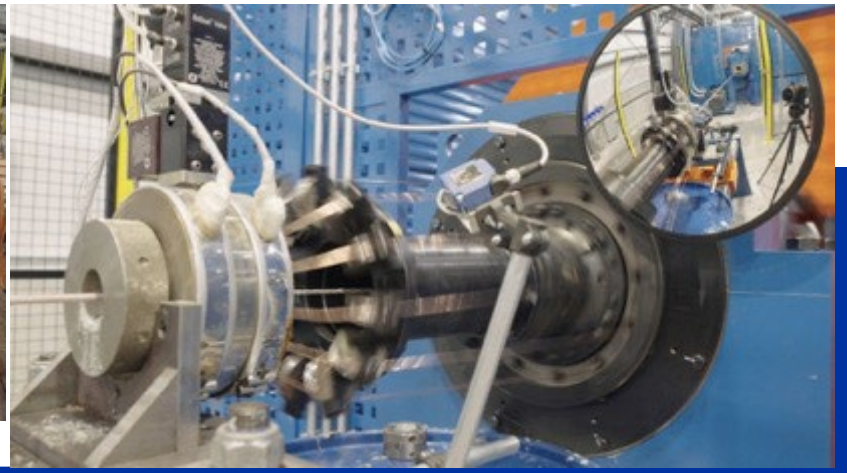
US Navy / Marmon A&D joint investment

Marmon Aerospace & Defense Group

Hooksett Facility Features:

- New state-of-the-art equipment, new building
- Fully automated production lines
- Combined operations
- Enhanced HVAC
- Proximity to power substation
- Quiet and safe





Product Portfolio

Innovative Brands – Solutions Delivered

Marmon Aerospace & Defense Group

95+% of all NAVSEA M24640 / M24643 qualifications

- **M24640/1-/18, /26 lightweight extruded** using polyolefin/PVDF primary insulation
- **M24640/19-/25 circuit integrity** cables using mica-polyimide primary insulation
- **M24643 power feeder** cables using silicone rubber / fiberglass tape primary insulation
- **M24643 power distribution** cables using silicone rubber primary insulation
- **M24643 control and instrumentation** cables using XLPO primary insulation
- **M24643 communication** cables using PO primary insulation

QPL Status

Marmon Aerospace & Defense Group

- Qualified to supply 95+% of all M24640 and M24643 types
- Currently qualified for all large power feeder cables M24643 /14-/19, /22, /63, /66-/68, /73 and /86 (5kV).
- Currently qualified for Cat5e Ethernet with Cat6A pending, pursuing additional Communications / Network qualifications.
- Currently manufacturing EMZ topside cables, pursuing qualification.

M24640 QPL Status

M24640/	Type	Status
1	DX	Common A&D-MT
2	TX	Common A&D-MT
3	FX	Common A&D-MT
4	TTX	Common A&D-MT
5	TTXS	Common A&D-MT
6	2XAO	Common A&D-MT
7	1XMSO	Common A&D-MT
8	MXO	Common A&D-MT
9	2XS	Common A&D-MT
10	MXSO	Common A&D-MT
11	3XS	Common A&D-MT
12	2XO	Common A&D-MT
13	2XSXO	Common A&D-MT
14	1XSOW	Common A&D-MT
15	2XSAW	Common A&D-MT
16	2XSW	Common A&D-MT
17	2XOW	Common A&D-MT
18	3XSW	Common A&D-MT
19	DXW	Marine Tech
20	TXW	Marine Tech
21	FXW	Marine Tech
22	7XW	Marine Tech
23	MXCW	Marine Tech
24	TTXW	Marine Tech
25	9XS	A&D
26	5XO	A&D

M24643 QPL Status

M24643/	Type	Status	M24643/	Type	Status	M24643/	Type	Status
2	LSDC, LSTC	A&D	29	LSMU A	Marine Tech	54	LS8NW-6	Marine Tech
3	LSDDH, FH,	No plan	29	LSMU, SLMU	No plan	55	LS4NW-8	Marine Tech
4	LSMCOS	No plan	30	LS1SWU	A&D	56	LS2SWL-7	A&D
5	LSMDU	A&D	31	LS2SU	A&D	57	LS2UW-4	A&D
7	LSMHOF	A&D	32	LS2SWA	A&D	58	LS2CS	A&D
8	LSMMOP	A&D	33	LS2SWU	A&D	59	LSC5	A&D
9	LSMRI	Marine Tech	34	LSMS A	Marine Tech	61	LSC5P	A&D
10	LSPBTMU	No plan	35	LS3SU	A&D	62	LSPB2SD	Comms
11	LSSSF	No plan	36	LS3SWU	A&D	63	LSYSGU	A&D
12	LSTTOP	A&D	37	LS3U A	A&D	64	LSTPSJ	Common A&D-MT
13	LSTTRS	A&D	38	LSECM	A&D	65	LS3C179DT	Comms
14	LSSSGU	Hooksett	39	LS1S75	A&D	66	LS2OW	A&D
15	LSDSGU	A&D	40	LS1SMU	A&D	67	LS3OW	A&D
16	LSTSGU	A&D	41	LS1SAU	A&D	68	LS4OW	A&D
17	LSFSGU	A&D	42	LS1SU	A&D	69	LSC264-4	Comms
18	LSMSCU	A&D	43	LS2,3,4SJ	Common A&D-MT	71	LSSCF	A&D
19	LS6SGU	Hooksett	44	LS3SF	A&D	72	LSFCF	A&D
20	LS7SGU	A&D	45	LS2U	A&D	73	LSTCF	Hooksett
21	LSTCJU	A&D	46	LS2WAU	A&D	75	LSLCFS-25	Comms
22	LS5KVT	Hooksett	47	LS1SMWU	A&D	76	LS5KVTEPSG	New RevD
23	LSTTSU	A&D	48	LSDNW	Marine Tech	77	LSC6	A&D
24	LSTCJX	A&D	49	LSTNW	Marine Tech	78	LSCBPSJ	New RevD
25	LSPI &	A&D	50	LSFNW	Marine Tech	79	LS2KVTSGSG	New RevD
26	LSDPS,	A&D	51	LSMNW	Marine Tech	80	LSTW	New RevD
27	LS2AU,	A&D	52	LSTPNW	Marine Tech	81	LSE	New RevD
28	LS1S50	A&D	53	LSSRW	A&D	82	LSE	New RevD
						83	LSE	New RevD
						84	LSEC6	New RevD
						85	LSE	New RevD
						86	LS5KVTSSGUSHF	Hooksett

Importance of Supplier Reliability

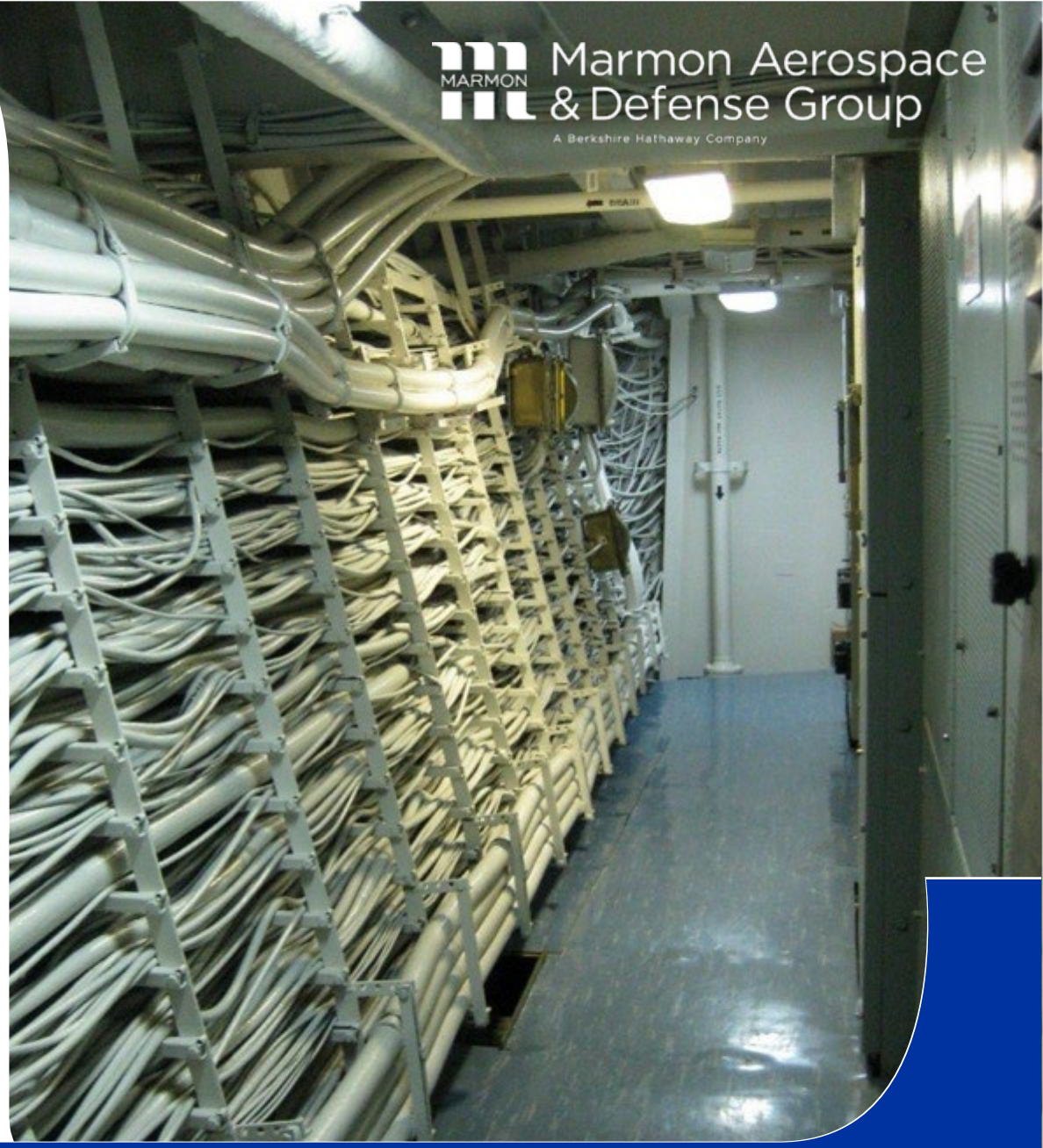
"*Price is what you pay. Value is what you get*." - **Warren Buffett**

Quality

- Consistently high quality product proven over an extended time period
- Low level of complaints and returns
- Effective corrective actions
- Inspection, installation or onboard issues are addressed quickly and effectively
- Longest lengths possible for lowest installation scrap
- Stand by your product with full support

Delivery: On-Time Performance / Lead Times

- Shortest lead times possible
- Operational redundancy to minimize long delays
- State-of-the-Art manufacturing equipment to ensure accelerated run speeds and minimize scrap



Applications

Innovative Brands – Solutions Delivered

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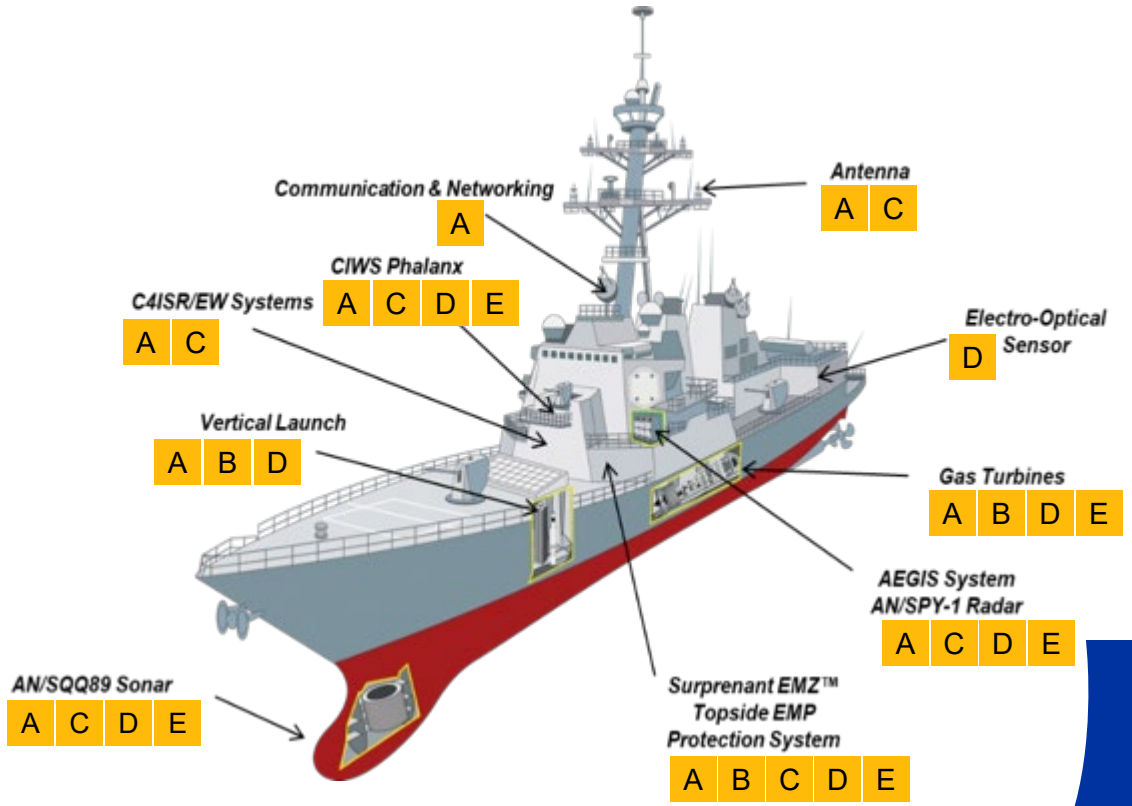
Application		Types
Comms & Network	A	Ethernet Data Cables TP Voice Cables
Power Feeder (Large Power Cables)	B	Large Silicone rubber insulated primaries, 1kV to 5kV, single and multiconductor
Power Distribution (10-18 AWG multiconductor cables)	C	Silicone rubber insulated primaries, 10-18 AWG, multi-conductor Polyolefin/PVDF Insulated conductors
Control & Instrumentation	D	Polyolefin insulated conductors Polyolefin/PVDF Insulated conductors
Circuit Integrity	E	Lightweight Mica / polyimide insulated primaries and pairs



Shipboard Cabling Trends / Evolution

"*In the long history of humankind… those who learned to collaborate and improvise most effectively have prevailed*"
- Charles Darwin

Application Trends / Needs

- Watertight cables show an increasing rate of usage above V-Line
  - Several Allies use exclusively watertight
- Power output and usage has increased exponentially
  - Pushing power feeder cable requirements into the medium voltage range
- Worldwide competition has necessitated a larger and increasingly capable fleet
  - Drivers for both increased productivity and innovation
- Increasing concern / abatement of EMP attack(s)
  - Necessitates increased EMP protection of cable plant
- Datacom bandwidth requirements continue to increase exponentially
  - Driving fiber optic and ever-increasing bandwidth copper requirements
- Increasing Circuit Integrity Requirements

Design Evolution

- Smaller cross-section, lighter weight, lower cost
- Continuously improving design tools
- Insulation materials advances – higher flame resistance, lower toxicity, more flexibility, higher strength, higher/lower temperature capabilities, higher insulation resistance, lower dielectric constant / lower dissipation factor

Process Evolution

- Exponentially increasing process control capabilities
- Automation advances – hands-on to hands-off operation evolution
- Precision mfg equipment

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Enhanced Products with Benefits

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US Navy EMP Protection Systems

- Cables exterior to the ship are run through conduit and are required to meet a US Navy Requirement of 60 dB EMP protection
- This system includes a shield construction applied over the core ensuring reliable and cost effective EMP protection for the vessel
    - Provides +80 dB of EMP protection
- Exhibited in MIL-DTL-24643 /79 thru /86
- Tried and Proven – installed and tested
- Reduces material and labor costs
- Eliminates failures associated with flexible conduit

US Navy has approved a full system, installation and test methods including grounding/sealing adapters for deck penetrations

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Enhanced Products with Benefits

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Rollable Ribbon Fiber for Shipboard – MIL-PRF-85045/33, /34, /35, /36

- Reduce cableway congestion and allow for increasing demand for fiber optic circuits aboard ship
- Current M85045 cables have multiple individual fiber optic core components
- Rollable Ribbon fiber optic cables can significantly reduce the space / weight up to 12X of Fiber Plant

Standard M85045 Cable Example

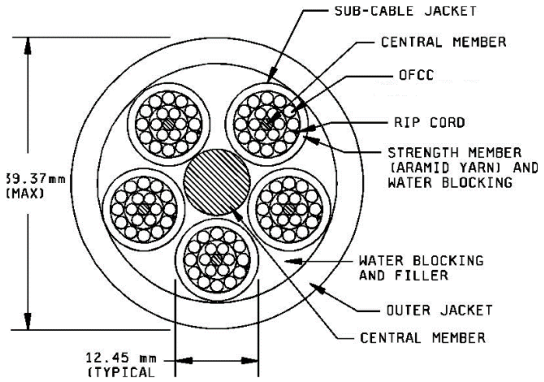
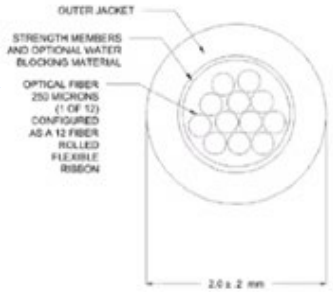
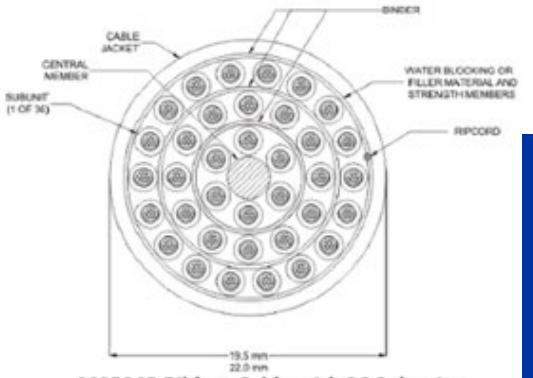


FIGURE 2. Ninety-OFCC fiber optic cable.

Current Fiber Cables vs Rollable Ribbon



12-Fiber Subunit



M85045 Ribbon Cable with 36 Subunits

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Enhanced Products with Benefits

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Rollable Ribbon Fiber for Shipboard – MIL-PRF-85045/33, /34, /36

Specification	# Subunits	Total Fiber Count
MIL-PRF-85045/33	1	12
MIL-PRF-85045/34	4	48
MIL-PRF-85045/35	8	96
MIL-PRF-85045/36	36	432

Amphenol FSI THDM Series MT Connector System

Ribbon Fiber Holders

AFL 90R Fusion Splicer

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Specialty Cables are Essential to the Evolution of US Navy Ships

Performance:

- Harsh environment – Low Temp, High Temp, Temp Cycling
- Corrosive fluid exposure – Fuels, lubricants, hydraulic fluids, acidic, alkaline, etc.
- Radiation Resistance
- Low smoke / Low Toxicity / Low Flammability / Circuit Integrity

Cable Attributes:

- Composite cables – mixed conductor sizes, fiber/copper, enhanced shielding, mechanical reinforcement, armor
- Wide range of size capabilities

- **Toolkit:**
- Wide Range of Insulation Types and Applications
- Engineering expertise / experience
- Mfg Capabilities

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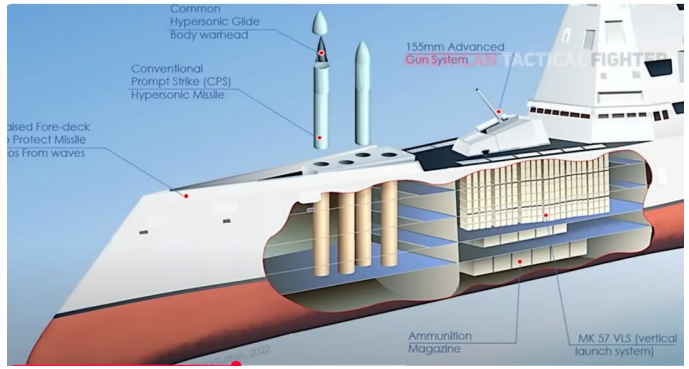
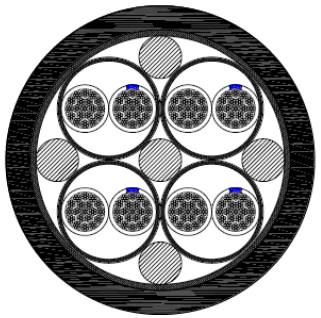
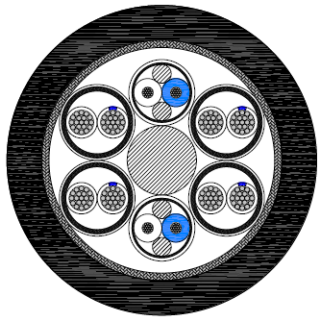
Specialty Cable Example – Hypersonic Missile Vertical Launch System Cables

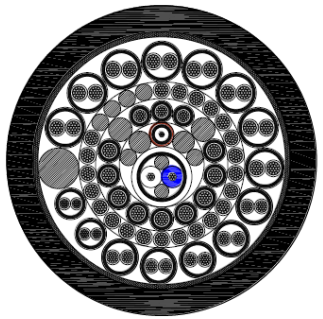




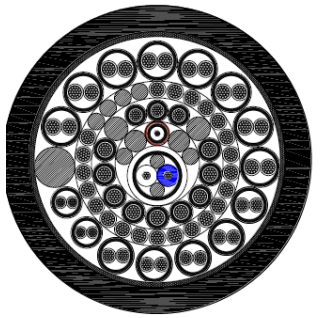
4 individually shielded XLETFE twisted pairs. Overall shield for EMP optimization and thermoset jacket.



4 individually shielded XLETFE twisted pairs with sealed tape binder. 2 individually shielded pairs foamed fluoropolymer 120-ohm impedance. 6 components cabled together with overall shield for EMP optimization and thermoset jacket.



67 conductor composite cable consisting of single conductor and twisted pairs with XLETFE insulation, along with a RG316 coaxial component and a 120-ohm shielded twisted pair. All 38 individual components cabled together with overall shield for EMP optimization and thermoset jacket.



67 conductor composite cable consisting of single conductor and twisted pairs with XLETFE insulation, along with a RG316 coaxial component and a 120-ohm shielded twisted pair. All 36 individual components cabled together with overall shield for EMP optimization and thermoset jacket.

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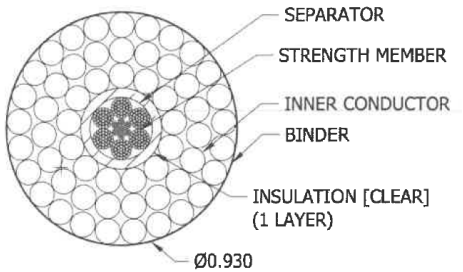
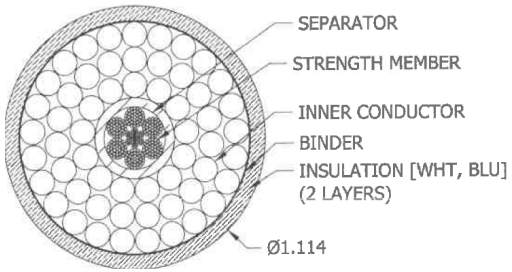
Specialty Cable Example - Minesweeper

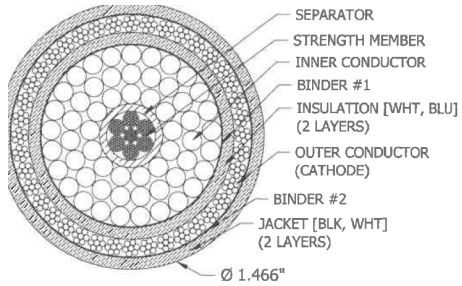


Strength Member –High strength galvanized steel rope, polyimide tape, fluoropolymer insulation

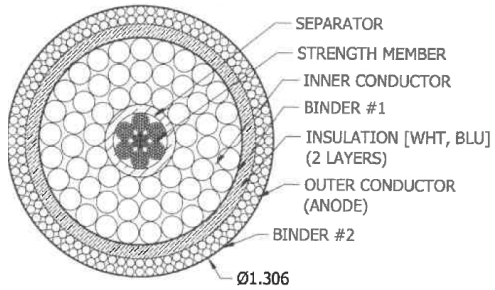
Inner Conductor –Stranded Aluminum
Binder – Kevlar, polyimide



Insulation- , multilayer fluoropolymer



Cathode – Stranded Nickel-Plated Copper
Binder – Kevlar, polyimide
Insulation – Multilayer Fluoropolymer



Anode –Iridium coated Cu Clad Titanium
Binder - Kevlar thread, polyimide tape

Innovation

Specialty Cable Example - Minesweeper

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Parting Shots

Important items for our future:

- Improvements to US Manufacturing base is essential to the strength of our fleet
- Higher productivity is required to ensure a dominant Navy
- Ability to respond to unexpected events without delay is required
- Increasing Engineering Experience and Expertise for Innovative Cable Design
- Solutions for application and installation issues
- Innovative products
- Collaboration of committees such as NSRP to provide innovative solutions to the US Navy and our allies

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Thank You!