

**AmphenolFSI**



# **CABLE ASSEMBLIES**

Amphenol Fiber Systems International Cable Assemblies

# AMPHENOL CABLE MANUFACTURING



Amphenol Military & Aerospace Operations (AMAO) has the capabilities to meet a diverse range of cable and harness assembly needs within the Military and Aerospace markets. We have over 550,000 sq. ft. of cable manufacturing space and multiple locations in North America, Europe, and Asia to design, manufacture, and install harsh environment cable assemblies. Our engineers have over 40 years of experience designing cables and harnesses to a wide variety of requirements. Amphenol's intra-company partnerships give us access to the largest interconnect product portfolio in the Military and Aerospace markets to design and build anything from simple point-to-point cables and pigtailed to complex multi-branch harnesses. AMAO offers the broadest range of harness technologies covering standard and aluminum wires, high-speed, fiber, high temperature, IP67 environment, RF and Microwave, semi-rigid, and flex PCB.

## Harness Design Capabilities:

### Electrical

- 3D design and routing (CAD, including CATIA V5 Software)
- Formboard for 2D definition Electrical wiring
- Electrical Netlist
- Design per EWIS best practices for Aerospace

### Serial Design

- Obsolescence management
- Equipment manufacturing engineering

## Overmolding:

- Amphenol excels in overmolding cable technology, perfect for ruggedized power applications
- Custom overmold solutions utilize either low or high-pressure manufacturing methods, and include various environmental materials
- Overmolding techniques can include straight and right-angle mechanical strain relief in a variety of backshells as well as overmolded in SantoPrene® and other elastomeric materials

## Production Capabilities Include:

- Primary wire extrusions/jacketing for high end applications
- Experienced IPC/WHMA-A-620 certified workforce
- Automated twistors, strippers, cutters, crimpers
- Crimp capabilities for 777MCM to 26AWG wire
- Custom overmold presses with in-house production tooling
- Twisted shielded pair and quadax cable assemblies
- Full testing capabilities for DWV, IR, continuity, etc.
- Meet RTCA DO160 and MIL-STD-810 qualification standards
- Five clean rooms (class 100,000) in North America, Europe, and Asia

## Automation and Quality Control:

- Laser and Ink Jet Marking
- Label and sleeve printing
- Komax: Mark, Cut, Strip, Twist, Crimp, Pull, X-Ray (Down to 32 AWG)
- AMP K-Press (Micro-D Pins, Terminals, etc)
- Komax BT-188T Twister
- Schleuniger: Cut/Strip Coax Cable
- Jetec: Ink Jet Marking
- Braiding Machine

## Testing and Environmental Screening:

- Design and Development of Test Equipment
- ESS Testing: Temperature, Humidity, Random-Axis Vibration, Shock and Leak
- Full Functional Testing to exercise components (automated/manual)
- In-Circuit Testing with JTAG and Software Development Capabilities
- EMI/EMC Testing
- Continuity and Isolation Testing for Cable Harnesses

## Qualification/Inspection & Test Lab Capabilities:

- Tensile Strength
- DWV/IR/Hi-pot/ESD
- Vibration
- Immersion & Altitude
- SI Analysis
- Cycling and Shock
- Temperature
- Corrosion
- EMI/ESD
- Optical Integrity
- Continuity
- Materials/Metallurgical lab
- Vacuum and radiation chambers



## Quality Certificates:

- AS9100/EN9100 – Aerospace Industry Standard
- NADCAP – Electronics Certification
- FAA Repair Station (North America and Europe)
- Air Agency Certificate
- Part 21-G
- J-STD-001 certified
- ISO 9001:2008
- ISO 14001:2015
- IPC J-STD-001
- MIL-STD-790
- IPC/WHMA-A-620
- IPC-A-610/620



# MILITARY & COMMERCIAL AEROSPACE

Amphenol is at the leading edge of the latest products and technologies demanded by the military aircraft, commercial aircraft, and rotorcraft markets. Whether it's proven legacy aircraft, the newest unmanned aircraft or rotorcraft, or the most technologically advanced future aircraft, Amphenol designs, builds, installs, and maintains Electrical Wiring Interconnection Systems (EWIS) as well as high-speed, high-reliable ruggedized product solutions for all subsystems to keep these aircraft flying.



## Aerostructure Cable Assemblies:

- Electrical harnesses for all aerostructure applications
- Build-to-specification and/or build-to-print capabilities
- EWIS compliance and aircraft certification support available



## Unpressurized Cable Assemblies:

- Electrical harnesses in engine and all unpressurized areas
- Build-to-specification and/or build-to-print capabilities
- Wiring diagrams, product change management, configuration management and electrical testing



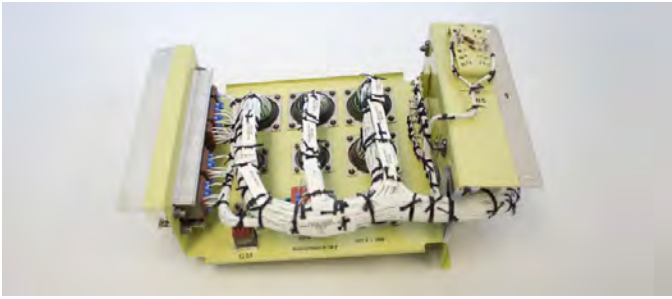
## Engine Harnesses:

- Temperature/abrasion/EMI-resistant over-braiding for harsh environment applications
- Complex harnesses utilizing high-temp Amphenol engine connectors and backshells
- APU Cables



## Avionics Rack and Virtual Unit:

- Small VU to more complex racks
- Complete integration and test
- Mechanical, stress and electrical simulation
- Aluminum or composite structures



### Power and Signal Harnesses:

- Wired panels, boxes, and chassis
- Utilize Amphenol connectors, terminal blocks, relay sockets, and system attachments
- Databus couplers



### In-Flight Entertainment/In-Seat Power:

- Power and data to the seat
- Rapid configuration Management



### High-Speed Data Transmission Cables:

- Used in Com Air and military aircraft for high speed data transfer
- Utilizes high speed interconnects such as Octonet and Oval Contact Systems for speeds of 10Gbps per channel
- Custom layouts and signal routing available



### Rigid Flex Jumpers:

- Custom design for any connector and configuration (BtB, I/O to BtB)
- Lightweight cable replacement with simplified assembly
- Shielding and grounding options



### Flex Printed Circuit:

- Light weight cable replacement design
- Possible weight saving in excess of 70% vs standard wire harness
- Large format, multi-layer
- Shielding and grounding options



### RF and Microwave Cable Assemblies:

- Semi-rigid and flexible RF cable assemblies
- Precision trimming and delay matching to +/- 1 ps
- Custom bends on CNC machine



# MILITARY & COMMERCIAL AEROSPACE



## MilTech Cable Assemblies:

- Designed and qualified to the harshest requirements of military aircraft
- Assemblies vapor sealed to assure prevention of contamination ingress
- Connectors used have standard RF interfaces, self-locking variants, and multiport connectors



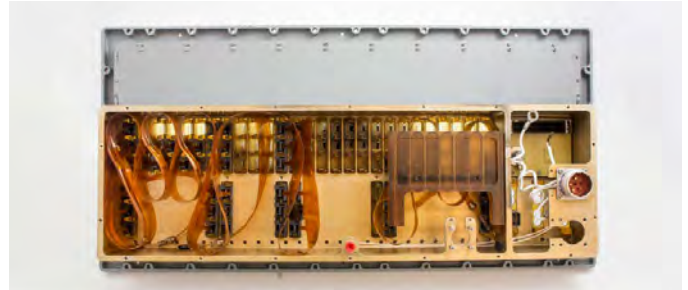
## Flight Test Installation Harnesses:

- Cables designed and built to the aircraft certification for measuring and monitoring flight data
- Harnesses can be integrated into the aircraft on the customer's Final Assembly Line (FAL)



## Fiber Optic Cable Assemblies:

- Connectors include: ARINC801, CF38999, EN4165, NGCON & ARINC 600
- Inflight Entertainment (IFE) and Commercial/Military Avionics applications
- Expanded beam, MT Fan out, Splitters and Hybrid solutions



## Optical Flex Circuit:

- Routes the fiber on multiple stacked substrates to achieve compact routing
- Ruggedized and quickly replaceable
- Available in any routing scheme



## Data/Media Converter:

- Copper to Fiber and Fiber to Copper
- Protocol Independent and Ethernet Media Conversion
- Multiple protocol available (XAUI, 10G Base T, HDMI)
- Multiple form factors (38999, VPX, Stand alone)



## Fuel Resistant Cables:

- For use in fuel tank environments
- Special sealing overmold design to eliminate risk of fluid intrusion into connector

# SPACE SYSTEMS

Amphenol has a rich history with space-related product developments found on many of the landmark space achievements over the years. As the market transitions to incorporate more commercial space development, Amphenol is working closely with the industry to ensure we're leading the design of interconnect solutions for the next generation of space exploration to Mars and beyond for both launcher and payload applications.



## SiO<sub>2</sub> Cable Assemblies and Systems :

- Extreme Temperatures, Enhanced Phase Performance, Demanding and Exotic Environments
- High radiation capabilities
- Crack-free, fired glass seal connectors



## Microwave Assemblies:

- Precision trimming and delay matching to +/- 1 ps
- Up to 67GHz
- Custom connector designs available
- High performance Times Microwave Systems Phasetrack and Space Flight cables available



## Multi-Port Microwave Assemblies:

- Lightweight solutions
- High density interconnection systems
- Standard interface and custom multiport designs available
- Improved electrical performance
- > -90 dB shielding , low VSWR



## Power/Control-Command Flight:

- 2D or 3D cabling boards can be used to ensure the perfect integration
- Cleanroom manufacturing (5 total worldwide)

# GROUND SYSTEMS & VEHICLES

Amphenol leads the military ground vehicle market with interconnect solutions. Current and future ground vehicles demand more sophisticated onboard C4I systems, power distribution, and active protection systems. Amphenol's innovative engineering and diverse product offerings meet and exceed the challenges of SWaP, high speed, and material restrictions for any vehicle sub-system.



## Ruggedized Ethernet & USB Cables:

- High Rel Ethernet (Cat5e/6A/7) & USB (2.0/3.0) cables
- UV resistant polyurethane HFFR jacket
- Large choice of connectors RJF, USBF & 38999 per MILVA NGVA, Quadrax contacts



## RJ Field & USB Field Cord Sets:

- Ruggedized RJ45 & USB connectors
- 38999 Series III (TV) and 26482 (PT) shells
- 100% tested on data rate



## Miniature Ethernet Cord Sets:

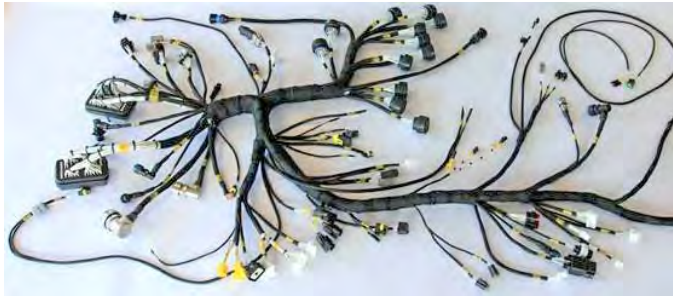
- Miniature 10Gb  $\mu$ Com cordsets
- Ethernet in size 8 contact format with Quadrax & Octonet (1Gb & 10 Gb) contacts
- 100% tested on data rate



## Tactical Fiber Optic Cable Assemblies:

- Connectors include: TFOCA, TFOCA-II, TFOCA-III, THD, THDM, TACBeam®, CTOS
- Thermal cycling, high-temperature aging, and environmental testing services
- 100% optical performance testing





### Overbraided Harnesses:

- Uses braiding materials such as PEEK, Stainless Steel, PTFE, Nylon
- Used where extra protection is needed for harsh environments
- Improved abrasion resistance



### Power Generation and Distribution:

- MIL-DTL-22992 Class L connectors for shelters
- High voltage cables for hybrid drives and on-board vehicle power (OBVP)
- Low voltage, multi-branch harnesses for avionics power



### Overmolded Cable Assemblies:

- Custom geometry and cable routing
- Added protection to wire jacket and conductors
- Replaces backshell and hardware; IP67 sealed
- Quick-turn mold design and manufacturing



### Encapsulated Harnesses:

- Cables protected with heat-shrink sleeve
- Used where extra protection is needed for harsh environments
- Reduced susceptibility to ingress from foreign object debris



### Conduited Harnesses:

- Various conduit materials available
- Good abrasion resistance
- Typically used on land vehicles



### Standard Harnesses and Cable Assemblies:

- Typically open-loomed or over-braided to precise electrical systems
- Meet RTCA DO160 and MIL-STD-810 qualification standards

# C4ISR & SOLDIER SYSTEMS

In the ever growing market of communications and surveillance, Amphenol provides a reliable, rugged, and innovative array of products to support the important task of information collection. From powering individual systems to providing secure and efficient transfer of data, Amphenol has the technology to accommodate any C4ISR application. Amphenol allows our soldiers to continue to obtain the most important resource of all, knowledge.



## MIL-DTL-55116 Audio Cables:

- For harsh environment applications using Amphenol M55116 connectors
- Rugged, watertight, two-stage molding process
- Finished, turnkey, factory-assembled, and molded cable assemblies



## Headset & Soldier Accessory Cables:

- Soldier-worn and ruggedized tactical communication cable assemblies using various Amphenol connectors (2M, Terrapin, MRC)
- Overmold technology withstands harsh environments
- Meets many SWaP (Size, Weight, and Power) requirements



## AN/PRC-117G & 152 Military Radio Data Cables:

- Interface with ruggedized laptops, intercom systems
- Available as field-installable connector kits and/or factory assembled molded cable assemblies
- Features a rugged, watertight, two-piece metal shell design; EMI



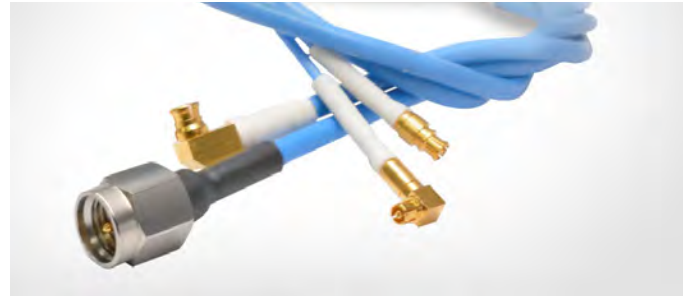
## Cable Adapters:

- Adapters can be designed and built using many common connectors
- Choose the connectors and cable length to make an on-demand cable
- Custom cables are available



### 2M Cable Accessories:

- Backward compatible and intermateable to Mighty Mouse
- Booted or Overmolded solutions available
- Fully tooled on most common sizes
- Cost competitive against competition



### RF and Microwave Cable Assemblies:

- Fits all standard interfaces including: SMA, 2.92mm, 2.4mm, SMP, SMPM & SMPS
- Low solder wicking and high flexibility allows for tight bends behind the cable ferrule
- Standard and custom cable options available



### Fiber Optic Cable Assemblies:

- Single-mode and multi-mode cable assemblies with D38999 III connectors
- Range from simplex jumpers to multi-fiber custom assemblies
- Reduced size and weight + high data rate capacity



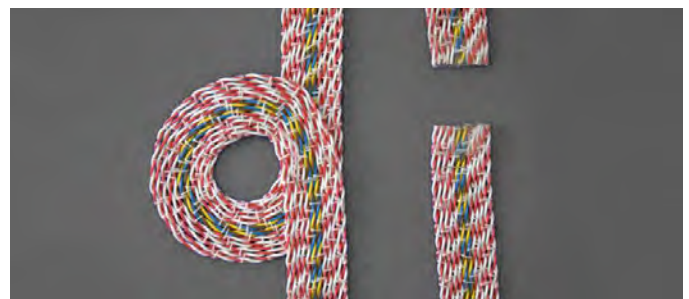
### Expanded Beam Fiber Optics Cable Assemblies:

- TACBeam, CTOS, TFOCA-XBT
- Large beam for easy transmission
- Supports both multi-mode and single-mode fiber
- Expanded beam technology is less susceptible to dust and debris



### Loopbacks:

- Loopback TFOCA, TFOCA-II®, and TACBeam® plug configurations
- Used for maintenance and troubleshooting of the tactical cable reels and systems
- Loopback plugs come in a variety of configurations from 0 dB to -23dB



### Woven Ribbon Harnesses:

- Custom flat ribbon cable
- Configurations can be designed to match bespoke customer requirements
- Very useful in with extreme packaging constraints



# MILITARY RADARS & SENSORS

Reliability is the most important aspect of interconnect design for military radars and sensors. The systems need to work perfectly every time, without fail. Amphenol has a wide range of high-reliable, high-speed, high-bandwidth products that reduce SWaP: from micro-miniature and backplane connectors to RF and microwave products, power cables and rigid-flex assemblies, to ensure effective missile defense.



## Micro-D Assemblies:

- Micro-D connectors qualified to M83513/3 and /4
- Cost-effective and reliable crimp solutions
- Custom backshell and mold transitions
- Fully tested and qualified assemblies



## Avionics Sensor Cables:

- Power distribution and avionics
- Utilizes multiple standard connectors: D38999, MIL-DTL-5015, MIL-DTL-26482, and ARINC
- Simple point-to-point or multi-branch harnesses



## Custom Molded Cables for Harsh Environments:

- High performance injection-molded cable assemblies
- Mold library supports most Amphenol and Mil-Spec connectors
- Potting and encapsulation with MIL-M 24041 epoxies



## High-Speed Copper Cable Assemblies:

- Quadrax, differential twinax, and other high-speed copper products
- Rigid testing performed on 100% of cables before they're shipped
- Wide range of Mil-Spec and special connector designs used with many hybrid and custom builds



### SiO2 Cable Assemblies:

- Cable operating temperature -273° to +1000° C (-273° to +600° C assembly)
- Operating pressure range 0 to 10,000 PSI
- Ultimate in phase tracking performance



### Low Smoke Zero Halogen Coaxial Cables:

- Fully QPL'd designs per Mil-DTL-17
- Low-Smoke, Low-Toxicity, Non-Halogen designs
- Meets IEEE-383 flame performance requirements



### MediaTac Cable Assemblies:

- Harsh environment fiber optic active cable assemblies
- Active plug eliminates system redesign when converting to fiber optic transport
- Supports simplex or full duplex transport over a single fiber



### PhaseTrack Cable Assemblies:

- For applications demanding minimal phase change over temperature
- Superior phase stability; PTFE 'knee' is non-existent
- Products include semi-rigid and flexible cables



### LMR Flexible Coaxial Cable:

- System of low loss coaxial cables, connectors, installation tools and accessories
- Used in internal equipment wiring, cabinet, base station, and antenna jumpers
- Flexible, low-loss, non-kinking, easy connector attachment



### Electrical Assemblies:

- Complete chassis design and manufacturing capabilities
- Vertically integrated including cabling, machining, CCA assembly, electrical and functional testing
- Leverage Amphenol content from multiple sources

# NAVAL

Amphenol is an industry leader of harsh environment electronic interconnects servicing the Naval market. Whether powering vital control systems, initiating countermeasures, or transmitting critical communication data; Amphenol's broad product offerings and high reliability ensure a safe and successful mission. We take pride in supporting the Naval market and will continue to provide our highest level of technology, quality, and service to do so.



## Shipboard Assembly :

- Armored cable and protections
- Low smoke/Zero Halogen Cable
- Utility hardware, cable grips
- Custom strain relief systems



## Pierside and Shipboard Fiber Optic :

- Pierside umbilical cables handle the rigors of deployment and harsh environment
- Shipboard low back reflection, such as RF-over-fiber or fiber optic sensor systems
- Multiple NavSea-qualified designs



## Microwave Cable and Multiport Assemblies:

- Armored
- Lightweight solutions
- Available in Stainless Steel & Titanium
- High density interconnection solutions



## Rugged and Engine Harness :

- High Temperature
- DC, RF & Fiber composite cable designs
- Custom designed connectors
- Overbraided for abrasion resistance



# AMPHENOL COMPLEMENTARY PRODUCTS

Amphenol Military & Aerospace Operations (AMAO) is the **largest supplier** of interconnect products in the military and aerospace markets.

Our cable assembly design teams will work jointly with our connector design teams to provide custom wiring interconnection solutions or to develop next generation technology. No other cable assembly manufacturer can match Amphenol's selection of cable connectors, accessories, and the guaranteed intermateability with the equipment receptacles. Amphenol's cable assembly expertise, combined with 21 interconnect divisions throughout North America, Europe, and Asia, provides users a complete cable assembly solution for virtually any system.



D38999 Series III



Terrapin



Custom Hermetic Feedthrough



Circular Filter Connector Adapters

## Circular Connectors:

### Mil-Spec Connectors

D38999, M26482, M83723, M22992, M5015, M55116, M55181, M26500

### Micro-Miniature Connectors

2M, Terrapin, TAC, Bantam, MRC, Grasshopper

### Mil-Spec Derivatives

High-Power, Breakaways, High-Density,

Filter (EMI/EMP) and Hermetic Connectors

## High Speed & Fiber Optics:

### Mil-Spec Derivatives

RJ Field, LC Field, ARINC 801, D38999

### TFOCA Connectors

TFOCA, TFOCA-II, TFOCA-III, TFOCA-XBT

### High Speed Solutions

USB, Ruggedized Ethernet

### Custom Designs



LC Field D38999



TFOCA-III



Rugged Ethernet RJ45



CTOS - Expanded Beam

# AMPHENOL COMPLEMENTARY PRODUCTS

## Rectangular Connectors:

**Rectangular Connectors**  
Push-Pull, Radio Data,  
SIM Connectors, Splices

**Rack and Panel Connectors**  
ARINC 404, ARINC 600, IEP Interconnects

**D-Sub and Micro-D Connectors**  
Custom Designs



Monomodule EN4165



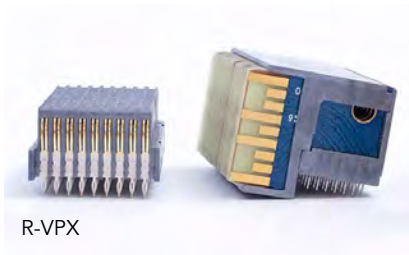
AN/PRC-117G



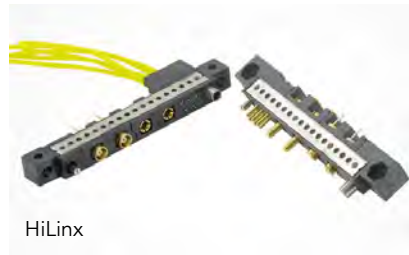
ARINC 600



Micro-D



R-VPX



HiLinX

## Board Level Connectors:

**R-VPX**

**LRM Connectors**

**HDAS**

**HiLinX**

**SMASH**

**Board-to-Board Jumpers**

**Custom Designs**



SMASH



Board-to-Board Jumpers

## Printed Circuit Board/ Flex/Rigid-Flex:

**Standard PCBs**

**Flex Products**

**Rigid-Flex Products**

**Backplane Assemblies**

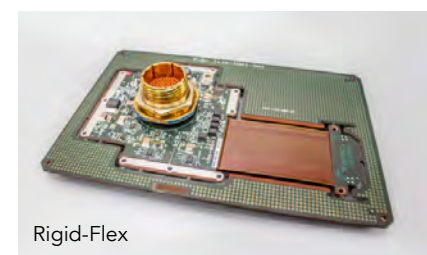
**Printed Electronics**

**RF Printed Circuit Boards**

**Circuit Card Assemblies**



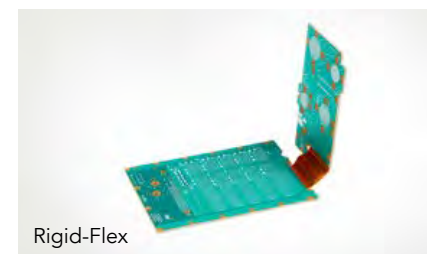
Type 3 Multi-Layer Flex



Rigid-Flex



PCB Backplane



Rigid-Flex



Mil-Spec RF



Multiport High Density



Quarterback Series



BNC Series

## RF & Microwave Interconnects:

- Mil-Spec RF Connectors
- Multiport HD Connectors
- Quarterback Series
- PTNC Series
- BNC Series
- TNC Series
- Custom Designs

## Backshell & Connector Accessories:

- AS85049 Backshells
- EMI/RFI Backshells
- Band Lock Adapters
- Composite Backshells
- Micro-D and Rectangular Backshells
- Strain Reliefs
- Dust Caps and Protection Caps



AS85049 Backshells



Environmental EMI/RFI Backshells



Micro-D EMI Backshell



Alumalight



P-Clamps & C-Clamps



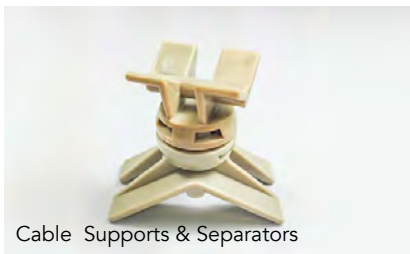
Standoffs

## System Attachments:

- P-Clamps & C-Clamps
- Standoffs & Raceways
- Cable Separators
- Harness & Hat Supports
- Fairlead Blocks
- Jig Board Clamps
- Hydraulic Pipe Supports



Fairlead Blocks



Cable Supports & Separators



# THE AMPHENOL ADVANTAGE



Amphenol Military & Aerospace Operations (AMAO) offers unique advantages that no other interconnect manufacturer can. The unique combination of interconnect expertise and harness manufacturing capabilities enables us to offer the optimum solution at the design phase by leveraging our connectors and wire management and harness solutions, with the goal of reducing weight, installation and maintenance times, as well as optimizing cost.

### **Global footprint, local support:**

With 21 divisions in North America, Europe, and Asia, we can provide a local, regional presence to design and build any interconnect solution.

### **Cost-effective partnerships:**

AMAO utilizes a vertically integrated supply chain to flow down the most competitive costs to our customers, even on the most complex solutions.

### **Manufacturing versatility:**

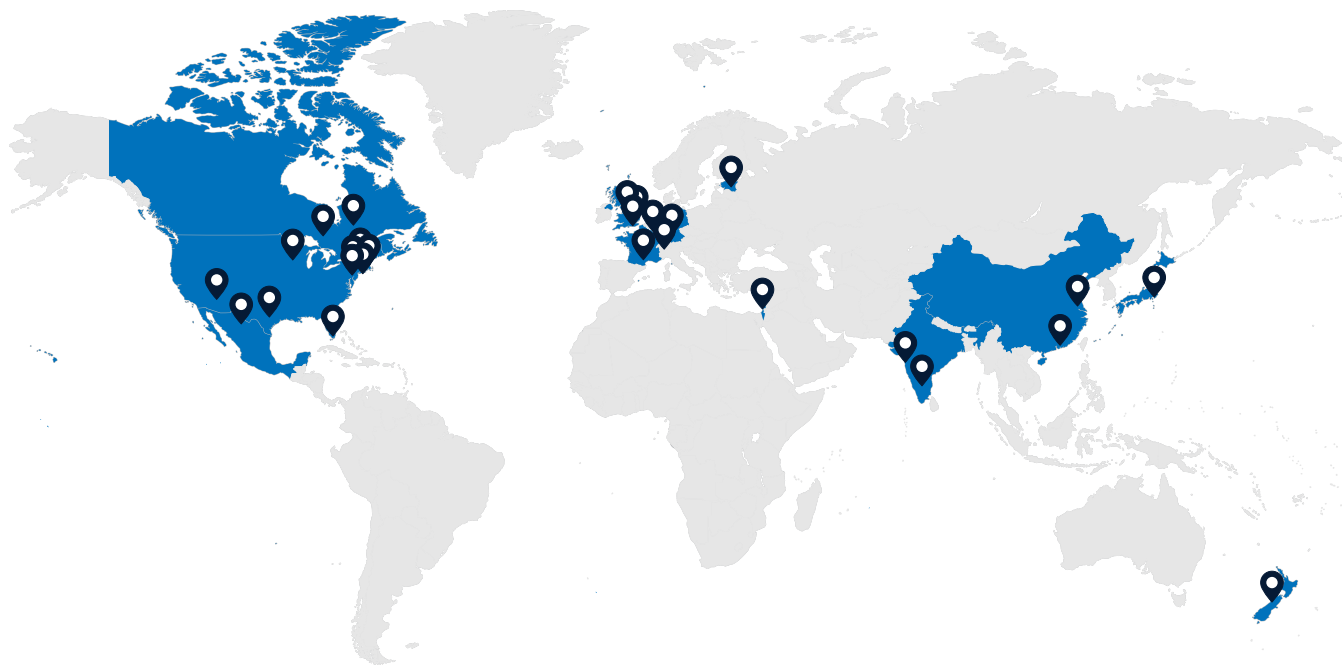
Many AMAO interconnect solutions have dual-production locations and off-set options (Mexico, Estonia, India, and China) which means our customers benefit from low-cost options without the fear of a single-source position.

### **Technology proliferation from other Amphenol divisions:**

As the 2nd largest interconnect company in the world, we're highly diversified and can provide our proven COTS technology from the antennas, sensors, industrial, and automotive markets to the military and aerospace world.

Amphenol Military & Aerospace Operations is perfectly aligned to provide the latest technologies, cost-effective manufacturing and supply chain management, and local support to solve any military and aerospace interconnect need.

# GLOBAL LOCATIONS



## **Amphenol Aerospace Operations**

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## **Amphenol Commercial Air Division**

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Stamford, CT 06902  
203-327-7300

## **Amphenol PCD**

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Beverly, MA 01915  
978-624-3400

## **Amphenol SV Microwave**

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561-840-1800

## **Amphenol Times Microwave, Inc.**

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