

ElectroniCast Consultants



**HARSH ENVIRONMENT FIBER OPTIC COMPONENTS & RELATED DEVICES/PARTS
GLOBAL TECHNOLOGY AND MARKET FORECAST 2009 – 2019**

Published: March 15, 2010
 Fee: \$9,800
 Text Pages: 219
 Plus, Excel Pages: 92

Fee Includes March 2010 report, plus two Executive Briefing Service Updates in July and November 2010

The environments encountered by the components included in this analysis and forecast often require custom designed packaging, with much smaller quantities required, compared to packaging of components for conventional/commercial applications. The environmental extremes that must be accommodated are greater, there often is a need for minimizing size and weight, shock and vibration environments are more extreme.

According to ElectroniCast, the American region in 2009, led in global consumption of harsh environment fiber optic components with 53 percent relative market share (\$328 million). The European region held second-place and the Asia Pacific occupied third-place. Over the 2009-2019 period, however, consumption of these components will expand faster in the European and the Asia Pacific regions.

Harsh Environment Defined Harsh Environment (HE) is defined, by ElectroniCast, as environment beyond the limits normally encountered by commercial telecom, datacom and commercial intra-equipment fiber data links; extremes of

- Temperature; above or below (-40 to +75) degrees C
- Shock and vibration
- Tensile strength (e.g., for fiber-guided missiles, tethered sensors, etc.)
- High electromagnetic or radio-frequency (EMI/RFI/EMP) interference
- Corrosive and/or solvent surroundings
- Atomic and other Radiation
- External pressure extremes
- Rough handling during installation/deployment
- Others

Necessary rough handling during installation or deployment also qualifies as a “harsh environment.

The 2009-2019 market forecast database is structured in a hierarchical format, with data groups at the lowest structural level, summing to a higher-level category for each significant fiber optic component and the supporting devices and parts, and by applications, as illustrated below. This market forecast data are segmented by region: Global Summary, America, Japan / China/Pacific Rim, and Europe.

Harsh Environment Applications, Components & Devices/Parts Category List

Component Application	Component Function	Device/ Parts Function
MILITARY/ AEROSPACE Aircraft/ Spacecraft Shipboard Missile Systems Base Facilities Other Military/ Aerospace	ACTIVE COMPONENTS Transmitters/ Receivers Optical Fiber Amplifiers Semiconductor Optical Amps Other Active Functions	ACTIVE DEVICES/ PARTS Emitters Detectors Optoelectronic ASICs Optoelectronic ICs Other Active Devices/ Parts
Total Military/ Aerospace	Total Active Components	Total Active Devices/ Parts
COMMERCIAL/ INDUSTRIAL Factory Heavy Duty/ Mobile Automotive Aircraft (Commercial) Medical/ Laboratory Other Applications	PASSIVE COMPONENTS Cable Assembly/ Harness Optical Backplanes Photonic Switches Filter Modules Other Passive Functions	PASSIVE DEVICES/ PARTS Fiber Cable Composite Cable Cable Connectors Optical Filter Elements Splitters/ Combiners Packages Other Functions
Total Military/ Aerospace	Total Passive Components	Total Passive Devices/ Parts
TOTAL CONSUMPTION	TOTAL CONSUMPTION	TOTAL CONSUMPTION

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ADDENDUM

HEFO Market Forecast Data Base (Excel spreadsheets: Value, Quantity, Price/Unit: 2009-2019)
 -Global Summary, America, Europe and Asia Pacific-
 PowerPoint Slides (Market Forecast Charts/Figures)

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SUBJECT HIGHLIGHTS

HARSH ENVIRONMENT FIBER OPTIC (HEFO) COMPONENTS & RELATED DEVICE/PARTS FORECAST

Passive Components Lead Value
 Devices and parts are Major Value Added
 Harsh Environment Defined
 Specialty Devices and Parts for Harsh Environment
 Numerous Application Categories
 Wide Variation in Applications
 United States Department of Defense 2011 Budget
 America Leads Consumption
 Dynamic Growth in Asian Consumption
 America Leads Weapons Sophistication
 Plastic Optical Fiber a Major Factor
 American Contractors Lead Global Consumption
 Available Market Trend
 Military/Aerospace Dominance Challenged by Automotive
 Strong Growth in European and Asia Pacific Consumption
 Dynamic Growth of Asia Pacific Applications
 List of Asia Pacific Countries
 Glass Fiber Based Components will Continue Dominance
 Dynamic Growth of POF Components
 LEDs Continue Strong
 Specialty Connectors Will Gain Market Value Lead
 Packages Expensive
 Numerous Contractors of Harsh Environment Fiber Optic Component-using Systems
 ASICs a Major Challenge
 Private Data Networks Ethernet Oriented
 Intra-Equipment/Intra-Enclosure Links Dominated by Multifiber
 Chasing the All-Optical Network
 Defense Advanced Research Projects Agency (DARPA)
 Microsystems Technology Office (DARPA - MTO)
 DARPA: Data in Optical Domain-Network (DOD-N)
 DARPA: Optical Data Router (ODR)
 DARPA: Architectures for DOD-N Networks
 DARPA: Dynamic Multi-Terabit Core Optical Networks: (CORONET)
 100-Gbps and 40-Gbps Ethernet communications standard
 Monolithic Integration Long Term
 VCSEL Historical Overview
 10 Gbps Serial VCSEL Packaging
 Advanced Transceiver Packaging: WWDW/CWDM Approaches
 Physical Implementations of Optical Interconnects
 Optical Backplanes
 SONET OC-192 Very Short Reach (VSR) Links
 The need is for a very short reach (VSR) 9.952 Gbps solution
 Twelve Channel Parallel VCSEL Option
 Four Channel Parallel VCSEL Option
 10 Gbps Serial VSR Options
 OC-768 Very Short Reach (VSR)
 Expected Usage by Module Type
 Optoelectronic Integrated Circuits- Materials
 Silicon-Germanium
 Compound Semiconductors

SUBJECT HIGHLIGHTS

Vendor Background of RF/Microwave
 Integration
 Hybrid versus Monolithic Integration
 Typical example is the digital crossconnect switch (DCS)
 Hybrid Opto ASIC Packaging
 Monolithic Integration
 Data Speeds
 Why Higher Data Rates are Tough to Achieve
 Integrated Circuits More Difficult
 Optical Fiber the Biggest Challenge
 Forward Error Correction (FEC) a Partial Solution
 Packaging
 America Leads Consumption
 Plastic Fiber
 Active Components Will Expand Consumption Value Share
 Transmitter/Receiver Modules
 Plastic Optical Fiber Transceivers to Gain Market Share
 Data Rate Trend Strongly Upward
 Singlemode Moving Up
 SBIR programs Awards-Ruggedized Transceivers
 Optical Fiber Amplifiers
 Semiconductor Optical Amplifiers
 Other Active Function Harsh environment components
 Cable Assemblies Provide Maximum Survivability
 Optical Backplanes for harsh environments
 VITA 66 Fiber Optic Interconnect
 Photonic Switches
 Optical Fiber Filter Modules
 DWDM Modules
 Other Passive Function Harsh Environment Fiber Optic Devices and Parts
 Active Devices/Parts
 Passive Devices/Parts
 Emitters used in harsh environment transmitters
 LEDs, VCSEL and EELDs
 Detector die, reducing cost and space and simplifying packaging
 Reduction of size and weight of components
 Military/aerospace fiber optic cables
 Armored fiber-optic cables for harsh-environment applications
 ARINC 801 Terminus
 The ARINC 801 standard
 ARINC 801 and EN4531
 Circular fiber optic connector for military applications
 From Vacuum Tubes to Supercomputers
 Trend to Miniaturization
 Multichannel Fiber Optic Package Interface for Avionics
 The United States - Navy SBIR 2009.1 - Topic N091-039 (PROGRAM: Joint Strike Fighter)
 Vendors selected for further consideration under DoD Program Solicitation
 Spacecraft/Military Aircraft Component Consumption
 Transmitters/Receivers Lead Spacecraft Fiber Optic Components
 DARPA Tactical Technology Office: DARPA-SN-10-31 (February 2010)
 MOIRE - Membrane Optic Imager Real-Time Exploitation (Optics for satellite surveillance)
 Weapon, communication and sensor systems on ships and submarines
 Unmanned Ground Vehicle (UGV) Using Fiber Optic Gyros
 Remote Stabilized Weapon Stations (RWS) Using FOGs

SUBJECT HIGHLIGHTS

U.S. Navy Cooperative Engagement Capability (CEC)
Fiber Optic Towed Decoy (FOTD)
POF – Major penetration into industrial and commercial applications
Fiber-coupled diode laser module: medical applications
Technology Collaboration
Packaging has three cost elements
Radiation Hardened Integrated Circuits
Flexible optical backplanes
Boeing and Raytheon
Harris
Lockheed Martin
BAE Systems
Mitsubishi
Exploration includes sound detection sensors
Mobile Machinery
Factory
Transportation
Medical
Other/Miscellaneous Applications
Harsh Environment Fiber Optic Connectors (Selected Vendors)
Fiber Optic Cable
Plastic optical fiber (POF)
Fiber optic transceivers
Optical Backplanes
Photonic Switches
Other Fiber Optic Components