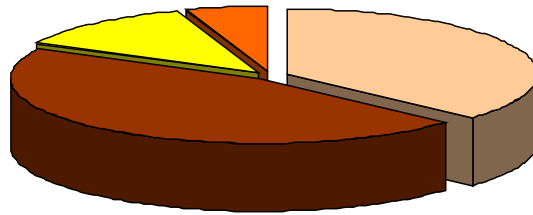


# Announcement

## Harsh Environment Fiber Optic Components & Related Device/Parts Global Technology and Market Forecast 2017-2027



February 26, 2018



## **Harsh Environment Fiber Optic (HEFO) Components & Related Device/Parts Global Technology & Market Forecast 2017-2027**

Published: February 26, 2018  
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Excel File: Market Forecast Database and Tables (2017-2027)  
PowerPoint File: Summary Data Figures  
Fee USD 9800 Files sent by E-mail

### Report Description

This market forecast report, which is available immediately, is part of a consultant service from ElectroniCast Consultants to our clients. This report presents ElectroniCast's estimates and forecast of global consumption and technology of fiber optic components, and their supporting devices and parts, which are designed to operate in harsh environments, beyond the environment of commercial telecom and datacom (premise) installations.

This extensive and detailed worldwide market estimates and forecast is presented for each significant fiber optic component category and the supporting devices and parts category. Regional market segmentation is provided. End applications are discussed, a competitive analysis is provided.

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.

**Harsh Environment Defined** Harsh Environment (HE) is defined, for this report, 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/decoys, 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 specifications of these environments also vary widely, beyond commercial specifications, depending on applications. A high temperature requirement of 85 degrees C for military/aerospace, instead of 75 degrees C commercial is most common, but there are 1000 degree C environments; 100G shock, 1500 rem/hr radiation, etc. that can be required of some fiber optic components. [*Rem (roentgen equivalent man), the rem is a unit used to derive a quantity called equivalent dose.*]

Although military applications, plus non-military aerospace, dominate the market value of harsh environment fiber optic communication links, commercial telecom and datacom links sometimes must withstand, and operate during, stress beyond typical specifications. Telecom cable installed in sewers and steam tunnels are examples, and also are RF signal (on optical carrier) links installed on antenna towers.

A significant concern of copper signal cables is the vulnerability of the signals to interference caused by radio signals, sparks of arc welders and motor brushes, hostile high-energy pulses, and engine cylinder ignition. As fiber signal link costs continue downward, and as transmitted data rates continue to increase, fiber increasingly will displace copper in automotive, factory and numerous other applications.

While conventional glass fiber cable and optoelectronics are immune to EMI and RFI, plastic optical fiber (POF) is equally immune, is more resistant to other harsh environments such as shock/vibration and rough handling during installation, and permits lower cost fiber links in high volume automated production.

To a large extent, harsh environment fiber optic components are designed to meet specific project specifications, rather than being semi-standard; suitable for a number of different applications. Fiber cable and connectors are exceptions; most harsh environment fiber cable assemblies use rugged connectors and cable that are standardized and commercially available from several vendors. Transmitter/receiver modules, optical backplanes, WDM modules and most other components, however, are designed, or modified to meet unique system applications. They are produced in quantities from a few dozen to a few hundred, per year, resulting in much higher unit prices (including amortization of R&D and tooling costs) compared to similar optoelectronic performance COTS (Commercial Off-The-Shelf) components.

Through the 1990s, harsh environment fiber optic interconnect link applications typically installed the optoelectronics in a protected, benign environment such as the staffed communication compartments of ships; transportable shelters and missile launch sites. Thus, connectors and fiber cable led component value.

Now in 2018, however, numerous aircraft, missile systems and other applications that are totally in harsh environments, using fiber optic interconnect links, which are advancing into volume production.

According to the ElectroniCast study, the worldwide value of Harsh Environment Fiber Optic (HEFO) components reached an estimated \$2.74 billion last year. In this new market study, for the first-time - ElectroniCast added the consumption totals of fiber point sensors used in harsh environments to the total value data.

The value of HEFO components are forecasted to increase at an average annual growth rate of 11.8% (2017-2022) and 8.6% during the 2<sup>nd</sup>-half of the forecast period (2022-2027), reaching \$7.26 billion in 2027. Market forecast data in this study report refers to consumption (use) for a particular calendar year; therefore, this data is not cumulative data.

The Military/Aerospace category is set to maintain the leadership position, in terms of value, throughout the forecast period; however in terms of volume (quantity of units), the Commercial/Industrial is set to maintain the dominant leadership position; HEFO components are priced relatively much lower in Commercial/Industrial applications versus Military/Aerospace applications.

### **Market Forecast by Region**

- ) Global Summary
- ) America
- ) Asia Pacific (APAC)
- ) Europe, Middle East, Africa (EMEA)

### **Market Forecast by Function**

- ) Consumption Value (US\$, million)
- ) Quantity (number/by 1,000 units)
- ) Average Selling Prices (ASP \$, each)

This market forecast and analysis, which covers the years 2017-2027, is presented for each significant fiber optic component category and the supporting devices and parts category. The Microsoft Excel-based 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 detailed in Tables 1 and 2.

**Table 1  
Harsh Environment Applications, Components & Devices/Parts  
Category List**

Component Application	Component Function	Device/Parts Function
<b>MILITARY/AEROSPACE</b> Aircraft Aircraft Spacecraft/Satellites Shipboard Systems Missile & Laser Weapon Systems Base Facilities Fixed Based Facilities Transportable Base Facilities Other Military/Aerospace  Total Military/Aerospace	<b>ACTIVE COMPONENTS</b> Transmitters/Receivers Transmitters/Receivers for Glass Fiber Transmitters/Receivers for Plastic Fiber Optical Fiber Amplifiers Semiconductor Optical Amplifiers Other Active Functions  Total Active Components	<b>ACTIVE DEVICE/PARTS</b> Emitters Edge Emitter Laser Diodes VCSELs LEDs Detectors Photonic Integrated Circuits (PICs) Other Active Device/Parts  Total Active Devices/Parts
<b>COMMERCIAL/INDUSTRIAL</b> Factory Systems Heavy Duty Mobile (Movable) Machines Automobile/Trucks Aircraft/Spacecraft/Trains/Ships Medical/Laboratory Other Commercial/Industrial Applications  Total Commercial/Industrial	<b>PASSIVE COMPONENTS</b> Cable Assembly/Harness Glass Fiber-Based Plastic Fiber-Based Optical Backplanes Photonic Switches Filter Modules Fiber Optic Point Sensors Other Passive Functions  Total Passive Components	<b>PASSIVE DEVICE/PARTS</b> Fiber Cable (Glass & POF) Composite Cable Cable Connectors Mil/Aero Connectors for Glass Optical Fiber Comm/Ind Connectors for Glass Optical Fiber Comm/Ind Connectors for Plastic Optical Fiber Optical Filter Elements Fiber Optic Point Sensor Elements Splitters/Combiners Packages (Components & Devices) Other Passive Devices/Parts  Total Passive Devices/Parts
<b>TOTAL CONSUMPTION</b>	<b>TOTAL CONSUMPTION</b>	<b>TOTAL CONSUMPTION</b>

Note: For the first-time, Fiber Optic Point Sensors are now included in the market data

## **Table 2 - Product Categories**

### **FIBER OPTIC COMPONENTS**

#### Active Components

- Transmitter/Receiver (Transceiver)
  - Transmitter/Receiver for Glass Fiber
  - Transmitter/Receiver for Plastic Fiber
- Optical Fiber Amplifier
- Semiconductor Optical Amplifier
- Other Functions

#### Passive Components

- Fiber Cable Assemblies/Harnesses
  - Glass Fiber Based
  - Plastic Optical Fiber Based
- Optical Backplanes
- Photonic Switches
- Optical Filter Modules
- Fiber Optic Point Sensors
- Other Functions

### **FIBER OPTIC DEVICES & PARTS**

#### Active Devices and Parts

- Emitters
  - Edge Emitter Laser Diode
  - VCSEL (Multichannel)
  - Light Emitting Diode (LED)
- Detectors
- Photonic Integrated Circuits (PICs)
- Other Active Devices/Parts

#### Passive Devices and Parts

- Fiber Cable
  - Glass Fiber Cable
  - Plastic Fiber Cable (POF)
- Composite Cable
- Cable Connectors
  - Glass Fiber Connectors
  - Plastic Fiber Connectors
- Optical Filter Elements
- Fiber Optic Point Sensor Elements
- Splitters/Combiners
- Packages
- Component/Module Packages
- Other Devices/Parts

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#### **ADDENDUM**

- HEFO Market Forecast Data Base (Excel spreadsheets: Value, Quantity, Price/Unit: 2017-2027)
  - Global Summary, America, EMEA and APAC
- PowerPoint Slides (Market Forecast Charts/Figures)