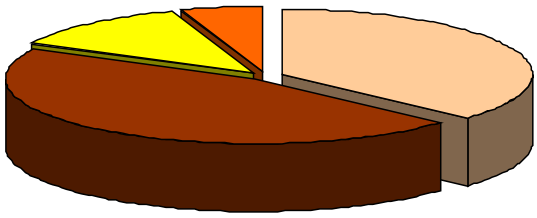
Announcement

Free Space Optics
Global Market Forecast and Analysis
2014-2020

Market Analysis of Outdoor Free Space Optics (FSO) Links Used in Non-Military/Aerospace Communication Applications



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Also Included:	Excel Market Forecast Data Base and PowerPoint Slides

Market Analysis of outdoor FSO Used in Non-Military/Aerospace Applications

Free Space Optics (FSO) is a line-of-sight (LOS) technology that uses directed laser beams, which provide optical bandwidth Transmitters and Receivers to link voice, video, and data intelligent transfer. A single FSO link product (from point A to point B) often may incorporate multiple transmitters along with receiver/s to ensure adequate performance, in case of interference.

This ElectroniCast *Executive Study Service* report provides an analysis and market consumption forecast of transmitter/receiver links used in non-military/aerospace stationary free space optical communication links. This report does not include all of the other parts that compose of the entire FSO system equipment, such as the mounting brackets, mux/demux, drivers, switches, amplifiers, wire/connectors, installation/service, etc.

The 2014-2020 forecast is presented for FSO Transmitter/Receiver (pair) link devices, segmented by distance and data-rate throughput, as detailed in Table 1. The forecast for each selected FSO link device, in turn, is segmented by geographic region:

- America (North America, Central and South America)
- EMEA (Europe, Middle Eastern countries, plus Africa)
- APAC (Asia Pacific)

The market forecast data are segmented by the following functions:

- Consumption Value (US$, million)
- Quantity (number/units)
- Average Selling Prices (ASP $, T/R Pair)

Note: The ASP is for a Transmitter/Receiver Pair, which you need to establish a link

Table 1
Market Data Category List by Distance/Meters and by Throughput/Mbps

500 Meters or Less
- **156 Mbps or Lower**
- **Higher Than 156 Mbps**

More Than 500 Meters
- **156 Mbps or Lower**
- **Higher Than 156 Mbps**

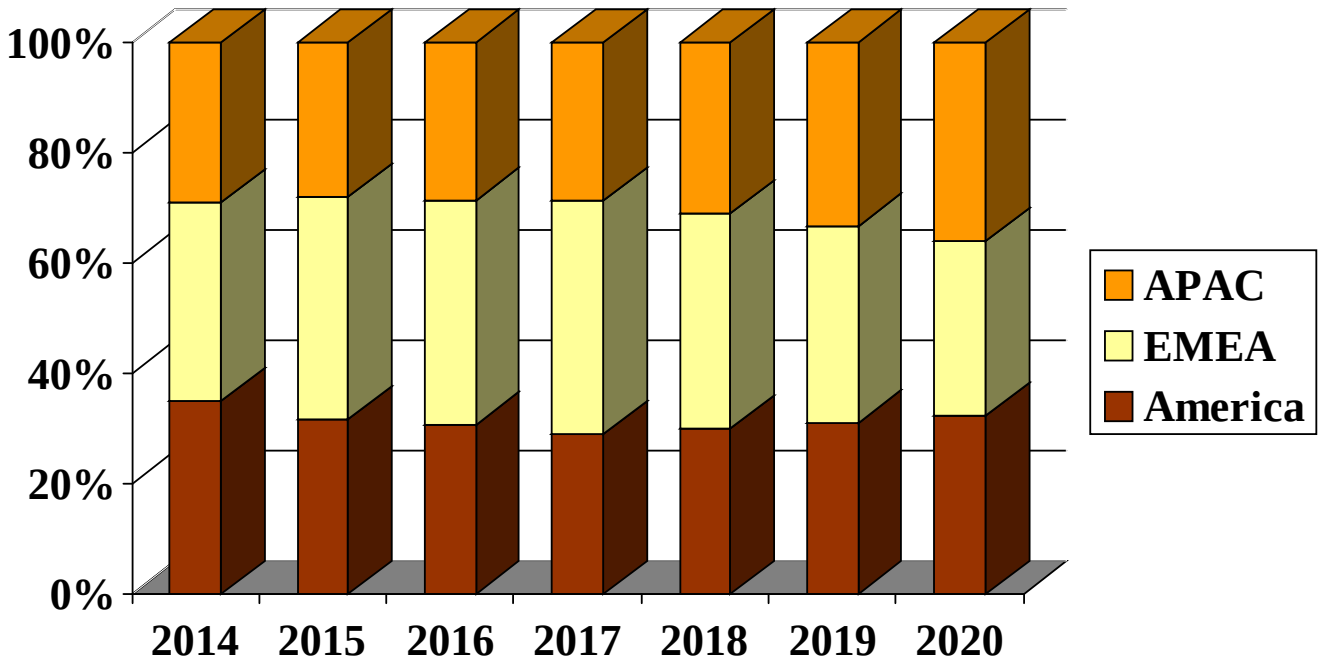
Free Space Optics: Market Forecast by Region According to ElectroniCast, the worldwide consumption value of FSO Transmitter/Receiver Link Devices used in stationary non-military/ aerospace applications was $37.23 million in 2014. EMEA held a slight lead in terms of relative market share in 2014. The increase in the consumption of FSO links in the America region will be attributed to not only continued upgrades and network facilitation in the United States and Canada, but partly from the accelerating economic growth of major cities in Latin America. Other market dynamics in the American region are increases in communication links needed for growing infrastructures, such as mass transit, security systems, broadcast and telecommunications.

European inner-city urban areas typically are difficult for wire-lines, including optical fiber cable installations; therefore, this fact promotes FSO or other wireless solutions. The APAC region has advanced communication technology deployed especially in Japan; however, other countries, such as Australia, China and India, are not as advanced in campus-wide and metropolitan optical communication deployment.

The APAC region has rapidly expanding market opportunities and therefore, our forecast shows the region with the fastest growth (2014-2020), with the region taking over the leadership position later on in the forecast period.

The market forecast data in this study report refers to consumption (use) for a particular calendar year; therefore, this data is not cumulative data.

Non-Military/Aerospace – Outdoor FSO Global Consumption Value
Market Share Percentage (%), By Region



Source: ElectroniCast Consultants

Research Methodology Market analysis and technology forecasting are complex tasks. Any predictions of the shape and trends of technology and economic movement start from the notion that the germ of what will be important tomorrow is present, although smaller or larger or in a different form, in our environment today. However, taking as a basis for a prediction the assumptions of current, conventional belief creates a set of preconceived notions that can lead to serious mistakes. ElectroniCast, instead, looks to the basic driving forces. The future market for a particular type of optical wireless product category depends on a number of factors, including:

- User equipment demand (telecommunication, data network, military/ aerospace and instrumentation) for optoelectronics (receivers, transmitters, transceivers), passive optical components (couplers/splitters, isolators, DWDM components and others (, connectors and of cable).
- The continuing trend of digital machines to higher speed and complexity, with increasing performance/cost ratio, driving an economics based expansion of their use.
- Displacement of previous transmission technologies, such as copper lines and microwave, by fiber optics, based on economic advantage and technology advancement.
- Possible displacement of these transmission technologies by other solutions, such as wireless/cellular and digital direct broadcast satellite (DBS and VSAT).
- Installation costs of wireless and wire-line networks or links.
- Costs relative to licensing and Right-of-Way concerns
- Shifts in the types and technologies of fiber optic/photonic components deployed, including discrete optoelectronics evolving to hybrid, evolving in turn to monolithic, and in their end applications.
- Trends in world economies, regional economies and government policies.

This study is based on analysis of information obtained continually over the past several years, but updated through the July 2015. During this period, ElectroniCast analysts performed primary research interviews with authoritative and representative individuals in the fiber optics industry plus telecommunications, datacom, military/aerospace and other communication industries, instrumentation/laboratory – R&D and factory/manufacturing, from the standpoint of both suppliers and users of communication link products. The interviews were conducted principally with:

- Engineers, marketing personnel and management at manufacturers of free space optics (FSO) system equipment, components and support equipment, as well as laser diodes and photodiodes, application-specific ICs, packages and cables, substrate materials, optical waveguide and other components used in the fabrication of optoelectronic transceivers, cable assemblies and installation apparatus

- Design group leaders, engineers, marketing personnel and market planners at major users and potential users of cable, cable assemblies, connectors, installation apparatus, passive devices and transceivers, such as

telecommunication transmission, switching and distribution equipment producers, data communications equipment producers (switches, hubs, routers), computer and workstation producers, weapon system, aircraft and spacecraft electronic equipment producers, optical instrumentation system producers and others.

- Other industry experts, including those focused on standards activities, trade associations, and investments.

The interviews covered issues of technology, R&D support, pricing, contract size, reliability, documentation, installation/maintenance crafts, standards, supplier competition and other topics. Customers also were interviewed, to obtain their estimates of quantities received and average prices paid, as a crosscheck of vendor estimates. Customer estimates of historical and expected near term future growth of their application are obtained. Their views of use of new technology products were obtained.

The analyst then considered customer expectations of near term growth in their application, plus forecasted economic payback of investment, technology trends and changes in government regulations in each geographical region, to derive estimated growth rates of quantity and price of each product subset in each application. These forecasted growth rates are combined with the estimated baseline data to obtain the long-range forecasts at the lowest detailed level of each product and application.

A full review of published information was also performed to supplement information obtained through interviews. The following sources were reviewed:

- Professional technical journals and papers; Trade press articles
- Technical conference proceedings; Product literature
- Company profile and financial information
- Additional information based on previous ElectroniCast market studies
- Personal knowledge of the research team.

In analyzing and forecasting the complexities of the North American and other world region markets for optical interconnect products, it is essential that the market research team have a good and a deep understanding of the technology and of the industry. ElectroniCast members who participated in this report were qualified.

ElectroniCast forecasts, as illustrated in the forecast data base structure are developed initially at the lowest detail level, then summed to successively higher levels. Background market research focuses on the amount of each selected data-rate capability range within each selected distance capability range of product used in each Region in the base year (2014), and the prices paid. This forms the base year data. ElectroniCast analysts then forecast the growth rates in component quantity use in each product category, along with price trends, based on competitive, economic and technology forecast trends, and apply these to derive long term forecasts at the lowest application levels. The usage growth rate forecasts depend heavily on analysis of overall end user trends toward digital broadband

communication equipment usage and economic payback.

Cross-Correlation Increases Accuracy The quantities of transmitter/receiver link devices used in non-military/aerospace fixed-location (stationary) Free Space Optic (FSO) optical wireless system equipment systems, as well as the use of fiber optic cable, connectors, transceivers, transport terminals, optical add/drop MUX, photonic switches and other products used in a particular application are interrelated. Since ElectroniCast conducts annual analysis and forecast updates in each fiber optic related product field, accurate current quantity estimates in each application are part of this corporate database. These quantities are cross-correlated as a "sanity check."

ElectroniCast, each year since 1985, has conducted extensive research and updated their forecasts of each fiber optic component category. As technology and applications have advanced, the number of component subsets covered by the forecasts has expanded impressively.

The calculation and analysis data spreadsheet technique is based upon input/output analysis, leveraging the quantitative consumption quantity, price and value of each item in each application at all levels to achieve reasonable quantitative conclusions; This interactive analysis concept, first applied on a major scale by Leonteff, of the US Department of Commerce, in the mid 1950s, was then adopted successfully by analyst/forecasting firms Quantum Science, Gnostic Concepts and (in 1981) by ElectroniCast.

About ElectroniCast

ElectroniCast, founded in 1981, specializes in forecasting technology and global market trends in fiber optics communication components and devices, as well providing market data on light emitting diodes used in lighting.

As an independent consultancy we offer multi-client and custom market research studies to the world's leading companies based on comprehensive, in- depth analysis of quantitative and qualitative factors. This includes technology forecasting, markets and applications forecasting, strategic planning, competitive analysis, customer-satisfaction surveys and marketing/sales consultation. ElectroniCast, founded as a technology-based independent consulting firm, meets the information needs of the investment community, industry planners and related suppliers.

Proprietary Statement

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