WDM Technologies on Military Platforms:

Where are we going and how should we get there?

Floyd A. Fazi, Jr.
Lockheed Martin Aeronautics Company
**WDM technologies on military platforms: Where are we going and how should we get there?**

DARPA/MTO, WDM for Military Platforms Workshop held in McLean, VA on April 18-19, 2000, The original document contains color images.
Topics of Discussion

- Technology availability, maturation, and development
- LM Vision of the future (military operational capabilities and platform missions)
- Standardization/Inter-Operability
Multiple programs will and are benefiting from WDM technology development
Commercial Market and Products

Customer Requirements
- High-speed applications-ATM
- Data center for resource sharing
- Storage area networking-Fibre Channel
- LAN backbones
- Video and others
Current LM Military Demonstrations

FAST Avionics Bus Demonstration

Current LM Military Demonstrations

FAST Avionics Bus Demonstration

FOBWDM™ Demonstration

Example of Bus Interface

US Patents 5,898,801 & 5,901,260
Future Uses of WDM in Air and Space

VMS and Health Management
- Sensors
- Data Links
- Pilot Interface

Avionics
- Sensors
- Communication Links
- Phased Array Antennas
Naval & Satellite Uses for WDM

**Naval**
- Ship Board Systems
- Communications
- Sensors
- Towed Arrays

**Satellite**
- Signal Distribution
- Phased array beamformers
- Processing
Standardization & Inter-Operability Issues

International Telecommunications Union (ITU):

- Point-to-point systems are deployed in “open” architectures
- “Grid” specifies a 1,550 wavelength band at 100GHz frequency spacing
- Industry products conform to the grid therefore elements are standardized/interoperable

Commercial WDM Solution:

- WDM is a proven method for low-cost increased bandwidth
- Increasing bandwidth by a factor of 30, with 50% cost reduction
- Large volumes of point-to-point WDM systems have been deployed to increase capacity of existing fiber cable plants

---

1 Multiwavelength Optical Networks, A Layered Approach, Stern, 5/99
# Serialized Data Streams

<table>
<thead>
<tr>
<th></th>
<th>1 per wavelength</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multimode Fiber Availability</td>
<td>Yes</td>
</tr>
<tr>
<td>Singlemode Fiber Availability</td>
<td>Yes</td>
</tr>
<tr>
<td>COTS Components</td>
<td>850nm, 1300nm, 1550nm</td>
</tr>
<tr>
<td>Cost Target</td>
<td>$100 per transceiver</td>
</tr>
</tbody>
</table>
# Multiple Wavelength Transmission

## Optical Transmission Formats:

<table>
<thead>
<tr>
<th></th>
<th>Wavelength Division Multiplexing</th>
<th>Dense Wavelength Division Multiplexing</th>
</tr>
</thead>
<tbody>
<tr>
<td># Serialized Data Streams</td>
<td>2 to 8</td>
<td>8 to 128</td>
</tr>
<tr>
<td>Multimode Fiber Availability</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Singlemode Fiber Availability</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>COTS Components</td>
<td>850nm, 1300nm, 1550nm</td>
<td>1550nm</td>
</tr>
<tr>
<td>Comment</td>
<td>Wide wavelength separation increases system reliability</td>
<td>Small wavelength separation requires precision laser temperature control</td>
</tr>
<tr>
<td>Cost Target</td>
<td>&lt;$200 per multichannel transceiver</td>
<td>$1K per multichannel transceiver</td>
</tr>
</tbody>
</table>
How Do We Get There

- Transition COTS Components into Military Environments
- Demonstrate WDM Components Enabling WDM Technologies on Military Platform
- Continue and Expand Research Efforts
- Transition LM Research into COTS products