Wavelength Division Multiplexing (WDM) Technology for Naval Air Applications

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## Wavelength Division Multiplexing Technology for NAVAIR Applications

**Title and Subtitle:**

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**Performing Organization:**

Naval Air Systems Command Patuxent River, MD

**Distribution/Availability Statement:**

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**Supplementary Notes:**


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- a. Report: unclassified
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**Limitation of Abstract:**

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10
Naval Aerospace Photonics

- Despite Significant Commercial and DARPA Funding of WDM Technology, the Technology Has Yet to Impact Naval Aerospace Platforms.
- Affordability, Environmental Compatibility, and Technology Readiness Level Remain Impediments.
- Directed Technology Maturation at the Component, Packaging, and System Level Are Required.
- Broad Application to Fighter, Transport, ASW, AEW, VSTOL, UAV/UCAV, Rotary Wing, and Space Platforms.
- Many Common Issues with FTTH and FTTH
Potential WDM Applications

Unified Networks for Aircraft/ UCAV Avionics & VMS

WDM Computer Backplanes/Interconnects

Free Space Interconnects

True Time Delay/ A/D Conversion

Smart Skins/Structures Interconnect and Diagnostics

Missile and Decoy Interfaces

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Current NAVAIR WDM Developments

- FOCUS Program - Gen. 1 WDM Digital/RF Network for EA-6B and Advanced Electronic Attack (AEA) Platform (30 months)

- SBIR Phase II WDM RF Network (24 months)

- P-3 “Hairy Buffalo” Demonstration Sensor Integration Platform using WDM Networks (on-going)

- Broadband WDM Component Developments
High Density Single Mode Cable Plant
- Optimized Aerospace Qualified Fibers
- Small Footprint Single Channel and Array Connectors
- Rugged Single Channel and Ribbon Cables

* ONR Has Initiated a Manufacturing Technology Program for Automated Termination of Single Mode Cables

- Tunable Connectorized Transceivers with Digital and RF capability up to 40GHz
- Parallel Digital Channels over single fiber via WDM for high performance computing/backplanes
Required Component Maturation

- Small Form Factor Tunable Filters
- Connectorized Planar Wavelength Selective Couplers and Array Waveguides, Add/Drops
- Compact Linear Multi-Band/Broadband Amplifiers
- Compact Wavelength Selective “All Optical” Switching - (nsec to µsec Switching Speed)
- Embedded Structural Diagnostics
  - Bragg Grating and Fabry Perot Micro-sensors
  - Integrated WDM VMS Sensor Interface
Packaging/Connector Issues

- Aerospace Environment (Temperature, Shock, Vibration…etc) Requires Highly Integrated Devices and Components with Sealed, Connectorized, Low Profile Packages.

- Non-TE cooling preferred

- Highly Integrated WDM Transceivers Should include Built-in-Test Features
  - Power Monitors
  - Simple Logic BIT
  - Environmental Protection for Circuitry
DOD AVIATION
High Speed Network
Road Map

STAKE HOLDERS:

OSD (DDR&E)
US ARMY, US NAVY, USAF
DARPA
Layered Approach

Approach: Face-to-Face Surveys

Layer 0
NAVAIR Only
Network Requirements

Approach: Face-to-face surveys

Layer 1 DOD Driven
Prime/System Contractors

Approach: Optical Industry Development Association (OIDA) via DARPA

Layer 2
Component Analysis & Risk Assessment

Naval Aviation

Platform

System

WRA

SRA

Microcircuits

Vendor P/N

Generic Circuits
Summary

• COTS Components Must be Integrated, Packaged or Screened to Operate in this Harsh Environment

• Aerospace Systems Requirements are Unique and Expanding:
  – Latency, Determinism, Throughput, RF Frequency Bands, Fault Tolerance, System and Structural Health Monitoring.
  – Aerospace Environment is the Challenge

• Leverage Internet Driven Commercial WDM Technology

• Common DOD/Industry High Speed Network Roadmap in Progress for Long Term Investment Strategy