Advance Program

Tuesday, 02 October 2007

ALL SESSIONS WILL BE HELD IN THE PACIFIC BALLROOM

08.30 - 10.10

Session TuA: ANALOG PHOTONICS I
Session Co-Chairs: Mark W. Beranek, *US Naval Air Systems Command, Patuxent River, MD, USA*
Thomas F. Dermis, *US Air Force Research Laboratory, WPAFB, OH, USA*

08.30 - 08.40 **Welcome**

TuA1 08.40 - 09.10 (Invited)

RF Photonics Challenges on Aerospace Platforms, W. L. Stewart*, Lockheed Martin, Benbrook, TX, USA*

This paper addresses some of the challenges of RF photonics on aerospace platforms. Single mode fiber optics is considered in meeting the need for low loss, light weight, and high bandwidth RF signal distribution systems.

TuA2 09.10 - 09.40 (Invited)

Considerations for Application of RF-Over-Fiber to Navy Systems, E. W. Jacobs, J. Rodgers, D. C. Evans, T. E. Weiner and C. Lin*, SPAWAR Systems Center, San Diego, CA, USA*

This paper summarizes system-level metrics relevant to Navy RF-over-fiber applications, discusses an example deployed RF-over-fiber system, and concludes with an update on recent progress on improved components and RF photonic link performance.

TuA3 09.40 - 10.10 (Invited)

Fiber-Optics for Future EW Platforms, R. Pirich and P. Anumolu*, Northrop Grumman Corporation, Bethpage, NY, USA*

An enabling technology for next-generation EW systems is an all fiber optic backplane. Fiber-optic systems are rapidly evolving and this paper will review the application of fiber optics for aircraft and specifically EW applications.

10.10 – 10.30 **COFFEE BREAK**

10.30 - 12.00

Session TuB: ANALOG PHOTONICS II
Session Co-Chairs: Gregory L. Abbas, *EOSpace Incorporated, Redmond, WA, USA*
John T. Gallo, *Xadair Technologies, Jacksonville, FL, USA*

TuB1 10.30 - 11.00 (Invited)

Analog Phase Modulation for Avionics Applications, V. J. Urick, F. Bucholtz, P. S. Devgan and J. D. McKinney*, US Naval Research Laboratory, Washington, DC, USA*

We present the result that analog phase modualtion can outperform analog intensity modulation for RF photonics applications. We cite the applications in an airborne environment where analog phase modulation can be employed.

TuB2 11.00 - 11.30 (Invited)

Electromagnetic Pulse Shaping and Applications, J. D. McKinney*, US Naval Research Laboratory, Washington, DC, USA*, D. Peroulis and A. M. Weiner*, Purdue University, West Lafayette, IN, USA*

We review the use of optical pulse processing technology to synthesize arbitrary radio-frequency (RF) electromagnetic waveforms (1-11 GHz). We illustrate the ability to tailor the spectral phase and amplitude of these waveforms and present an intriguing application: compensation of antenna distortions on ultrawideband RF waveforms.

TuB3 11.30 - 12.00 (Invited)

Multi-Octave Microwave Transmission over Fiber with a Single Optical Phase Modulator, B. M. Haas and T. E. Murphy*, University of Maryland, College Park, MD, USA*

We describe recent experimental results showing second-order distortion suppression using a single optical phase modulator. This enables multi-octave operation of phase-modulated fiber optic links with Spur-Free Dynamic Range matching that of a Mach-Zehnder based link.

12.00 – 14.00 **LUNCH BREAK**

14.00 - 15.30

Session TuC: **ANALOG PHOTONICS III**
Session Co-Chairs: Vincent J. Urick, *US Naval Research Laboratory, Washington, DC, USA*
Paul Matthews, *Northrop Grumman Corporation, Baltimore, MD, USA*

TuC1 14.00 - 14.30 (Invited)

Wideband Agile Receiver, C. Cerny*, US Air Force Research Laboratory, WPAFB, OH, USA*

ABSTRACT NOT AVAILABLE

TuC2 14.30 - 14.45

Towards RF Photonic Integrated Circuits, D. Hunter and H. Mendis*, Defence Science & Technology Organisation, Edinburgh, SA, Australia*

This paper will examine the potential for integrating commercially available photonic components onto an optical substrate. The goal is to provide components and photonic integrated circuits for application in airborne RF photonic and sensing systems.

TuC3 14.45 - 15.00

Hybrid Analog-Digital Fiber Optic Network for Aircraft Communication and Control, P. S. Devgan, V. J. Urick, J. D. McKinney and K. J. Williams*, US Naval Research Laboratory, Washington, DC, USA*

A hybrid analog-digital network for intra-aircraft communication is presented. 2.5-GHz digital data and 1-GHz analog signal are modulated onto a single laser. The Q-factor and third harmonic show no degradation due to unwanted crosstalk.

TuC4 15.00 - 15.15

A Suppressed Carrier Ring Laser Oscillator for Coherent Analog Optical Links, B. J. Bortnik, Y.-C. Hung, H. R. Fetterman*, University of California - Los Angeles, Los Angeles, CA, USA*, R. Forber and W. Wang*, IPITEK, Carlsbad, CA, USA*

A laser ring oscillator for heterodyne links is proposed where an intracavity modulator outputs a suppressed carrier signal while recirculation the carrier around the ring. This transmitter was demonstrated experimentally with high spurious-free dynamic range.

TuC5 15.15 - 15.30

Free Space Optical Communication, T. Manzur*, US Naval Undersea Warfare Center, Newport, RI, USA*

This paper will discuss the current implementations of free space optical communications (FSO) and telemetry, and will describe concepts for integrating this capability into the existing and future DoD and submarine applications.

17.00 – 19.00 **WELCOME RECEPTION – Pacfic Ballroom**

Wednesday, 03 October 2007

08.30 - 10.00

Session WA: **APPLICATIONS/SECURITY**
Session Co-Chairs: E.W. Jacobs, *SPAWAR Systems Center - San Diego, San Diego, CA, USA*
William L. Stewart, *Lockheed Martin, Benbrook, TX, USA*

WA1 08.30 - 08.45

Weight and Size Reduction by Integrating Avionic Optical Components, R. Hartman, L. J.-P. Ketelsen*,* P. Parayanthal*, CyOptics, Inc., Breinigsville, PA, USA*, and U. Koren*, Alcatel-Lucent, NJ, USA*

CWDM integration of electro-optical properties into a monolithic PIC or hybridized with a PLC can replace 10 packages with one package of equivalent performance. This development can reduce fibers and packages for Avionic applications.

WA2 08.45 - 09.00

Fiber Optic Considerations for Insertion into Legacy Avionics Platforms, P. Anumolu and R. Pirich*, Northrop Grumman Corporation, Bethpage, NY, USA*

At times, fiber optics are inserted into avionics systems without a rigorous analysis of the benefits. In this paper, we define some considerations for fiber optics insertion and derive a rubric to serve as a guideline for insertion.

WA3 09.00 - 09.15

Novel Secure Platform for Avionic Applications based on Optical CDMA, I. Glesk, Y.-K. Huang*,* P. R. Prucnal*, Princeton University, Princeton, NJ, USA*, and B. L. Uhlhorn*, Lockheed Martin, Eagan, MN, USA*

Novel OCDMA platform for use in avionic applications with data security approaching “One-time Pad” was demonstrated. It supports OC-24 data rates with raw BER<10^{-12} and allows conduct eavesdropping studies.

WA4 09.15 - 09.30

Optics for Information Assurance on Platforms, W. P. Krug*, Boeing Company, Seattle, WA, USA*, S. Etemad and S. F. Habiby*, Telcordia Technologies, Inc., Red Bank, NJ, USA*

ABSTRACT NOT AVAILABLE

WA5 09.30 - 09.45

OCDM-based All Optical Multi-Level Security, S. Etemad*, Telcordia Technologies, Inc., Red Bank, NJ, USA*

We describe an OCDM methodology using passive optically integrated phase coders. The proposed all optical operations support MLS in avionics applications for both preventing inadvertent receipt of optical signal and providing robustness against malicious exhaustive and/or archival attacks.

WA6 09.45 - 10.00

Progress Towards A Virtual Quadrant Receiver for 4-ary Pulse Position Modulation/Optical Code Division Multiple Access (4-ary PPM/O-CDMA) Networks, V. J. Hernandez, C. V. Bennett, W. J. Lennon*, Lawrence Livermore National Laboratory, Livermore, CA, USA*, A. J. Mendez*, Mendez R&D Associates, El Segundo, CA, USA*, and R. M. Gagliardi*, University of Southern California, Los Angeles, CA, USA*

A virtual quadrant receiver for 4-ary PPM/O-CDMA is described, simulated, and implemented. Simulations show the impact of multi-access and optical beat interference on system performance. The implementation maximizes photonic processing and can ultimately be implemented as a monolithic PLC-based device.

10.00 – 10.30 COFFEE BREAK

10.30 - 11.45

Session WB: **WDM I**
Session Co-Chairs: Michael J. Hackert, *US Naval Air Systems Command, Patuxent River, MD, USA*
William P. Krug, *Boeing Company, Seattle, WA, USA*

WB1 10.30 - 11.00 (Invited)

Development of a Scalable WDM LAN for Avionics Networking, J. B. Stark*, Defense Photonics Group, Inc., New York, NY, USA*

As communication bandwidth requirements grow on aerospace platforms, WDM provides flexibly allocated, scalable capacity carried on an optical fiber infrastructure that endures for the life cycle of the platform. The SAE AS-5659 subcommittee is defining the standard for this new generation of communications infrastructure.

WB2 11.00 - 11.30 (Invited)

Planar Photonic Integration of VCSEL-based Wavelength Division Multiplexed Optoelectronics Arrays, J. Cheng*,* K. Yang*,* K. M. Patel*,* T. J. Eustis*,* X.-J. Jin, S. Q. Luong and P. S. Guilfoyle*, OptiComp Corporation, Zephyr Cove, NV, USA*

Waveguide grating couplers enable the effective coupling of light from vertical-cavity devices such as VCSELs and resonant photodetectors to bidirectional in-plane waveguides. This enables WDM multiplexing and demultiplexing in a compact, planar integrated format.

WB3 11.30 - 11.45

CWDM for Aerospace Applications – Temperature Testing of COTS Technologies, N. B. Aldridge*,* H. J. White*,* M. A. Watson, G. Proudley and A. Proudfoot*, BAE Systems, Filton, Bristol, UK*

This paper discusses the performance of commercial CWDM filter and source technologies. Specifically, we look at their performance in terms of wavelength stability across the temperature ranges they are likely to encounter in aerospace applications.

11.45 – 14.00 LUNCH BREAK

14.00 - 16.15

Session WC: **CABLING & INTERCONNECT**
Session Co-Chairs: Michael J. Hayduk, *US Air Force Research Laboratory, Rome, NY, USA*
Praveen Anumolu, *Northrop Grumman Corporation, Bethpage, NY, USA*

WC1 14.00 - 14.30 (Invited)

Hybrid Glass as Protective Coatings for Aerisoace Fiber: An Overview, A. B. Wojcik*, Hybrid Glass Technologies, Inc., Monmouth Junction, NJ, USA*

Hybrid glass coating replaces polyimide buffer currently used on optical fibers for military aircraft. Hybrid glass bonds to the fiber and protects it from heat, water and chemical corrosion improving the reliability of aerospace cables.

WC2 14.30 - 14.45

Measurement of Coupling Between Cleaved or Polished Fibers using an Automated Fusion Splicer, J. E. Toney and J. S. Mazurowski*, Penn State Electro-Optics Center, Freeport, PA, USA*

In this paper we present experimental results on repeatability of insertion loss measurement, using an automated fusion splicer as a platform for aligning fibers with cleaved or polished end faces. We demonstrate that high repeatability can be achieved with single-mode and multi-mode fibers.

WC3 14.45 - 15.00

High Performances Single Mode Fiber Optic Cable for Aerospace Applications, G. Trouillard*, Draka Fileca, Sainte Geneviève, France* and A. Bergonzo*, Alcatel-Lucent, Marcoussis, France*

The fibre optic use is growing in the aerospace industry. This paper describes a new single mode fibre optic cable which features a high temperature performance, low bending losses and ease of installation in future aerospace environments.

WC4 15.00 - 15.15

Design and Evaluation of Fiber Tip Lenses for Fiber Optic Transmitter and Receiver Applications, G. Shu, M. P. Bozeman, R. S. Hays, D. P. Robinson, W. K. Wright and A. Kuan*, Teledyne Electronic Technologies, Los Angeles, CA, USA*

A simple yet effective fiber tip lens has been designed, evaluated, and utilized in a military fiber optic transceiver. The optimized fiber tip lens offers over 80% optical coupling and more than 10 µm offset margin at each of 3-axis optical alignment.

WC5 15.15 - 15.30

End-of-Life Insertion Loss Methodology, S. Newland*, Harris Corporation, Melbourne, FL, USA*, D. A. Hardy*, W. L. Gores & Associates, Newark, DE, USA* and T. Goodwin*, W. L. Gores & Associates, Elkton, MD, USA*

Single-mode cable assemblies are increasingly being used in rugged avionics environments. We present here several different methodologies for calculating end-of-life insertion loss based on summations of individual tests.

WC6 15.30 - 16.00 (Invited)

Optical Phase Domain Reflectometers, D. N. Harres*, Boeing Company, Hazelwood, MO, USA*

A new approach to optical fiber reflectometry is presented in which a single frequency is used to modulate the laser. Numerical methods are used to decompose the reflected waveform into its constituent components.

WC7 16.00 - 16.15

Millimeter Resolution Optical Reflectometry Over Up to Two Kilometers of Fiber Length, D. Gifford, M. Froggat, M. Wolfe*,* A. Sang*,* B. J. Soller*, Luna Innovations, Blacksburg, VA, USA*, and S. Kreger*, Blue Road Research, Gresham, OR, USA*,

We demonstrate OFDR measurements with mm resolution over 2 km. Individual events such as connectors, bends, and breaks can be identified and precisely located. We also demonstrate high-temperature and strain sensing with the same technique.

Thursday, 04 October 2007

08.30 - 10.00

Session ThA: **WDM II**
Session Co-Chairs: Michael J. Hackert, *US Naval Air Systems Command, Patuxent River, MD, USA*
William P. Krug, *Boeing Company, Seattle, WA, USA*

ThA1 08.30 - 09.00 (Invited)

Sandia Photonics Technologies for Avionics, G. Vawter and C. T. Sullivan*, Sandia National Laboratories, Albuquerque, NM, USA*

Avionics-related optoelectronics R&D is a core capability of Sandia National Laboratories. We will review activity in VCSELs, MEMs and photonic-integrated circuits as applied to applications from atomic clocks to beam forming and RF data links.

ThA2 09.00 - 09.30 (Invited)

InP Photonic IntegratedD Circuit and DWDM-on-Chip Technology, S.-T. Ho*, Northwestern University, Evanston, IL, USA*, Y. Huang and J. Ma*, OptoNet, Evanston, IL, USA*

The author will give a review of several leading platforms for InP photonic integrated circuit. Meanwhile, a novel DWDM-on-chip technology developed recently based on ultra-high efficiency super compact grating on InP wafer will be discussed.

ThA3 09.30 - 09.45

Priority-based Ring-Hybrid WDM LANS for Avionics, M. Stringer-Blaschke*,* A. Kumar*,* M. Sivakumar and J. Y. McNair*, University of Florida, Gainesville, FL, USA*

A priority-based ring-hybrid WDM LAN architecture is proposed, using both ring and point-to point topologies to support hybrid avionic sub-systems with variable-priority traffic. Simulation results demonstrate variable and consistently low latencies for all subsystems.

ThA4 09.45 - 10.00

Network Layer Modeling of WDM Fiber Optic Network Architectures for Aerospace Platforms, H. N. Poulsen, D. J. Blumenthal, *University of California - Santa Barbara, Santa Barbara, CA, USA*, D. H. Richards and A. Ramapanicker, *RSoft Design Group, Inc., Ossining, NY, USA*

We use a proposed reference network architecture to investigate the fault tolerance of an avionics DWDM network. Our simulations show modest increases in the numbers of hops and packets lost for low number of line failures.

10.00 – 10.30 **COFFEE BREAK**

10.30 - 12.00

Session ThB: **Optical Components I**
Session Co-Chairs: Neal K. Bambha, *US Army Research Laboratory, Adelphi, MD, USA*
Rick C. Stevens, *Lockheed Martin, Eagan, MN, USA*

ThB1 10.30 - 11.00 (Invited)

Next Generation of Passive and Reconfigurable Fiberoptic Components, J. Zhao, *Agiltron Inc, Woburn, MA, USA*

Agiltron design eliminates the progressive damage caused by thermal cycling stresses by use of packaging materials with matched coefficients of thermal expansion to the fiber. This approach not only provides ultra-high reliability but also excellent temperature stability performance.

ThB2 11.00 - 11.15

Bi-Directional Fiber Optic Transceivers for Avionics Applications, S. Bidnyk, M. Pearson, A. Balakrishnan and S. O'Keefe, *Enablence Inc., Ottawa, ON, Canada*

A bi-directional avionics transceiver based on planar lightwave circuit technology has successfully been designed, fabricated, and tested. The transceiver has been shown to operate at 2.5 Gb/s, while weighing only 1.9 g.

ThB3 11.15 - 11.30

Multimode Fiber Links for 40Gb/s Avionic Applications, S. Datta, X. Wang, A. Joshi, D. A. Becker, R. Howard and C. Wree, *Discovery Semiconductors, Inc., Ewing, NJ, USA*

We report a 300m long 40Gb/s multimode transmission utilizing a multimode-fiber-pigtailed top-illuminated photodiode. The frequency response of the multimode fiber and the photodiode is experimentally determined for various polarizations using an optical heterodyne setup.

ThB4 11.30 - 11.45

Military Avionics Fiber Optics Photonics Packaging Technology Forecast, M. W. Beranek, *US Naval Air Systems Command, Patuxent River, MD, USA*, R. Jenkins and R. I. Voigt, *US Naval Academy, Annapolis, MD, USA*

A new wave of photonics packaging research and development is required to enable a robust next generation BIT-capable avionics LAN technology solution based on single mode fiber and advanced WDM and RF components.

11.45 – 14.00 **LUNCH BREAK**

14.00 - 15.45

Session ThC: **Optical Components II**
Session Co-Chairs: Daniel N. Harres, *Boeing Company, Hazelwood, MO, USA*
Ron Pirich, *Northrop Grumman Corporation, Bethpage, NY, USA*

ThC1 14.00 - 14.30 (Invited)

Integrated High-Perfornabce Tunable Wavelength Converter Technologied for Future Terrestrial and Avionic Optical Networks, M. L. Masanovic, J. A. Summers, A. Tauke-Pedretti, V. Lal, J. S. Barton, L. A. Coldren, D. J. Blumenthal, *University of California - Santa Barbara, Santa Barbara, CA, USA*, T. Gibbons, L. Elgin, and M. Zhang, *MIT Lincoln Laboratory, Lexington, MA, USA*,

This paper gives an overview of the state-of-the-art in the field of integrated tunable wavelength converters, in particular focusing on the recent results related to the monolithic integrated wavelength converter DARPA funded research conducted at the University of California in Santa Barbara.

ThC2 14.30 - 14.45

Performance Testing of Bit-Enabled Aerospace Transceiver, C. B. Kuznia, *Ultra Communications Inc., Vista, CA, USA*

We describe performance testing of a quad transceiver module developed for harsh environment applications. This 850 nm VCSEL-based transceiver operates over 4 independent transmit and receive channels using multi-mode fiber. We present characterization of performance and built-in-test (BIT) features over temperature.

ThC3 14.45 - 15.00

Advanced Compact Transient Modeling of Er-Doped Amplifiers for Avionic Fiber-Optic Systems, P. V. Mena and D. H. Richards, *RSoft Design Group, Inc., Ossining, NY, USA*

We describe a compact transient model for EDFAs and EDWAs that is ideal for efficient simulation of avionic photonic systems. The model accounts for ASE generation, background loss, homogeneous upconversion, and thermal effects.

ThC4 15.00 - 15.15

Optical Branching Devices for Avionic Passive Optical Network, M. Farries, B. Napier, A. Robertson, and D. Smith, *Sifam Fibre Optics, Ltd., Torquay, Devon, UK*,

The development of fused optical components for operation over the -55C to +125C in the uncontrolled areas of an aircraft is reported. The use of these high reliability fused components for power splitting or wavelength multiplexing in passive optical networks on future aircraft is discussed.

ThC5 15.15 - 15.30

Design Theory and Experiment of All-Optical Tunable Filter Utilizing Acoustically induced Microbending Modultaion in Thin Optical Fibers, F. Abrishamian, S. Nagai, S. Sato and M. Imai, *Muroran Institute of Technology, Muroran, Hokkaido, Japan*

Spectral response of acoustically induced microbending through thin fiber is discussed from theoretical and experimental viewpoints. We successfully fabricated all-optical tunable filter using thin fiber (80um) and confirmed the frequency tunability at 1550nm.

ThC6 15.30 - 15.45

MEMS Based Fiberoptic Solutions for Avionic Applications, M. Muha and P. Benguhe, *DiCon Fiber Optics Inc, Richmond, CA, USA*

MEMs based devices enable robust fiberoptic systems for avionic applications, due to superior performance and reliability. Initially considered for switching and attenuation applications, they can now facilitate wavelength management in future WDM systems.

END OF PROGRAM