Track 6 - Open Systems Architecture

Chair: Louis Bottino, FAA Technical Center

In the recent past because the U.S. Defense budget was downsizing, the Department of Defense (DoD) realized it had limited resources and could not "go it alone". This is why the applicability of hardware/software open system architectures with the use of Commercial-off-the-Shelf (COTS) products for avionics and related technologies has grown over the past few years. The present climate of security and safety concerns has accelerated the need to be more cost-effective and efficient. To satisfy these concerns much can be gained from the wealth of technology available from the commercial sector in electronics. New open system applications in telecommunications, computing, display, sensing, signal processing and optics have surfaced. DoD policies are currently placing emphasis on performance specifications and open standards to better leverage the marketplace. This track will investigate the emerging open system standards and architectures for avionics and related technologies, quantify lessons learned in the application of open systems concepts and present practical applications.

**Session A - Hardware and Software Architectures**

Chair: Theodore Bayruns, Boeing Helicopter Division

6A1 Bi-Directional High Speed Network for Open System Avionics  
6A2 Identifying Rate Mismatch through Architecture Transformation  
6A3 System-Of-Systems Integration of Air-Ground Telecommunications with the Software Connector  
6A4 Commercially Available, DO-178B Level A Certifiable, Hard Partitioned, Posix Compliant Real-Time Operating System and TCP/UDP Compliant Ethernet Stack Software  

**Session B - Open Systems Applications**

Chair: Philip Cole, Seaweed Systems

6B1 The Flight Object - A New Flight Data Management Concept for Europe  
6B2 Current State and Future Direction for Military Aircraft Fiber Optics Networks  
6B3 The Route to the Intelligent Systems Engineering Enterprise  
6B4 Manned/Unmanned Common Architecture Program (MCAP): A Review  
6B5 Optical Communications - The Origins of the State of the Art
Session C - Commercial-Off-The-Shelf (COTS)
Chair: Donald Wilkins, Boeing Aircraft

6C1 The Feasibility of Applying Safety Certifiable Software Standards to Comanche Mission Processing
6C3 Ruggedized PC/104-Plus PowerPC Processor Card for Avionics
6C4 Systems Design Of Healthcare Systems
6C5 A Bandwidth Allocation Scheme for Scalable Coherent Interface (SCI) Based Avionics Real-Time Network

Theodore Bayruns
Chris Hall
Fredrick Kasparian
George Caple
Zhen Jiang
Track 7 – Space Systems

Chair: Bob Moore, Johns Hopkins University, Applied Physics Laboratory

This track focuses on the unique requirements of avionics associated with spacecraft, launch vehicles, and other system components designed to operate in space. This track addresses the needs of current and future space missions in terms of launch vehicle systems, avionics, the enabling microelectronics and packaging technology, scientific exploration, the international space station, re-usable launch vehicles, and space flight software. Applications covered include commercial, civil, defense, and scientific space systems, with a view toward implementing space systems faster, better, and cheaper without sacrificing quality and reliability.

Session C - Launch Vehicles & Spacecraft Avionics Systems

Co-Chairs: Felix Soto Toro, NASA Kennedy Space Center
Terry G. Koelbl, NASA Space Flight Center

Positive Position Feedback Based Vibration Attenuation For a
Flexible Aerospace Structure Using Multiple Piezoelectric
Actuators

Tony Adami

Time-Varying Notch Filters for Control of Flexible Structures
and Vehicles

Joseph Haber

Using a Commercial PCI IP Core in Space Flight Avionics:
Lessons Learned

Lingfeng Wang
Track 8 – UAVs and Missiles

Chair: Rolf Rysdyk, University of Washington

Several sessions will be dedicated to avionics systems applied for UAV Guidance, Navigation, and Control. These include aspects of autonomous decision making, multi-agent cooperative and coordinated control, and related technologies that enhance UAV systems used to meet military, research, or commercial objectives. Topics include: hazard avoidance, autonomy, mission planning, guidance, control, and navigation methods, payload integration, operator and user interfaces, UAV specific information architectures, coordinated and formation flight, sensors, communications, system integration, operational reliability and safety improvements. A joint session with the Intelligent Interactive Systems track will address UAV decision making support and situational awareness, and human interaction with semi-autonomous vehicles.

Session A - Cooperative Control – Theoretical

Chair: Ravi Vaidyanathan, Case Western Reserve University

8A1 Low Cost GPS/INS Sensor Fusion System for UAV Navigation
Chang-sun Yoo

8A2 Brumby Uninhabited Aerial Vehicle Flight Dynamics-Instrumentation and Flight Test Results
Jacob Campbell

8A3 Simulation-Based Development of Real-Time, Embedded Software for Cooperative, Autonomous Aerial Vehicles
Arthur Reyes

8A4 Attitude Command Attitude Hold and Stability Augmentation Systems for a Small-Scale Helicopter UAV
Aaron Kahn

Session B - Cooperative Control - System Implementation

Chair: Ravi Vaidyanathan, Case Western Reserve University

8B1 Feasibility of Using Synthetic Vision Technology for UAV Operator Support
Jochum Tadema

8B2 Vision-Only Aircraft Flight Control
Christophe De Wagter

8B3 Flight Path Following Guidance for Unmanned Air Vehicles with Pan/Tilt Camera for Target Observation
Sebastian Stolle

8B4 The Trans-Pacific Crossing: Long Range Adaptive Path Planning for UAVs Through Variable Wind Fields
Juan Rubio

Session C - Intelligent Interactive Systems for UAVs (Joint with Track 2, Session C)

Chair: Dr. David Rathbun, The Insitu Group

8C1 A Human Factors Testbed for Command and Control of Unmanned Air Vehicles
Kam Tso

8C2 Social Control Of A Group Of Collaborating Multi-Robot Multi-Target Tracking Agents
Madhava Krishna

8C3 Application of Artificial Intelligence Techniques in Uninhabited Aerial Vehicle Flight
Warren Dufrene
Track 9 - Synthetic Vision and Situational Awareness

Co-Chairs: Tim Etherington, Rockwell Collins
Maarten Uijt de Haag, Ohio University

This track provides insight into new developments for cockpit-based systems to improve the safety of approach, landing, and surface operations. Pilot awareness of hazards due to terrain, traffic and weather are critical to the safe conduct of flight. Automation surprise and lingering accident rates are spurring renewed interest into integrated graphical flight deck displays. Many new sensor and display technologies are under development for application that will provide pilots with enhanced situational awareness in the flight deck under all weather conditions. Special emphasis will be in synthetic vision, enhanced vision, human factors of flight deck displays, and visualization of aircraft hazards of terrain, traffic, weather and flight path on the ground and in flight.

**Session A - Situational Awareness**

**Chair: Erik Theunissen, Delft University of Technology**

9A1 Rotary Wing Terrain Awareness Warning Study
9A2 The Development and Evaluation of a Real-Time Turbulence Auto-PIREP System for Aircraft Network Centric Interoperability - Using a Variable Message
9A3 Format (VMF) Based Data-Link to Improve Situational Awareness and Close Air Support (CAS)
9A4 Flight Information Publication Digital Enroute Charts for Department of Defense
9A5 A Multidisciplinary Framework for Empirical Analysis of the Applicability of 3D Stereoscopic in Air Traffic Control

**Session B - Surface Movement Guidance and Traffic Awareness Displays**

**Chair: Tom Schnell, University of Iowa**

9B1 An Exocentric SGS Display Format: Design and Evaluation Effects of Traffic Display Size and Location on Visual
9B3 Advanced Developments in Airport Surface and Terminal Area Traffic Surveillance Applications
9B4 Safety Benefits of PathProx - A Runway Incursion Alerting System
9B5 Validation of Information Requirements for Surface Map Displays: A Simulation Study

**Session C - Synthetic Vision Technology**

**Co-Chairs: Andy Barrows, Nav3**

*Steve Young, NASA Langley Research Center*

9C1 Human Factors Flight Trial Analysis for 2D Situation Awareness and 3D Synthetic Vision Displays
9C2 The Application of LiDAR to Synthetic Vision System Integrity
Integration of Information in Synthetic Vision Displays: Why, to What Extent and How?

Terrain Awareness & Pathway Guidance for Head-Up Displays (TAPGuide); A Simulator Study of Pilot Performance Improving the Detection Capability of Spatial Failure Modes using Downward-Looking Sensors in Terrain Database Integrity Monitors Spatial Image Content Bandwidth Requirements for Synthetic Vision Displays

Session D - Enhanced Vision and Sensor Technology

Chair: Dick Newman, University of Iowa

Passive Landing Aids for Precision EVS Approach and Landing Robust Position Estimation Using Images From an Uncalibrated Camera Skeyeball: Real-Time Vision System for an Autonomous Model Airplane Neural Net Based Processor for Robust, High-Integrity Multisensor and Synthetic Vision Fusion Advanced Display Certification Issues Pathway Displays: A Literature Review

Session E - Synthetic Vision and General Aviation Display Technology (Joint with Track 12, Session E)

Co-Chairs: Monica Hughes, NASA Langley Research Center Lou Glaab, NASA Langley Research Center

Track 10 – Systems Engineering

Chair: Gary Van Oss, Wright Patterson Air Force Base

A systematic optimization of the development process is essential to respond to modern market forces, whether defense, space, or automotive. More and more complex systems are evolving to respond to these forces whether they are military or commercial. The effective application of systems engineering and related best practices are key to achieving and maintaining organizational excellence. A diversity of topics will be discussed including: Department of Defense views on systems engineering, Air Force transformation to capabilities and architecture based investment planning, the new AF Center for Systems Engineering, innovative applications of tools, analysis, and modeling, techniques and technology for sustaining and modernizing legacy systems, and network centric concepts and interoperability.

Session A - Tools, Modeling, and Analysis

Chair: Keith Jones, United States Air Force

10A1 A Methodology for Developing New Product Line Requirements Through Gap Analysis  
Thomas Redling  
10A2 Matlab® 'Add-on' Tools for State-of-the-Art Embedded Software Development  
Scott Ranville  
10A3 Application of Systems Engineering Principles to Proposal Writing  
Janice Davis  
10A4 Optimizing the Execution of Independent Multi-Version Programs  
Mritunjay Malhotra  
10A5 Space-Time Correlation Analysis of Quality-of-Service at Major US Airports - O’Hare International and Minneapolis Airports: A Case Study  
Loan Le

Session B - Innovative Applications

Co-Chairs: Gerald Mersten, Naval Air Systems Command

Norman Harbaugh, Wright Patterson Air Force Base

10B1 The Gurkh Project: A Framework for Verification and Execution of Mission Critical Applications  
Lars Asplund  
10B2 Spiral Evolution Applied to Legacy Avionics Systems?  
Dan Surber  
10B3 Very High Performance Computing for Military Avionics Applications Using FPGAs  
Richard Pedersen  
10B4 Avionics Architectures for Real-Time Multi-Platform Spectrum Allocation  
Atindra Mitra  
10B5 Image Compression Coder Selection and Specific Implementations in a COTS Versus Custom Software/Hardware Environment  
John Allen
Session C - Current Trends

Co-Chairs: Col. Rakesh Dewan, Air Force Space & Missile Center
Lt. Francis Lyons, Wright Patterson Air Force Base

10C1 Center for Systems Engineering
10C2 Designing Systems for Future Obsolescence
10C3 A Life Cycle Systems Engineering Approach to Sustainment

Session D - Future Battlefield Concepts

Chair: John Geise, Wright Patterson Air Force Base

10D1 Feasibility Demonstration of the Automated Targeting and Cross-Cueing System (ATACCS) at the Air Combat Command Transformation Center
10D2 Evolutionary Transformation of Predator from Reconnaissance to Hunter/Killer and Beyond
10D3 Tactical Sensor Models
10D4 Airborne Wireless Intercom System Utilizing an Ultrawideband Waveform
10D5 MS/1553- DOD Success Story-Past, Present, and Future

Karen Bausman
David Barton
Mark Canner
Lea Gordon
Frank Grimsley
Michael Hagee
Dennis McLean
William Wilson
Track 11 - Aging Avionics/Vehicle Health Management Systems

Chair: Ellis Hitt, Battelle

Aging avionics are impacting the flight readiness and operating costs of military and commercial aircraft, as well as the production of new aircraft. Papers in this track focus on the causes and solutions to the aging avionics problems including health monitoring and technology refresh. The rapid change in avionics technology leads to product obsolescence within 2 years, which has a serious impact on new aircraft production and modification programs for existing aircraft. Changes in systems design, production, and management processes are needed to refresh the avionics periodically during a modification, or a long production program.

Session D - Health Usage and Monitoring Systems (HUMS)

Chair: Ellis Hitt, Battelle

11D1 Wavelength Division Multiplexed (WDM) Optical Technology Solutions for Next Generation Aerospace Networks
Andrew Glista

11D2 Designing Domain-Specific HUMS Architectures: An Automated Approach
Ravi Mukkamala

11D3 HADL: HUMS Architectural Description Language
Ravi Mukkamala

11D4 Managing Change through Roadmapping
Brian Hicks

11D5 An Information-Centric Framework for Computing Mission Capability
Jayakanth Srinivasan

Session E - Wiring and Electromagnetic Compatibility (EMC)

Chair: Jan Davis, Smiths Aerospace Electronic Systems

11E1 Technology Update I: Wiring Prognostic Tools
Christopher Teal

11E2 Technology Update II: Wire Systems Diagnostics & Prognostics
Christopher Teal

11E3 Strategic Health Care Demands Modern NDE Processes
Christopher Teal

11E4 Graphical and Statistical Analysis of Airplane Passenger Cabin RF Coupling Paths to Avionics
Madiha Jafri
Track 12 - General Aviation/ Business Aviation

Chair: Ken Goodrich, NASA Langley Research Center

General Aviation covers an extremely broad range of operations from large business jets at one extreme to sport aviation at the other. The flight systems of business jets certified under Part 25 closely mirror those of airliners and the technologies and challenges relevant to this type of operation are well represented throughout the DASC. For sport aviation in its purist form, technology might be seen as a distraction from immersion in the sensations of flight and tolerated only as needed to facilitate safe and convenient operations. The focus of this track is between these two extremes and on the accelerating revolution of advanced flight systems that are enabling expansion of flexible, safe, reliable, and cost effective transportation by small aircraft to the multitude of rural, suburban, and urban destinations not well served by traditional commercial services. Sessions will cover systems, technologies, and issues that are of particular interest to private (i.e., self-flown) operations or innovative commercial operations such as regional air-taxis networks. Systems enabling improved safety, simplified pilot training, and enhanced operational capabilities through advanced technologies will also be covered.

Session C – Avionics and Operations

Co-Chairs: Lance Sherry, Athena Technologies

Ken Goodrich, NASA Langley Research Center

12C1 The NASA Langley Research Center's General Aviation Baseline Research System

12C2 Performance of Automotive-Grade MEMS Sensors in Low Cost AHRS for General Aviation

12C3 The Cockpit Associate: A "Co-Pilot in a Box" for General Aviation

12C4 Certification of Electronic Displays for Part 23 Airplanes (Small Airplanes)

12C5 Evaluation of a Trajectory-Based Operations Concept for Small Aircraft: Airborne Aspect

Session E - Joint Session (See Track 9, Session E)
Track 13 - Electronic Flight Bag (EFB)

Chair: Steve Zellers, Veridical

Topics that will be covered in this track include portable and installed aviation charting computers and technologies, software architectures for electronic flight bags, vector airport and obstacle databases, certification guidance for portable cockpit devices, and a review of fielded technologies.

Session D - Software Architectures and Aeronautical Databases

Chair: Stephane Dubet, Direction Générale de l'Aviation Civile

13D1 Aeronautical Charts for Electronic Flight Bags
13D2 Terrain, Obstacle and Airport Databases for Electronic Flight Bags
13D3 World-Wide Precision Airport Mapping Databases for Aviation Applications

Session E - Fielded Technologies

Chair: Dennis Schmitz, Teledyne Controls

13E1 Fielded EFB and Aviation Information Solutions
13E2 A Tool for Structured Evaluation of Electronic Flight Bag Usability
13E3 SMART Solutions For Electronic Kneeboard Applications
13E4 Description of a 3D Tracking Compass Symbology