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By Ellis Hitt

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21st Digital Avionics Systems Conference Air Traffic Management for Commercial and Military Systems

Paul Geiser, ARINC, General Chair
Hyatt Regency
Irvine, CA
27 – 31 October, 2002
www.dasconline.org

Avionics will be key to providing the next generation air traffic management (ATM) systems by bringing together all of our areas of expertise. The ATM system must provide the capacity needed to ensure minimal delays to achieve the economic benefits needed for growth of the air transportation systems worldwide. Communications, Navigation, and Surveillance (CNS) technologies will form the basis for improvements. Human factors principles will help design systems that meet the needs of pilots and controllers. Safety assessments will build on methods of analyzing safety-critical systems. Systems engineering will provide methods of designing, analyzing and verifying very large, very complex systems and sets of software. Finally, imagination and interdisciplinary efforts to bring together all of our knowledge will allow us to conceive new, innovative methods of air traffic management.

Challenges in integrating these technologies into existing aircraft are many. These types of systems take many years from initial installation to final phase out of older systems. The air traffic management system's impact on the air transportation system is multifaceted with the success or failure of businesses dependent on the successful integration, operation, and support of the future systems.

**Air power alone
does not guar-
antee America's
security, but I
believe it best
exploits the na-
tion's greatest
asset — our
technical skill.**

*Gen. Hoyt S.
Vandenberg*

The State of Avionics in 2002

Ellis F. Hitt

Battelle

Chairman, AIAA Digital Avionics Technical Committee

The terrorist actions of September 11, 2001 and subsequent events have changed avionics. The Quadrennial Defense Review (QDR) published in October reflected the impact of these events and provided insight to coming changes in the U. S. military. The military action in Afghanistan provided a clear look at the successful use of the unmanned aeronautical vehicle (UAV) and smart weapons. These successes were directly the result of successful application of avionics.

The press, public, and some engineers have portrayed avionics as a means of preventing future hijacking of commercial aircraft and use of that aircraft as a terrorist weapon.

(Continued on page 4)



Frank H. Gern
Avionics Specialties, Inc.

Dr. Gern received his Ph.D, M.S., and B.S. in Aerospace Engineering from the University of Stuttgart. His primary professional interests include avionics,

air data sensors, and computational fluid dynamics. He has extensive experience with aerodynamic modeling and materials.

He is currently Manager of New Business Development at Avionics Specialties where he directs and executes programs that deal with the identification of new technologies and concepts necessary to move product lines into the next generation.

Frank has written over 50 papers for peer-reviewed journals and presented papers at many conferences.



Robert Hammett
C.S. Draper Laboratory

Mr. Hammett is a Principal Member of the Technical Staff at Draper. Rob has 23 years of experience in design, development, test, and manufacture of digital electronic

control systems for aircraft, spacecraft, and submarines. His technical interests include fault-tolerant systems, aircraft and space control systems, avionics architectures, health monitoring and diagnostics, and multiplexed data buses.

Rob has a MSEE from Rensselaer Polytechnic, and a BSME for the University of Toledo. At Draper Laboratory, he is technical director of the NASA SFINX program to develop smart, fault-tolerant systems technology demonstrations, and task leader and Integrated Product Team leader for the Kistler reusable launch vehicle, Vehicle Health Management system development. Prior to joining Draper Laboratory in 1984, he worked for Allied Signal Aerospace, and Pratt and Whitney on full authority digital engine controls.

Rob served as a technical chairman for two sessions at the 20th DASC. He has authored and presented papers at many conferences during the past 10 years. He received the IEEE Mimno Award at the 20th DASC.



Steven Young
NASA Langley Research
Center

Mr. Young received his BSEE, from the West Virginia Institute of Technology, 1987; MSEE, from Georgia Institute of Technology, 1990, and is currently a PhD EE Candidate at Ohio University. He has been a Flight Systems Researcher

at NASA since 1987. His primary professional interests include CNS and display systems, GPS and data link, runway incursion prevention technologies, and flight critical systems—fault tolerance, monitoring, and designing for dependability. Steve has published 26 technical papers. He is Co-chair of the RTCA/EUROCAE Special Committee (SC-193), Sub-group 3

20th Digital Avionics Systems Conference

The 20th Digital Avionics Conference was held in Daytona Beach, FL on October 14-18, 2001 and had 333 registered participants. There were 25 pre-Conference tutorials offered on topics such as Software Fault Tolerance, Safety Critical Software, RF Spectrum Strategy, Airline EMI Testing, Free Flight, Spacecraft Avionics, Launch Vehicle Avionics, Digital Avionics & Architectures, Open Architectures, Certification Issues, and Advanced Diagnostics.

Plenary Speakers for the 20th DASC were Geoffrey Bailey, Head of Communications Unit, EUROCONTROL: "Wideband Communications - 3G the Future?"; George H. Ebbs, President, Embry-Riddle Aeronautical University: "Are Our Universities Serving the Avionics Community?"; David H. Lehman, Senior Vice President for Information and Technology, The MITRE Corporation: "Technical Trends as Enablers of 21st Century Avionics"; David S. Watrous, President, RTCA: "RTCA's Role in Digital Avionics Standards"; Dr. Robert E. Gold, Payload Manager, Messenger Mission, Johns Hopkins University, Applied Physics Lab.: "Near Earth Asteroid Rendezvous Mission"; Frederick D. Gregory, Associate Administrator, Office of Safety and Mission Assurance, NASA: "Space - Aviation's Next Frontier".

Technical Sessions for the 20th DASC were arranged into 9 Tracks: Flight Critical Systems, Enhanced Situational Awareness, Aging Aircraft Avionics/Vehicle Health Management, Systems Engineering, Open Systems, Human Factors, General Aviation/

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If you have never participated in a DASC, or you're an old-time DASC alumnus, this year's conference is really starting to take shape. Since the major purpose of the DASC is to provide a medium by which the avionics community exchanges information on new technical ideas and efforts via **technical papers, tutorials, exhibits, and presentations from leaders in the aviation community**, the volunteer conference committee has developed the following format:

Tutorials --- (gandrew@qssmeds.com)

Twenty-four tutorials will be presented on the 27th and 28th, a Sunday and Monday. This allows you to take advantage of the "low over-a-Saturday-night airfares". Topics and presenters are about 80% locked in, but if you would like to present or have a topic suggestion contact George.

Technical Program --- (amy.pritchett@isye.gatech.edu)

Eight technical tracks, each with 5 sessions and 6 papers per session (total of **240 technical papers**) will be held October 29th through the 31st. The track topics are: **Flight Critical Systems, Enhanced Situational Awareness, Aging Aircraft Avionics/Vehicle Health Management, Systems Engineering/Open Systems, Human Factors, General Aviation/SATS/Simulation Platforms, Air Traffic Management, and Space Systems**. Papers are still needed. Submit abstracts at <http://www.dasconline.org>. Contact Dr. Pritchett at amy.pritchett@isye.gatech.edu if you have questions about the technical program. Student papers are evaluated to select the 5 best papers for special recognition at the conference. All papers are evaluated to select the best in session, track, and conference.

The **Plenary Session** will be held in the morning of the 29th with keynote presentation by **Leaders in the Aviation Community**.

On the 30th at the **Awards Luncheon**, the conference will recognize outstanding papers from students, as well as recognition of the best papers from the 20th DASC.

Technical Exhibits --- (glen.logan@osd.mil)

The **Technical Exhibits** will be open all day on the 28th and 29th and in the evening of the 29th. The exhibits luncheon on the 28th and the reception the evening of the 29th will be held in the exhibits area. Please contact Glen for information on your company exhibiting at the DASC.

Fun Things ---

For the most current information on the **21st DASC** see www.dasconline.org.

(Continued from page 2)

Simulation, Air Traffic Management, and Space Systems. In these Tracks, more than 200 papers were presented. The best papers from each session and track, as well as the best student papers, and conference papers begin on page 5.

Exhibitors for the 20th DASC included the AIAA, Actel, Battelle, The Boeing Company, DY4 Systems, Embry-Riddle Aeronautical University, FAA William J. Hughes Technical Center, General Dynamics Information Systems, Greenhills Software, Inc., Honeywell, DoD Open Systems Joint Task Force, General Dynamics Information Systems, Green Hill Software, IEEE, The MITRE Corporation/CAASD, Rannoch Corporation, and the US Army Aviation and Missile Command.

Frederick Gregory, Associate Administrator, Office of Safety and Mission Assurance, NASA spoke on Safety and Mission Assurance at the Awards Luncheon. Awards presented and the recipient included: Best Paper, 19th DASC—Chuck LaBerge, Honeywell. The top 5 student best papers awards (page 6) were presented by Dr. Jim Rankin, Ohio University.



The Digital Avionics Systems Award was presented to Jim Dieudonne. Pictured with Jim are Dr. John Ruth, Fred Gregory, Carey Spitzer, and Tom Smith, Director of Information Systems, AIAA.

Embry Riddle Aeronautical University received the Avionics Distinguished Institution Award.

The Social Event for the 20th DASC was held at the Astronaut Hall of Fame. A catered meal was followed by entertainment by Tom Smith, Glen Logan, Open System Joint Task Force staff. Music was provided the Al Helfrick trio.

Avionics in 2001

(Continued from page 1) The State of

Unfortunately, this is not easily done for existing aircraft since manual control inputs to most aircraft override the autopilot generated commands. Proposals to add the locations of tall buildings or targets into the terrain database assumed that the ground collision avoidance system was an automatic control system that prevented the aircraft from flying into the ground. Current GCAS provide warnings, but the pilot is still in control of the flight.

Major avionics contract awards in the military during the past year included the C-130 Avionics Modernization Program (AMP) and the selection of the Lockheed-Martin X-35 as the winner of the Joint Strike Fighter (JSF) competition. The C-130 AMP acquisition funding slipped two fiscal years in the FY02 Presidential Budget. The start of production and delivery of the JSF are many years in the future based on the FY02 budget. The FY03 budget may reflect new priorities that change funding lines in the FY02 budget. The FY03 budget may also reflect an increased emphasis on use of UAV in not only reconnaissance but also in combat missions. The Predator has been armed with the Hellfire missile and the Boeing X-45 UCAV is undergoing testing at Edwards AFB.

The commercial avionics outlook dimmed with the cancellation of contracts or delay of production delivery for commercial aircraft. The US Department of Defense may pick up some of the commercial aircraft output with the announcement that the USAF intends to lease 100 Boeing 767 aircraft for ten years for use as tankers and airlift aircraft. Many of the airliners mothballed by U.S. airlines were the older aircraft with old avionics. When these aircraft are brought back to flying status, avionics upgrades may be required for communication, navigation, surveillance/air traffic management (CNS/ATM) functions. The market for avionics for the regional jet (RJ) market continues to grow as more carriers replace or introduce routes previously served with larger aircraft with an RJ operated by a contract carrier such as Chautauqua Airlines.

The USAF Aeronautical Systems Center Aging Aircraft System Program Office, System and Technology, held meetings with industry to brief their new acquisition approach for avionics. USAF plans on using a Best Value Methodology in avionics procurements to ensure that avionics viability considerations are reflected in selection of contractors. The viable avionics approach recognizes that the avionics in weapons are in the field use obsolete

technology and are experiencing support problems. It also focuses on the fact that many of these weapon systems will remain in the inventory for many years, as will new weapon systems. Future avionics procurements will place more responsibility on the contractor to ensure that the avionics installed in existing and new aircraft will be capable of growth, producible over long periods of time, and capable of sustainment for periods approaching 80 years. The B-52 and KC-135 fleets are examples of aircraft that have exceeded the original lifespan and may be in the inventory for another 40 years. The production quantities envisioned for the JSF may be impacted in future years by the UCAV. In nearly every scenario for avionics production of new or retrofit avionics, funding constraints force production to occur over time periods that far exceed the current technology life.

Funding constraints then force a new approach to the design, production, and support of avionics. The ASC approach to viable combat avionics (VCA) focuses on growth viability, producibility viability, and sustainment viability. ASC has established assessment criteria for these three areas with specific guidance for evaluation of growth, producibility, and sustainment viability pertaining to business strategy, processes, and system design and development activities.

The approaches proposed by the contractors may impact the sustainment roles of the USAF Air Logistics Centers. Affordability is emphasized for viable combat avionics. Affordability is a function of the sustainment approach since the sustainment period is the longest part of the avionics life cycle. Contractors and the ALCs may team for Sustainment of the avionics hardware, software, and support systems to achieve the most affordable solution by allocation of work between contractor and ALC. This is consistent with the QDR emphasis on reexamination of "core" workload with contractors performing all work that is not directly in support of the war fighting mission of DoD.

Air traffic control modernization continues in 2002, but the operation was impacted by the terrorist attacks of September 11. Congestion over the U.S. has been reduced temporarily, but the transition to CNS/ATM will continue. Reduced vertical separation minimums go into effect in January in European airspace. There is a push for privatization of ATC services by Boeing. The direction this will take bears watching since it could lead to mergers of ATC equipment manufacturers.

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The FY03 Presidential Budget does not include any substantial increase in avionics funding. The RDT&E budget for avionics remains close to that for FY02. The FY03 procurement budget for avionics modifications on existing aircraft remains basically the same as the plan in the FY02 budget with some stretch out in time of modifications underway or planned.

20th DASC Best Papers 14 - 18 October, 2001 Plaza Resort & Spa Daytona Beach, FL

Track 1 – Flight Critical Systems

Best of Track – Y. C. (Bob) Yeh, Safety Critical Avionics for the 777 Primary Flight Controls System

Best of Session A – Charles Hall, Jr., A Real-Time Linux for Autonomous Navigation and Flight Attitude Control of an Uninhabited Aerial Vehicle

Best of Session B – Kelly Hayhurst, A Practical Approach to Modified Condition/Decision Coverage

Best of Session C – Same as Best of Track

Best of Session E – Courtney Rollins, Electromagnetic Compatibility Testing for the NASA Langley Research Center Boeing 757-200

Track 2 – Situational Awareness Systems

Best of Track – Sohel Merchant, Yongjin Kwon, Tom Schnell, Evaluation of Synthetic Vision Information System (SVIS) Displays Based on Pilot Performance

Best of Session A – John McGuirol, Presenting In-Flight Icing Information: A Comparison of Visual and Tactile Cues

Best of Session B – Christopher Gill, An Evolution of QoS Context Propagation in Event-Mediated Avionics Architectures

Best of Session C – Same as Best of Track

Best of Session D – R. Cassell, C. Evers, B. Sleep, and J. Esche, Initial Test Results of PathProx - A Runway Incursion Alerting System

Best of Session E – Carl Hawes, The Local Area Augmentation System: An Airport Surveillance Application Supporting the FAA Runway Incursion Prevention Demo at DFW Airport

Track 3 – Aging Aircraft/Vehicle Health Management

Best of Track – Karen Sprague, V. Gavrillets, D. Dugail, B. Mettler, E. Feron, & I. Martinos, "Design and Applications of an Avionics System for a Miniature Acrobatic Helicopter

Best of Session A – John Moore, USAF C/KC-135 Avionics -- Preparing for the Second Forty Years of Service

Best of Session B – Daniel Koppen, Comparison of Bulk Cable Injection to Reverberation Chamber Methods On a Fault Tolerant Flight Control Computer

Best of Session C – Same as Best of Track

Best of Session D – Benoit Vincent, Requirements Specification for Health Monitoring Systems Capable of Resolving Flight Control System Faults

Best of Session E – Ronald Vance, Rapid Retargeting to Mitigate

Obsolescence in the AN/ALQ-126B

Track 4 – Systems Engineering/Open Systems

Best of Track – Steven Miller and Alan Tribble, Extending the Four-Variable Model to Bridge the System-Software Gap

Best of Session A – Lars Kristenssen, Jonathan Billington, Zahid Qureshi, Modelling Military Airborne Mission Systems for Functional Analysis

Best of Session B – Brian Ippolito and Earll Murman, Improving the Software Upgrade Value Stream

Best of Session D – Terry Morris and Peter Beling, Space Shuttle RTOS Bayesian Network

Best of Session E – Same as Best of Track

Track 5 – Human Factors

Best of Track – Deborah Allinger, Application of Speech Technology to Unmanned Vehicles

Best of Session A – Marc Nikolic, Orr, and Sarter, The Effects of Display Context on the Effectiveness of Visual Onset for Attention Capture

Best of Session B – Same as Best of Track

Best of Session C – Benjamin Bell and John Wise, Crew Intent-Inference: A Human Factors Approach to Flight Deck Automation and Decision Support

Best of Session D – Christina Frederick-Recascino, Monitoring Automated Displays: Effects of and Solutions for Boredom

Track 6 – Business & GA/SATS/Simulations

Best of Track – James Chamberlain, Convective Weather Detection by GA Pilots with Conventional and Data-linked Graphical Weather Information

Best of Session A – Same as Best of Track

Best of Session C – Dr. Steven Thompson, An Operational Concept for the Smart Landing Facility

Best of Session D – James Call, Industry and FAA Test New Technologies in Alaska

Best of Session E – Lauren Martin, Simulation and Modeling of Air Traffic Over the Western Atlantic Route System

Track 7 – Air Traffic Management

Best of Track – Keith Wichman, Göran Carlsson, Lars Lindberg, Flight Trials: "Runway-to-Runway" Required Time of Arrival Evaluations for Time-Based ATM Environment

Best of Session A – Phil Smith, IPSky: IPV6 for the Aeronautical Communications Network

Best of Session B – Fraser McGibbon, Autonomous Aircraft Operations to Managed Airspace Transfer Management Tool (T-MAT)

Best of Session C – Thomas Seliga and Francis Coyne, Potential Enhancements to the Performance of ASDE Radars Derived from Multi-static Radar Principles

Best of Session D – Chris Dhas and Chris Wargo, Potential for the Use of Internet Protocols in Aviation

Best of Session E – Anand Mundra & A. Smith, Capacity Enhancements in IMC for Converging Configurations with Down-Link of Aircraft Expected Final Approach Speeds

Best of Session F— Same as Best of Track

Track 8 – Space Systems

Best of Track – Stephen Moynahan, Development of a Modular On-Orbit Serviceable Satellite Architecture

Best of Session A – Phillip T. Meade, Use of Product Line Based Checkout Systems for Payload Processing

Best of Session B – B. Earl Wells, On the use of Distributed Reconfigurable Hardware in Launch Control Avionics

Best of Session C – Binh Le, An Advanced 3D Electronic Packaging Design for the CONTOUR Remote Imaging Spectrograph Digital Processor Unit

Best of Session D – Same as Best of Track

Best of Session E – Chuck LaBerge, Performance of Turbo Codes in Aeronautical SATCOM Multipath Environments

Track 9 – Systems Engineering / Open Systems

Best of Track – David Corman, Jeanna Gossett, WSOA - Weapon Systems Open Architecture Demonstration

Best of Session A – Harold Lowery, Feasibility of Modernizing F-15A/D Avionics Using an Open Systems Approach

Best of Session B – David Sharp, Mike Effinger, Caleb Miller, Wendy Roll, Douglas Stuart, Challenges and Visions for Model-Based Integration of Avionics Systems

Best of Session E—Same as Best of Track

Best of Conference – A Tie

Kara Sprague, V.Gavrilets, D.Dugail, B.Mettler, E.Feron, I. Martinos, Design and Applications of an Avionics System for a Miniature Acrobatic Helicopter

James Chamberlain, Convective Weather Detection by GA Pilots with Conventional and Data-linked Graphical Weather Information

Best Student Papers

Undergraduate

Joris Koeners and Kristel Kerstens, Delft University of Technology, The Netherlands, "Pictorial Representation of ATC Instructions for Airport Surface Operations: Design and Evaluation"

Alicia Lechner & Kevin Ecker, St. Cloud State University, St. Cloud MN, "Voice Recognition - Software Solutions in Real Time ATC Workstations"

Graduate

Yannick Devouassoux and Amy Pritchett, Georgia Institute of Technology, Atlanta GA, "Application of Kalman Filtering to Pilot Detection of Failures"

Fraser McGibbon and Colin Goodchild, University of Glasgow, Glasgow UK, "Autonomous Aircraft Operations to Managed Airspace Transfer Management Tool (T-MAT)"

Jacob Campbell and Maarten Uijt de Haag, Ohio University, Athens OH, "Assessment of Radar Altimeter Performance When Used for Integrity Monitoring in a Synthetic Vision System"



Robert Hammett, C.S. Draper Laboratory, received the IEEE Mimno Award at the 20th DASC.



Exhibits at the 20th DASC.

Thanks

The DATC members would
like to thank

20th DASC Exhibitors

DATC Events

February 28th-March 1st
DATC Meeting
Irvine, California
21st DASC Paper Selection

May 10th
DATC Meeting
Indianapolis, Indiana
Digital Avionics Today Articles Due

July 1, 2002
Digital Avionics Today
Volume 4, Issue 2

August 5-6, 2002
DATC Meeting
Monterey, CA

September 15th
Draft Aerospace
America Due to AIAA

October 27-31
21st DASC
Irvine, CA

December :
Digital Avionics Highlight
Article Published in Aerospace America

DATC MEETINGS

Feb 28- March 1, 02: The DATC will be meeting at the Hyatt Irvine, in conjunction with the 21st DASC paper selection meeting

May 10, 02: The DATC will be meeting in Indianapolis

Aug 6, 02: The DATC will be meeting in Monterey in conjunction with the AIAA Guidance and Control Conference.

Oct 28, 02: The DATC will be meeting at the 21st DASC: Hyatt Regency Irvine
17900 Jamboree Boulevard
Irvine CA 92614



Hotel Information:

http://www.hyatt.com/usa/irvine/hotels/hotel_irvin.html

Thanks

The DATC members would like to thank

Jim Dieudonne

For all of his hard work and dedication as 20th DASC chair .

Thanks

The DATC members would like to thank

20th DASC Committee

For all of their hard work and dedication

For changes and corrections
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I would like to thank
Ron Schroer, Editor-
in-Chief of the IEEE
AESS "SYSTEMS"
magazine for
providing the DASC
photographs

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