Industry Support Project

ACAST/SBT Workshop Review

August 16, 2005
Agenda

- Project Scope
  - Industry Groups Supported
- Group Work Plan Summaries
  - Activity Highlights
- Summary
Project Scope

- Title
  - Industry Support

- Project
  - Includes support for a selected set of AEEC Committees, AEEC User Forums, RTCA Committees, RTCA Forums and related Industry bodies
  - NASA GRC Leads: Israel Greenfeld and Jun Mao

- Plan/Deliverable
  - Industry forum participation
  - Working paper preparation
  - Meeting minutes
  - Quarterly review

- Today’s Focus
  - Snapshot of key initiatives
  - RTCA Committees supported by Mulkern Associates Inc.
Accomplishments:

- Provided inputs to NASA GRC regarding aviation industry Communications, Navigation & Surveillance (CNS) activities for guiding research to be consistent with FAA and aviation industry CNS trends.
- Provided ongoing, specialized NASA GRC representation in key aviation industry committees.
- Provided objective participation on behalf of NASA GRC in the development of aeronautical CNS operational requirements and standards.
- Maintained participation in aviation industry CNS architecture development.
- Based on committee participation, fostered ideas for solutions to specific aviation industry CNS issues and problems.
- Provided knowledge-based, informal liaison between/among committees.
<table>
<thead>
<tr>
<th>Industry Group</th>
<th>Goals</th>
<th>Degree of Criticality to NASA</th>
<th>Related ACAST Sub Project(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aircraft Data Networks (ADN) Working Group</td>
<td>Design next generation aircraft networks</td>
<td>High</td>
<td>Transitional CNS Architectures</td>
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<td></td>
<td>Transition from ARINC 429 to ARINC 664</td>
<td>Medium</td>
<td>Global Air/Ground Networks</td>
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<td></td>
<td>Ethernet technology and avionics</td>
<td>Low</td>
<td>Multimode/Multifunction Avionics</td>
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<td></td>
<td>Use of IP in aviation community</td>
<td>Low</td>
<td>CNS Technologies</td>
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<td>Transport of flight critical data over IP</td>
<td>Low</td>
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<td></td>
<td>Example cabin architecture</td>
<td>Low</td>
<td>CNS Technologies</td>
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<td>Example avionics architecture</td>
<td>Low</td>
<td>CNS Technologies</td>
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<td></td>
<td>Adapt commercial protocols and services to ATN</td>
<td>Low</td>
<td>CNS Technologies</td>
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<tr>
<td>Data Link Systems (DLK) Subcommittee</td>
<td>Maintain ACARS standards</td>
<td>Low</td>
<td>Global Air/Ground Networks</td>
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<td>Develop standards to support ATN</td>
<td>Low</td>
<td>Multimode/Multifunction Avionics</td>
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<td>Develop standards to support VDL Mode 2</td>
<td>Low</td>
<td>VHF Systems Optimization</td>
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<td>Data Link Security</td>
<td>Low</td>
<td>CNS Technologies</td>
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<tr>
<td>Air Ground Communications System (AGCS) Subcommittee</td>
<td>Develop emerging and maintain Satcom standards. Includes Swift 64, Aero H, BGAN</td>
<td>Low</td>
<td>Global Air/Ground Networks</td>
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<td>Develop HFDL and maintain legacy HF communication standards</td>
<td>Low</td>
<td>Multimode/Multifunction Avionics</td>
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<td>Develop VDL Mode 2 and maintain legacy VHF communication standards</td>
<td>Low</td>
<td>Oceanic/Remote Communications and Surveillance</td>
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<td>Forum to review FAA’s VDL Mode 3 effort</td>
<td>Low</td>
<td>CNS Technologies</td>
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<tr>
<td>Aircraft Information Security (SEC) Working Group</td>
<td>Develop a common security framework for aeronautical community</td>
<td>Low</td>
<td>Multimode/Multifunction Avionics</td>
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<td>Develop a common security mechanism</td>
<td>Low</td>
<td>CNS Technologies</td>
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<td>Provide a integrated international effort on future security equipments</td>
<td>Low</td>
<td>CNS Technologies</td>
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<td></td>
<td>Minimal effect on current airline operations</td>
<td>Low</td>
<td>CNS Technologies</td>
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### ACAST Sub Project Applicability Matrix - 2/3

<table>
<thead>
<tr>
<th>Data Link Systems (DLK) Users Forum</th>
<th>♦ Establish and maintain interoperability between airborne users and ground communication service providers</th>
<th>♦ Transitional CNS Architectures</th>
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<tbody>
<tr>
<td></td>
<td>♦ Ensure efficient use of limited frequency spectrum</td>
<td>♦ Global Air/Ground Networks</td>
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<td>♦ Promote the progression from legacy to next generation technologies</td>
<td>♦ Spectrum Research</td>
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<td>♦ Forum for airspace users and ATS service providers to coordinate datalink applications</td>
<td>♦ Multimode/Multifunction Avionics</td>
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<td></td>
<td>♦ Establish and maintain consistency among the services offered by ATS service providers</td>
<td>♦ VHF Systems Optimization</td>
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<thead>
<tr>
<th>AEEC General Session</th>
<th>♦ Provides an overview of important technical developments in air transport avionics and aircraft electronics</th>
<th>♦ All ACAST Sub Projects</th>
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<tr>
<td></td>
<td>♦ New standards are discussed and approved</td>
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<td>♦ Initiates work program for following year</td>
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<td>♦ Marks the culmination of the year's standards development work</td>
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<tr>
<th>RTCA SC 186 Automatic Dependent Surveillance - Broadcast (ADS-B)</th>
<th>♦ Develop Revision A to DO-286, TIS-B MASPS</th>
<th>♦ Global Air/Ground Networks</th>
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<tr>
<td></td>
<td>♦ Developing standards for the Surveillance Transmit Processing (STP), Airborne Surveillance &amp; Assurance Processing (ASSAP) and CDTI subsystems of ASAS</td>
<td>♦ Oceanic/Remote Communications and Surveillance</td>
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<td></td>
<td>♦ Develop with EUROCAE harmonized operational concepts, SPR, and Interop specification for aircraft and ground surveillance applications</td>
<td>♦ Space based Surveillance</td>
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<td>♦ CNS technologies</td>
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<td></td>
<td>♦ Terminal Area Communications</td>
</tr>
<tr>
<td></td>
<td></td>
<td>♦ Surface Integrated CNS Network</td>
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</table>
## ACAST Sub Project Applicability Matrix - 3/3

### RTCA SC-206

<table>
<thead>
<tr>
<th><strong>Aeronautical Information Services (AIS) Data Link</strong></th>
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</table>
| ► Identify FIS & AIS communications system performance requirements for all airspace domains and ground operations | ● | ●Global Air/Ground Networks

|  |  | Multimode/Multifunction Avionics
|  |  | Surface Integrated CNS Network
|  |  | Terminal Area Communications
|  |  | Oceanic/Remote Communications and Surveillance
|  |  | CNS technologies
| ► Define message content attributes and protocols for FIS/AIS data communications | ● | ●Change 1 to DO-252, Minimum interoperability specification for Automated Meteorological Transmission (AUTOMET)

|  |  | Change 1 to DO-267A, FIS-B MASPS; Provide guidelines for "lossy" compression for more efficient use of data link bandwidth
|  |  | ► Define MASPS for tactical (vs. advisory) use of FIS/AIS applications
|  |  | ► Provides a briefing of Industry activity, Industry focus and future work plans
|  |  | ► Provides a program status review
|  |  | ► Develop ATN technical provisions
|  |  | ► Monitor operational requirements
|  |  | ► Develop new standards and/or guidance material as required
|  |  | ► Work on addressing IP mobility issues

### RTCA Symposium / Forum

<table>
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| ► Provides a briefing of Industry activity, Industry focus and future work plans | ● | ●Global Air/Ground Networks

|  |  | Multimode/Multifunction Avionics
|  |  | Surface Integrated CNS Network
|  |  | Terminal Area Communications
|  |  | Oceanic/Remote Communications and Surveillance
|  |  | CNS technologies
| ► Insight into FAA and Industry programs | ● | ●Change 1 to DO-267A, FIS-B MASPS; Provide guidelines for "lossy" compression for more efficient use of data link bandwidth

|  |  | ► Define MASPS for tactical (vs. advisory) use of FIS/AIS applications
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### Aeronautical Communications Panel (ACP) Working Group N

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| ► Provides a briefing of Industry activity, Industry focus and future work plans | ● | ●Global Air/Ground Networks

|  |  | Multimode/Multifunction Avionics
|  |  | Surface Integrated CNS Network
|  |  | Terminal Area Communications
|  |  | Oceanic/Remote Communications and Surveillance
|  |  | CNS technologies
| ► Insight into FAA and Industry programs | ● | ●Change 1 to DO-267A, FIS-B MASPS; Provide guidelines for "lossy" compression for more efficient use of data link bandwidth

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|  |  | ► Monitor operational requirements
|  |  | ► Develop new standards and/or guidance material as required
|  |  | ► Work on addressing IP mobility issues

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**Computer Networks & Software, Inc**
Objective
- Design next generation aircraft networks
- Transition from ARINC 429 to ARINC 664
- Adapt commercial protocols and services to the ADN (IPv4 and IPv6)

Standard - ARINC Specification 664 Aircraft Data Network
- Part 1 Systems Concepts and Overview
- Part 2 Ethernet Physical and Data Link Layer Specifications
- Part 3 Internet based Protocols and Services
- Part 4 Internet based Address Structures and Assigned Numbers
- Part 5 Network Interconnection Services and Functional Elements
- Part 6 Reserved
- Part 7 Deterministic Networks
- Part 8 Interconnection with Non-IP Protocols and Service

Interest to NASA
- Foster next generation aircraft data networks based upon IP
- Use of IPv6 in Aviation community
- Transport of flight essential information over IP data links
- Mobile IP approaches and security
ARINC 664 Part 8

Objective
» Interoperation with Non-IP Protocols and Services
» Provides guidance for development of aeronautical applications and services that can be transported over the TCP/IP network
» Definition of a secure, acceptable path for transition from ATN to TCP/IP environment

Status
» Developed and discussed approximately 12 different models of connectivity
» Working consensus developed on depiction of transition model and approach
» Work to be considered as input to ICAO ACP WG “N” current study
» Completed three draft iterations
» AEEC has adopted Part 8 as of 28 March 2005
**Data Link Systems (DLK) Subcommittee**

- **Objective**
  - Develop and maintain standards for data transfer between aircraft and ground stations
  - Standards cover existing ACARS and the emerging ATN

- **Standards**
  - ARINC Specification 618 Air/Ground Character Oriented Protocol
  - ARINC Specification 619 ACARS Protocols for Avionics End Systems
  - ARINC Specification 620 Data Link Ground System Standard and Interface
  - ARINC Specification 623 Character Oriented ATS Applications
  - ARINC Specification 637 ATN Implementation, Provisions, Protocols & Services
  - ARINC Characteristic 758 Communications Management Unit (CMU) Mark 2

- **Interest to NASA**
  - Principle committee for the C component of CNS
  - Continuous monitoring of technical changes for aviation data links
  - Relates to transition of future ACAST mobile communication architecture and networks
Objective
- Develop and maintain standards for Air/Ground communications using SATCOM, HF, VDL Mode 2, or VDL Mode 3
- Standards cover existing ACARS and the emerging ATN
- VDL Modes 2, 3 activities fused into AGCS

Standards
- ARINC Characteristic 741 Part 2 Aviation Satellite Communications Systems Design & Equipment Functional Description
- ARINC Characteristic 781 Mark 3 Aviation Satellite Communications System Aircraft Installation Provisions
- ARINC Characteristic 750-2 VHF Digital Mode 2 Data Radio
- ARINC 750-X VHF Digital Mode 3 Data Radio

Interest to NASA
- ACAST Sub Projects covering En Route, Terminal and MMDA activities
- Oceanic/ Remote Airspace flight data
- Aero H; Swift 64;
- Characteristic 781: BGAN (or SwiftBroadband) services using Inmarsat 4
Objective

- Develop a Concept of Operation (ConOps) for a common security framework, and a common set of security mechanisms
- Other industry groups will follow recommendations as provided by the Security ConOps
- Security perspective for today and tomorrow

Standards

- Draft 1 of ARINC Project Paper 811: *Commercial Aircraft Information Security Concepts of Operation and Process Framework* will be circulated in 2nd half 2005

Interest to NASA

- SEC to share its results with other AEEC committees
- The subcommittee endorsed the creation of an Aircraft Information Security Forum. An APIM will be prepared for consideration by AEEC.
- Open aviation industry forum to deliberate a common security infrastructure
- Aviation security developments will influence ACAST sub projects
- Integrated international effort on future security requirements
Data Link Users Forum (DLUF)

- **Objective**
  - Improve system performance
  - Maximize air/ground data link communications services
  - Coordinate activity among aviation industry players leading to the identification and resolution of common problems.

- **Standards**
  - None

- **Interest to NASA**
  - Industry forum to deliberate data link issues, new developments
  - FAA-Eurocontrol Future Communications Study
  - Possible participation in the Link 2000+ program
  - Update industry about ACAST program
**Objective**
- Provide an overview of the important technical developments in air transport avionics and other aircraft electronics
- Provide an overview of the year’s standards development efforts by all sub committees and working groups
- Formal meetings of AEEC
  » New standards are proposed, discussed and voted for approval to begin work

**Standards**
- All ARINC standards status are reviewed

**Interest to NASA**
- Forum for monitoring developments in industry
- Provides an insight into work activities of other industry groups not currently supported
- Bearing on future NASA architecture design and development studies
**SC-186 Document Hierarchy**

ASA MASPS (DO-289)
- Other ASA Functions
- Surveillance Systems
- MASPS

ADS-B MASPS (DO-242A)
- TIS-B MASPS (DO-286)

Link MOPS(s)
- 1090, UAT, VDL-4 (DO-260A, DO-282A)

MASPS

ASAS Surveillance Processing
- CDTI (DO-243, DO-259)

DO-XXX, ASAS MOPS

SC186 Surveillance Systems
- Other Surveillance Systems
  - TCAS
  - TIS
  - Weather Radar

SC186 Systems
- Other Systems
  - FIS
  - Terrain

Navigation

ASA: Airborne Surveillance Applications
ASAS: Airborne Separation Assistance System
**SC-186 Involvement**

- **WG-2: Traffic Information Services - Broadcast (TIS-B)**
- **WG-4B/Surveillance Transmit Processing SubGroup**
  - Providing SubGroup Secretary
- **NASA’s Interest**
  - Principle committee for the S component of CNS
  - Keep up on latest concepts for distributing surveillance data via multiple data links
  - JPDO considers ADS-B to be a critical component of NGATS
  - Standards apply to ACAST Sub Projects covering surface, terminal, en route and MMDA activities
Task: Develop revision A to the Traffic Information Services - Broadcast (TIS-B) MASPS (DO-286)

Revision A adds functions to support the Airborne Surveillance Applications (ASA) MASPS plus adds a rebroadcast of ADS-B as TIS-B messages.

- UAT ADS-B messages rebroadcast as 1090 ES TIS-B messages
- 1090 ES ADS-B messages rebroadcast as UAT TIS-B messages

Status
- DO-286A published on April 7, 2005
Task: Develop an Airborne Separation Assurance System (ASAS) MOPS

Surveillance Transmit Processing (STP) SubGroup
- Specify requirements for translating navigation system and other data into ADS-B required inputs. First version of ASAS MOPS will describe STP subsystem requirements.

Airborne Surveillance and Separation Assurance Processing (ASSAP) SubGroup
- Specify basic surveillance processing requirements (e.g., correlation of TCAS, TIS-B, and ADS-B data).
- Specify application processing requirements.

Status: Anticipate publishing ASAS MOPS containing:
- STP subsystem requirements – Mar 06
- ASSAP subsystem requirements – Mar 07
Tasks: Prepare 3 documents
- Revise DO-267A, MASPS FIS-B Data Link
- Revise DO-252, MIS AUTOMET
- Develop MASPS for FIS/AIS applications - “Tactical Use” (as opposed to “advisory, non-control use”)

Status: First meeting held July 18-20, 2005

NASA’s Interest
- Committee dealing with the N component of CNS
- Keep up on latest concepts for distributing navigation related data via multiple data links
- SC-206 aligned with JPDO Weather IPT NGATS concepts
- Standards apply to ACAST Sub Projects covering surface, terminal, en route, oceanic and MMDA activities
Symposium
- Theme: Implementing the 21st Century Global ATM System
- March 15 - 16, 2005

Forum
- Theme: Safe Flight 21 - Operational Benefits Through Collaboration
- May 25, 2005

Interest to NASA
- Keep NASA informed of NAS modernization activities
- Activities apply to ACAST Sub Projects covering terminal, en route and oceanic activities
Objective

» Develop ATN technical provisions
  • Further advancement is expected as operational requirements evolve and new requirements emerge
» Monitor operational requirements and develops new standards and/or guidance material as required
» Subgroups
  • N1 Internet Communication Services
  • N2 Air/Ground Applications
  • N3 Ground/Ground Applications
  • N4 Security Services

Standards

– ICAO Manual 9705
ICAO ACP WG “N” (cont’d)

Interest to NASA
- Participate under FAA lead
- NASA funded tasks supported FAA introduction of information paper “ATN over IP” (Basis was CNS/GRC studies/analysis 1999, 2000)
- Setting IPv6 end-to-end standards (including A/G data link)
- Transition to IP for flight critical data
- Secure protocols and security techniques for flight essential data
- Protected Mode CPDLC
- Leverage NASA/EUROCONTROL IPv6 studies
- FAA – Eurocontrol Future Communications Study

Current Work Plans
- N1 completed Recommendation Paper – presented June 2005
- Change from ISO to IP network protocols
- Ground-Ground changes proceeding
- Air-Ground IP
  » 12 month study to address IP mobility, security and other issues in order to conform to ATN requirements
  » Decide on mobility in application or network layer
- Other Applications
Future Activity Summary

- Continued participation in Industry Standard Groups
  - AEEC
  - RTCA
  - ICAO
- Determine needs for JDPO/NGATS
- Foster the adaptation of IP in aviation segments
  - ADN 664, Part 8 has been adopted by AEEC as of 28 March 2005
  - ICAO ACP WGN now ready to address IP for air-ground data link (mobility issue)
  - ADN WG Part 5 Updates: Quality of Service, Security & Mobility
  - ADN WG Part 8
    » Industry chair on Part 8 of ARINC 664 – Update after ICAO study
    » Accepted industry author for draft 1 supplement 1 for IP mobility for flight essential data link
    » Accepted industry author for collaboration middle-ware for system wide information system (SWIM)
Future Activity Summary

- **SC-186 (ADS-B)**
  - **Surveillance Transmit Processing (STP)**
    - Secretary for STP SubGroup
    - Compiling and editing inputs plus preparing the STP subsystem section of the ASAS MOPS. Publication anticipated in Mar 06.
  - ASSAP subsystem development effort underway
  - ADS-B Package 1 OSED, SPR and Interop specification development
  - CDTI subsystem development on-going

- **SC-206/EUROCAE (Aeronautical Information Services)**
  - Revise MASPS for FIS-B data link
  - Revise Minimum Interoperability Standard (MIS) for AUTOMET to include air-to-air data exchanges
  - Develop MASPS for using FIS and AIS applications tactically
Contact Information

Computer Networks & Software, Inc.
7405 Alban Station Ct.
Suite B-215
Springfield, VA 22150-2318
1.703.644.2103
http://www.CNSw.com

Chris Wargo
1.443.994.6137 (cell)
Chris.Wargo@cnsw.com

Mulkerin Associates, Inc.
Tom Mulkerin
1.703.644.5660
Tom.Mulkerin@Mulkerin.com