ACAST Workshop 2005

Space-Based Technologies Project

CNS Technology Subproject Review

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CNS Technologies Subproject Review

- Subproject Overview – Monty Andro
  MMDA, VHF Optimization, Advanced CNS
- MMDA Certification and Business Case Analysis
  Mike Harrison, Aviation Management Assoc.
- Fiber Optic Research
  Hung Nguyen, NASA GRC
- SDR Forum Special Interest Group for Avionics
  Charles Sheehe, NASA GRC
- Advanced Radio Guidance System
  Edward Heinzerling, ARGUS Avionics

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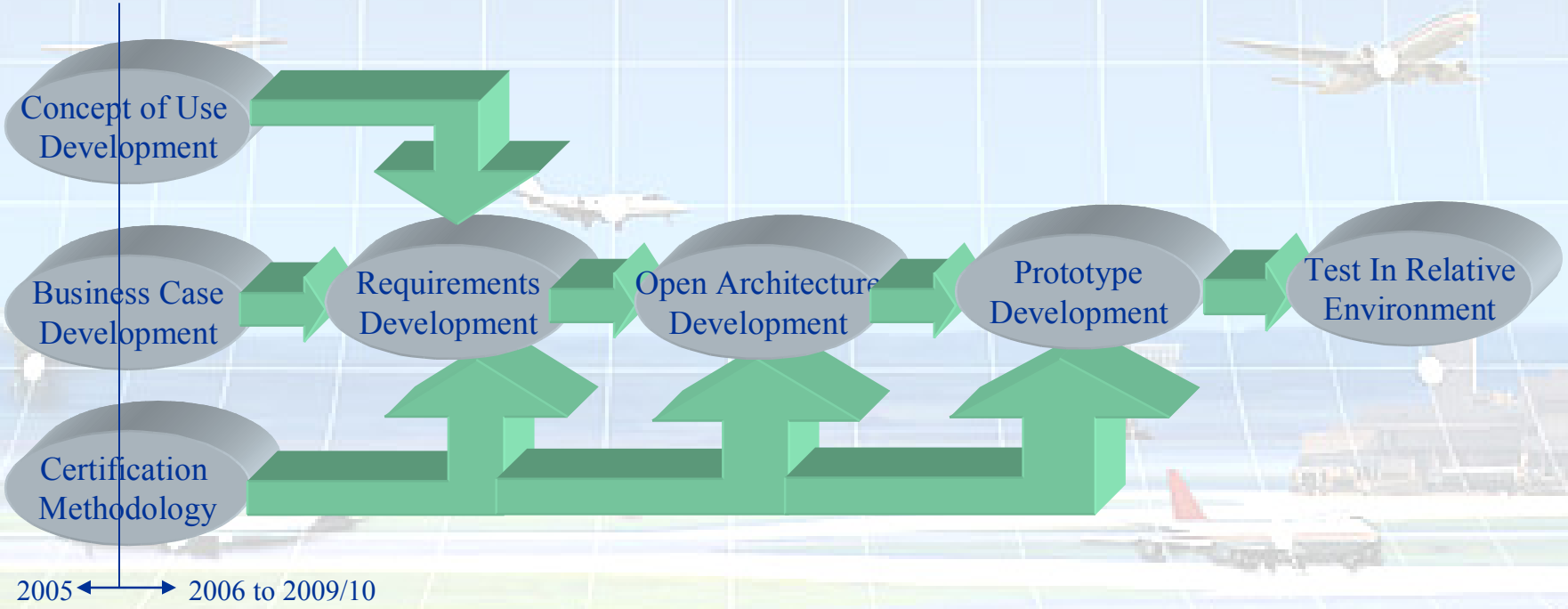
- MMDA – Multimode, Multifunction Digital Avionics
  - Develop and demonstrate in a relevant environment a Multifunction, Multimode Digital Avionics (MMDA) prototype that illustrates lower total system cost and faster certification/re-certification.
- VHF Optimization
  - Identify near/mid term technologies to improve the performance and spectrum efficiency of current and emerging VHF communication systems.
- Advance CNS Technologies
  - Identify, select and initiate R&D on low TRL CNS technologies with the potential for major advancements in NAS performance.

MMDA

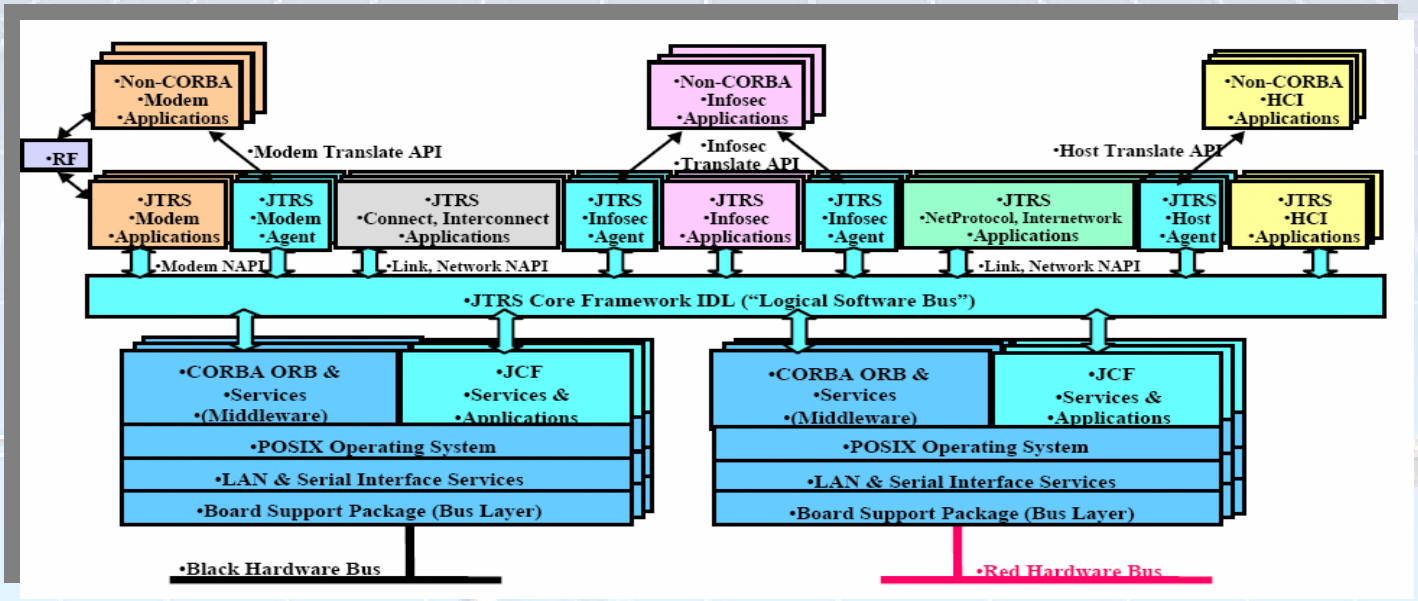
- **Objective**
  - Develop and demonstrate a Multimode, Multifunction Digital Avionics prototype with a selected suite of functions and modes.
  - Develop an open hardware and software MMDA architecture for civil aviation applications.
  - Validate and demonstrate compliance with redundancy, certification and safety standards and requirements.

- **Rational**
  - Existing certification methodologies are expensive and based on proprietary methodologies
  - Agent of change enabling transitional architectures and network centric operations
  - Certifiable, modular open architecture illustrates lower total system cost and faster certification/re-certification (reduced maintenance cost).
  - Flexible, open and extendable architecture addresses the number of waveforms (both new and legacy) that is beginning to overwhelm the ability to fit aircraft with new capabilities
  - Serves as an open architecture that can leverage best commercial standards and innovations in implementation as they emerge over time
  - Provides flexibility for users to decide which capabilities they need and when

- **Approach**
  - Work with avionics industry partners and standards bodies/working groups
  - Develop and validate system prototype technologies
  - Demonstrate MMDA prototype in relevant environment
  - Develop and validate certification methodologies with certification authorities



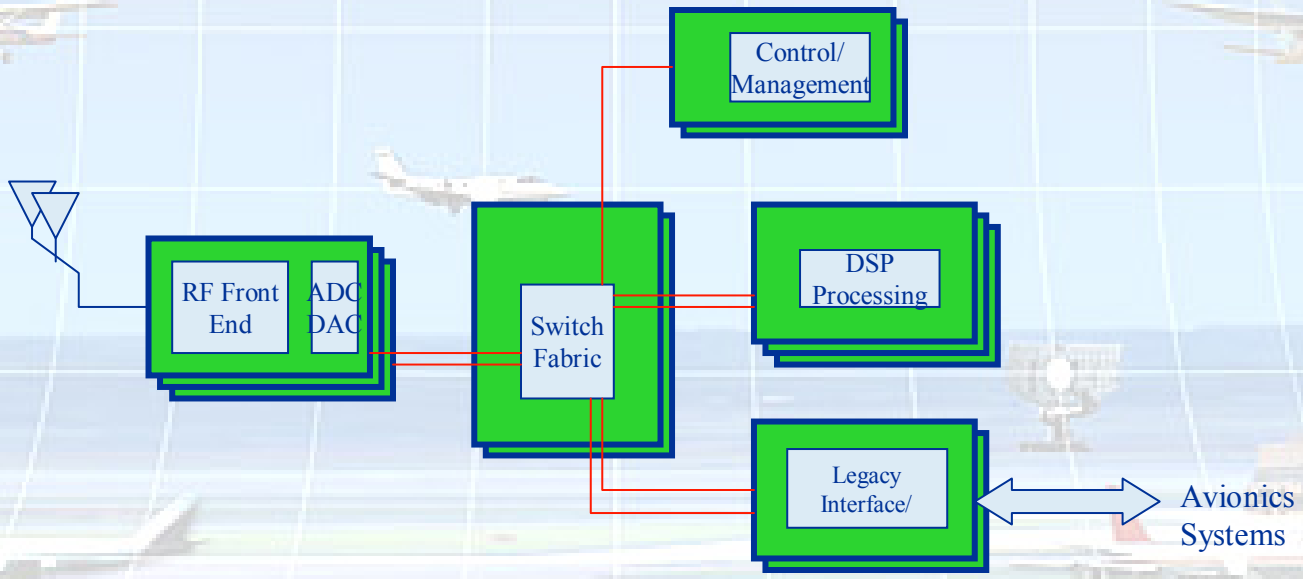
Leverage the Best of JTRS/SCA



- Concerns
  - Certification concerns
  - Cost
  - Complexity/Overhead
- Plan
  - Utilize applicable parts of SCA
  - Lessons learned
  - Monitor progress
  - Monitor security work
    - Common Criteria/DO 178B integration

Laboratory Development

- **Evaluation of COTS Technologies**
- **Foster industry and standards body partnerships**
- **Integrate into ACAST and SWIM/MCNA test-beds**



MMDA

- Accomplishments
  - Preliminary assessment and analysis completed
    - Contracted study to analyze current state of the art of software radio technology currently use in commercial technologies.
    - Contracted study to analyze the certification of DOD's JTRS technology.
    - Contracted study to analyze and assess the current software certification methodology.
    - Contract study to identify standards, organizations and working groups actively developing software based avionics standards.
  - Contacts established to government and industry partners
    - Contacted AEEC, FAA, DOD JTRS program office, RTCA SC-200 working groups and standards bodies.
    - Architecture and technology discussions with avionics stakeholders
  - Certification guidance, strategies development and business case
    - Contract for the assessment of certification strategies and guidance based on SC-200 integrated modular avionics standards and guidance provided by FAA Designated Engineering Representative (DER).
  - Initiated OMG, software radio for avionics SIG (Special Interest Group)

- Future Work
  - Release of a competitive procurement for prototype development
  - Continue to participate in standards and working groups
  - Develop laboratory for technology assessment

VHF Optimization

- **Objective**
  - Develop VHF avionics technology improvements with at least a 25% improvement in performance or efficiency of selected technologies.
    - Develop and analyze dynamic geographic frequency allocation architectures.
    - Analyze CDMA based overlay systems and evaluate transition approach and it's impact to current VHF system.
    - Characterization of VDL digital link with software/hardware co-simulation test-bed environment.

- **Rational**
  - Near term performance improvements can ease limited VHF communication system capacity

- **Approach**
  - Investigate technologies with near to mid term impact with highest potential
  - Perform research and analysis combined with university and avionics partners
  - Develop technologies to implementation and conduct demonstration in relative environment

VHF Optimization

- Accomplishments
  - Performance assessment and selection of candidate VHF optimization technologies.
    - Study and investigate co-site interference mitigation technologies, assess VHF guard band reduction techniques, dynamic frequency allocation systems, CDMA technologies.
  - Formalizing alternative overlay approach.
- Future Work
  - Develop simulation models and assess performance
  - VHF digital link characterization test planning and development

Advanced CNS Technologies

- **Objective**
  - Investigate technologies with far term impact with highest potential
    - Investigate navigation technologies for advanced landing capabilities
    - Develop advanced antenna technologies to improve CNS and data link capabilities
    - Investigate optical technologies for increased performance and reduced weight and power.
- **Rational**
  - Identify and develop select CNS technologies with potential high payoff
- **Approach**
  - Perform research and analysis combined with university and avionics partners
  - Develop technologies to implementation and conduct demonstration in laboratory environment

Advanced CNS Technologies

- Accomplishments
  - Advanced landing technologies
    - Contract study for requirements analysis and concept development of low cost, interferometer based landing technology.
  - Advanced communication technologies
    - Contract study for development of full duplex based VHF architecture study – concept submitted to Future Communication Study (FCS).
    - Participation in FCS activities and reviews
  - Requirements and analysis of advanced antenna technologies currently on-going.
  - Advanced guidance systems through Argus contract
  - Evaluation and assessment of optical based architectures for RF distribution
    - Completed cost, performance and weight assessments of candidate architectures.
- Future Work
  - Continue technology assessments and select most promising technology for laboratory demonstrations