Workshop on Software Defined Multi-function Multi-mode Avionics

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Software Defined Avionics Issues

- **Market-driven**
- **Equipage**
- **Implementation**
- **Cost**
- **Certification**

Market-driven Issues

- **What are the most desirable/marketable combinations of legacy and/or emerging CNS functions and/or modes?**
  - **For those combinations, what are the application(s), flight domains and aircraft categories?**
    - **Multi-mode avionics more marketable than multi-function avionics (easier certification; esp for integration of communication modes and integration of navigation modes; market: international air traffic, international business jet operators)**
      - **Desirability of software reconfiguration as opposed to multiple hardware implementations**
      - **Easier international standardization**
    - **How do we capture the best of open architectures vs proprietary innovations?**
      - **The market size just isn't that large; hard to obtain enough market share when market isn't large to begin with.**
    - **Other**
      - **Potential for reduction of legacy ground infrastructure once a certain percentage of the (military) fleet is equipped (UHF, TACAN)**
      - **Potential for implementation of SDA in ground infrastructure for future-proofing (next generation air-ground com) and cost reduction**

Market-driven Issues - Cont'd

- **What are the most desirable/marketable combinations of legacy and/or emerging CNS functions and/or modes?**
  - **For those combinations, what are the application(s), flight domains and aircraft categories?**
    - **Synergistic integration and fusion of existing and emerging functions may enable higher total system performance reliability and therefore operation in more desirable airspace and airports, preferential routing, etc.**
      - **May require policy & procedure changes**
      - **Self-separation at high altitudes**
      - **Reduced spacing for oceanic routes**
      - **Human machine interface (managing/reducing workload, novel or more intuitive ways of presenting information)**
    - **Other benefits:**
      - **Reduced training needs**
      - **Reduced costs of equipage, maintenance, spare parts**
      - **Added capabilities for greater reach into other markets (increase revenues)**
      - **Reduced downtime for re-equipage via software download (raises significant certification issues)**

Market-driven Issues - Cont'd

- **What are the most desirable/marketable combinations of legacy and/or emerging CNS functions and/or modes?**
  - **For those combinations, what are the application(s), flight domains and aircraft categories?**
    - **Drawbacks**
      - **Complexity issues**
      - **Human machine interface (too complex??)**

Equipage Issues

- **What equipage/sparing strategies are enabled by software defined avionics to reduce cost?**
  - **For broad suite of integrated functions (e.g. VHF/UHF/L-Band)**
  - **For narrow suite of functions (e.g. VHF/UHF and L-band)**
    - **Box level reconfiguration of functionality as opposed to board level replacements**
      - **Issues of open (built to a standard performance and interface specification) vs proprietary architecture**
      - **The level of functional integration may be offset by single point of failure**
    - **Graceful degradation to minimal functionality**
    - **Certification of the suite of components at the functional level is responsibility of avionics integrator**
    - **Reduced box count, reduced physical size of box, reduced spare parts (helps with cost, reliability, maintainability)**
    - **Need to address safety and robustness aspects of reduced equipage (A failsafe capability? A safe restart mode? Graceful degradation to minimum capabilities for safe flight?)**

Implementation Issues

- **What implementation considerations are most critical for success?**
  - **E.g. open SDA architecture; integration level of hardware and software; performance degradation from integration; security concerns**
    - **Consider a tailored subset of the SCA as a viable alternative for civil aviation (as opposed to JTRS subset of SCA)**
    - **Partitioning DO178b software certification specifications**
      - **Aspects of certifying multiple modes in the same function may be different from certifying multiple functions in an SDA**
    - **Antennae issues (location, interference) caused by multi-function avionics**
    - **Need to consider the human-machine interface**
      - **Should be intuitive**
      - **Opportunity to take advantage of background/experience of rising generation of users**
      - **Should leverage the fusion of …**
    - **Minimize downtime for MRO (maintenance, repair, operations)/Upgrades**
    - **Sparing philosophy and equipage issues may force novel implementation backups**

Implementation Issues - Cont'd

- **What implementation considerations are most critical for success?**
  - **E.g. open SDA architecture; integration level of hardware and software; performance degradation from integration; security concerns**
    - **Security & Safety: multiple channels for varying security levels (e.g. red/black portions of JTRS architecture)**
    - **Must still maintain safety and security standards of today**
    - **Authentication, verification and validation aspects of SDA**

Cost Issues

- **How will initial cost, annual operating costs and life cycle cost of SDA have to compare with that of conventional avionics to be attractive in the next 5 years?**
  - **What are the best ways to improve those cost perceptions?**
    - **Pricing strategies of initial investment**
    - **Who should pay for initial equipage costs?**
      - **Benefit to FAA and NAS?**
      - **Benefit to user of NAS?**
    - **Leveraged development of ground and airborne components that perform the same function (hardware and software components)**
    - **International operability to increase market size**
    - **International harmonization of standards to increase market size**
      - **RTCA & EUROCAE**

Certification Issues

- **What are specific concerns facing certification of SDA?**
  - **What recommendations will reduce cost and time of certification and life-cycle recertification of SDA?**
    - **The nature of the software architecture for the SDA greatly affects its certifiability**
    - **Certify at the performance level as opposed to the internal implementation level**
    - **Aircraft location at time of upgrade (reconfigurations on ground or in flight would have different security, safety and certification issues to consider)**
    - **Is the FAA certification methodology equipped to address certification of SDA? Does it impress another policy decision by the FAA concerning how certification is accomplished?**
    - **Can software development tools aid the certification process with certifiable process steps/tools?**
    - **Lessons learned from prior experience from SDA:**
      - **Avidyne avionics radio for NEXCOM**
      - **Honeywell EPIC radio**
      - **Scalability, flexibility, adaptability**

Attendees

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