Overview

- AvSTAR Future System Effort Critically important
  - Challenge is real
  - Need to deliver
  - Already time critical
- Investment in the future
  - Protect from encroachment due to near term pressures
- Need to follow a systems engineering process
  - System must be integrated from the start
  - Tasks must be linked in the system concept
- Efforts need to be worked in worldwide context
Areas

- Policy Issues
- System Attributes
- Concepts
- Metrics
- Research Issues

Policy Issues

- General
  - Political and business commitment to action and implementation
  - Adopt vs. specifically develop technologies & methodologies
    - Examine other similar efforts – avoid duplication
  - ATN issues and spectrum availability
  - Harmonize air transportation with other transportation modes. Define the boundary of the system?
    - Integrated multi-modal
    - Door-to-door or gate-to-gate
  - Information management + system architecture
    - Do we have the national competency to do this job?
System Attributes

- **System Guidelines/Scope**
  - Mission/goal driven research
  - Set realistic expectations
  - Account for differing views of system requirements
    - Passenger-centric vs. aircraft-centric vs. airline-centric vs. airport-centric
- **System Characteristics/design constraints**
  - Transitional and revolutionary
  - Concurrent transition planning
  - Layered system
    - Must be robust to sub-system failures/changes
- **System Performance Parameters**
  - Safety
  - Reliability
  - Availability
  - Affordability
  - Adaptable to all aircraft types

Concepts

- **Concurrence on need for greater automation / movement away from current approach to**
  - Decentralization of airspace as a means of improving traffic throughput
    - **Automated Airspace** (Erzberger)
      - Remove human as separation assurance monitor
      - Tactical control loop
      - Implications for automation
    - **4-D Dispersed Control**
      - Computer strategic checking
      - Aircraft tactical separation
      - Separation based on collision risk management
    - **NextGen flight-based ATM**
      - Same controller handles all flight phases
      - Hybrid Distributed Control
- **Airport Runway Technologies**
  - Runway Independent Operations
- **System-Level Considerations**
  - System-level information management (emphasized)
  - Modeling must account for up to a "300,000" IAC (Instantaneous Airborne Count)
  - New airline business approaches
  - Review of prior concepts of operations
    - Impact of new technologies
- **Weather**
  - Future system automation must properly account for weather and uncertainty in its predictability
Metrics

- Safety
  - Target level of safety (TLOS)
- Environmental impact
- Fleet coverage
- Door to Door
- Passenger Throughput
- Cargo Throughput
- Efficiency
- Capacity
- Etc...

Research Issues (1)

- Modeling and Understanding
  - Methodology for evaluating concepts
    - Economic feedback loops
    - Reality test
    - Models
  - Benchmarking and understanding of current system
    - Dynamic behavior
    - Non-normal events (e.g., weather)
    - Inefficiencies
    - System-level modeling
    - Economic feedback
    - Controller limits
  - Safety analysis
    - Barrier to transition
    - System design issues
    - Partition and allocation of risk and responsibility
  - Understanding transition dynamics
    - Barriers
  - Robustness of large, distributed, highly-automated systems
    - Validation/certification
    - Software
Research Issues (2)

- Technology Developments
  - Multiple objective-function optimization
  - Airborne Conflict Management
    - Intent
  - Weather integration in systems and research
  - Communications issues
  - Sensor issues

- Operational Issues
  - Develop confidence for re-allocation of separation responsibility to automation
  - Robustness and fall-back modes

Detailed Research Example

- Automated Airspace (Erzberger)
  - Size of super-sector
    » How big is the biggest?
  - Psychological impact on pilots
    » Dealing with automation-provided ATC clearances
  - Mixed operations in automated airspace
    » Transitional design issue
  - Communication infrastructure
    » Not ATN? UMTS? Satellite-based?
**First Aviation System Technology Advanced Research (AvSTAR) Workshop**

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