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
    - Concurrency transition planning
    - Layered system
    - Must be robust to sub-system failure/changing conditions

- 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
  vectorization 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
  - New less flight-based ATM
    - Same controller handles all flight phases
  - High-Distributed Control

- Airport Runway Technologies
  - Runways Independent Operations

- Systems-Level Considerations
  - Systems-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 (eg 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?
This Conference Proceeding documents the results of a two-day NASA/FAA/Industry workshop that was held at the NASA Ames Research Center, located at Moffett Field, CA, on September 21-22, 2000. The purpose of the workshop was to bring together a representative cross section of leaders in air traffic management, from industry, FAA, and academia, to assist in defining the requirements for a new research effort, referred to as AvSTAR (Aviation Systems Technology Advanced Research). The Conference Proceeding includes the individual presentations, and summarizes the workshop discussions and recommendations.