Large Increases in Capacity, Safety and Efficiency Require a New Approach

- Air traffic growth is increasingly constrained by the capacity limits of sectorized control, wherein a controller is responsible for separation assurance, planning, communications, coordination, etc.
- Capacity gains through re-sectorization and sector size reduction have reached the point of diminishing returns.
- Decision Support Tools provide modest gains but can't circumvent basic controller workload limits.
- Constraints that limit flight efficiency can't be reduced at high traffic density because that would further exacerbate the controllers workload problem.
- The inevitability of human error limits further improvements in safety with current procedures.
- Potential of reduced separation can't be fully exploited because of workload and reaction time limits with controllers performing current duties.
Current ATM System

Graphical User Interface

Sector Controller

Voice

Link

A/C

A/C

A/C

A/C

Surveillance Sensor System, Host Computer

Decision Support Tools

ATM Performance Gains

Automated Airspace
Reduced separation standards

Current separation standards

DST's

DST's + Improved sensors

'00 - '08

'06 - '15

'15 - '25
Automated Airspace Operations

- Sector controllers are "liberated" from the responsibility of separation assurance and are "promoted" to the new role of airspace controller.
- Several traditional sectors are combined into super-sectors, each managed by an airspace controller.
- Conflict detection and resolution is fully automated and distributed between ground-based and airborne systems connected via data link.
- Sequencing and spacing control in the terminal area is fully automated on the ground and is executed via data link.
- Voice communication between airspace controller and pilots will be available to handle special needs, i.e. special pilot request, emergencies, loss of data link.
- Access to automated airspace will be restricted to equipped aircraft.
- Automated airspace can revert to conventionally controlled airspace during low demand periods.

Automated Airspace System
Development Challenges

- Gaining acceptance of concept by operators, controllers and the public.
- Design of system architecture that has multiple safety nets to protect users against various types of failures.
- Automated failure detection and reconfiguration of system to operate in a degraded mode.
- Roles and responsibilities of airspace controllers.
- Design of the interface between airspace controller and system element; retaining the human-centered design while changing the role of the human.

Development Challenges (cont.)

- Transitioning from manual to automated airspace operations.
- Providing airspace and runway access for unequipped aircraft.
- Upgrading the CTAS algorithms and software to level of performance required for autonomous operation.
- Establishing minimum equipment standards for airspace users.
- Verification, validation and testing of concept.
Approaches to Automated ATC

- Time-based (4D) Guidance
- Self-Separation and advanced TCAS
- Automated Airspace
Types of Automated Airspace

- Self separation airspace
- High altitude transition airspace: mixed climbing, descending and over-flights
- Arrival and departure management airspace
- Final approach sequencing and spacing airspace

Fort Worth Center Traffic Flows
FL240 and above
Automated Airspace Sectorization
Fort Worth Center

Automated Airspace for DFW
Real Approach Separating and Stepping
Benefits of Super Sector

- Boundaries unconstrained by current center boundaries.
- Elimination of trajectory constraints imposed by conventional sector structure and altitude stratification.
- Reduction of handoff coordination.
- Shared airspace for arrivals, departures and overflights allows flexibility in use of airspace and routes.
- Unified airspace of super sectors enables increasing the range and effectiveness of conflict resolution.
- Increased controller productivity.

Steps Toward Automated Airspace

- Complete deployment of decision support tools for critical ATM specialties (2010).
  - DST technology is the foundation for Automated Airspace.
- Introduce Distributed Air Ground procedures and improved sensors (2006).
  - When combined with DST's, this begins the process of changing sector controller roles and responsibilities.
- Build high performance and secure air-ground data link required to support automated airspace operation (2012).
- Evaluate prototype automated airspace system in selected high altitude airspace (2015).
- Install in high density on route airspace (2017).
- Install in high density terminal areas (2020).