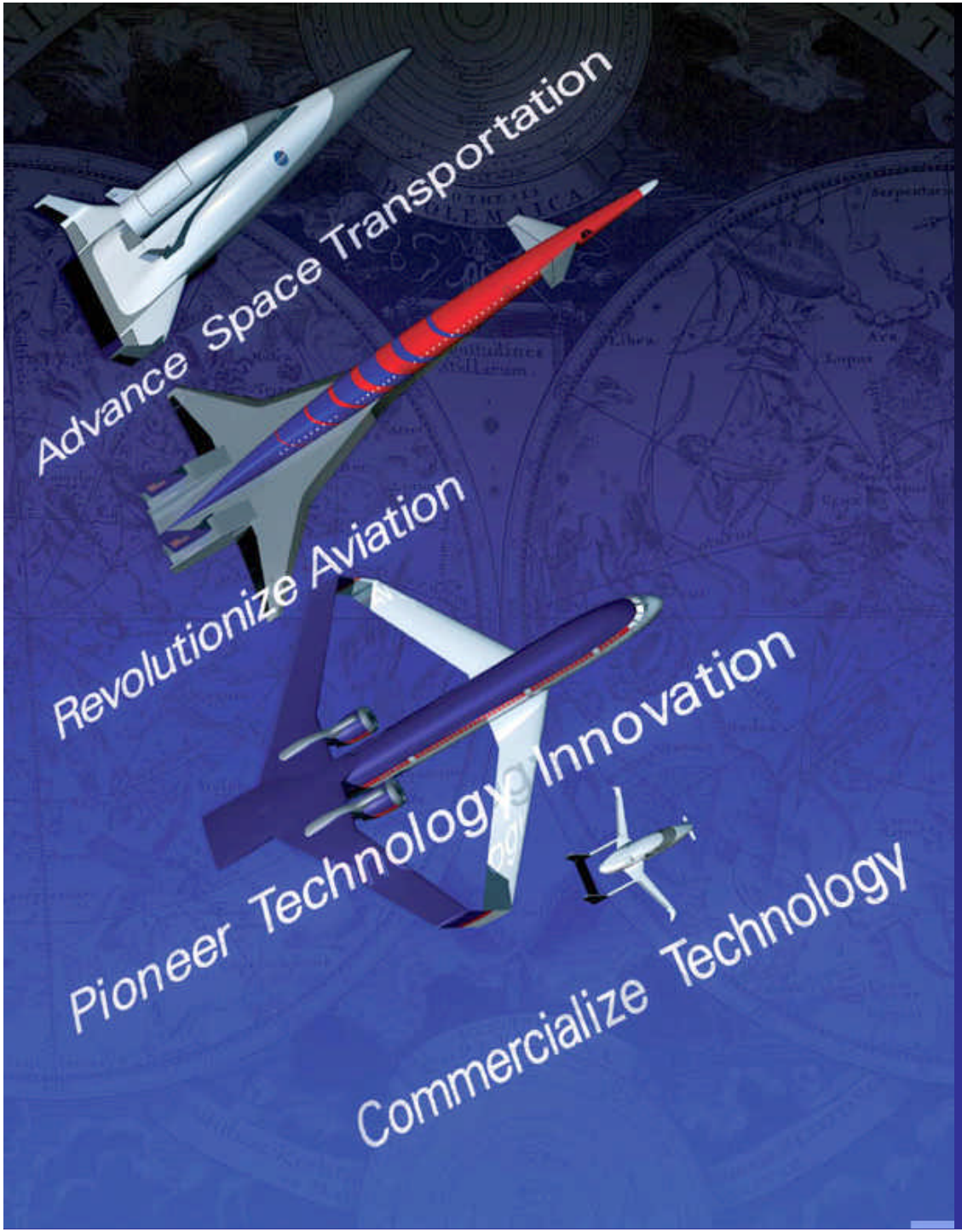


Air Traffic Management: Communications, Navigation, and Surveillance

Samuel L. Venneri
Associate Administrator for
Aerospace Technology

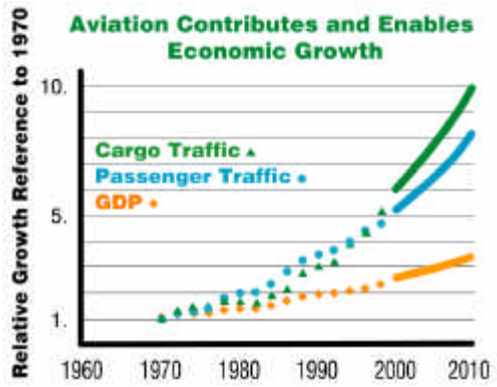
April 29, 2002

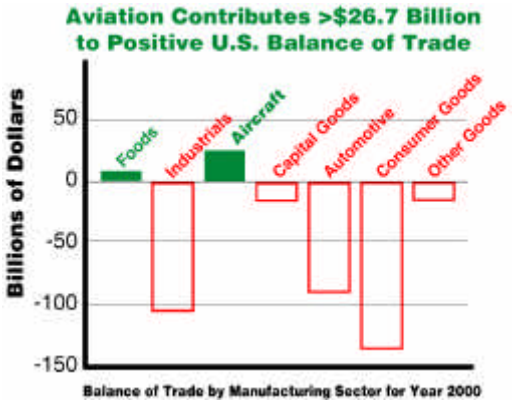
Aviation is Critical to the U.S.

Economic Growth
- Productivity
- Global Competition
- Fullest Commercial Use

National Security
- Air Superiority
- Global Mobility

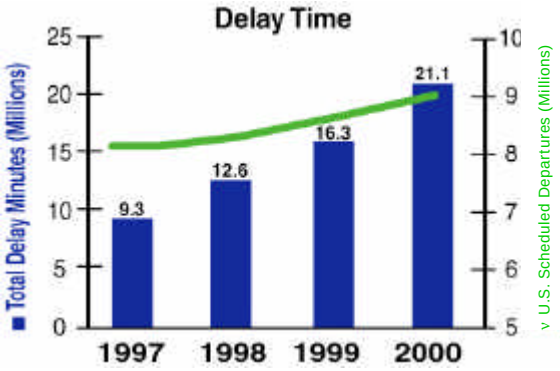
Quality of Life
- Freedom of Movement
- General Welfare



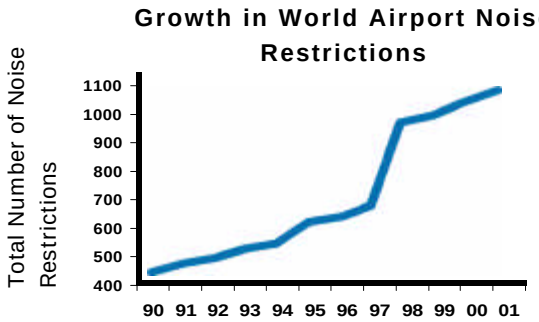


Key Aviation Challenges

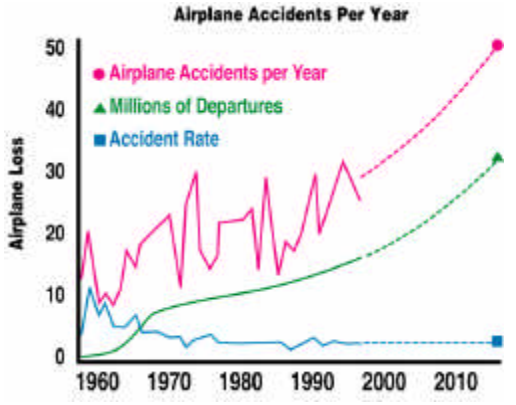
- **Limits to capacity - U.S. aviation system is approaching gridlock.**



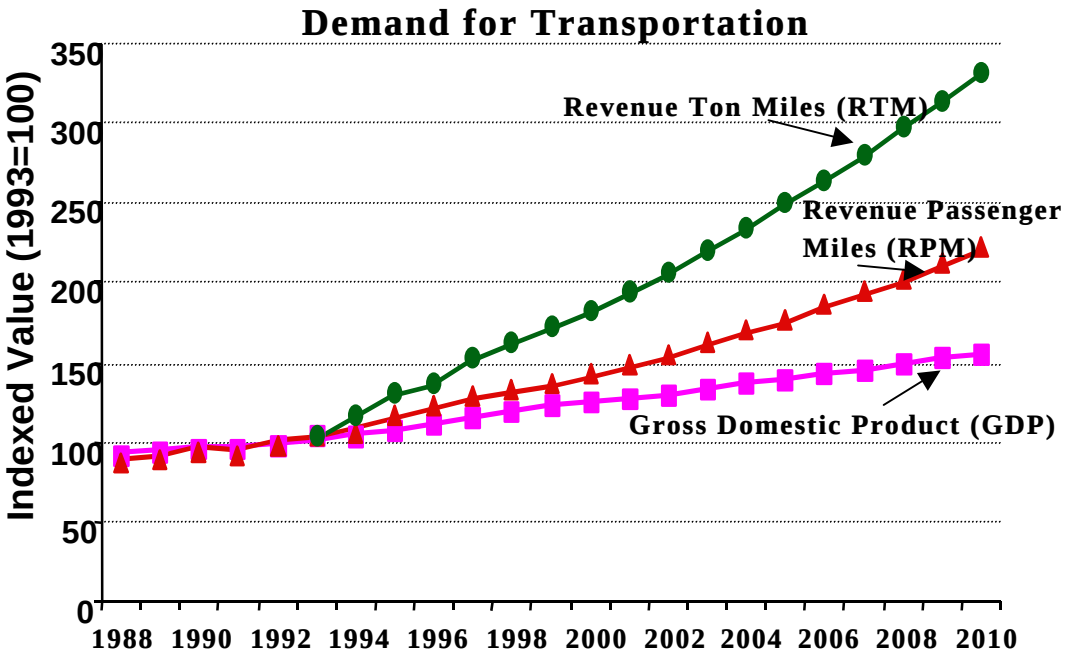
- **Noise and emissions are constraints on aviation growth.**



- **Security and safety must be maintained.**

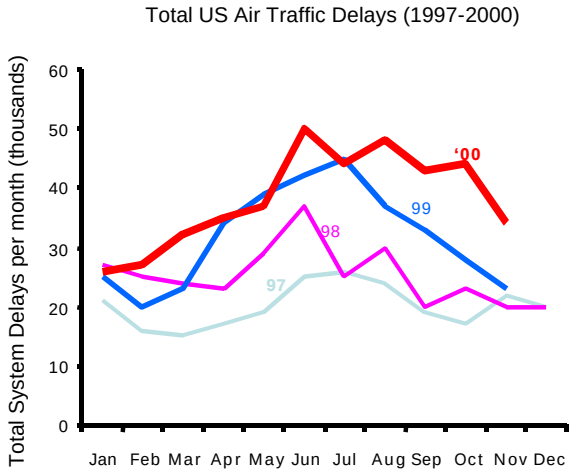


The Aviation System Problem…

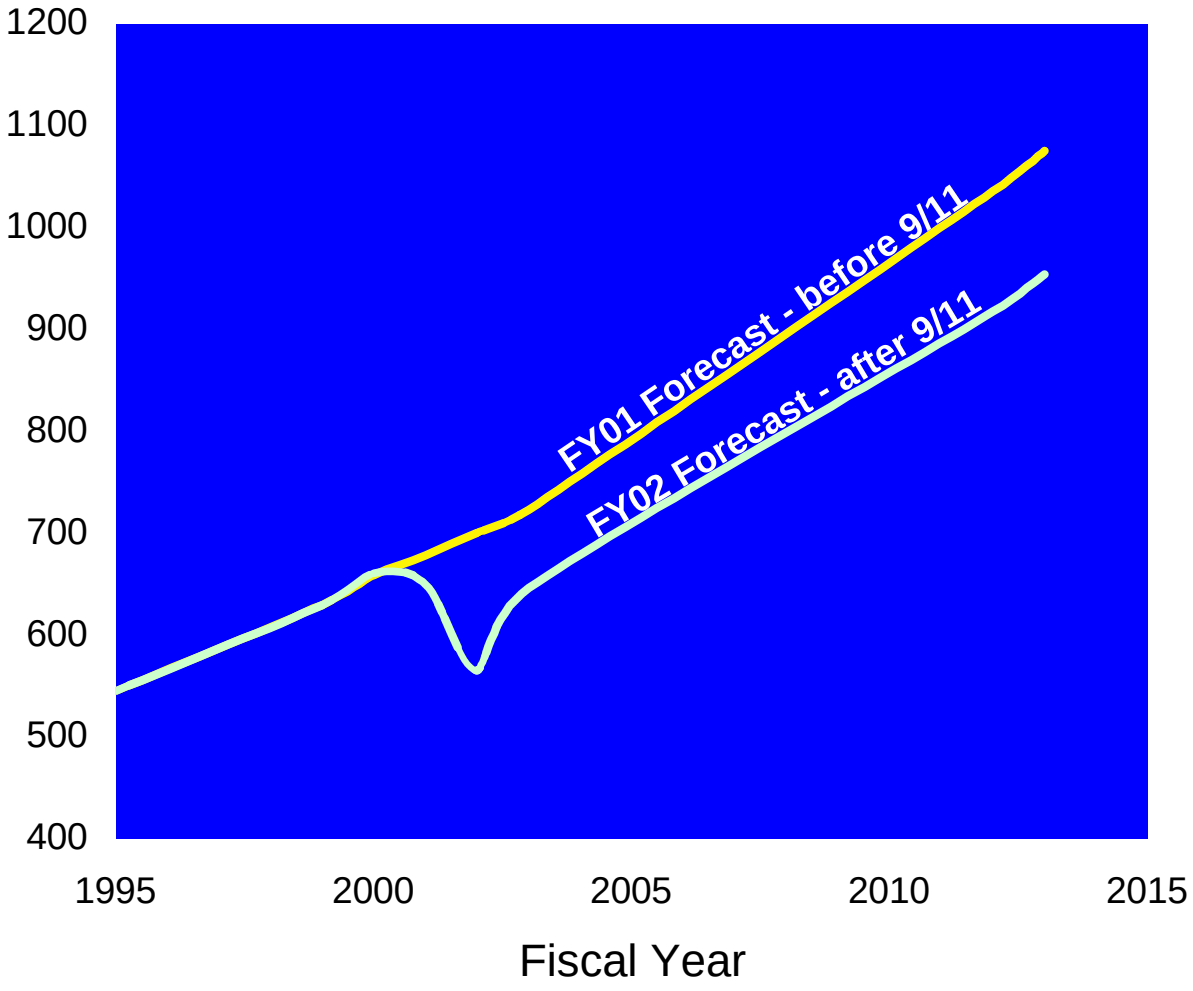


Demand is growing...

Delays are climbing…



FAA Commercial Aviation Forecast
U.S. Air Carrier Passenger Enplanements

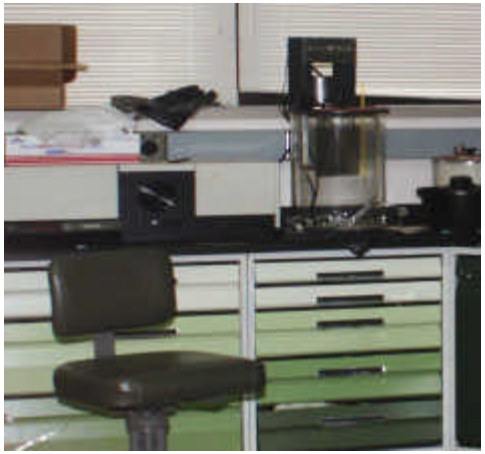


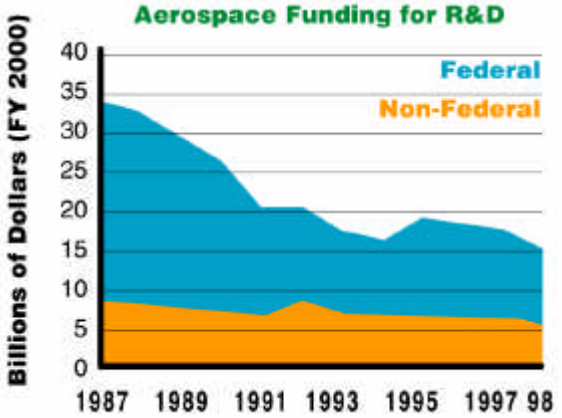
Key Aviation Challenges (Continued)

- The changing national security threat demands technical superiority.

Courtesy of IKONOS

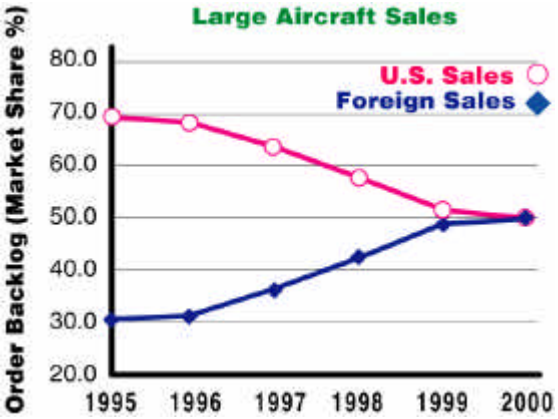
- Aerospace R&D investments and skilled workforce are declining.





- The U.S. is losing global market share and leadership.

European Aeronautics Strategic Plan for Winning Global Leadership



A Bold New Era of Aviation is Possible

- On-Time–All the Time

- Freedom of Mobility, Access to Communities Large and Small


The New Times

Six Communities Vie for New Neighborhood Airport

- Clean, Quiet, Good-Neighbor Airports

- Aviation Security and Safety

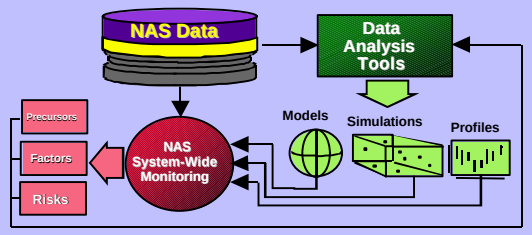
- Meeting the Changing Threat

- New Choices in Personal Air Transportation

Revolutionize Aviation – Aviation Safety

System Safety Technologies

Aviation System Monitoring & Modeling
Monitors and assesses data from every flight for known & unknown issues



System-Wide Accident Prevention
Improves human/machine integration in design, operations, & maintenance

Weather Safety Technologies

Icing Research
Icing detection and protection systems, training aids, tools for design and certification of aircraft systems

Weather Accident Prevention
Brings intelligent weather decision-making to every cockpit

Vehicle Safety Technologies

Synthetic Vision
Provides commercial & general aviation pilots with clear-day operations all of the time

Accident Mitigation
Increases survivability when accidents occur

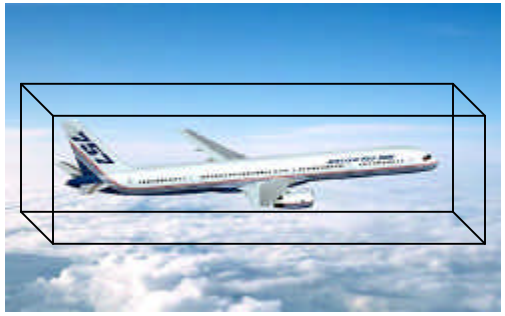
Single Aircraft Accident Prevention
Develops health management & robust control technologies to enable aircraft that are "self healing" & "refuse to crash"

Security Threat Mitigation Approach

Aircraft & System Hardening

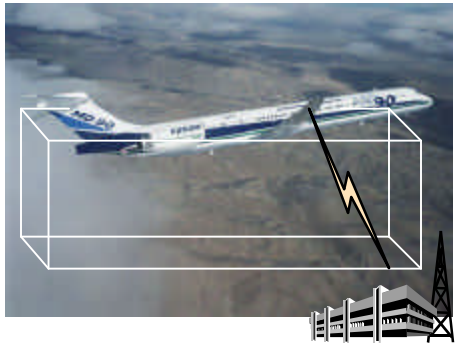
- Failure/Damage Tolerant Sys. Design
  - –Recoverable Computers
  - –Reconfigurable Avionics
- Onboard Network Security Protection
  - –E-Viruses
  - –Intrusion
- Protected Data Transmission
- Fuel Inerting

Enhanced Flight Procedures



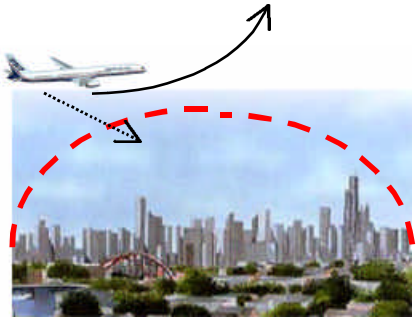
- Precision Flight Path Management
- Complex Curved Path Approaches
- 4-D Approaches
- Air to Air Security
- Laser Mitigation
  - –Pilot Blinding

Surveillance & Alerting



- Detection & Alerting of Deviation from Intended Flight path
- Detection & Alerting of Potential Onboard Terrorists
- Detecting & Alerting of Onboard Hazardous Materials or Threats

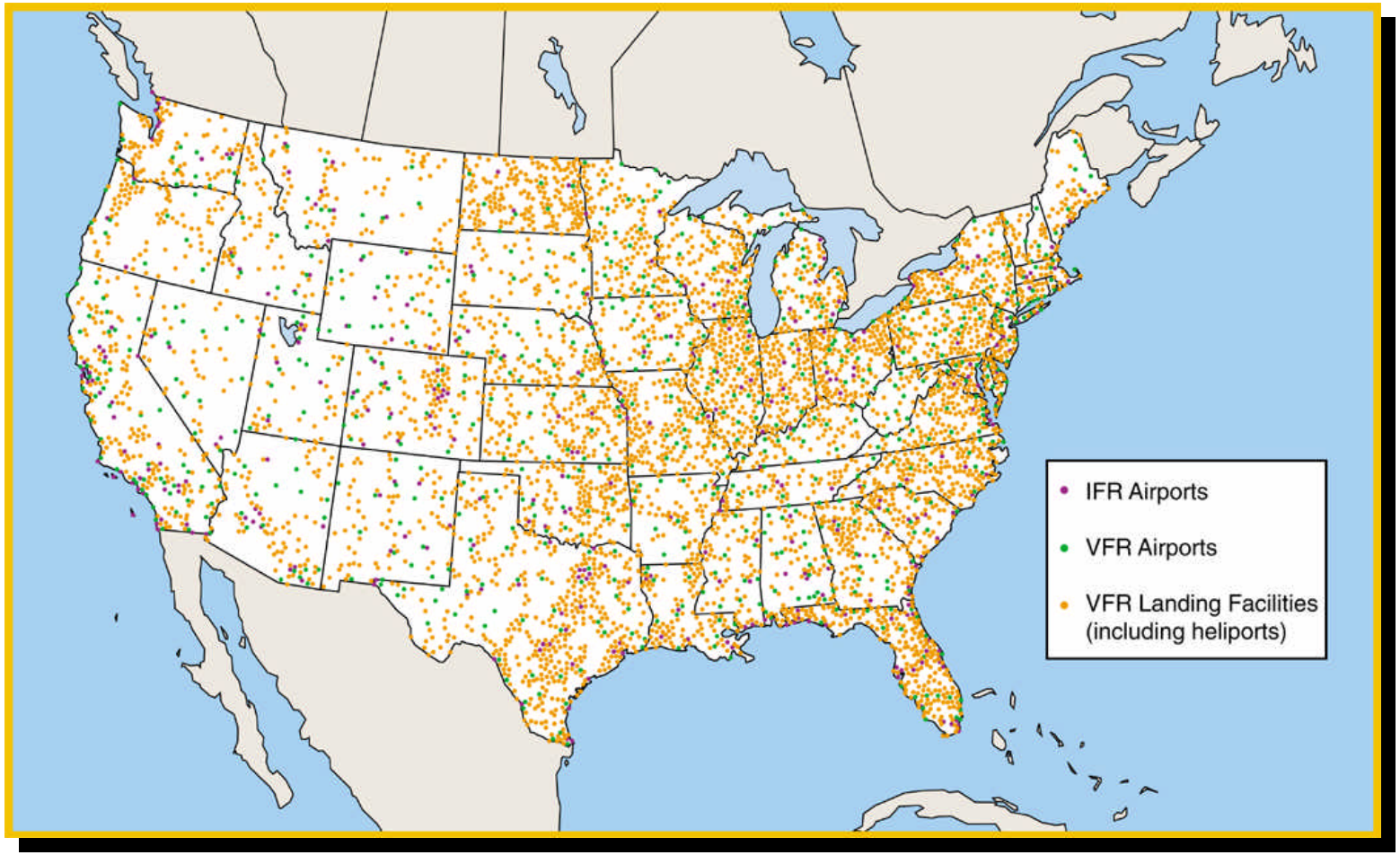
Flight Control Interventions



- Refuse-to-Crash System Technologies
  - – Enhanced Auto GCAS
  - – Auto Nav/Land
- Failure Accommodation

GOAL: Improved Safety and Security

Current System in Limited by Legacy, Ground-Based ATC Infrastructure and Hub & Spoke Architecture



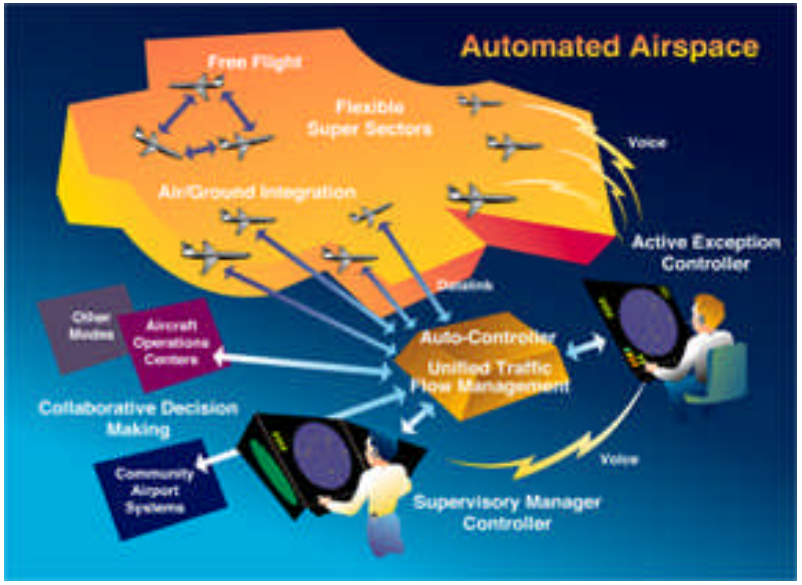
5400 Public Use Airports

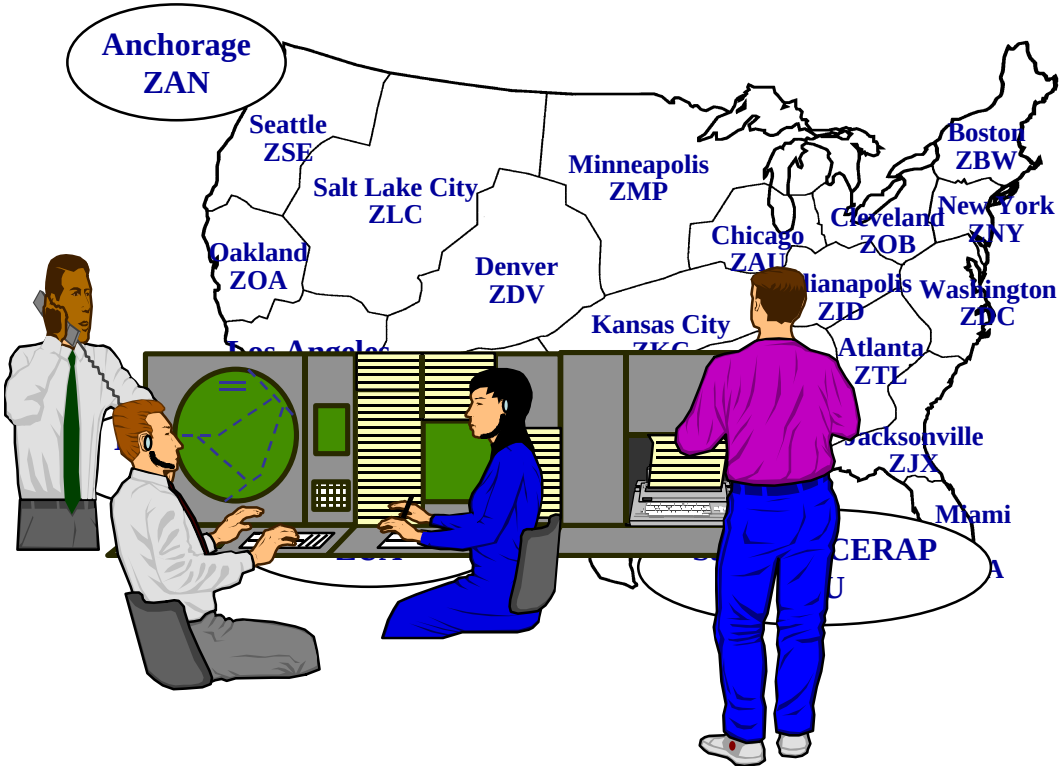
715 Airports with Precision Instrument Approaches (ILS)

Top 64 Hub Airports Enplane 80% of all Passengers

ATC - Now and in the Future

Tomorrow… strategic management of the airspace with aircraft self-separation and air - ground collaborative decision making - *an integrated, scalable approach*



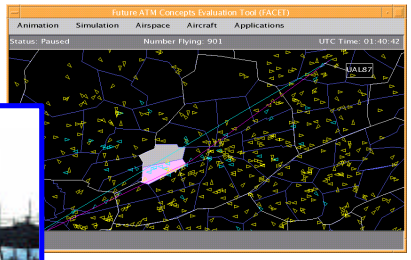


Today… highly compartmentalized radar surveillance and control of aircraft separation - *a hierarchical, self-limiting approach*

Continuing ATC Modernization

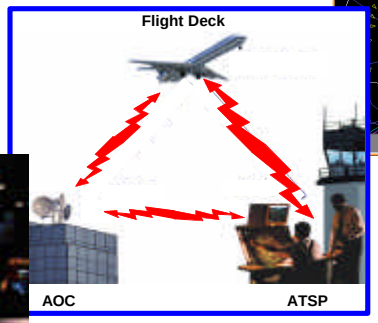
Improved traffic flow management

Remove restrictions across facility/sector boundaries



National Traffic Flow Management Decision Support Tools

Reduce separation in the terminal area



Integrated Airspace Decision Support Tools

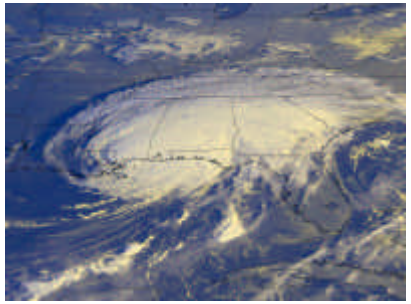
Eliminate surface congestion

Arrival/Departure Decision Support Tools

Runway Productivity Technologies

Surface Congestion Alleviation Decision Support Tools

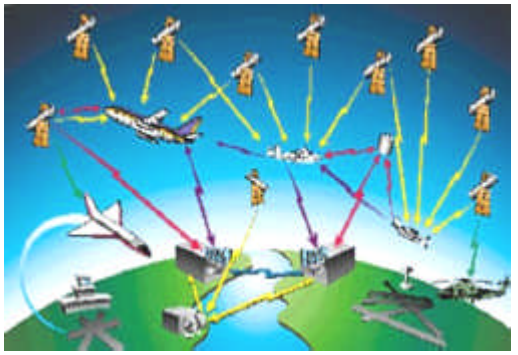
Aircraft Technology & Operations



ATM/TFM Weather Integration

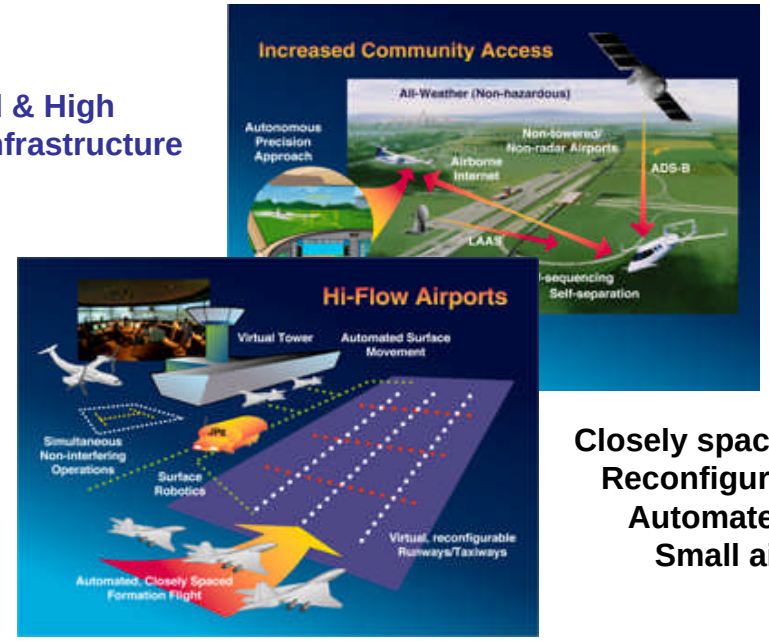
A Revolutionary Approach to Air Traffic Management

Advanced, Global Communication, Navigation & Surveillance



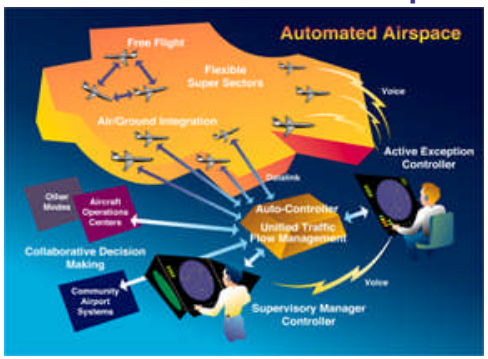
Robust, global systems
Precision approach to every runway in the U.S.
System-wide information sharing

Distributed & High Capacity Infrastructure



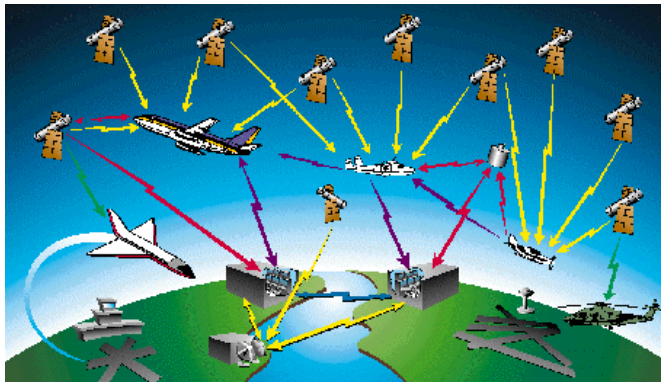
Closely spaced aircraft takeoff and landing
Reconfigurable runway/taxiway
Automated zero visibility surface movement
Small airports integrated into the NAS

ATM Automation Concepts



Integrated, strategic management of the airspace
Aircraft self-separation
Collaborative decision making

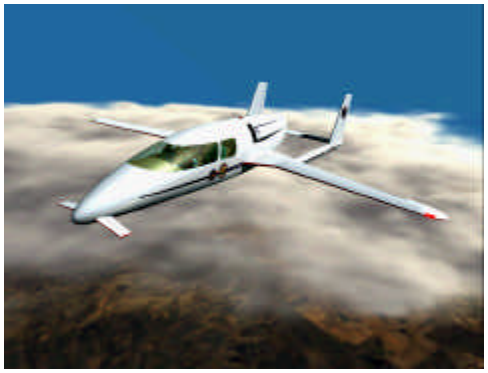
Revolutionize Aviation – Airspace Systems



Advanced Air Transportation Technologies (AATT)

In alliance with the FAA, enable next generation of increases in capacity, flexibility and efficiency, while maintaining safety, of aircraft operations within the U.S. and global airspace system:

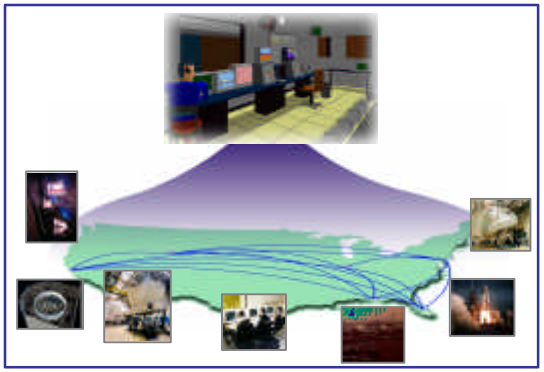
- increasing terminal throughput 40%
- increasing enroute throughput 20%



Small Aircraft Transportation System (SATS)

Develop and demonstrate technologies for routine and easy access to underutilized small airports by general aviation.

- Frees people and products from today's delays
- Creates access to more communities in less time



Virtual Airspace Modeling Project (VAMS)

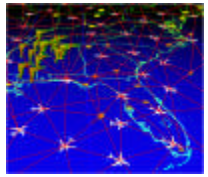
Provide the foundations required to define and assess the next generation Air Transportation System

- Develop the capability to model and simulate behavior of the air transportation system
- Develop and assess advanced system-level Air Transportation concepts

Direct-To Field Test

Fort Worth Center - May 21 - June 14, 2001

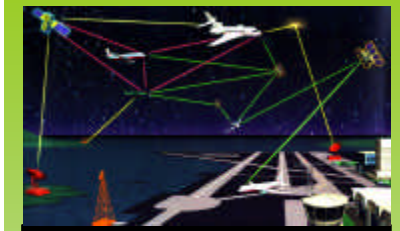
The Airspace System–CNS*



Today's Challenges:

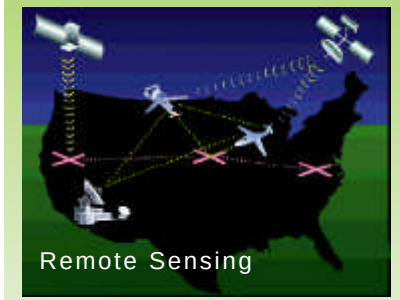
- **Congested frequency spectrum limiting air traffic growth**
- **Voice-based air traffic control cannot support complex air traffic management concepts**
- **System provides insufficient security & integrity**
- **Communications capacity cannot support future air traffic management**
- **Coverage is lacking in remote and oceanic regions**

Technology Solutions:



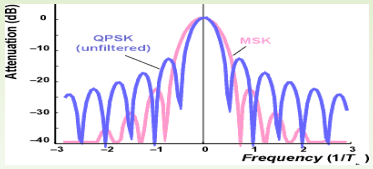
Airborne Internet

- **Airborne internet**
- **Secure networked communications**



Remote Sensing

- **Remote surveillance of all airspace**
- **Satellite communications and surveillance**
  - Global surveillance and communications
  - Real-time cockpit weather and other hazard awareness



Secure digital communications

- **Digital broadband communication**

*Communication, Navigation, and Surveillance

Future CNS: The Critical Backbone of Tomorrow's Air Transportation System

- New CNS system needed to support the requirements and functionality that is needed for the future
  - Global coverage
  - Robust and reliable systems
  - Architecture scales with traffic increases
  - Full situational knowledge for pilots and controllers
    - Weather, traffic, terrain, vehicle health, etc.
  - Safe and secure flight operations
  - Distributed decision making
  - Precise flight path management from gate to gate
  - Precision approach to all runways

CNS Challenges

- While a new system is needed, the challenges are enormous
  - Understanding and managing the risks in a new system
  - Graceful degradation of the system
  - Developing a transition path from today's system
  - Managing massive information flows
  - Implementing a new ops concept to achieve the benefits of a new CNS system
  - Managing mixed equipage
- Research must address these critical challenges

Conclusion

- There is a real and growing need for a new CNS system
- Potential benefits to capacity, efficiency, safety and security of the system
- Allows new markets
- Challenges are substantial - will need significant research and partnership