NextGen

Next Generation Air Transportation System

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Date: 05 March 2009
EIWAC: Tokyo, Japan

Federal Aviation Administration

The Current System Is Not Performing Adequately

Worst-ever July for air traffic delays — *The Boston Globe*

By Bloomberg News | September 5, 2007

WASHINGTON - US airlines had the worst July for flight delays on record, as only 70 percent of flights arrived on time amid bad weather and a surge in traffic.

- Delays are mounting
- Gate-to-gate time is up for all flights
- Although demand is down it remains up in already congested markets

- The problems are worse in the highest density airspace

Bush on travel woes: 'We've got a problem'
President tasks transportation boss to ensure passengers treated fairly
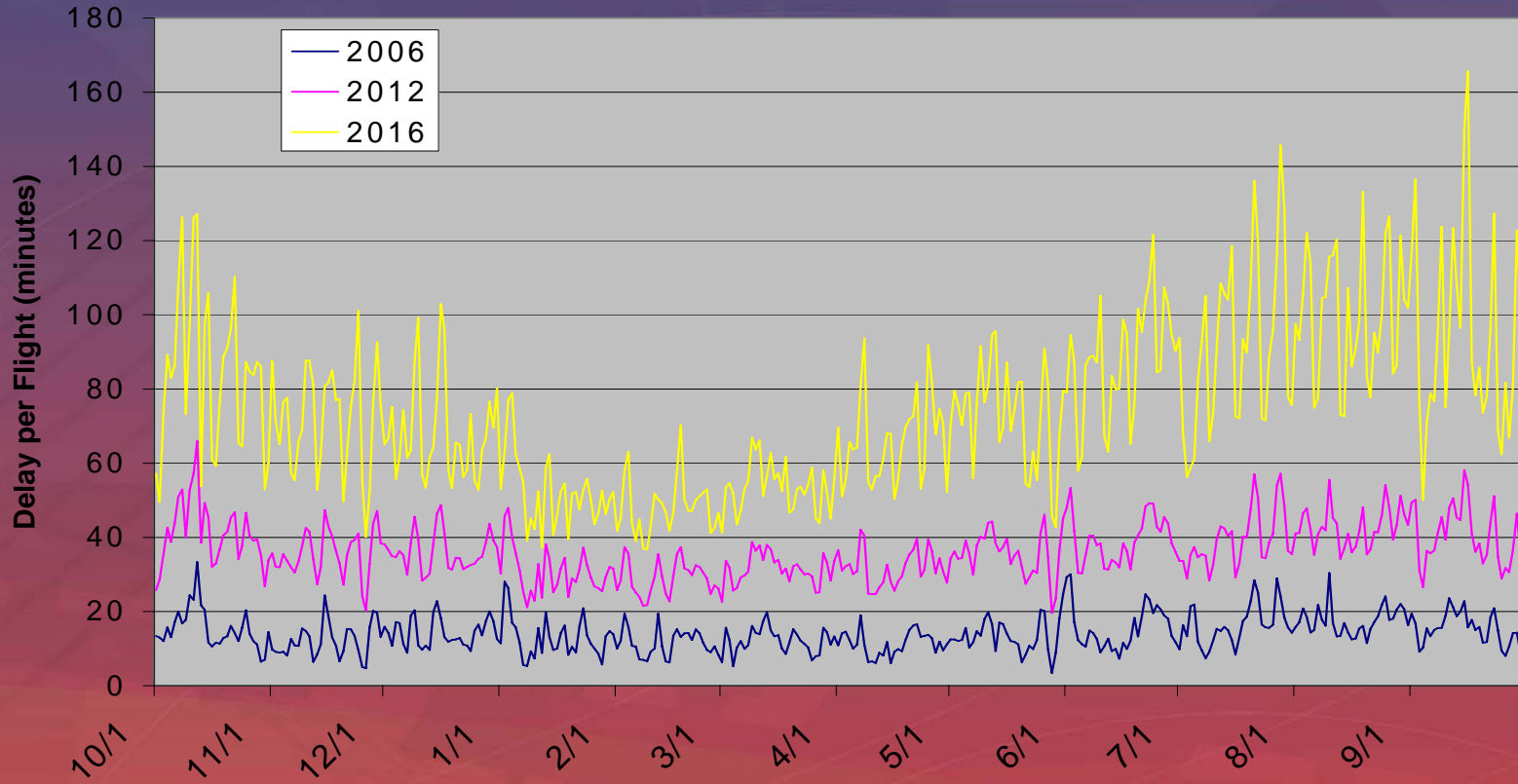
Kevork Djansezian / AP file

Planes from US Airways and Virgin Atlantic wait between terminals one and two to taxi at LAX last month.

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If We Do Nothing… Delays Will Grow*

Delays projected using ATO Network Forecasts
Assumes weather in 2012 and 2016 the same as 2006
* Projections assume no capacity improvements

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Delays Cost Billions

A May-2008 report by the Joint Economic Committee Majority Staff found that,

"Air traffic delays cost the U.S. economy up to $41 billion in 2007"

Airline Operating Costs	Value of Passenger Time	Spillover Costs to the Economy	Total
$19.1 Billion	$12.0 Billion	$9.6 Billion	$40.7 Billion

Delayed flights consumed about 740 million additional gallons of jet fuel

Almost 20 % of total domestic flight time in 2007 was wasted in delay

"The economic costs of air traffic delays to the U.S. economy are large and far-reaching. As air traffic has grown over the last two decades, the number of domestic flights and air flight delays has reached record levels. Increasing flight delays and cancellations are placing a significant strain on the U.S. air travel system and costing both passengers and airlines billions of dollars each year."
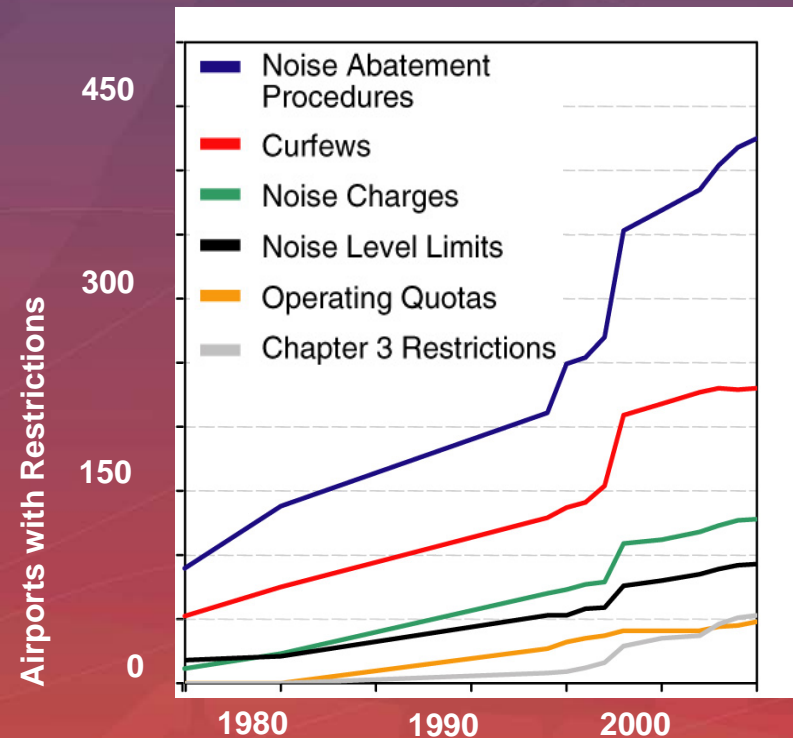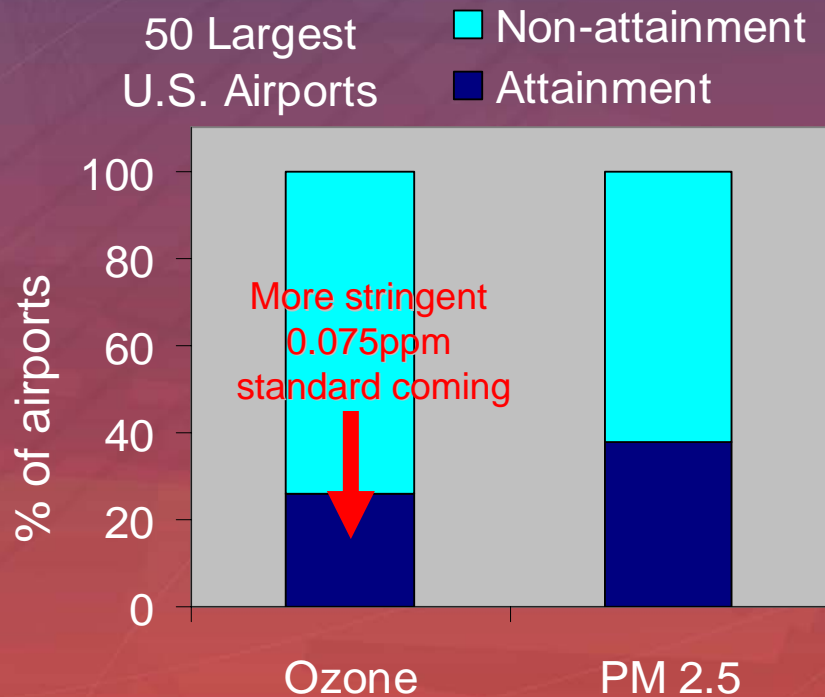
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Environmental Constraints

Trends show that environmental impacts from aircraft noise and emissions will be a critical constraint on NAS capacity and flexibility -- unless managed & mitigated
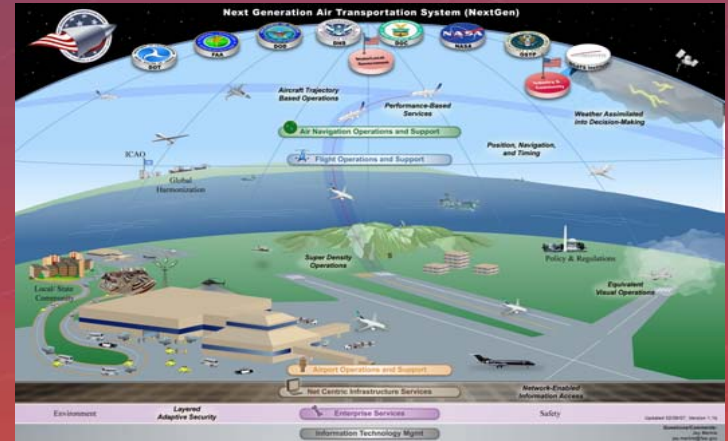
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NextGen: Improving Service Delivery

Today's NAS

Ground-based Navigation and Surveillance

Air Traffic Control Communications By Voice

Disconnected Information Systems

Air Traffic "Control"

Fragmented Weather Forecasting

Airport Operations Limited By Visibility Conditions

Forensic Safety Systems

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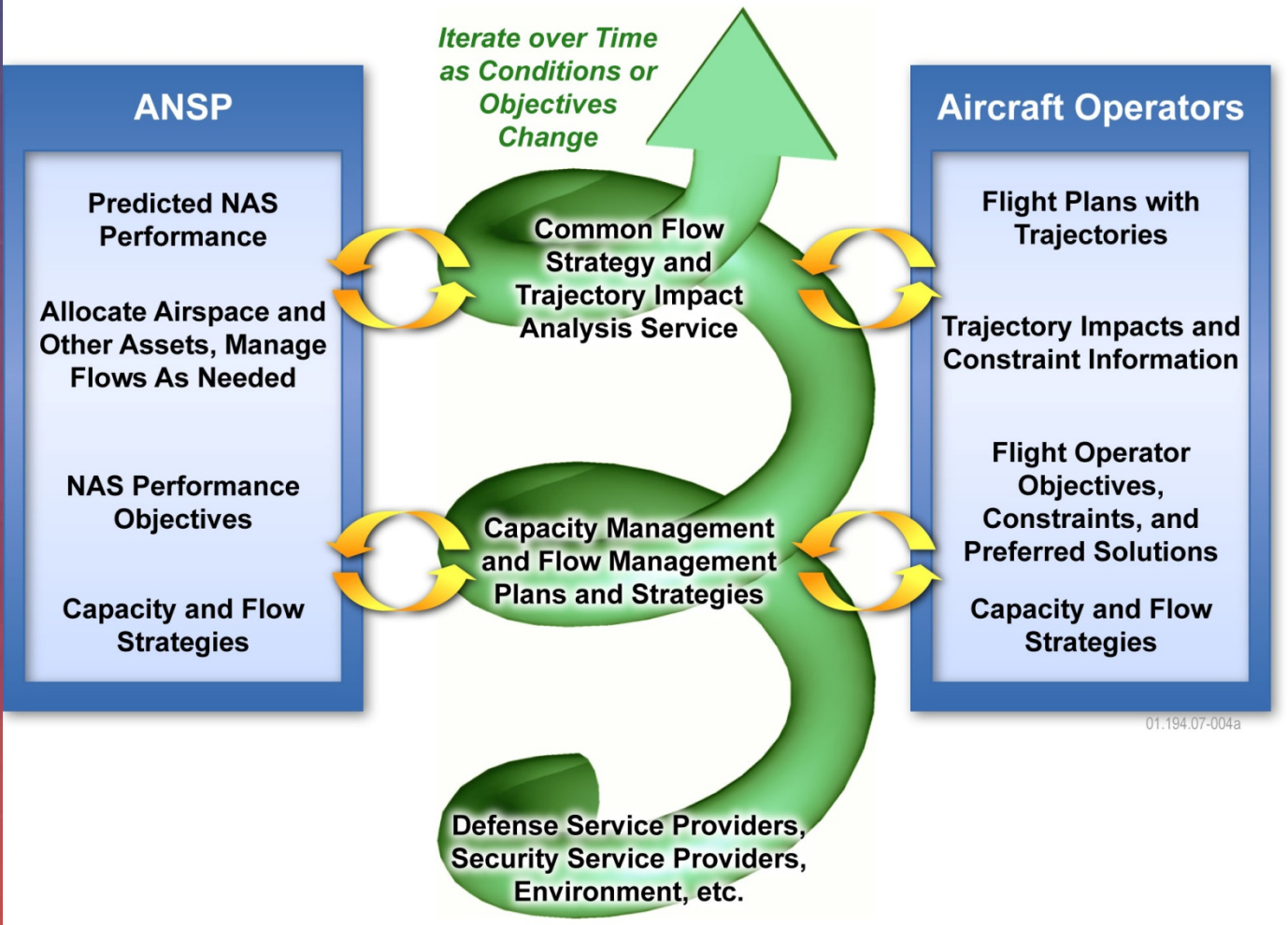
Satellite-based Navigation and Surveillance

Clearance Trajectories and Routine Information Sent Digitally

Information More Readily Accessible

Air Traffic "Management"

Forecasts Embedded into Decisions

Operations Continue Into Lower Visibility Conditions

Prognostic Safety Systems

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ATM Decisions—Interactive and Integrated Across Time Horizons
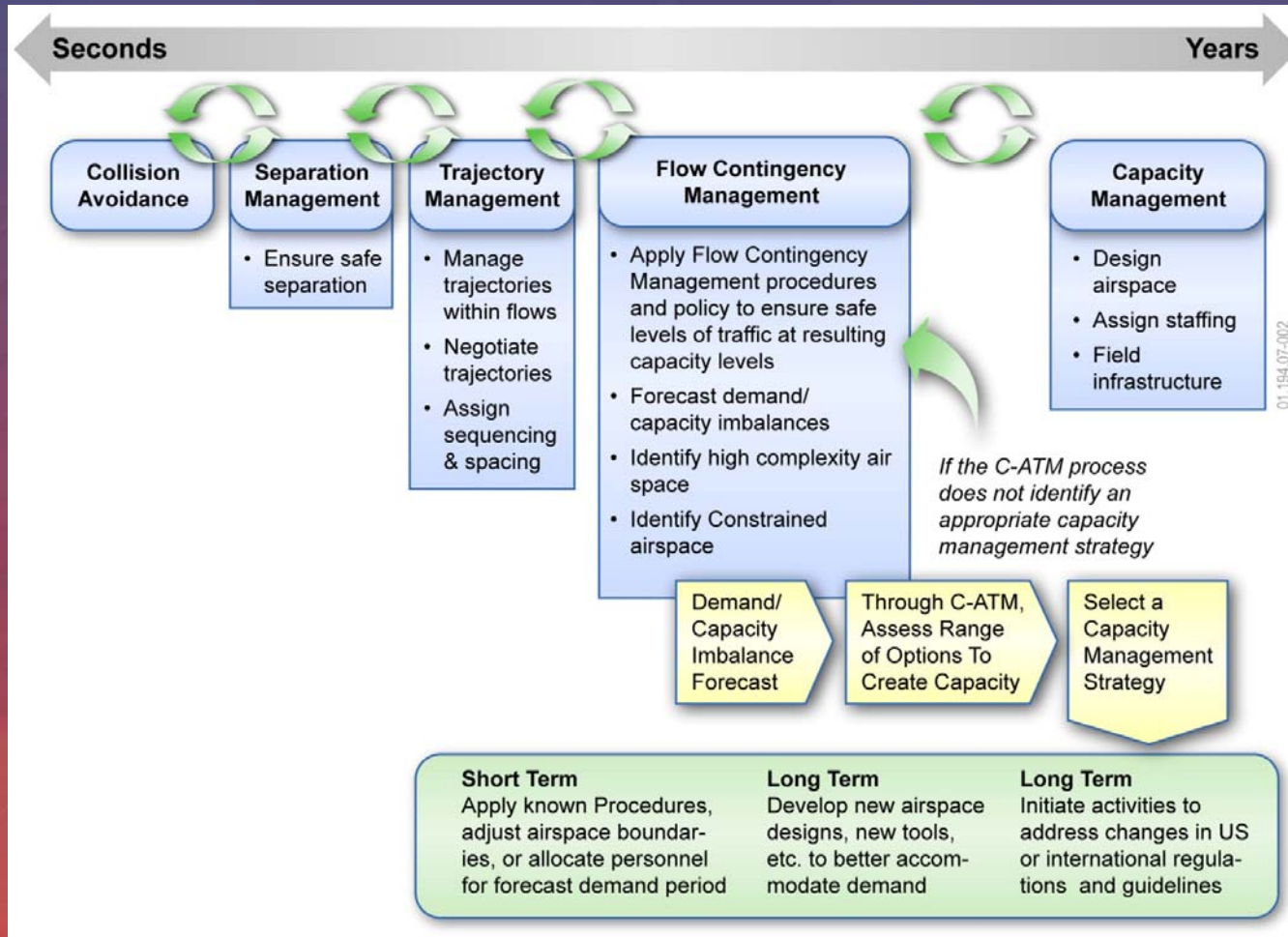
Concept Harmonization

- **The NextGen and SESAR concept are based on the ICAO Global Concept**
  - Continue to evolve the guidance through the ATMRPP

- **NextGen and SESAR are working towards**
  - Holding a series of technical interchange meetings to compare concepts, architectures and performance objectives

- **Shared Demonstration**
  - Atlantic Interoperability Initiative to Reduce Emissions

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FAA's NextGen Implementation Plan

Focus on integration and execution

- *Leverage capabilities of existing systems & avionics for near-term impact*

- *Advance capabilities for the mid-term*

Airport Development
- OEP Airports
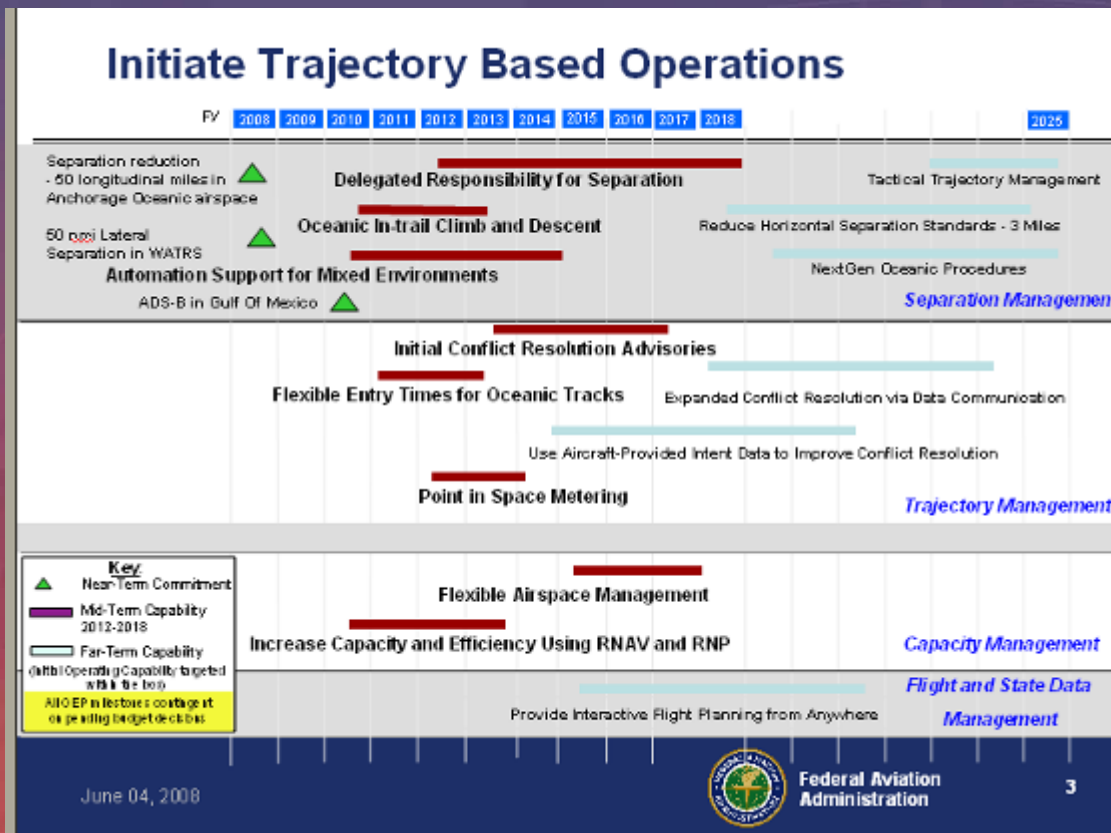- OEP Metro Areas

Air Traffic Operations
- Initiate Trajectory-based Operations
- Increase Arrivals and Departures at High Density Airports
- Increase Flexibility in the Terminal Environment
- Improve Collaborative Air Traffic Management
- Reduce Weather Impact
- Improve Safety, Security and Environmental Performance
- Transform Facilities

Aircraft & Operator Requirements

NextGen Implementation Timelines
Portfolio – *Operational Level Descriptions*

Initiate Trajectory Based Operations

Separation Management
- Separation reduction - 50 longitudinal miles in Anchorage Oceanic airspace
- Delegated Responsibility for Separation
- Tactical Trajectory Management
- 50 nmi Lateral Separation in WATRS
- Oceanic In-trail Climb and Descent
- Reduce Horizontal Separation Standards - 3 Miles
- Automation Support for Mixed Environments
- NextGen Oceanic Procedures
- ADS-B in Gulf Of Mexico

Trajectory Management
- Initial Conflict Resolution Advisories
- Flexible Entry Times for Oceanic Tracks
- Expanded Conflict Resolution via Data Communication
- Use Aircraft-Provided Intent Data to Improve Conflict Resolution
- Point in Space Metering

Key:
- Near-Term Commitment
- Mid-Term Capability 2012-2018
- Far-Term Capability (Initial Operating Capability targeted within the box)
- AIIO EP milestones contingent on pending budget decisions

Capacity Management
- Flexible Airspace Management
- Increase Capacity and Efficiency Using RNAV and RNP

Flight and State Data Management
- Provide Interactive Flight Planning from Anywhere

June 04, 2008

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NextGen Integration and Implementation Office

Separation Management
Separation between aircraft, airspace and terrain
Conflict Management

Trajectory Management
Provide the most efficient "flow" of aircraft
Traffic Synchronization

Flow Contingency Management
Manage demand with flow exceed capacity *(Strategic Flow)*
Demand Capacity Balancing

Capacity Management
Airspace Design and Management
Airspace Organization and Management

Flight and State Data
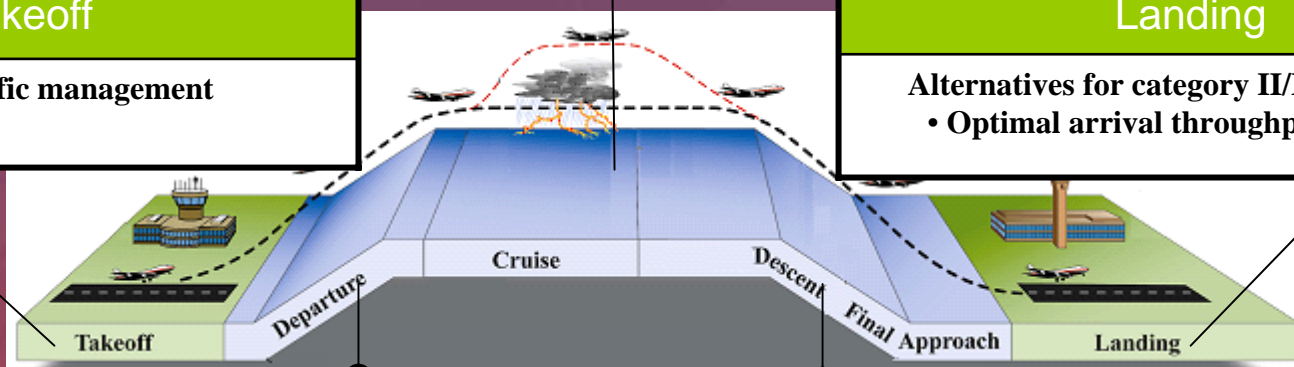Safe and Efficient Flight Planning and Execution
Information Management

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11

Summary Mid-Term (2012-2018)
Top Level View

Cruise

- **Flexible entry times to oceanic tracks**
- **Oceanic in-trail climb and descent**
- **Conflict Resolution Advisories**

- **Point-in-space time based metering**
- **Procedures with tailored separation**
- **Enhanced flight data management**

Takeoff

Surface traffic management

Landing

Alternatives for category II/III approaches
- **Optimal arrival throughput to CSPR**

Departure

- **Wind-based wake departure procedures for CSPR**
- **Area navigation above FL180 and RNP 1 navigation**

Descent/Final Approach

- **Optimized profile descent**
- **Integrated arrival departure management**

Weather impact evaluation   On-demand NAS information   Flow Management Tools

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Near-Term: Today – 2012
Maximize current capabilities while enabling mid-term infrastructure

RNAV/RNP De-conflict

RNAV/RNP De-conflict

Acronyms

ASDE-X	Airport Surface Detection Equipment-Model X
RNP	Required Navigation Performance
RNAV	Area Navigation
TMA	Traffic Management Advisor

RNAV/RNP Deconflict

Traffic Management Advisor

Surface Management with ASDE-X

Predictive Weather

Mid-Term: 2013-2018
Capabilities enabled by today's actions

ADS-B Enabled CDTI Applications

• Surface Moving Map

• Merging & Spacing

• Paired Approaches

• Closely Spaced Parallel Operations

Integrated Predictive Weather

Traffic Management Advisor

Surface Traffic Management System Required Navigation Performance/Area Navigation Routes Between Major City Pairs

Air-Ground Data Communications

Low Visibility Tower Operations

RNAV/RNP

Improved Service to Non-Radar Areas

Integrated Arrival/Departure Management

Acronyms

ADS-B
Automatic Dependent Surveillance-Broadcast

CDTI
Cockpit Display of Traffic Information

STMS
Surface Traffic Management System
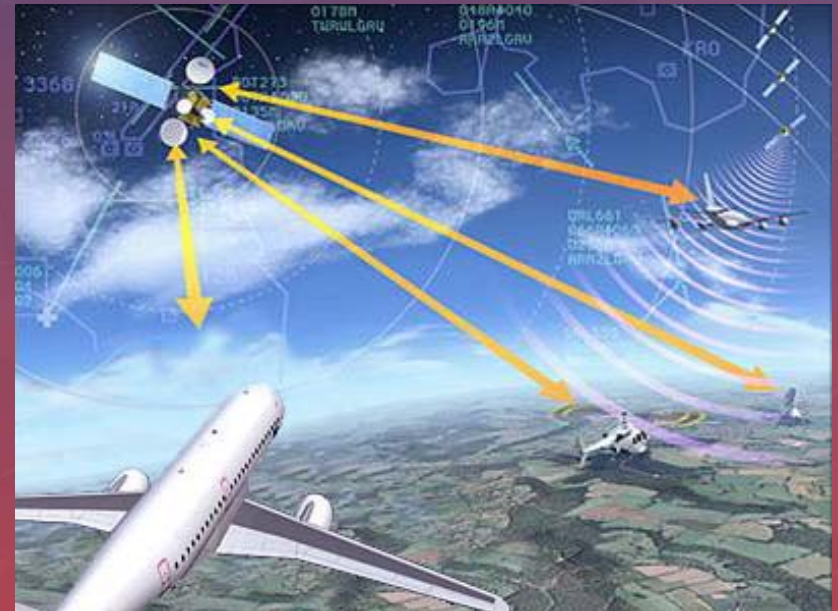
TMA
Traffic Management Advisor
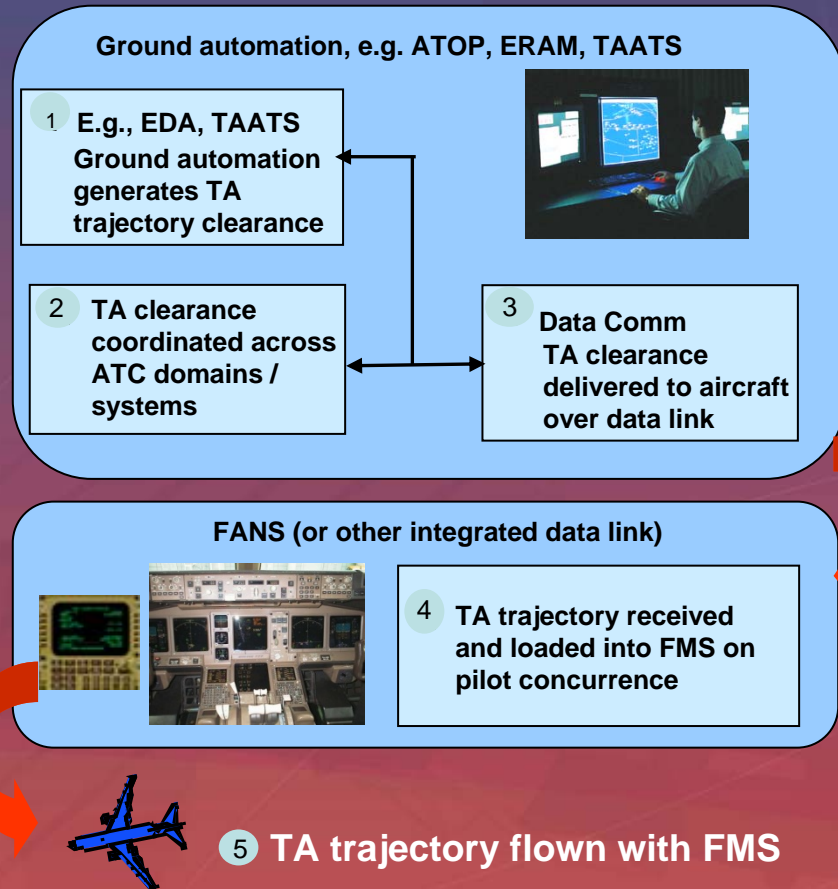
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NextGen Transformational Programs form the Foundation for Mid-term Capabilities & Beyond

- Automatic Dependent Surveillance Broadcast (ADS-B)

- System Wide Information Management (SWIM)

- Data Communications

- NextGen Network Enabled Weather (NNEW)

- NAS Voice Switch (NVS)

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Demonstrations
Tailored Arrivals (TAs) Demonstration

Ground automation, e.g. ATOP, ERAM, TAATS

1. E.g., EDA, TAATS Ground automation generates TA trajectory clearance

2. TA clearance coordinated across ATC domains / systems

3. Data Comm TA clearance delivered to aircraft over data link

FANS (or other integrated data link)

4. TA trajectory received and loaded into FMS on pilot concurrence

5. **TA trajectory flown with FMS**

- Initiative: **Integrate automation tools and Data Comm to provide cleared trajectory path, which is uplinked to the aircraft and flown by Flight Management System (FMS)** *

- Benefits:
  - 400/600 LBS of fuel reduction per arrival in end-state
  - Reduced fuel burn and environmental footprint

- Partners: **NASA Ames, Boeing, Sensis, American Air Lines & European Partners/Carriers**

- Schedule: **FY08 Live Flight Trials at MIA (Sept)**

- Domain: **Terminal**

- NextGen Solution Set: **High Density, Safety, Security & Environment**

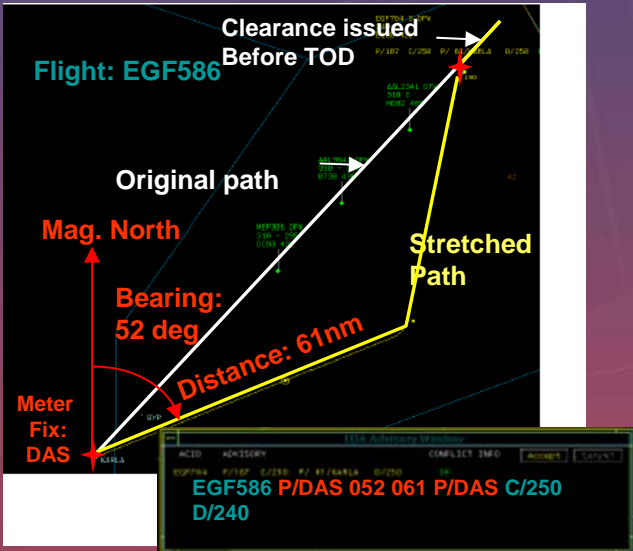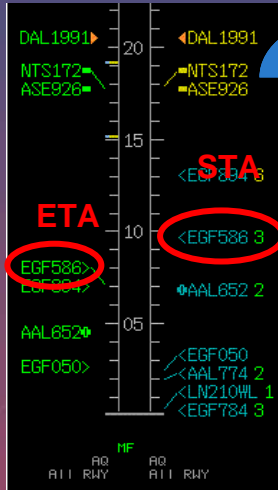*** Supporting Atlantic Interoperability Initiative to Reduce Emissions (AIRE)**

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Demonstrations
3D Path Arrival Management (3D PAM)

2) EDA Tool Generates Advisories to Meet TMA Schedule (absorb delay)

Flight: EGF586

Clearance issued Before TOD

Original path

Mag. North

Stretched Path

Bearing: 52 deg

Distance: 61nm

Meter Fix: DAS

EGF586 P/DAS 052 061 P/DAS C/250 D/240

STA

ETA

1) TMA Generates Required Time Delays

3) EDA Generates Path Required Path Stretch in Place, Bearing, Distance

4) Controller issues clearance (initially via voice). Pilot loads in FMS, then flies via RNAV/RNP

- **Initiative:** Move toward 4-D Trajectory Management; aircraft executes TMA plan

- **Benefit:** Move from controller-based to aircraft centric 4-D Trajectory Management

- **Approach:** Conduct live trials at DEN; integrate enhancements to TMA with FMS equipage

- **Partners:** NASA Ames, Boeing, Sensis, Continental, AAL

- **Schedule:**
  - FY08 Human-in-the-Loop Simulation
  - FY09 Live Flight Trials at DEN
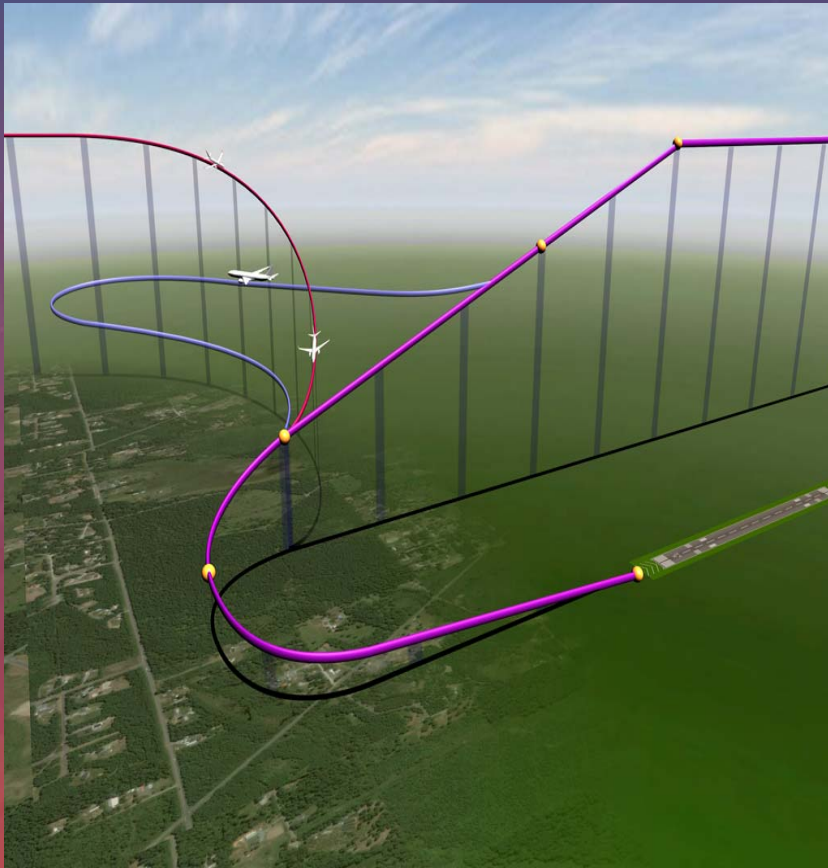
- **NextGen Solution Set:** High Density

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Continuous Descent Arrivals (CDA)

- **Initiative: Uses Area Navigation (RNAV) / Required Navigation Performance (RNP) arrivals with optimized vertical profile**

- Benefit:
  - 200 to 400 LBS of fuel per arrival
  - Reduced noise and emissions

- Partners: **American Air Lines, Delta, European Partners/Carriers, Georgia Tech, MITRE**

- Schedule:
  - ATL Flight Test – May 08
  - MIA Flight Test – July 08

- Domain: **Terminal**

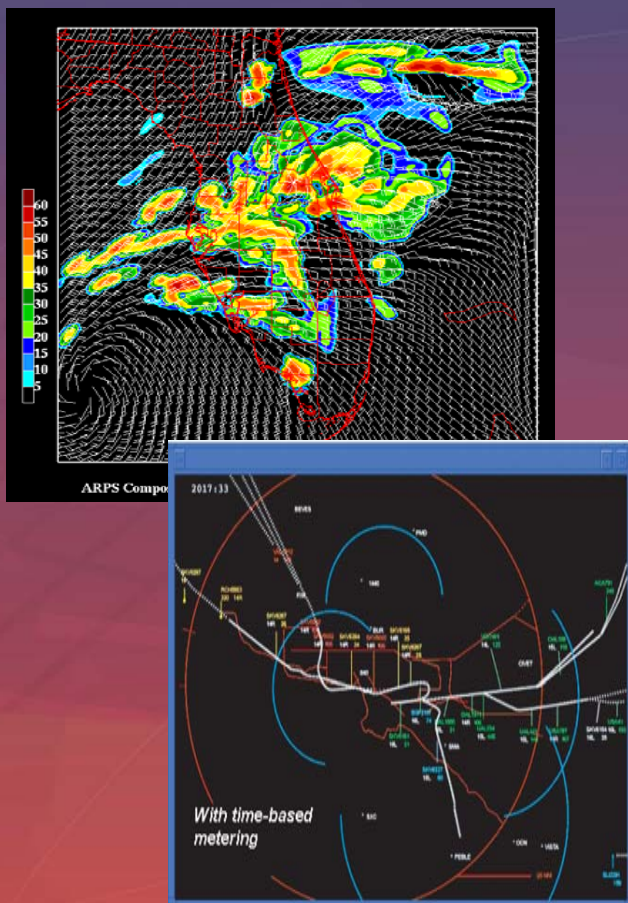- NextGen Solution Set: **High Density, Safety, Security & Environment**

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Demonstrations
Improved Weather Detection / Prediction Integrated with Traffic Management Advisor (TMA)

ARPS Compo... 2017:33

With time-based metering

- **Initiative: Improve weather detection and prediction, pass to TMA via System-Wide Information Management (SWIM) network**

- **Benefits: Expand use of TMA during convective weather periods**

- **Partners: Embry-Riddle, Lockheed Martin, CSC, ENSCO**

- **Approach: Conduct Advanced Concept Technology Development (ACTD) to demonstrate integrated capability – also possible partnership**

- **Schedule: FY08 - Demonstration September 2008**

- **Domain: Terminal / En Route**

- **NextGen Solution Set: Reduced Weather Impact, Safety, Security & Environment**

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NextGen…

Applying 21st Century technology to transform our aviation system -

expanding capacity, enhancing safety and security, and protecting the environment.

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