Next Generation Air Transportation System: Meeting the Enterprise System Engineering Challenges

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25 October 2007

Pressure from Growing Traffic Congestion and Airline Delays

The New York Times

Flying the Crowded Skies: Challenges for Aviation

J. Emilio Flores for The New York Times

Air traffic controllers at the Los Angeles airport.

By MATTHEW L. WALD
Published: January 15, 2007

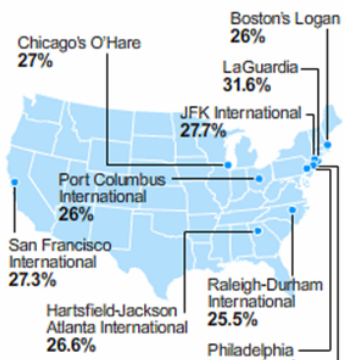
WASHINGTON, Jan. 14 — By 2025, government experts say, America's
three times as many planes, and not just the kind of traffic flying today. Th
of tiny jets, seating six or fewer, at airliner altitudes, competing for space v
drones that need help avoiding midair collisions, and with commercially o
carrying satellites and tourists into space.

USA TODAY

Updated 1/26/2007 2:35 PM ET

Airline Delays Set Record in 2006

Large airports² with the highest percentage of delayed flights January-November 2006:



By Alan Levin,

Airline delays inc
to record highs b
weather starting
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By several meas
exceeded those
thunderstorms c
schedules that p
Congress threate
carriers.

TIPPING POINT
passengers

Statistics
Gelles, USA TODAY

% of flights on large
the federal Bureau

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AVIATION WEEK & SPACE TECHNOLOGY

06/28/2007

Record Delays Loom

Summertime and the traveling won't be easy in the U.S. National Airspace System

David Hughes/Herndon, VA.

With summer air traffic delays expected to set a record for the second year in a row, the FAA acknowledges that long-term relief will depend on the not-yet-assured NextGen ATC system.

THE WALL STREET JOURNAL.

July 21, 2007
HOT TOPIC

Why the Skies Have Gotten Crowded

By SARAH NASSAUER

Data this past week validated what many fliers already suspected -- the number of delays and cancellations in June may have been the worst ever. According to FlightStats.com, 20,301 flights were canceled in the U.S., more then double the number grounded in June 2006. Among the 40

THE WALL STREET JOURNAL.

July 17, 2007

THE MIDDLE SEAT
By SCOTT MCCARTNEY

Why Fliers Find Summer Travel Growing Tougher

Number of Cancellations
More Than Doubles
Amid Storms, Gridlock

James
ion's
12-18

Pressure from Delays and Cancellations on Airline Quality of Service Standards

The Washington Post

Flying Late, Arriving Light

Air Carriers Are Delaying More Flights and Losing Your Shirts

(By Laurence Kesterson -- Associated Press

By Del Quentin Wilber
Washington Post Staff Writer

Thursday, February 8, 2007; Page D01

Air travelers had a tough year getting

Airlines' on-time performance droppe
arriving late or not at all, according to
Statistics.

It was the worst year since 2000, whe
from getting to their destinations on t

The airlines also mishandled a massiv
1,000 passengers, the industry's worst
in lost bags stemmed from stricter sec
their luggage.

There was less consensus on the incre
and that's one of the reasons 2006 hit
Federal Aviation Administration, said

The Atlanta Journal-Constitution

Congress eyes standards for airline service

By BOB DART
The Atlanta Journal-Constitution
Published on: 04/20/07

Washington — Airlines have not kept their promises to protect passengers f
horrors, so Congress may need to set federal standards for customer servic
Transportation Department investigator told a House subcommittee Friday.

The New York Times

Federal Agency Investigating Airline Arrival-Time Promises

By JEFF BAILEY
Published: April 21, 2007

The Transportation Department said yesterday that it was investigating several domestic airlines for publishing unrealistic flight schedules — including ones that list arrival times the carriers know they cannot achieve — and said as many as eight could be fined for failing to provide accurate flight-delay information.

The agency is under pressure from Co
recent episodes where several carrier
Airways, stranded passengers for hou

The actions disclosed Friday do not d
which is being reviewed by the agency
after June 30.

Rather, these actions aim at airlines t
to customers, when asked, the on-tim
required.

A Transportation Department spokes
not to be identified, said the agency c
information on particular flights. The
statistic on 41 percent of the calls, the
involved.

THE WALL STREET JOURNAL.

February 6, 2007

THE MIDDLE SEAT
By SCOTT MCCARTNEY

A Report Card On the Nation's Airlines

Despite Financial Recovery, Many Carriers Still Plagued By Spotty Customer Service

110TH CONGRESS
1ST SESSION

H. R. 1303

To amend title 49, United States Code, to improve air carrier passenger services.

IN THE HOUSE OF RE

Passenger Bill of Rights

A BILL

To amend title 49, United States Code, to improve air carrier passenger services.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE.

This Act may be cited as the "Airline Passenger Bill of Rights Act of 2007".

Pressure from Airlines on ATM System Performance

CNNMoney.com

Delta Takes Steps to Mitigate Impact On Customers as Severe Weather Approaches Northeast

Delta Urges Congress to Modernize Air Traffic Control System

June 28, 2007: 12:03 PM EST

ATLANTA, June 28, 2007 (PR
customers booked on flights
U.S. to make adjustments to
weather expected in the regi
the Northeast corridor and a
flights could be canceled. Cu
cancellations may request re
without fee or penalty.

Impacted cities include the fo

- New York (JFK)
- New York (LGA)
- Newark
- Hartford
- Providence
- Boston
- Washington Reagan
- Washington Dulles
- Baltimore
- Philadelphia

"Delta's focus is always the c
continue to work to mitigate
delays. However, today's sto
Congress act to modernize th
Kolshak, Delta's executive vi
fundamentally unfair to our customers that we are operating in a system that was built in the 1940s and can't accommodate today's air travel demand without costly and frustrating delays and congestion that are beyond our control. The FAA has presented a plan to Congress that helps ensure airline passengers are provided with an updated, 21st century air traffic control system. We urge Congress to approve the FAA's plan to increase airspace capacity, especially in the Northeast, and to get away from the status quo and act boldly to modernize our nation's outdated air traffic control system."

U.S.News & WORLD REPORT

Airlines Attribute Delays to Poor Traffic Control

April 3, 2007 | 5:15 PM ET | Permanent Link

In response to an Airline Quality Rating report released yesterday that found that instances of delayed flights and lost baggage were up last year over 2005, the Air Transport Association, the trade group representing the major airlines, released a statement yesterday.

In short, the airlines attribute the uptick in delays to one of the most contentious political issues in transportation this year: the updating of the air traffic control system and just who should pay the bulk of the bill for the much-needed improvements.

"The 2007 Airline Quality Rating study once again focuses on the symptoms rather than the root causes of passenger and airline frustrations," ATA President and CEO Jim May notes in the statement. He says that since the majority of delays are caused by weather problems that the current system can't handle, Congress must now take its "historic opportunity" to "approve an action plan for the Next Generation Air Traffic Control system ... while ending the multibillion-dollar subsidy of business jets at the expense of the commercial airline passengers."

For the inside story on the big-time Washington battle over restructuring the FAA, see associate editor Angie C. Marek's March 30, 2007, article here. Marek tells us that bills addressing the subject should appear in Congress soon.

THE WALL STREET JOURNAL.

July 21, 2007
REVIEW & OUTLOOK

Gridlock in the Air

No one who has traveled by plane recently needs to be told that our commercial air-travel system
atistics support the anecdotal evidence of crowded airspace, taxiways and
inistrator Marion Blakey recently noted that 2006 was the worst year on
d cancellations and that 2007 bids to be worse still. On one day this past
lf the planes at JFK in New York City were on time. Nationwide for the
re than 30% of all flights were delayed. It's enough to make you think they
hour to every departure time.

f course. But we're not sure that firing Ms. Blakey -- which is Chuck
rm for addressing the problem -- would be any more effective. Ms. Blakey
g anyone who will listen to fix some of the problems with the air-travel
efore this summer's delays put the overcrowding in the headlines and on
s.

tough with the air-traffic controllers union, which has placed her on the least-
t of a number of Democratic politicians, including New York's Senator
lly, Ms. Blakey last year fought and won a battle with the controllers union
pay package that was eating up a vast portion of the FAA's budget.

r-increasing pay (it rose 75% between 1998 and 2005) left the FAA with less
spend on modernization projects that might actually alleviate some of the
ing "counterproductive," as Mr. Schumer claimed, Ms. Blakey's victory over
cessary step toward to getting the air-travel system back on track.

really wants to do some good for New York's airports, though, he might talk
om Connecticut. The delays in New York and around the country are not
y have a tendency to become tangled in the competing interests of Nimbyism,
ourse, money. When you combine those with Washington partisanship, the
the air.

the three main New York-area airports that Mr. Schumer is so concerned about. The airspace around New York, including the flight paths for getting in and out of the area, dates back decades, when traffic was much lighter. The FAA has been trying for years to "redesign" it, in its phrase, to allow more planes more ways to get in and out. But activists in Connecticut don't want the planes going over their houses, and neither, it seems, does anyone else. So redesign becomes a political football, and the planes sit on the taxiway.

The good news is that the FAA is supposed to issue a redesign rule for New York by the end of August. The bad news is that even if the new routes work as intended, the result will just be

Pressure of Global Warming Concerns on Flight Efficiency and Fuel Consumption

Internationally

FLIGHT INTERNATIONAL

Needless delays add to pollution

By David Learmount

Eurocontrol demands more efficiency from air traffic manage and fewer carbon emissions

Aircraft flying in European airspace last year poured thousands of t warming carbon dioxide into the sky unnecessarily just because of management inefficiency, according to the Eurocontrol Performanc Commission (PRC).

The report on calendar year 2006, published on 11 May, shows tha delays have been increasing for three years in a row, and PRC chai Williams says that the need to improve ATM efficiency is rising as a

This excess of emissions results from inefficiencies in the continent which mean every flight travels nearly 50km (27nm) farther throug needs to in order to reach its destination, the PRC reports. The Eur has set ATC service providers the target of eliminating this problem and 2010, saving an estimated 2.3 million tonnes of CO2 emissions airline costs by a billion euros.

© Gary Lewis / AirT

Europe's airlines are wasting tonnes of fuel each year due to

... and Domestically

USA TODAY

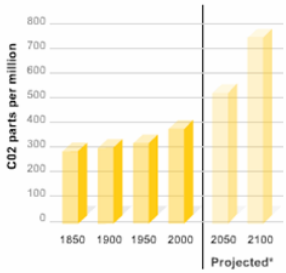
Updated 12/19/2006 9:13 AM ET

Concern grows over pollution from jets

By Andre Penner, AP file

A Boeing 737 lands in Brazil. Jet emissions such as carbon dioxide, nitrogen oxide and water vapor can contribute to climate change.

Carbon dioxide represents about 80 percent of the man-made greenhouse gases blamed for global warming. Though experts have called for the United States and other nations to cut emissions of C02, current trends show atmospheric C02 concentration would double by the end of the century.



* Projected concentration levels assuming continuing "business as usual" behavior.

Source: Scripps Institution of Oceanography and the Pacific Northwest National Laboratory's Global Change Research Institute at the University of Maryland.

By Ron Coddington and Josh Hatch, USA TODAY

By Gary Stoller, USA TODAY

Aviation and the environment are on course. The number of airline flights growing and expected to skyrocket o coming decades. Aircraft emissions and threaten by 2050 to become one largest contributors to global warming scientists have concluded.

Much remains unknown about climat and the role aviation plays, though cli scientists express particular concern emissions in the upper atmosphere, warming effect from some pollutants

Now, aviation is believed to be less a Earth's warming than power plants or traffic. But its emissions are consider New York-to-Denver flight, a commer generate 840 to 1,660 pounds of carb per passenger. That's about what an generates in a month.

With the projected explosion in world air pollution from aviation is a growin among scientists, and it's drawing inc scrutiny from governments, particular

"It's an issue that has to be addresse Brenda Ekwurzel, a climate scientist of Concerned Scientists, an environm advocacy group.

David Travis, a climate science profe University of Wisconsin-Whitewater, emissions "are currently one of the fa growing contributors to global warmir

The European Union is considering s on aircraft emissions, an action strongly opposed by the White House because of its potential effect on U.S. airlines.

Aviation Daily

News

Rep. Markey Wants FAA To Account For Global Warming In NextGen Plan

Aviation Daily
08/16/2007

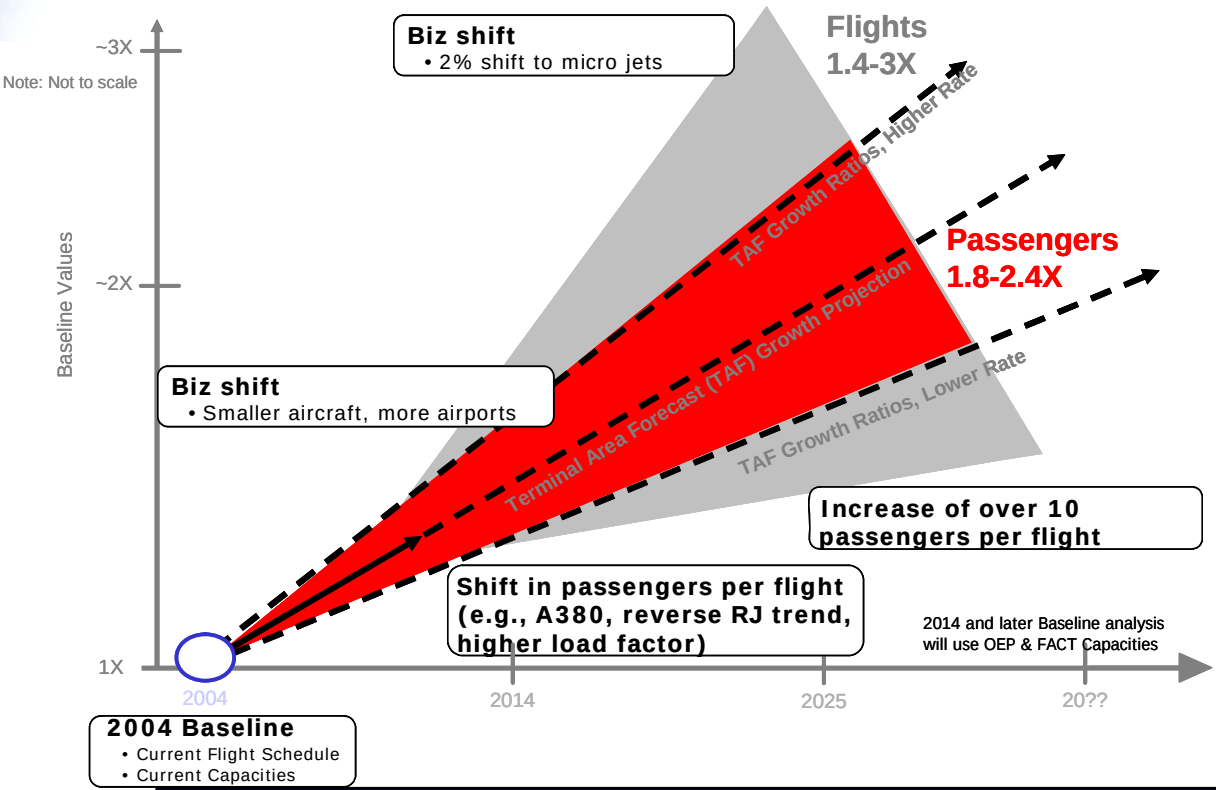
John M. Doyle

A House committee chairman wants the FAA to include global warming in its Next Generation Air Transportation system (NextGen) planning.

Rep. Edward Markey (D-Mass.) wrote FAA Administrator Marion Blakey Aug. 14 to express concerns that the agency wasn't taking global warming into account as it planned the future or air traffic control. "American aviation has made the word a smaller place and now it can make it a healthier place by taking action on global warming," said Markey, chairman of the house Select Committee on Energy Independence and Global Warming.

The letter asks FAA to report back by Sept. 4 on four questions: What does NextGen consider aviation's current and anticipated impact on global warming?; How many tons of carbon dioxide does aviation emit on a yearly basis in the U.S. -- both in the air and on the ground?; What strategies is NextGen considering to address emissions at airports?; and how far along is NextGen in developing a national roadmap on the viability of alternative fuels for aircraft?

Why NextGen?



- Growth in volume and complexity of operations
- Scalable to encompass a range of possible futures
- Broader diversity of:
  - Aircraft performance characteristics
  - Aircraft capabilities
  - Operator business models
- Space Operations
- Unmanned Aerial Systems

Transformation is Needed to Accommodate Projected Traffic Levels and Characteristics

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What is NextGen?

Transformation goals:

- Leadership in global aviation
- Scalable up to 3x increase in capacity
- Ensure our national defense (readiness and homeland security)
- Enhance the environment (noise, air quality)
- Improve safety
- Globally harmonized

Capabilities:

- Network-Enabled Information Access
- Performance Based Operations & Services
- Weather Assimilated into Decision Making
- Layered, Adaptive Security
- Position, Navigation, and Timing Services
- Aircraft Trajectory Based Operations
- Equivalent Visual Operations
- Super Density Arrival/Departure Operations

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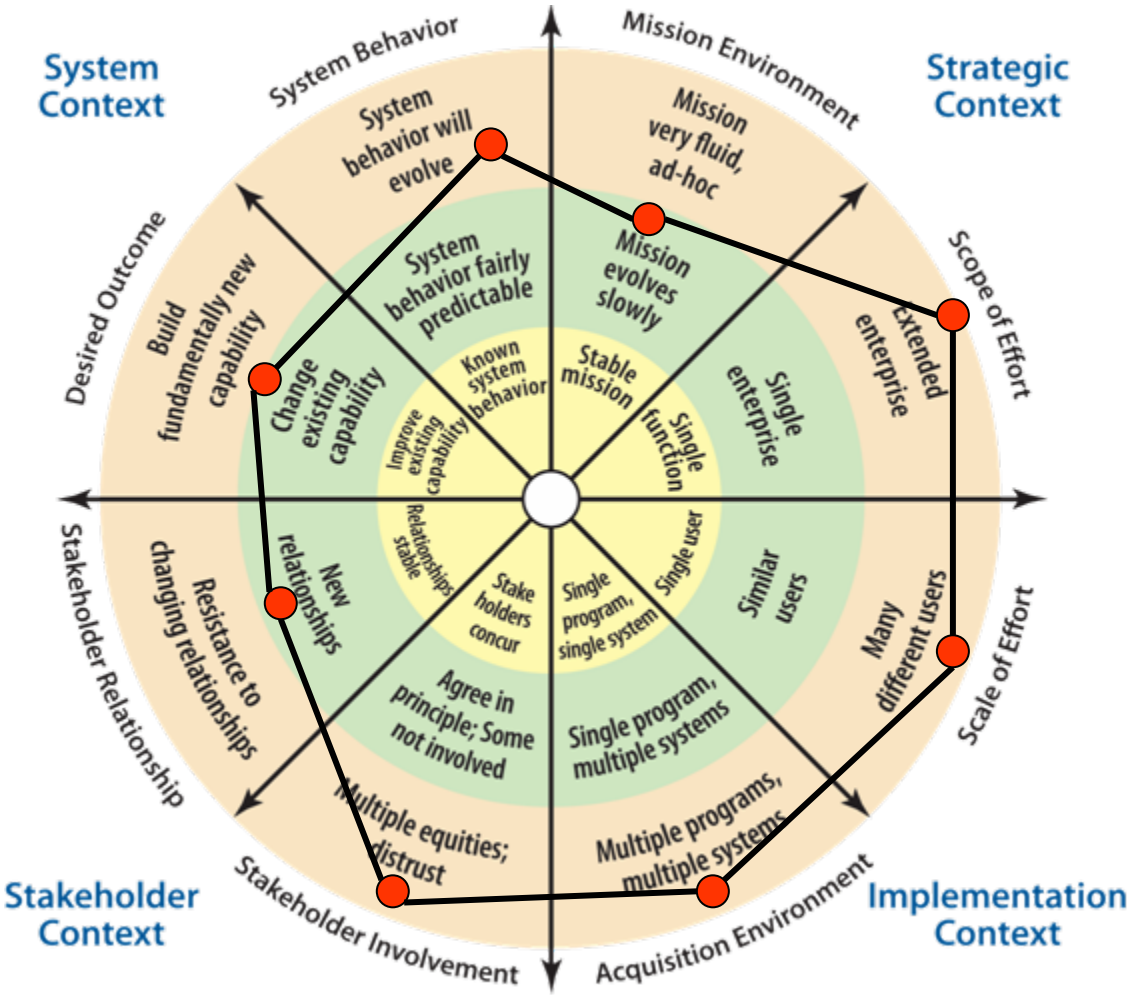
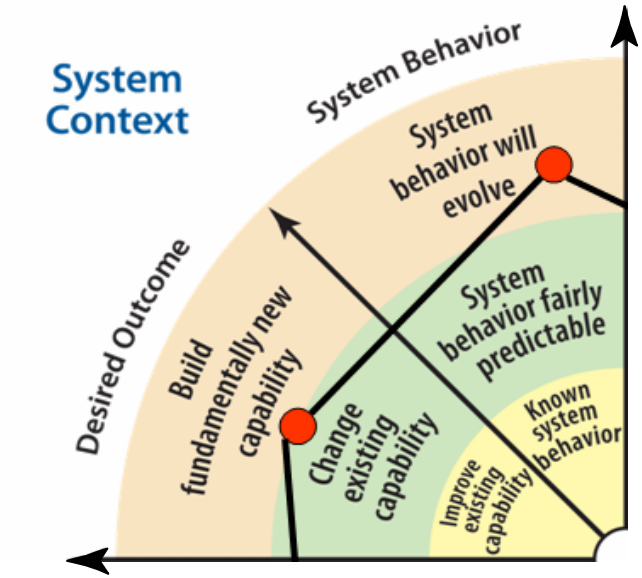
NextGen Enterprise System Engineering Challenges



Enterprise System Engineering Profiler ™

NextGen Challenges: Strategic and System Contexts



- System Context
  - System Behavior
    - NextGen must be flexible to meet a range of air transportation system futures
  - Desired Outcome
    - Transformed air transportation system that leverages new technologies and requires policy and roles and responsibility changes

- Strategic Context
  - Scope of Effort
    - Interdependencies of all elements contributing to air transportation
  - Mission Environment
    - Mission evolving to accommodate new types of operations

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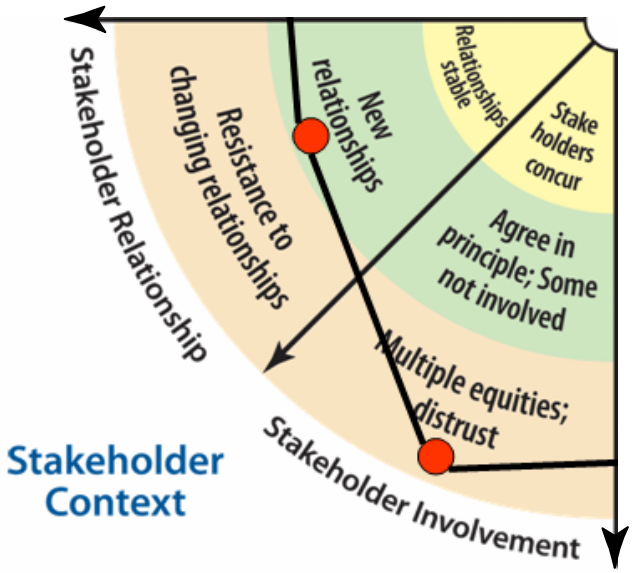
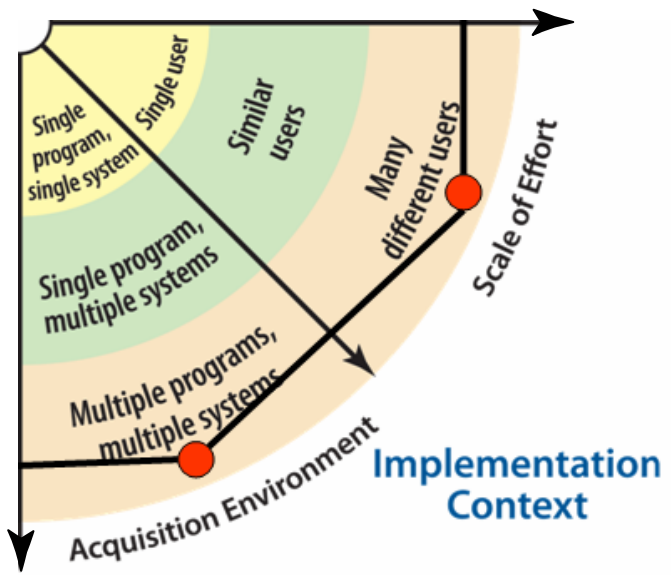
NextGen Challenges: Stakeholder and Implementation Contexts





- **Stakeholder Context**
  - **Stakeholder relationship**
    - **Large and diverse stakeholder community**
  - **Stakeholder Involvement**
    - **Diversity of stakeholders leads to conflicting objectives; e.g.,**
      - **NextGen funding mechanisms**
      - **Aircraft equipage mandates**
      - **Airspace access**

- **Implementation Context**
  - **Acquisition Environment**
    - **Synchronization of research, development, and implementation of multiple government agencies and the private sector**
  - **Scale of Effort**
    - **Flexibility required to accommodate multiple user operating models**

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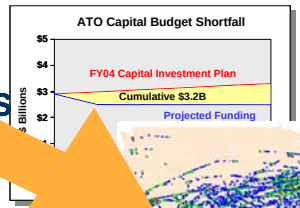
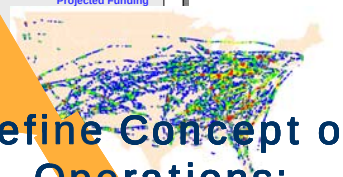
Process for Achieving NextGen

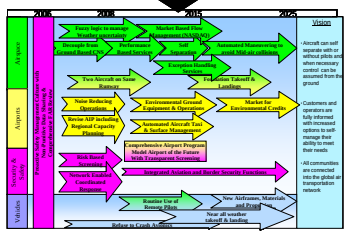
Measure Post-Implementation Performance, Service, and Cost of Segment

Baseline and Assess Today's Performance





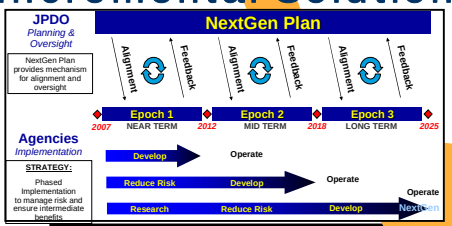
Define Concept of Operations; Identify Operational Improvements



- **Define the "What"**
- **Architect & Analyze**
- **Define Solutions**
- **Execute & Measure**

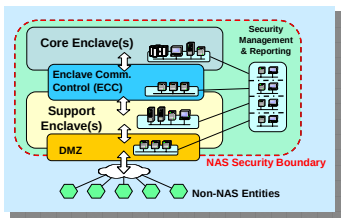
Develop Enterprise Architecture; Analyze Alternative Solutions and Assess Tradeoffs

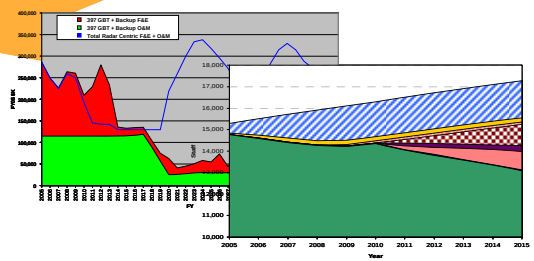
Define and Implement Incremental Solutions



Policy, Portfolio, Roadmaps, and Business Cases

Determine Program and Research Needs





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Baseline and Assess Today's Performance

- **Understand Federal agency and private sector plans, including architectures**
- **Baseline current capabilities and performance**

Concept of Operations

- Describes national airspace system (NAS) in 2025
  - Highlights differences from today's operations
- Presents an "aggressive" set of concepts
  - Maximize benefits and flexibility to users
- Identifies key research issues needing resolution
- Highlights areas for policy decisions
- Many possible futures
  - Down-selection and refinement of concepts to occur through research and policy decisions

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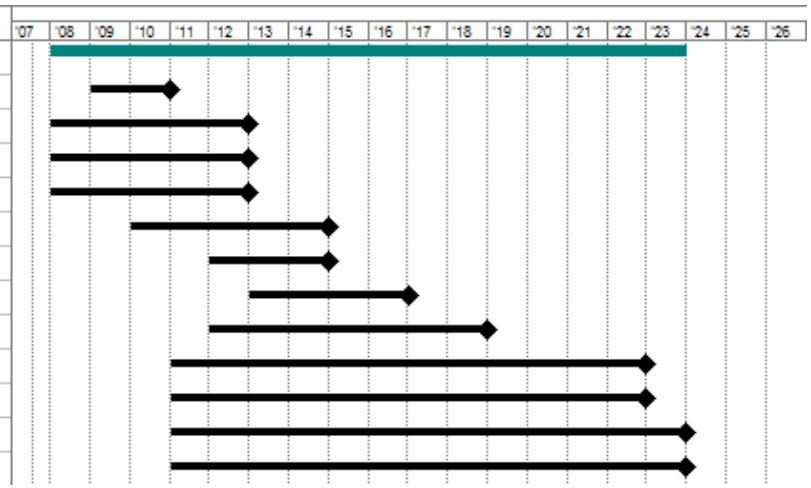
Operational Improvements

ID	Task Name
	Capacity Management
OI-0346	SUA Airspace Management - Level 1 Real-time Scheduling Information
OI-0310	Improved General Aviation Access to Traverse Terminal Areas
OI-0350	Flexible Routing
OI-0351	Airspace Reconfiguration - Level 1 Limited Dynamic En Route
OI-0361	Flexible Resource Allocation for Airspace Management
OI-0307	Airspace Reconfiguration - Level 2 Limited Dynamic Arrival/Departure
OI-0337	Flow Corridors - Level 1 Static
OI-0367	Airspace Reconfiguration - Level 3 Dynamic En Route
OI-0365	SUA Airspace Management - Level 2 Improved Coordination
OI-0366	Dynamic Airspace Reclassification
OI-0342	Airspace Reconfiguration - Level 4 Dynamic Arrival/Departure
OI-0368	Flow Corridors - Level 2 Dynamic



- **Definition – A change in operations that produces a beneficial result and moves the air transportation system toward the 2025 NextGen Goals and Objectives**
- **~ 130 OIs are grouped to describe the *operational* transition path toward the future**
- **OI roadmaps span the strategies and key capabilities described in the Integrated Plan**

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Enterprise Architecture

- Federal Enterprise Architecture Framework (FEAF) and extensions for air transportation
- Department of Defense Architecture Framework (DODAF) – selected and tailored operational, system, and technology views
- Federal Transition Framework (FTF) – Air Transportation Line of Business proposal

- Tool to relate and integrate NextGen Federal agency and private sector efforts
  - Planning, portfolio management, and system acquisition
  - Key purpose: support OMB investment decision process
- Models to describe the NAS from operational, information, systems, technology, and performance perspectives

Determine Program and Research Needs

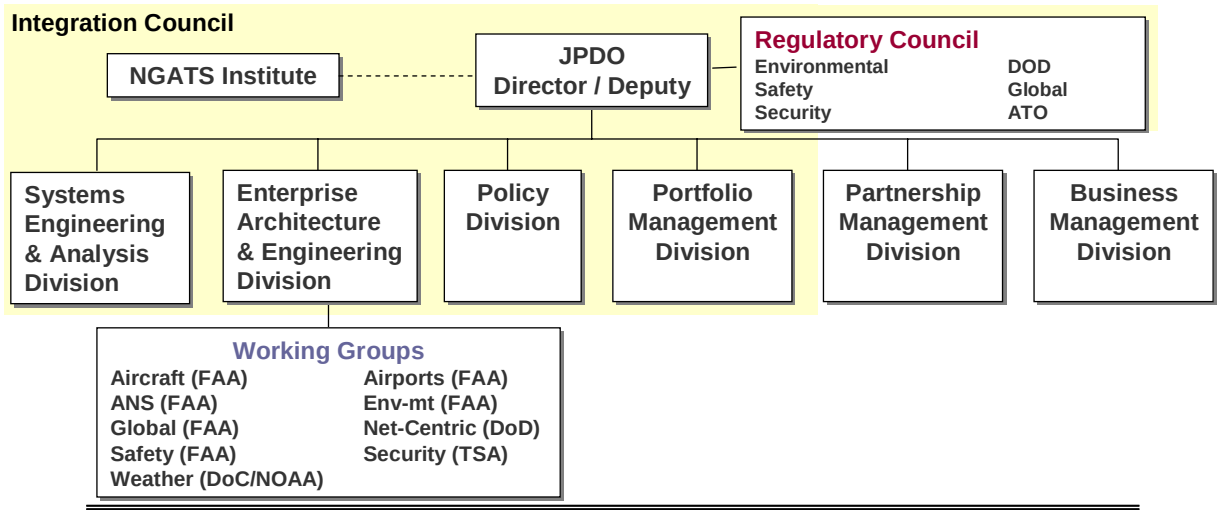
- JPDO working with government agencies and private sector to determine program and research needs
  - Considers agency specific strategic plans
- CONOPS has top-level research issues
- FY09 to FY13 Research and Development Plan developed to support budget formulation
- Demonstrations identified to assess operational concepts, system implementations, or technologies

Define and Implement Incremental Solutions

- Full range of DOTMLPF solutions applies across public and private sectors
- Policy issues addressed in an integrated manner
  - Examples: surveillance integration, navigation system backup, and equipage for required performance
- Portfolio management
  - Investments selection (program and research)
  - Collaborative effort among stakeholders, including the agencies, and OMB
  - Business case includes benefits and costs
  - "Portfolio" view is needed to justify investments contributing to OIs – not a program by program view

- NextGen Integrated Work Plan
  - Time phased plan consolidating OI roadmaps, research plans, policy needs, and other implementation supporting material
- Agencies and private sector implement; JPDO monitors and assess progress, including performance and cost

JPDO Organization



Governance

- Senior Policy Committee
- Board of Directors

Advisors

- REDAC Executive Committee
- Institute Management Council

Inter-Agency Coordination

- Joint Architecture & Engineering Board

- Government leadership reflects participation from NextGen agencies
- Organization tailored to achieve enterprise transformation
- JPDO includes government, contractor, and Federally Funded Research and Development Center (FFRDC) managers and staff
- Working Groups responsible for domain-specific products
  - Include government, NextGen Institute, and FFRDC members
- Multilevel governance includes cabinet level leadership (SPC)

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NextGen Stakeholder Participation

Stakeholder	Roles and Responsibilities
Agencies	Develop and review overarching products, conduct government research, and implement government programs
Private sector	Develop and review overarching products, conduct private sector research, and implement private sector programs
Office of Management and Budget	Review NextGen EA and review of NextGen Business Case
Congress and Government Accountability Office	Conduct review of NextGen progress reports and selected products, and review of JPDO effectiveness
Department Inspectors General	Conduct review of JPDO effectiveness

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Lessons Learned

- **Governance must be established early to ensure the roles and responsibilities of participating government organizations and industry stakeholders are clearly defined and described**
  - **Boundaries and activities which delineate the "who does what"**
  - **Scope and depth of the interoperability required between multiple agencies' and industry, various activities and systems/applications**
  - **Information exchange required among participants**

- **JPDO could not reuse existing single agency processes and products without changes to plan and oversee implementation of NextGen**
  - **Single agency coordination processes and products were not sufficient to address mission needs, although most came from the participating agencies themselves**
  - **Need to consider public-private partnership, multi-agency operations, cross agency investments, and long term planning horizon influence**

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Lessons Learned

- **Multi-agency organizations require a common way to describe key aspects of cross agency planning**
  - **Common products and process flow**
  - **Level of detail varies by area – overlap with agency products expected**
  - **Concerns differs across stakeholders – White House, Congress, industry groups, etc.**
  - **Visibility into evolving products needed while protecting sensitive information**
- **JPDO continues to deal with complexity that increases with scope, diversity of stakeholders, time horizon, applicable technologies, policy areas, etc. – more complex than single agency effort**
  - **Processes continue to evolve to achieve the products that are understandable by the various agencies and industry**
  - **Long time horizon means that "design space" will not close until R&D complete**
- **Public-private partnerships require government and industry leadership and staffing**
  - **Work groups have government and private sector co-leads and participation**
  - **Industry representatives are members of the Integration Council**

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Summary

- **NextGen is a pathfinder for addressing large scale, multi-agency enterprise system engineering challenges**
  - **Joint and sometimes conflicting missions**
  - **Transformation of services**
  - **Reducing costs for government, industry and the public**
- **Multi-agency and public-private efforts involve higher complexity and additional products and processes compared to single agency programs**
- **Progress depends on satisfying multiple stakeholders while maintaining focus on most important products and impacts**

For More Information

- **Joint Planning and Development Office:**
  - http://www.jpdo.gov
- **NGATS Institute:**
  - http://www.ncat.com/ngats/index.html