Air Traffic Organization
Operation Planning Services (ATO-P)

Federal Aviation Administration

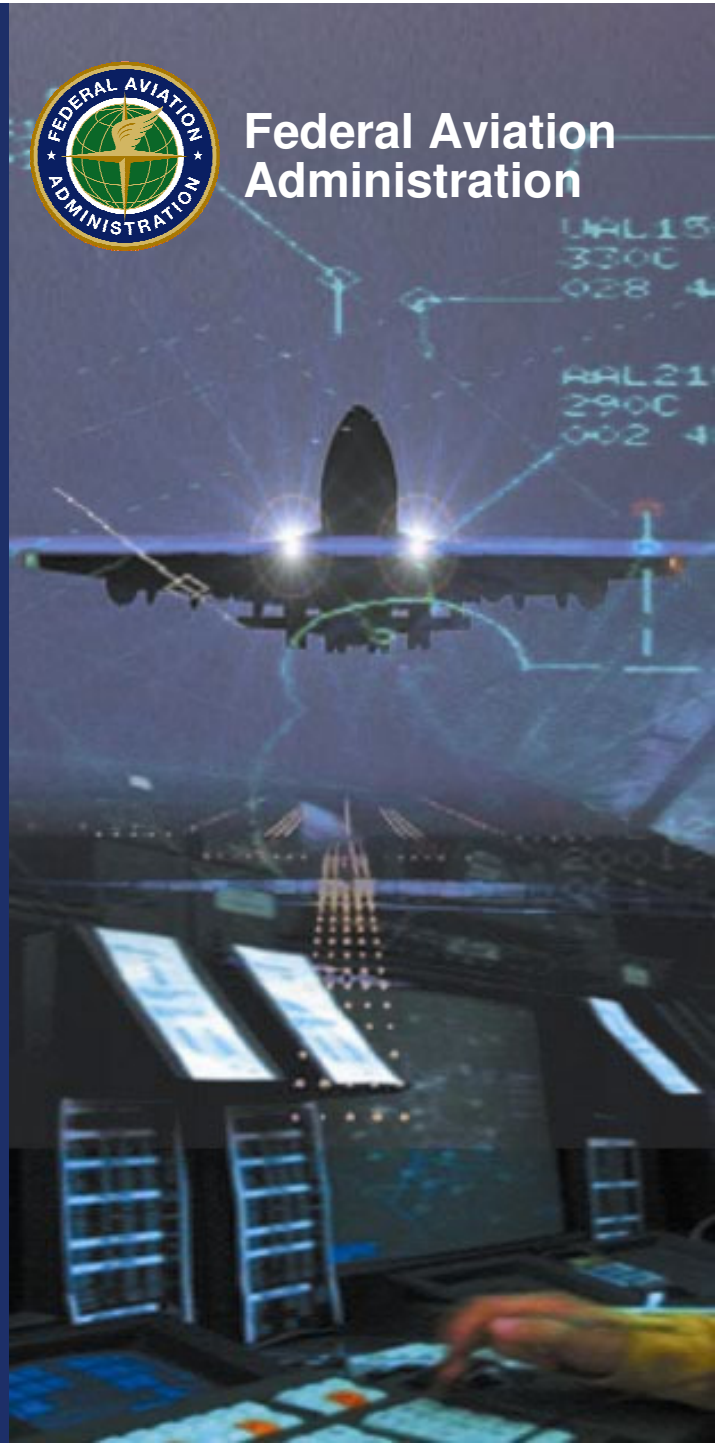
NextGen

Overview Briefing

Presented To: NAS Performance Workshop

Presented By:
Barry Scott, Acting Director ATO-P R&TD

Date:
September 5, 2007

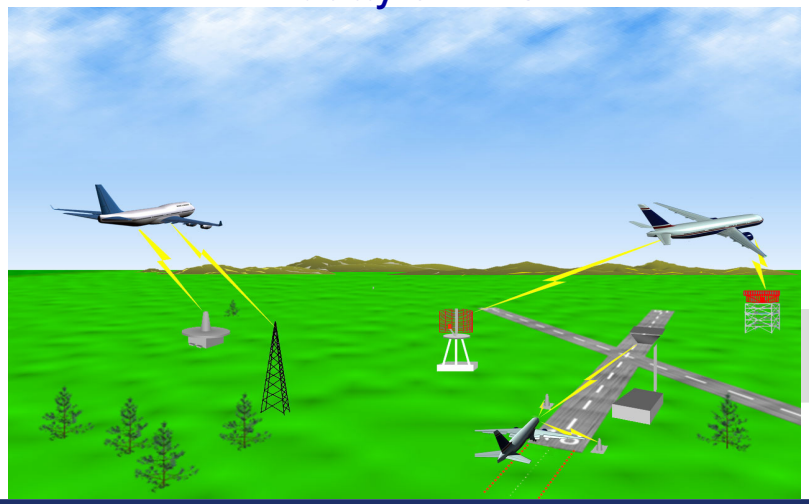


NextGen… "What is it?"

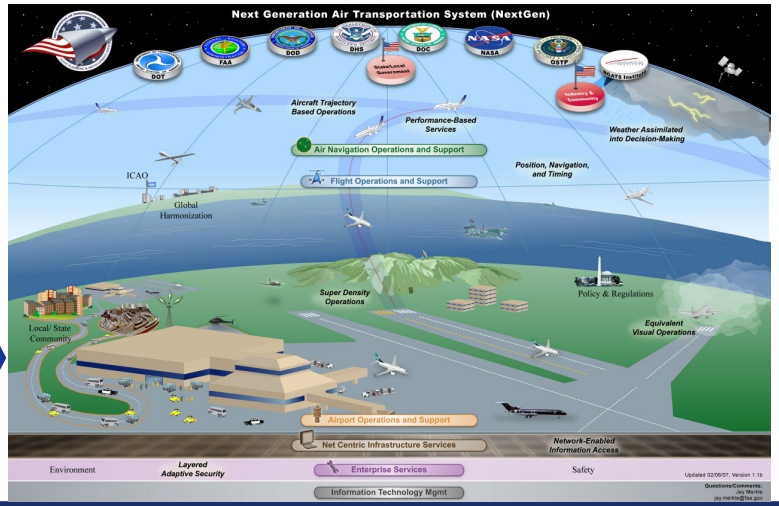
- Ground-based Technology
- Dependent on human interface and decisions
- Limited use of automation
- Single channel voice control
- Aging Infrastructure

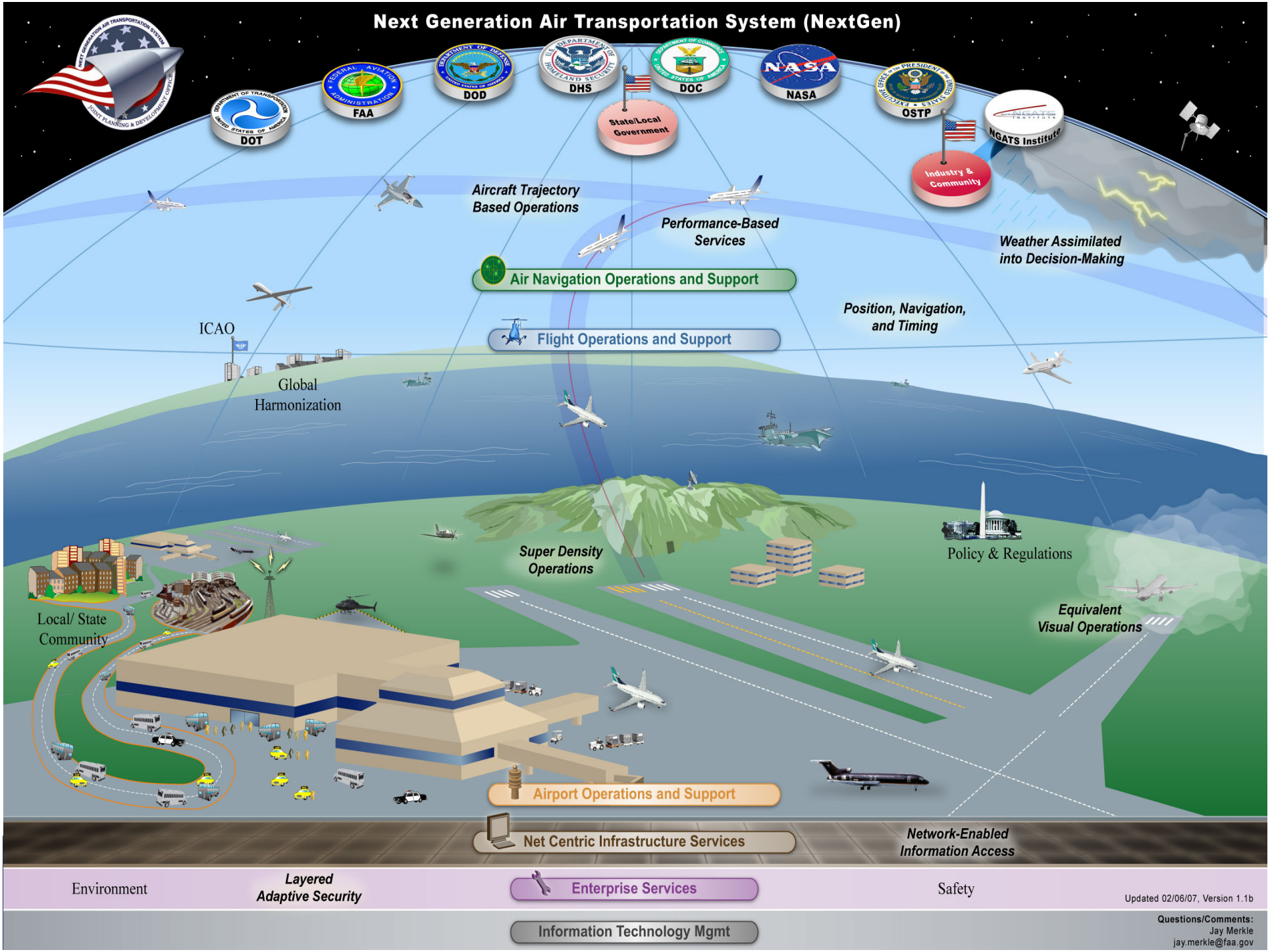
- Net Centric Environment
- Trajectory Based Operations
- Performance Based Services

Today's NAS

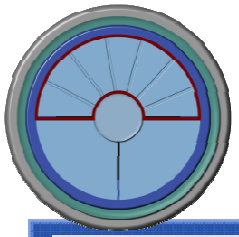


Year 2025




Next Generation Air Transportation System (NextGen)
DOT
FAA
DOD
DHS
DOC
NASA
OSTP
State/Local Government
NGATS Institute
Industry & Community
Aircraft Trajectory Based Operations
Performance-Based Services
Weather Assimilated into Decision-Making
Air Navigation Operations and Support
Position, Navigation, and Timing
Flight Operations and Support
ICAO
Global Harmonization
Super Density Operations
Policy & Regulations
Local/ State Community
Equivalent Visual Operations
Airport Operations and Support
Net Centric Infrastructure Services
Network-Enabled Information Access
Environment
Layered Adaptive Security
Enterprise Services
Safety
Information Technology Mgmt
Updated 02/06/07, Version 1.1b
Questions/Comments:
Jay Merkle
jay.merkle@faa.gov

NextGen Capabilities



NextGen Transformational Programs

- ERAM
- STARS/CARTS
- ADS-B
- TMA
- TFM-M
- SWIM
- DATA Comm
- Precision Navigation
- Network Enabled Weather

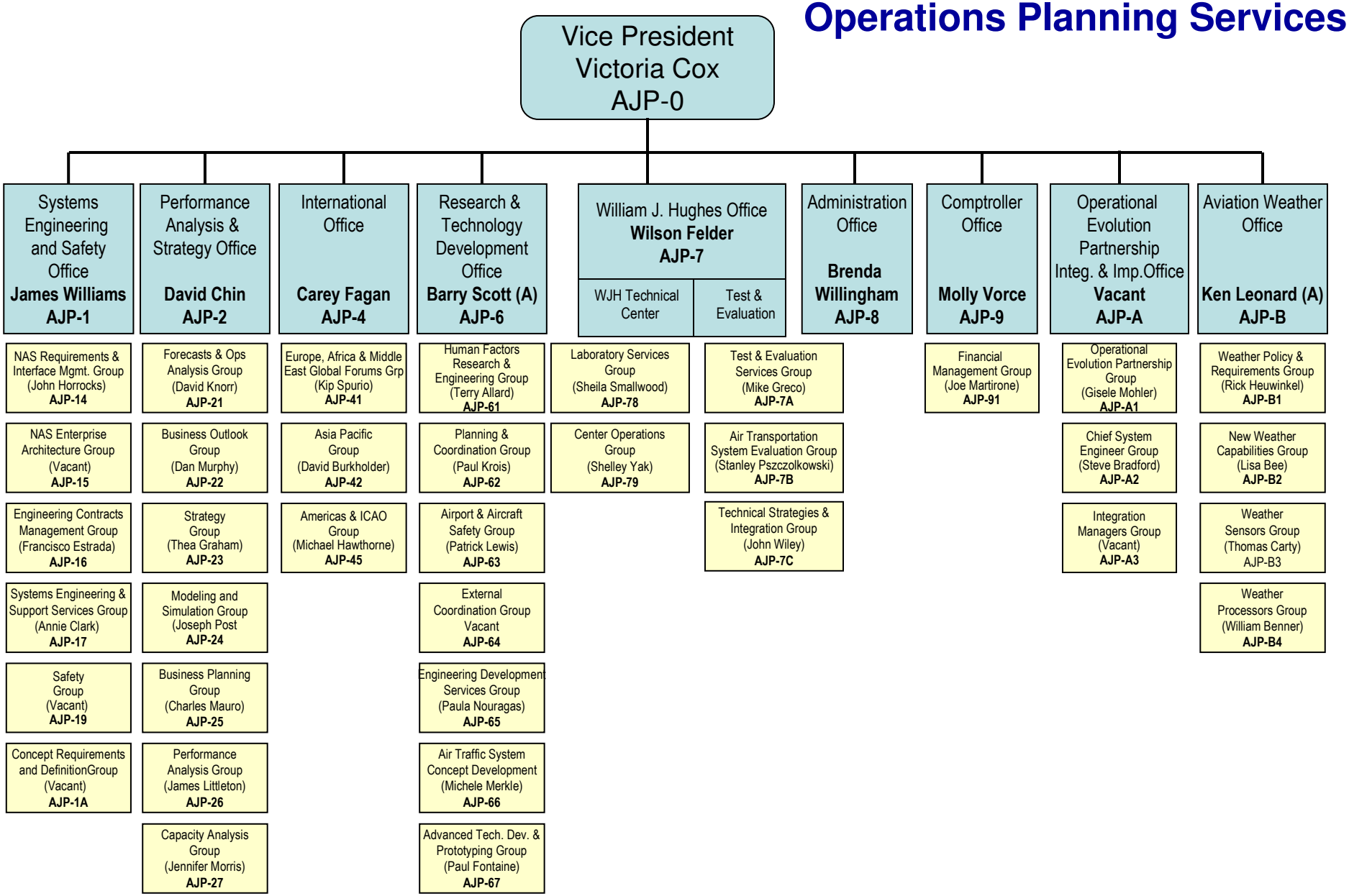
Mid Term Capabilities (2012-2018)

- ERAM Enhancements
  - Automated Problem Resolution
- Concept Demonstrations
  - Trajectory Based Ops/High Density
- Infrastructure – Trajectory Based Ops
  - Time Based Metering
- TFM-M Enhancements
  - Time-Based Metering
- RNP/RNAV Expansion
  - Precise Navigation
- Data Communications
  - Flight Intent Downlink
- ADS-B
  - Aircraft Separation
- SWIM/Net-Enabled Weather
  - Net-Centric Information Sharing

Next Gen 2025 and Beyond

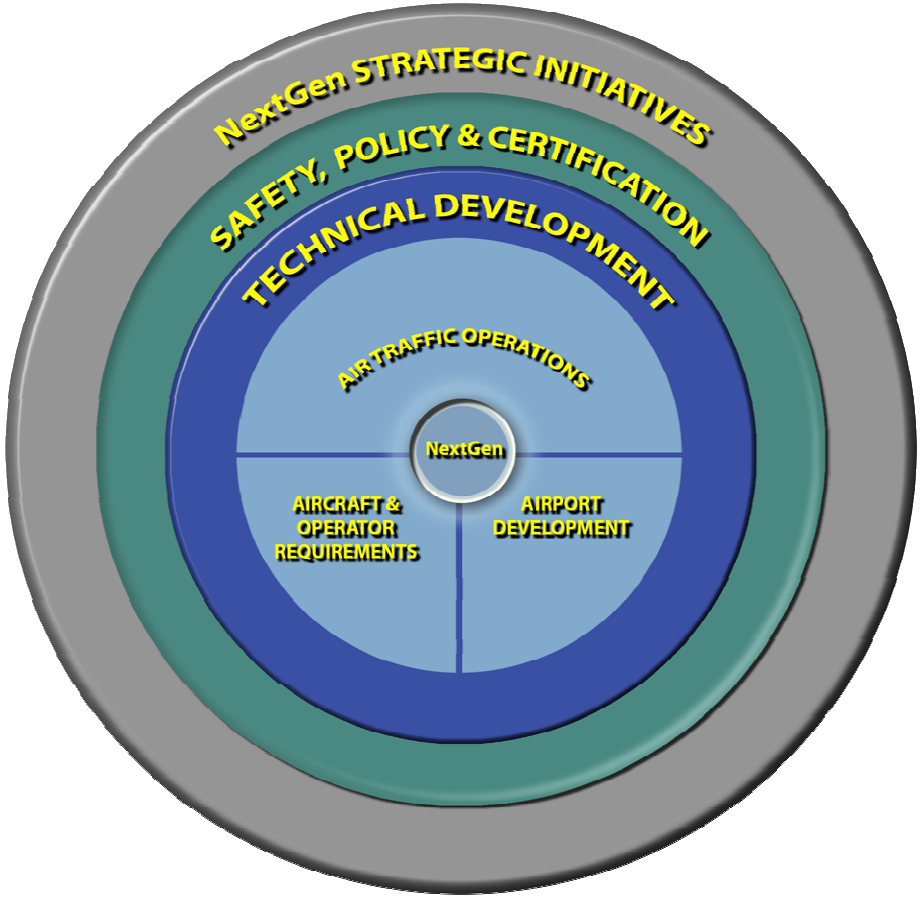
- Initiate Trajectory Based Operations
- Increase Arrivals/Departures at High Density Airports
- Increase Flexibility in the Terminal Environment
- Improve Collaborative ATM
- Reduce Weather Impact
- Increase Safety, Security, and Environmental Performance
- Transform Facilities

Operations Planning Services



Operational Evolution Partnership (OEP)

Domains



- **Air Traffic Operations**

  ATO-wide activities necessary to accomplish the FAA NextGen capabilities

- **Airport Development**

  Surface Capacity Enhancements and Reduced Delays

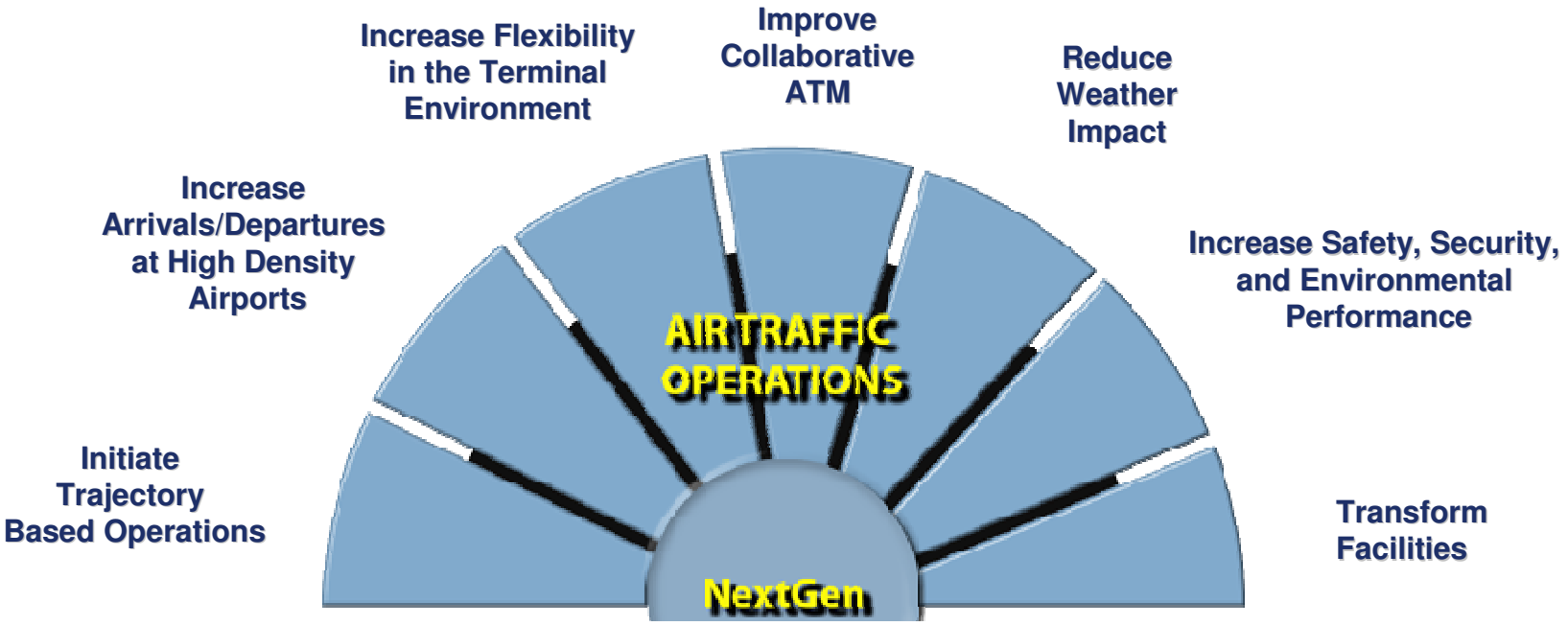
- **Aircraft & Operator Requirements**

  Define Aircraft roadmap with focus on standards, policy, etc. to implement an integrated Avionic approach for the NextGen aircraft

Slide 6

js3 Change to correct logo
OEP, 2/21/2007

OEP
Air Traffic Operations Solution Sets

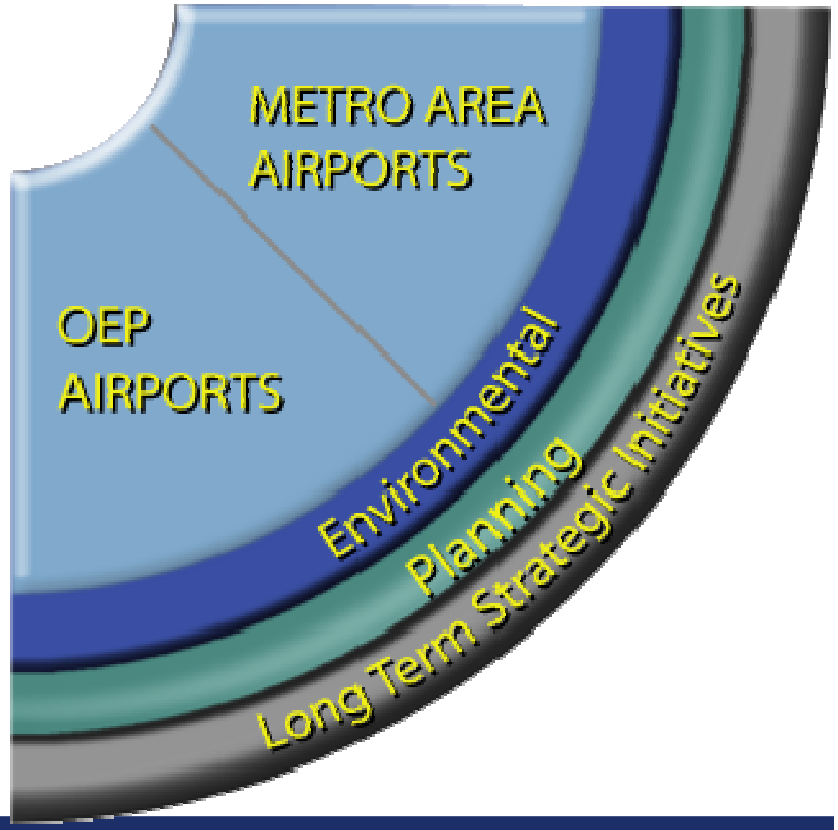


OEP

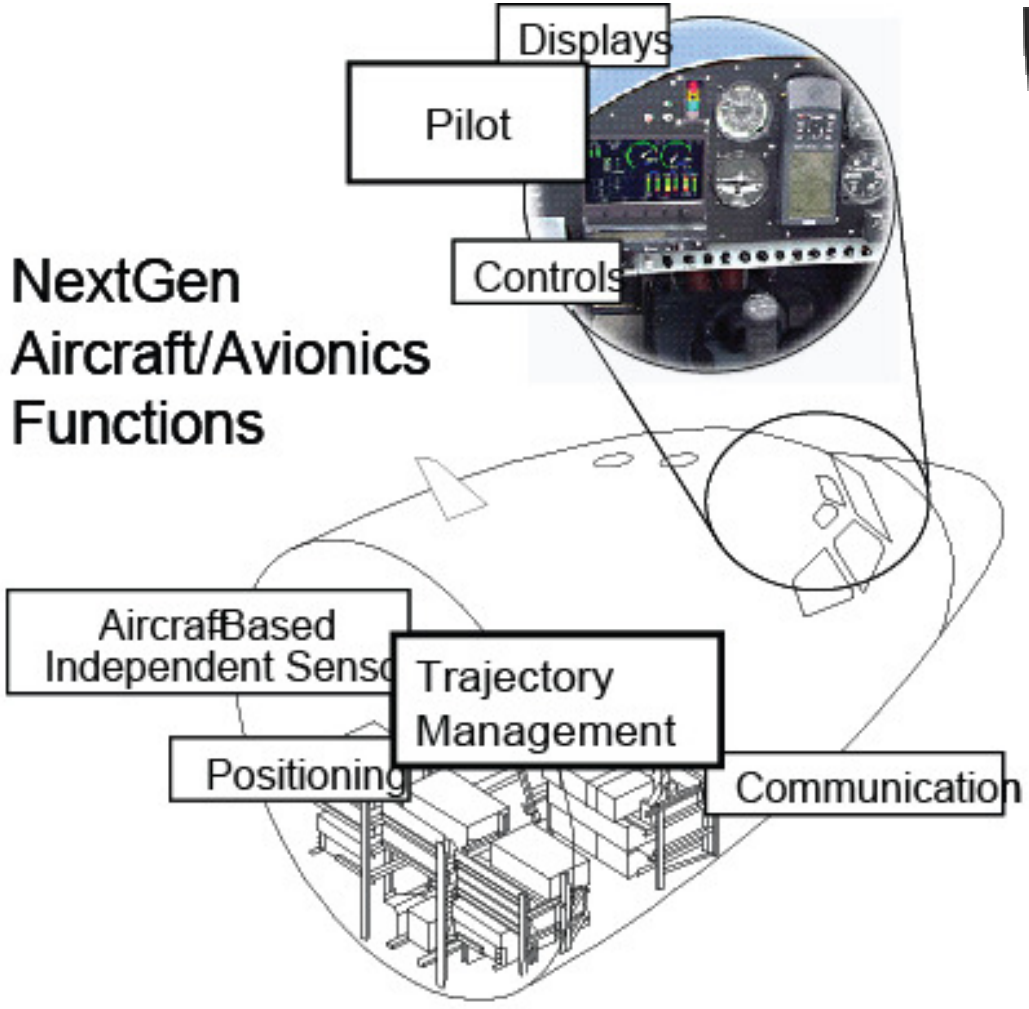
Airport Development Domain

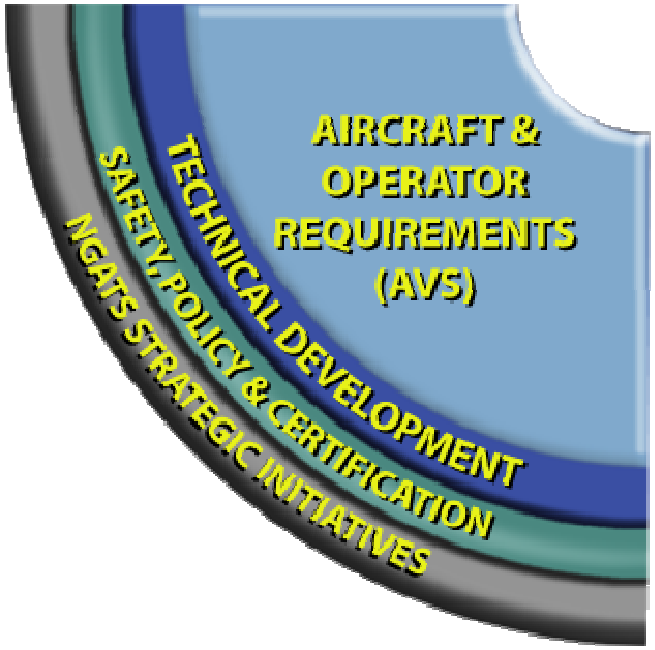
Focus: **Surface capacity enhancements and delay reduction.**

- 2 Core Wedges
  - **OEP Airports (35)**
  - **Metropolitan Regions (15)**
- 3 Rings
  - **Long Term Strategic Initiatives**
  - **Planning**
  - **Environmental**



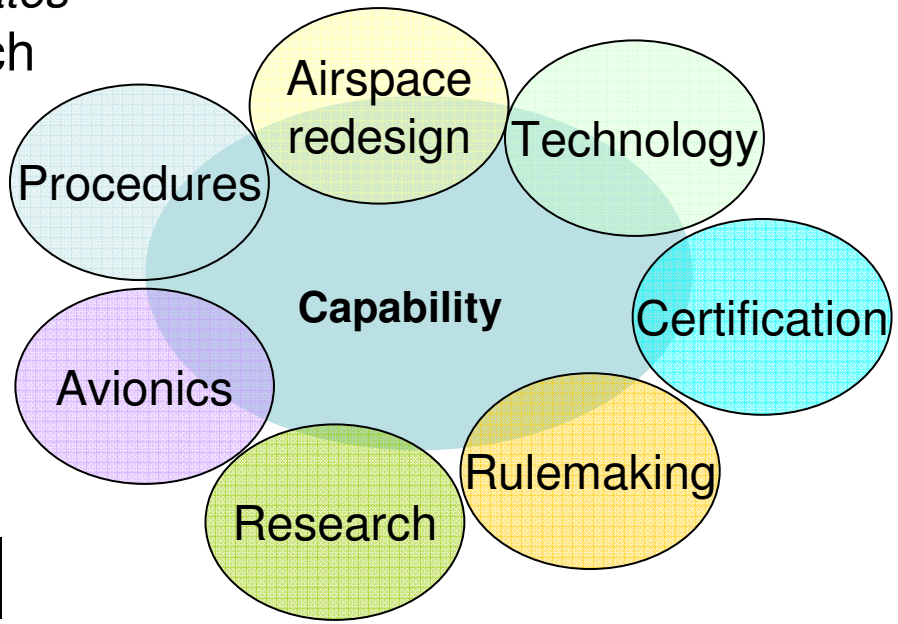
OEP
Aircraft & Operator Requirements Domain





How is NextGen connected to the New OEP?

- FAA's NextGen implementation framework
  JPDO Concept → EA Roadmaps → Capability Commitments
- Integration & Implementation tracking and reporting
- FAA Agency-wide NextGen planning
- FAA Portfolio Optimization and Decisions
  OEP Review Board → OEP Associates
- Industry coordination and outreach



OEP Version 1 was published in June 2007

NextGen Investment Portfolio

FY 08–FY 12
$ 4.6 Billion

	FY08	FY09	FY10	FY11	FY12	Total
Total Capital	2,462	2,959	3,115	3,353	3,506	15,395
NextGen Capital Portfolio	173	653	957	1,256	1,295	4,334
Total RE&D	140	191	190	194	196	911
NextGen RE&D Portfolio	63	63	62	64	65	317
Total NextGen *(Capital + RE&D)*	**236**	**716**	**1,019**	**1,320**	**1,360**	**4,651**

($ Millions)

FY 2008 NextGen R,E&D Programs

▪ Initiatives	
▪ Wake	$7,689,000
▪ Air Traffic Control/Technical Operations Human Factors	$1,000,000
▪ Flightdeck/Maintenance HF	$1,000,000
▪ Base Program Contributors	
▪ Environment and Energy	$15,469,000
▪ Weather Program	$16,888,000
▪ Unmanned Aircraft Systems	$ 3,310,000
▪ JPDO	$14,321,000
▪ Wake	$ 3,066,000
Total:	$62,743,000

NextGen Capital Investments

FY0 8-FY 12

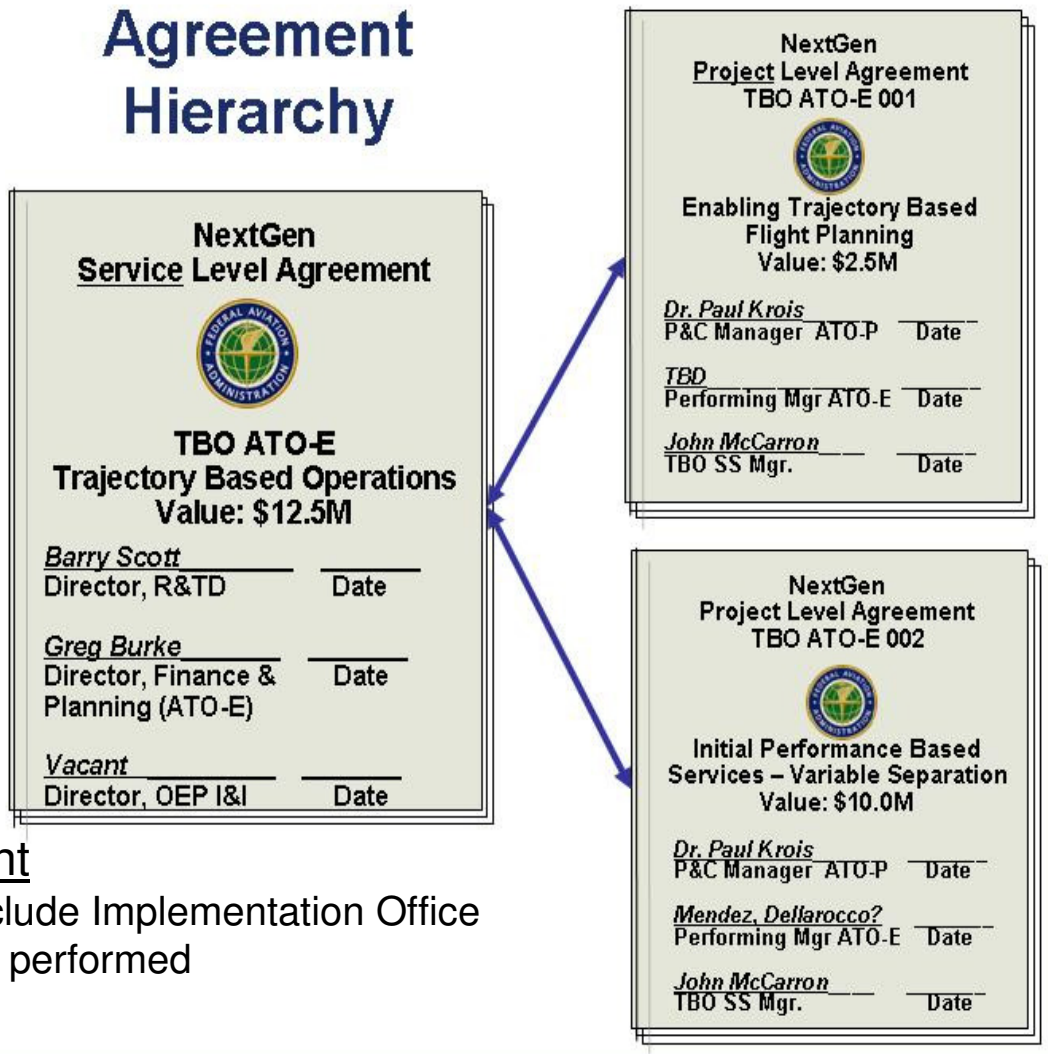
	FY08	FY09	FY10	FY11	FY12	Total
ADS-B	85	93	140	156	91	**564**
SWIM	21	31	31	38	52	**173**
NextGen Data Communications	7	15	29	37	38	**126**
NextGen Network Enabled Weather	7	20	25	25	25	**102**
NAS Voice Switch	3	14	40	50	50	**157**
NextGen Demonstrations and Infrastructure Development	50	30	30	30	30	**170**
Future NextGen		450	662	921	1009	**3042**
Total	**173**	**653**	**957**	**1256**	**1295**	**4334**

($ Millions)

NextGen Portfolio Management Process

- **Portfolio Accountability**
  - Establish a Portfolio Management process to ensure fiscal and programmatic accountability
  - Robust process that will integrate with current program and financial planning and management practices
- **Process Considerations**
  - Develop products that align with Solution Set / Domain Requirements / Capabilities / Enterprise Architecture
  - Ensure accountability for performance related to funding and milestones
  - Define portfolio management metrics
  - Establish and maintain a portfolio performance reporting capability

NextGen Portfolio Management Process Documents:



NextGen Service Level Agreement

Director Level Agreement – to include Implementation Office
High level definition of work to be performed

Project Level Agreement

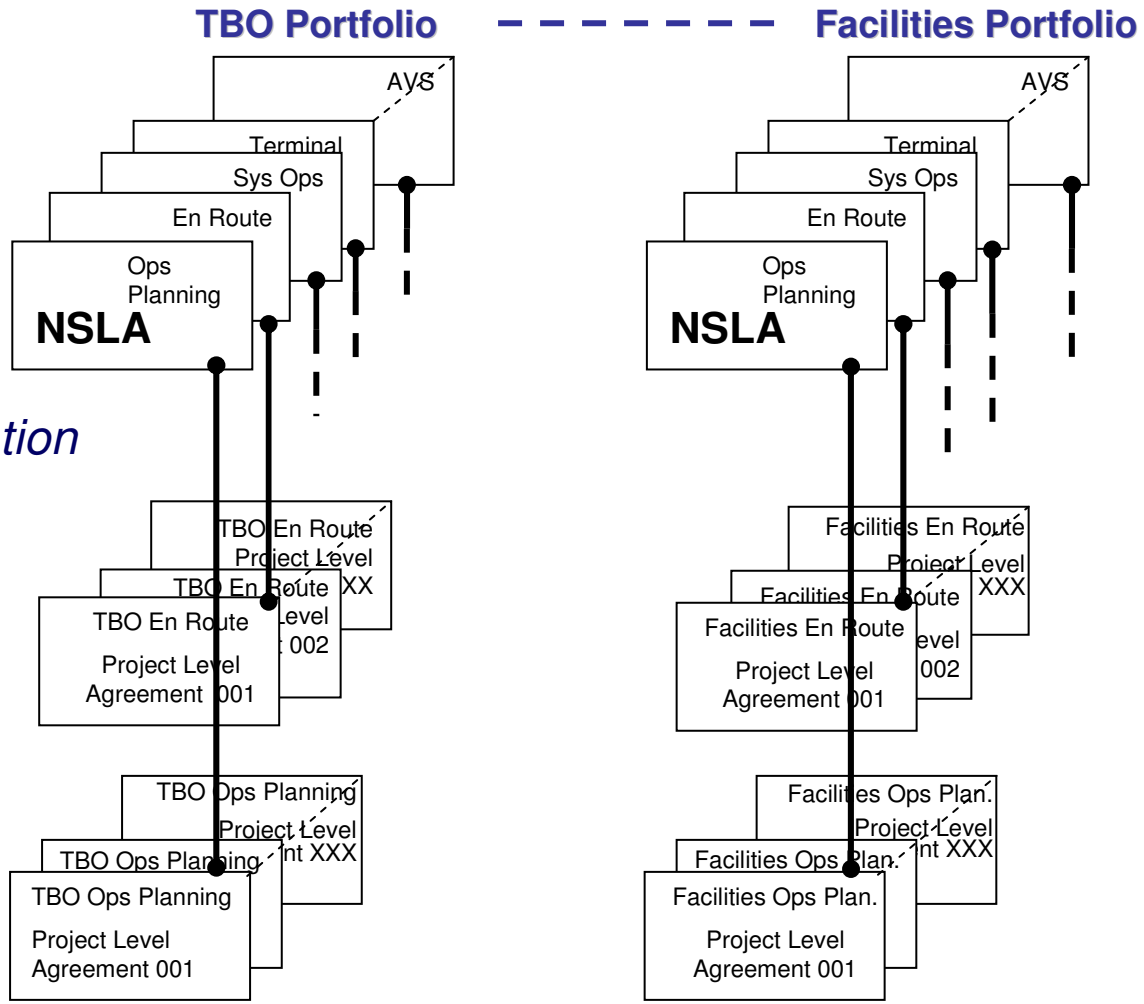
Project Manager Level Agreement – to include Implementation Office
Detailed description of milestones, funding, spend plan, etc.

Notional

NextGen Service Level Agreement (NSLA)

Hierarchy and Relationships

- Portfolio Management
  - *By Solution Set*
  - *By Service Unit/Organization*
- Project Funding
- Schedule
- Milestones
  - *Tracking/Reporting*
- Metrics
  - *SMP, OEP, Flight Plan*



FY2008 NextGen Service Level Agreements

Service Unit	Solution Set	Project	Budget
ATO-P	Trajectory Based Operations	Oceanic Trajectory Based Operations Demo	$4,800,00
		People in TBO	$4,000,000
		Enabling Trajectory-Based Flight Planning	$10,000,000
	High Density Arrivals and Departures	High Density Airport Time-based RNAV/RNP Demo	$4,600,000
		Accelerate TBO on Airport Surface	$5,000,000
	Flexible Terminals and Airports	ATC Human Factors	$921,000
		Flight Deck Human Factors	$921,000
		Wake Vortex	$7,370,000
	Weather	NextGen Network Enabled Weather	$7,000,000
ATO-R	High Density Arrivals and Departures	Accelerate Transition of TMA to TBO	$4,000,000
	Collaborative ATM	Accelerate Deployment of C-ATM Capabilities	$4,100,000
ATO-E	Trajectory Based Operations	Initial Performance Based Services – Variable Separation	$10,000,000

Next Steps *& Way Forward*

- Execute FY 08 NextGen Portfolio
- *Establish research contributions to EA roadmap key decisions*
- *Assess needs for labs*
- *Assess needs for engineers, contract specialists*
- Prepare for FY '09 NextGen Portfolio
  - Planning!! - Activities, Costs, Acquisition Strategy, etc.
  - Develop a NextGen Portfolio Management Process the works for the whole ATO.
  - Establish standard NextGen Portfolio Management tools and reports.
- How can we work together to get ready for NextGen?

The road to NextGen … ***October 1, 2008!!!***

FY08 R,E&D NextGen Initiatives

- BACKUP

FY 2008 R,E&D NextGen Initiatives

- Flightdeck/Maintenance/System Integration Human Factors**: Human-automation integration activities necessary to ensure intended capacity benefits from NextGen:**
  - Determine information requirements necessary to accomplish self-spacing, passing, and merging in en route airspace
  - Identify certification and operational approval issues and requirements necessary to ensure timely and efficient implementation of self-spacing, merging, and passing in en route airspace
  - Identify human error risks associated with the new operations and develop appropriate mitigation strategies
  - Determine which functions (self-spacing, merging, and passing) are best accomplished by automation and which are best done by humans
  - Develop research plans for initial air-ground integration simulations to quantify human performance in terms of workload, situational awareness, and task performance at increasing capacity levels and in mixed equipage environments

FY 2008 R,E&D NextGen Initiatives

- Air Traffic Control/Technical Operations Human Factors**: The NextGen Concept of Operations introduces Automated Virtual Towers (AVT) and Staffed Virtual Towers (SVT) as a method to use automation to increase services, increase capacity in response to changes in demand, and decrease the cost of air traffic services. The research will:**
  - Perform an analysis to determine the level of service needed at airports served by virtual towers
  - Determine the air-ground integration issues to assure that aircraft and airmen can operate successfully and safely in the virtual tower environment
  - Develop the advanced workstation concept for virtual towers to assure that the service provider has the appropriate information to provide the required level of service and safety at the remote airport.
  - Plan and prepare for simulations of virtual tower concepts to determine the displays, controls, communication needs, surveillance information, and flight data information required
  - Determine the weather information requirements and display needs to assure that aircraft avoid hazards

FY 2008 R,E&D NextGen Initiatives

- Wake Turbulence: **The FAA will begin developing the capabilities needed to make wake separation requirements supportive of NextGen operations:**
  - Develop wind prediction algorithm as part of development of a ground based decision support tool for approaches of 757 and “heavy” category aircraft to closely spaced parallel runways
  - Develop approach for establishing the criteria for defining a “wake free” zone
  - Determine ground and aircraft based situational display concepts relative to separation constraints (wake, weather, and visibility)
  - Initiate development of approach to evaluate system-wide safety risk for new separation standards
  - Initiate development of recommendations for new separation standards and procedures based on improved communication, navigation, surveillance, and aircraft performance capabilities within the constraints of aircraft generated wake vortices, weather, and visibility
  - Develop enhanced analysis tools for evaluating the potential of wake turbulence encounters resulting from the design of airspace efficient routes, air traffic control procedure changes, and the introduction of new aircraft designs

FY 2008 NextGen R,E&D Contributors

- Joint Planning and Development Office
- Wake Turbulence
- Unmanned Aircraft Systems
- Weather
- Environment and Energy

NextGen R,E&D Contributors:
Joint Planning and Development Office

- Mission: **Assisting agencies in development and implementation of the Next Generation Air Transportation System with the goals of increasing the capacity, security, safety, and efficiency and reducing the environmental impact of the air transportation system.**
- FY 2008 Request: **$14,321,000**

NextGen R,E&D Contributors: JPDO

- Challenge: **By 2025, triple current capacity in selected areas; reduce curb-to-curb transit time by 30%; reduce system operating costs by 25%; provide for 95% on-time arrivals and departures by minimizing weather impacts and other disruptions; integrate capabilities across federal agencies and industry**
- Near-Term Goals:
  - FY 2009:
    - Based on research results, assist agencies in deploying critical infrastructure
    - Establish policy for aircraft equipage rules
    - Initiate research in key areas such as 4-dimensional trajectories (4-DT), space-based NAV, RNP/RNAV, and decision support tools
  - FY 2010-2011: Continue research on 4-DT management, roles of pilots and controllers, etc
  - FY 2012: Initiate research in Super Density Operations and identify alternatives
- FY 2008 Plans:
  - Coordinate, validate, and begin implementation of early opportunity projects and identify new opportunities
  - Coordinate aviation and aeronautics research programs

NextGen R,E&D Contributors: Wake

- Mission: **Mission: Develop wake turbulence mitigation procedures for all domains of flight**
- FY 2008 Request: **$3,066,000 (in addition to the NextGen initiative)**
- Challenges**:**
  - Increase airport and terminal airspace capacity during inclement weather
  - Reduce separation through integration of wake turbulence separation minima modifications and contributions from the other elements of Required Total System Performance (surveillance, navigation, communications, etc)

NextGen R,E&D Contributors: Wake

- Near-Term Goals:
  - FY 2010: Determine air traffic control situational display concepts required for implementation of the NextGen "Super Density Operations" concept
  - FY 2011: Determine the infrastructure requirements for safely implementing the NextGen "Super Density Operations" concept within the constraint of aircraft generated wake turbulence
- FY 2008 Plans:
  - Continue development of enhanced suite of wake turbulence encounter evaluation tools
  - Develop a national change to Air Traffic Order 7110.65 as it applies to the use of closely spaced parallel runways for dependent ILS approach operations
  - Develop airport specific procedure modifications to enable use of closely spaced parallel runways for dependent ILS approach operations
  - Develop ground- and aircraft-based air traffic management wake mitigation concepts (with EUROCONTROL) and decision support tool capability requirements that include integration of weather information

NextGen R,E&D Contributors: Unmanned Aircraft Systems (UAS)

- Mission: **Integrate UAS safely into the national airspace system**
- FY 2008 Request: **$3,310,000**
- Challenge**: Provide technical information necessary to implement new UAS certification procedures, airworthiness standards, and operational requirements**
- Near-Term Goals**:**
  - FY 2009: Determine performance characteristics and operational requirements for detect, sense, and avoid (DSA) technologies
  - FY 2010: Analyze data on the safety implications of system performance impediments to command, control, and communications (C3) in different classes of airspace and operational environments
  - FY 2012: Conduct field evaluations of UAS technologies in an operational environment, including DSA, C3, and flight termination technologies
- FY 2008 Plans**:**
  - Complete UAS overall technology survey with support documentation and data
  - Complete the risk-based system safety study of potential hazards of UAS operations in the NAS, determine severities, analyze mitigation strategies, and make safety recommendations

NextGen R,E&D Contributors: Weather

- Mission: **Develop aviation weather algorithms to enhance safety, capacity, and efficiency**
- FY 2008 Request: **$16,888,000**
- Program Elements
  - In-Flight Icing
  - Turbulence
  - Ceiling and Visibility
  - Convective Weather
  - Oceanic Weather
  - Weather in the Cockpit
- Challenges**:**
  - Turbulence causes an estimated $200 million per year in passenger and crew injuries, flight delays, rerouting of aircraft, and aircraft damage
  - Icing causes, on average, 25 accidents and $100 million per year in damage to general aviation and small commuter aircraft
  - Convective weather (thunderstorms) cause 75% of warm season cancellations and delays and results in $22 million per year in injuries, fatalities, and aircraft damage

NextGen R,E&D Contributors: Weather

- Near-Term Goals:
  - FY 2009: Develop a consolidated forecast capability
  - FY 2015: Develop high-glance-value weather products with longer forecast lead times and increased accuracy for turbulence, severe convective activity, icing, and restricted visibility
  - By FY 2015: Employ the aircraft as a node in the National Airspace System. Enable flight deck weather information technologies that allow pilots and aircrews to engage in shared situation awareness and shared responsibilities with controllers, dispatchers, Flight Service Station specialists, pertaining to preflight, en route and post flight aviation safety decisions involving weather.
- FY 2008 Plans:
  - Obtain FAA approval to test flight level winds and volcanic ash products
  - Implement CONUS national ceiling, visibility, and flight category analysis products operationally
  - Demonstrate consolidated weather forecast capability
  - Complete baselining weather products and determine pilot weather information needs in the cockpit

NextGen R,E&D Contributors: Environment and Energy

- Mission: **Provide knowledge, analysis tools and approaches to enable significant reduction of aerospace environmental impact in absolute terms**
- FY 2008 Request: **$15,469,000**
- Program Elements
  - Noise and Emissions Analyses
  - Aircraft Noise Metrics, Mitigation & Control
  - Aviation Emissions Metrics, Mitigation & Control

NextGen R,E&D Contributors: Environment and Energy

Challenges

- Aircraft noise and emissions issues are limiting capacity
  - Local community noise and emissions issues are delaying construction of new runways at major airports needed to increase capacity
  - Over 600 airports have operational constraints
  - Over $300M spent each year to mitigate noise and emissions at U.S. airports
  - Over 25% of commercial airports (80% of top 50 airports) in non-attainment or maintenance areas for national ambient air quality standards
  - Increased concern about aviation related emissions, including climate impact, hazardous air pollutants and particulate matter
- Noise and emissions are interdependent – but we lack tools to assess these interdependencies
  - Environmentally responsible aviation policy and rulemaking must be based on a new, interdisciplinary approach
  - The approach must be made as affordable as it is effective

NextGen R,E&D Contributors: Environment and Energy

- Near-Term Goals:
  - FY 2010: Develop tools and metrics to effectively assess and communicate environmental effects, interrelationships, and economic consequences and inform policymakers on best options:
    - **Environmental Design Space (EDS):** An aircraft systems model that integrates engine and aircraft design with aircraft operations to examine environmental performance
    - **Aviation Environmental Design Tool (AEDT):** A publicly available, regulatory/planning component (Local) and policy component (Global)
    - **Aviation Environmental Portfolio Management Tool (APMT):** The environmental impact and economic analysis capability to be integrated with AEDT and EDS
  - FY 2011: Identify optimized airport, terminal area and en route operations that reduce or mitigate aviation impacts on noise and air quality and enhance fuel efficiency and reduce emissions

NextGen R,E&D Contributors: Environment and Energy

- Examples of FY 2008 Plans:
  - Deliver Environmental Design Space and Aviation Environmental Design and Aviation Portfolio Management Tools Version 2.0
  - Work with several airports to implement Continuous Descent Approach for mixed operations.
  - Continue to assess potential benefits of using newly-developed noise and emissions reduction technologies; identify technology and operational goals for long term reduction of aircraft noise and aviation emissions
  - Develop methodologies to quantify and assess the impact of Particulate Matter and Hazardous Air Pollutants (HAPs)
  - Promulgate new procedures and technical guidance for noise certification for aircraft

Issues

- Research needs that the FAA has communicated to NASA and are currently in work.
- Research requirements that have not been addressed for whatever reason.
- FAA perspective on the progress and expectations associated with currently funded NASA research projects of interest to the FAA.
- How will NASA's new approach (return to fundamentals) effect FAA's ability to incorporate new technologies into the NAS?

FAA/NASA Agreements

MOU

A Partnership to achieve goals in Aviation and Space Transportation

MOAs

- **Development & Evaluation of Enhanced Situational Awareness Technologies**
- **Aircraft Noise Reduction Technology**
- **Joint University Research in Air Transportation**
- **Support of FAA R&D Field Offices at NASA Centers**
- **Aeronautical Safety and Human Factors**
- **ATM Research and Technology Development**
- **Wake Turbulence Research & Development**
- **Impact of Aviation Air Emissions on Climate & Global Atmospheric Composition**
- **Aviation Safety & Reporting System (ASRS)**

FAA/NASA Interagency Agreements (Fund Transfers)

- Voice over Internet Protocol Codec Study - Glenn
- Icing Research - Glenn
- Aircraft Material Characterization of Engine Failure Debris - Glen
- Vibration Algorithm Threshold Assessment on Test Rig and Flight Test Data - Glenn

---

- Rotorcraft/Propeller Damage Tolerance - Johnson
- NASGRO - Johnson

- Aircraft Noise Reduction Technology - Langley
- Wire Crimp Tool/Technique - Langley
- Develop Minimum Performance Standards for Airborne Turbulence Detection Systems - Langley

FAA/NASA Interagency Agreements (Fund Transfers) (cont'd)

- **Voluntary Aviation Safety Information Sharing Program** - **Ames**
- **Aviation Safety Reporting System** - **Ames**
- **HUMS – Rotorcraft** - **Ames**
- **Performance Data Analysis Report** - **Ames**
- **Human Factors** - **Ames**
  - *Team Decision Making*
  - *HF in Maintenance of UAS*
  - *Vision Model to Predict Target Detection & Recognition in UAS*
  - *Symbol Identifiability*
  - *HF in Air-Ground Interaction*

Wake Turbulence Research

Before	After
Basic Phenomenology Research (e.g., wake acoustics	**TBD**
Weather and Wake Sensors and Predictors	
Wake Modeling	
Controller Tools	
Safety Analyses	
System Engineering & Integration	
Independent Honest Broker	

Human Factors

Before	After
Accident Investigations	**Air/ground Integration Concept Exploration**
Fatigue Research & Countermeasures	
Flight Deck Training and Checklist Procedures	
Maintenance Human Factors	
Team discussion-making including crew resource management, risk perception & risk management	
Human automation interactions	

Aircraft Safety

Before	After
VASIP/ASIAS ▪ **Technology and Infrastructure Demo**	**FAA – Take over** **NASA – Development of Vulnerability, Data Mining and Trend Analysis Tools**
Fuel Tank Inerting ▪ **Developed High Temp Membrane Separator**	**FAA – Take over**
Hidden Fires ▪ **Develop Fire Detection Sensors with Low False Alarm Rates**	**Industry pick up**
Fire Resistance of Graphite Epoxy Materials	**Industry pick up**
Crashworthiness and Cabin Safety	**FAA picking up some of the work**

Environment and Energy

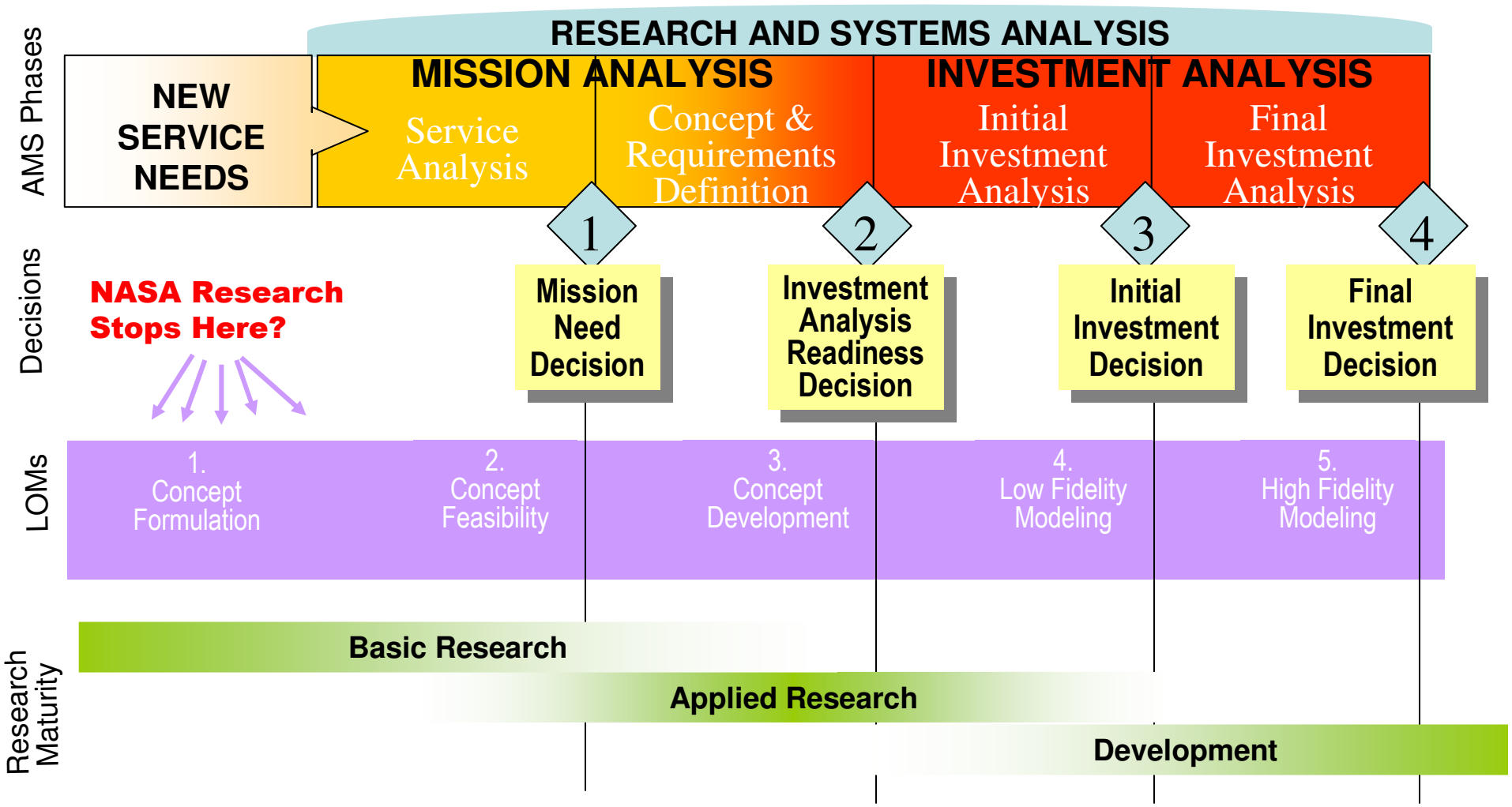
Before	After
Maturing Noise / Emissions Technologies to TRL 6	**FAA Picked up**
Community Noise Impacts	**FAA Picked up**
Characterizing Particulate Matter Hazardous Air Pollutant from Aircraft Engines	**FAA Picked up**
Establishing Aviation Climate Impacts	**FAA Picked Up**

R,E&D 5-Year Outlook, Including NextGen Focus Efforts

Research, Engineering and Development (R,E&D)		2007	2008	2009	2010	2011	2012
A11.a	Fire Research and Safety	6,638	7,350	7,481	7,577	7,788	7,960
A11.b.	Propulsion and Fuel Systems	4,048	4,086	4,139	4,160	4,264	4,336
A11.c.	Advanced Materials/Structural Safety	2,843	2,713	2,746	2,757	2,826	2,871
A11.d.	Atmospheric Hazards/Digital System Safety	3,848	3,574	3,633	3,670	3,770	3,846
A11.e.	Aging Aircraft	18,621	14,931	15,071	15,056	15,397	15,599
A11.f.	Aircraft Catastrophic Failure Prevention Research	1,512	2,202	2,219	2,211	2,259	2,284
A11.g.	Flightdeck/Maintenance/System Integration Human Factors	7,999	9,651	8,751	8,784	9,000	9,146
A11.h.	Aviation Safety Risk Analysis	5,292	9,517	8,581	8,555	8,742	8,845
A11.i.	Air Traffic Control/Technical Operations Human Factors	9,654	10,254	9,468	9,624	9,906	10,147
A11.j.	Aeromedical Research	6,962	6,780	6,959	7,174	7,423	7,671
A11.k.	Weather Program	19,545	16,888	16,919	16,691	16,988	17,069
A11.l.	Unmanned Aircraft Systems Research	1,200	3,310	4,353	4,344	4,441	4,497
A12.a.	Joint Planning and Development Office	18,100	14,321	14,447	14,290	14,559	14,654
A12.b.	Wake Turbulence	3,066	10,755	2,764	2,733	2,784	2,802
A12.c.	GPS Civil Requirements	0	3,600	3,657	3,596	3,656	3,666
A13.a.	Environment and Energy	16,008	15,469	15,547	15,416	15,721	15,850
A14.a.	System Planning and Resource Management	1,234	1,184	1,188	1,174	1,196	1,203
A14.b.	William J. Hughes Technical Center Laboratory Facility	3,430	3,415	3,572	3,667	3,789	3,905
	NextGen Efforts		0	59,505	58,521	59,491	59,649
	TOTAL	**130,000**	**140,000**	**191,000**	**190,000**	**194,000**	**196,000**

Note: Out year numbers for planning purposes only

The NASA Research Gap



The Research phase of the AMS Lifecycle with associated decisions, Level Of Maturity (LOM), Research Maturity is illustrated above. We are currently working with NASA to learn what research and at what LOM will be provided to the FAA.

Trajectory Based Operations

- Description
  - Shift from clearance-based control to trajectory-based operations
  - In the new high-performance ATM environment, aircraft will transmit and receive precise data including routes and times to cross key points in the airspace
- Solution Benefits
  - **Increased customer efficiency** by increasing system precision and enhanced automation that support more efficient use of flight levels so aircraft can more closely fly routes that maximize the airlines' goals for fuel efficiency, aircraft operations, and schedule
  - **Increased safety** since the problem prediction capability will continuously check for problems independent of traffic volume or complexity
  - **Reduced FAA cost/increased controller productivity** due to automation performing routine tasks in both mixed- and high-equipage airspace and supporting problem prediction and resolution

Trajectory Based Operations

FY2009 Highlights

- Assess trajectories used in automation to develop a common trajectory standard
- Trade studies on current avionics capabilities for defining operational requirements
- Pilot/controller roles and responsibilities
  - Develop a human-systems integration process
  - Develop human error management strategies
  - Develop metrics and design requirements for aircraft and ATM systems

Collaborative ATM

- Description
  - Exchange of information to create a mutual understanding among participants of overall objectives and influence decision making among stakeholders
  - Covers strategic and tactical interactions
  - Decisions supported through access to rich information exchange environment
- Solution Benefits
  - **Improved tools** support better assessment of potential impacts of decisions, reducing likelihood of unintended consequences
  - **Improved timing of decisions** provides more information about relevant issues, reduces lead times for implementation, responses can be more specific, and solutions can be more flexible to change
  - **Targeting of information exchange** is clearer to appropriate decision makers, reduces workload and unnecessary actions by those not affected

Collaborative ATM

FY2009 Highlights

- Lower level concept and validation for managing airspace to flow
- Airborne SWIM - Develop proof of concept and assess information exchanges
- Probabilistic Traffic Flow Management to assess information needs and automation requirements
- Strategy and trades for integrating forecast and other weather data into ATM and Flight Operations Center (FOC) decisions and tools

Reduced Weather Impacts

- Description
  - Involves integration of weather into decision support tools, improved forecasts and supporting observations
  - Develop new capabilities to fuse ground-, airborne-, and space-based weather observations and forecasts into a single, national weather information system
- Solution Benefits
  - **Improved weather information accessible to FOCs** will reduce fuel costs and costs of aircraft cancellations and diversions due to unforeseen, adverse weather
  - **Better weather information** will improve safety by enabling pilots and FOCs to plan or re-plan around hazardous weather, and with integration into controller decision tools will improve the quality of decisions and reduce controller workload during bad weather

Reduced Weather Impacts

FY2009 Highlights

- Develop and test a consolidated convective weather forecast capability providing longer forecast lead times and increased accuracy for turbulence, severe convective activity, icing, and restricted visibility
- Human factors issues supporting “weather in the cockpit”
- Concept of use and initial requirements for current and forecast grids of thunderstorms, turbulence, ceiling/visibility, icing, volcanic ash and solar phenomena
- Requirements for NextGen Forecast Engine incorporating probabilistic weather information

High Density Arrivals/Departures

- Description
  - Development of trajectory-based terminal operations and flow management
  - Includes dynamically configurable airspace, development of “equivalent visual” approach procedures, and digital data exchange
- Solution Benefits
  - **Increased capacity and efficiency** at super-density terminal areas
  - **Improved prediction of wheels-off times** for more accurate load prediction for NAS resources
  - **Integrated arrival/departure airspace structure** will reduce arrival delays due to earlier sequencing, expansion of terminal separation standards further from airports, and reduced noise and emissions per flight

High Density Arrivals/Departures

FY2009 Highlights

- Aircraft-based wake separation concepts and analytic benefit models
- Concept of use for wake separation in integrated arrival/departure management assignments
- Requirements for delivering RNAV/RNP instructions via data communications
- Concept of operation for surface management: digital taxi clearance and conformance
- System engineering for multi-center TMA capabilities

Flexible Terminals and Airports

- Description
  - Capability to dynamically change airspace and airports to provide greater capacity, efficiency and safety
  - Flexible surface operations allow access to a wider range of aircraft
  - Taxi operations integrated into aircraft's 4D path allowing the controller to manage flow for streamlined departures
- Solution Benefits
  - Enhanced situation awareness to improve surface management for controllers and pilots
  - Improved usage of runway capacity

Flexible Terminals and Airports

FY2009 Highlights

- Requirements for precision departures and wake
- Concept development and simulation for precision approaches (LAAS)
- System engineering for terminal, tower and surface systems (Runway Status Lights, electronic flight strips, etc.)
- Evaluate required tower service levels to develop virtual tower performance criteria

Safety, Security, & Environment

- Description
  - Safety – Integrating and sharing high-quality, relevant and timely aviation safety information
  - Environment – Managing and mitigating impacts from increased traffic
  - Security – Each security partner has a user-defined operating picture based on common information shared rapidly and securely
- Solution Benefits
  - **Safety** – NextGen implementation of an integrated safety management system
  - **Environment** – Procedures that mitigate impacts by lowering noise and engine emissions, and saving fuel
  - **Security –** Improved situation awareness

Safety, Security, & Environment

FY2009 Highlights

- Automated tools for Aviation Safety Information Analysis and Sharing (ASIAS) for monitoring safety issues
- Risk management concepts, models and tools
- Tools to reduce aircraft noise and emissions
- Continuous Low Energy, Emission and Noise (CLEEN) Consortium for quieter, cleaner aircraft
- FY09 F&E request focus on security (tools, information security)

Transform Facilities

- Description
  - Improvements in resource management including allocation of staffing and facilities to provide services, use of more cost-effective and flexible systems for information sharing and back-up, and management and training for human assets
- Solution Benefits
  - **Increased cost-effectiveness** better matches assets to demand with reduced need for local surge buffers

Transform Facilities

FY2009 Highlights

- Future communications for network facilities
- Strategy development for future facilities planning

Paths for Transitioning OEP Outer Rings

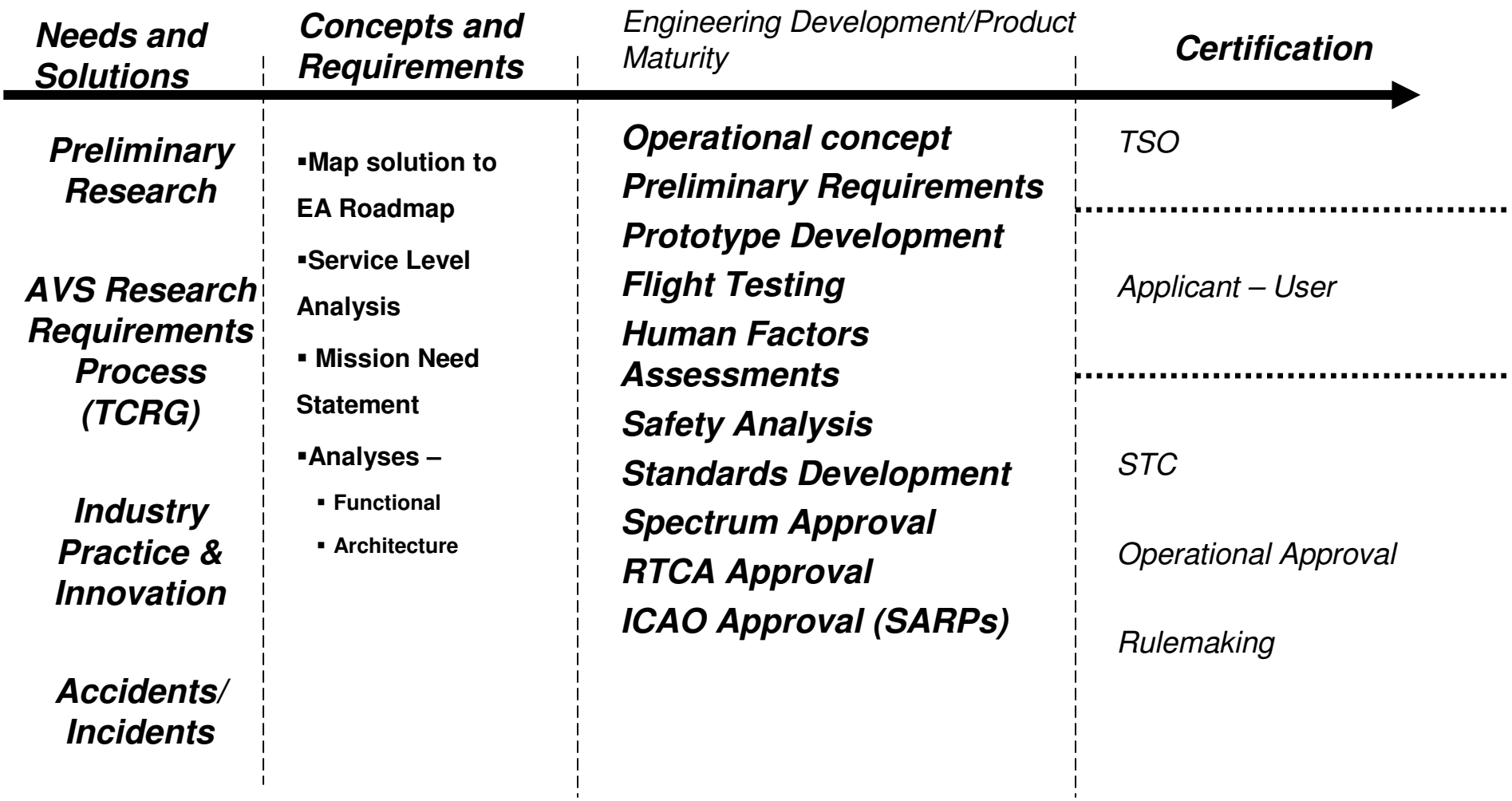
- ***Acquisition Management System (AMS) Path to JRC2a investment decision***
- ***AVS Path for Flight Standards and Aircraft Certification***

Acquisition Management System Path

Concepts and Requirements Development (CRD)

Solutions	Service Analysis to get in CRD	CRD outputs	*Pre-Investment Engineering Development*	JRC 2a/b
Research Innovations **NASA** **Industry** **Labs** **Universities**	**▪Map solution to EA Roadmap** **▪Service Level Analysis** **▪ Mission Need Statement** **▪Analyses –** **▪ Functional** **▪ Architecture** **▪CRD Plan**	**▪Detailed Shortfall Analysis** **▪Preliminary Program Requirements** **▪Concept of Use** **▪Safety Analysis** **▪Cost/Benefit analysis** **▪Operational & System Views for EA** **▪Identify 3 Alternatives** **▪Investment Analysis Plan**	•*Prototypes and Equipment* •*Operational Evaluations* •*Performance Standards* •*Policy Decisions* •*Certification Requirements*	•Life Cycle Cost Analysis •Benefits Analysis •Risk Assessment •Business Case Analysis Report •Architecture Assessment •HF Assessment •Info Security Assessment (SCAP) •Safety Risk Mgmt •Preliminary Requirements Doc •OMB-300 •Program Transition Plan •ATO Executive Council and JRC Approvals

AVS Path


Needs and Solutions
Concepts and Requirements
Engineering Development/Product Maturity
Certification
Preliminary Research
AVS Research Requirements Process (TCRG)
Industry Practice & Innovation
Accidents/ Incidents
▪Map solution to EA Roadmap
▪Service Level Analysis
▪ Mission Need Statement
▪Analyses –
▪ Functional
▪ Architecture
Operational concept
Preliminary Requirements
Prototype Development
Flight Testing
Human Factors Assessments
Safety Analysis
Standards Development
Spectrum Approval
RTCA Approval
ICAO Approval (SARPs)
TSO
Applicant – User
STC
Operational Approval
Rulemaking