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Meeting Summary, February 22, 2017
NextGen Advisory Committee (NAC)

The twentieth meeting of the NextGen Advisory Committee (NAC) was held on February 22, 2017 at The MITRE Corporation, Mclean, VA. The meeting discussions are summarized below.

List of attachments:

- Attachment 1 – Attendees
- Attachment 2 – Presentations for the Committee meeting - (containing much of the detail on the content covered during the meeting)
- Attachment 3 – Approved October 5, 2016 Meeting Summary
- Attachment 4 – NextGen Advisory Committee 2017 Membership List
- Attachment 5 – NAC Chairman's Report
- Attachment 6 – FAA Response Letter from The Honorable Michael Huerta, FAA Administrator to the Honorable Congressmen Thune
- Attachment 7 – Joint Analysis Team (JAT) – Final Report: Performance Assessment of Wake ReCat in Indianapolis and Philadelphia and Fuel Analysis for North Texas Metroplex
- Attachment 8 – Enhanced Surveillance Task Group: Enhanced Surveillance Capabilities in FAA Controlled Oceanic Airspace: Operational Need and Added Benefits – Interim Report

Welcome and Introductions

Chairman Bronczek opened the meeting at 8:35 a.m. and welcoming the NAC members and others in attendance. He communicated his desire to bridge the communications gap between the NAC and the aviation industry. He expressed the need to take the best of NextGen and implement it in the northeast corridor. He stated that "if New York is running the rest of the country is running." He recommended, "bolder more aggressive steps forward on ATC." He followed these remarks by asking all NAC members to introduce themselves and

comment on their length of service on the NAC. He then commented on his goal to improve communications with his colleagues in the airline industry. He shared comments on the airline executive's most recent visit to the White House and emphasized the support of an infrastructure package across all stakeholders.

Designated Federal Official Statement

The DFO, Victoria Wassmer (Acting FAA Deputy Administrator) read the Federal Advisory Committee Act notice, governing the public meeting.

Approval of October 5, 2016 Meeting Summary

Chairman Bronczek asked for consideration of the written summary of the October 5, 2016 meeting. By motion, the Committee approved the Summary (Attachment 3).

Chairman's Remarks

The following is a summary of the remarks made by Chairman Bronczek (Attachment 5):

Chairman Bronczek began by thanking Lillian Ryals and The MITRE Corporation for hosting the meeting. He also thanked Angie Heise and Leidos for sponsoring the NAC dinner. He thanked all of the industry for their work on the NAC. He emphasized that consensus among the industry must continue to achieve success. Following this, he welcomed the new NAC Committee Members:

- Steve Dickson, Senior Vice President, Flight Operations, Delta Air Lines
- Craig Drew, Senior Vice President, Air Operations, Southwest Airlines
- Tracy Lee, Vice President Network Operations, United Airlines
- Winsome Lenfert, Acting Associate Administrator for Airports
- Wayne Schatz, Associate Deputy Chief of Staff, Operation, United States Air Force
- Kimball Stone, Vice President, Flight, American Airlines

All other NAC members and attendees from the public are identified in Attachment 1.

Next, he highlighted the many accomplishments of the NAC over the past 6 years. He mentioned the historic industry work of the Task Force 5 and how they set the conditions for success to deliver NextGen capabilities that remain critical to the modernization of the nation's air traffic control system. He followed these remarks by highlighting the work of the NAC over three time frames: 2010-2012, 2012-2014, and 2014-2016.

Chairman Bronczek mentioned the efforts starting in 2010 and ending in 2012 that validated the concepts of Time Based Operations, initiated DataComm, established policies, performance metrics, city-pairs, and locations for NextGen implementation.

He highlighted efforts to implement Performance Based Navigation (PBN), identifying solutions to remove barriers for PBN implementation, establishing an environmental review process, and prioritizing NextGen capabilities. Next, he mentioned the 2014-2016 efforts of supporting the top 4 NextGen priorities: Data Comm, Multiple Runway Operations (MRO), PBN, and Surface implementation. He mentioned the 2016 efforts to improve community outreach for NextGen procedures and connecting to the longer-term vision of NextGen.

He followed these comments by focusing on the goals and priorities of the NAC. He mentioned the need to continue building on the strong 8-year foundation of collaboration with Task Force 5 and the NAC. In addition, he emphasized the desire to achieve VMC performance parameters in IMC conditions, which will result in increased predictability and reduced delays and emissions. He highlighted the need to concentrate on the near term operational implementations and benefits, while acknowledging the need to support the long-term NextGen vision. Chairman Bronczek mentioned how Wake ReCat is an example of a capability that provides immediate benefits and sets a path for long-term efficiencies similar to PBN. He highlighted an example of savings, mentioning the 17 million gallons of fuel from the FedEx hub in Memphis. Next, he spoke to the significance of the Decision Support tools, the Ground-based time, and the Speed and Spacing metering tools demonstrated the day before, during the MITRE tour and demonstrations.

Chairmen Bronczek initiated a discussion on New York, communicating that we need to make New York a priority given that 78% of system delays begin in the Northeast Corridor. Chairman Bronczek encouraged the NAC to recognize the challenges up front and work to mitigate them. He highlighted improving efficiency, reducing emissions, and decreasing delays as goals. Following this, the Chairman spoke to evaluating and assessing NextGen implementations, focusing on metrics. He spoke to short-term wins and successes based on measurements, establishing paths for longer-term payoffs, ensuring policy and procedures are aligned with FAA flight standards. He followed this by emphasizing accountability and how it is critical to evaluate performance against past improvements.

He spoke to the reports being presented by the Four Priority Teams: DataComm, MRO, PBN, and Surface and Data Management. He provided a preview of the Joint Analysis Team report, assessing performance improvements attributable to the implementation of select NextGen capabilities. In addition, he underscored the importance of the report on Wake Recategorization at Indianapolis International Airport and Philadelphia International Airport and the fuel impacts related to the North Texas Metroplex initiatives. He also talked about the Enhanced Surveillance Task Group and its evaluation of enhanced capabilities in oceanic airspace controlled by the FAA.

In closing, Chairman Bronczek thanked the NAC members for their commitment to implementing NextGen. He urged the group to continue participating in the close, consensus-based, transparent collaboration between the FAA and the aviation industry. He urged the NAC members to stay at the table, and make change happen. He stressed that RTCA's collaborative, consensus-building process is the best approach to modernizing the air transportation system. He concluded by saying that 2017 would be a banner year for all of the NAC.

FAA Report – Victoria Wassmer, FAA Acting Deputy Administrator

Ms. Wassmer began her comments by thanking Jim Bowman, FedEx Express, for his service to the NAC and representing the cargo side of the industry. Next, she spoke to the appointment of the Honorable Elaine Chao as the Secretary of Transportation. She emphasized Secretary Chao's wealth of public service experience, and highlighted her service as Deputy Secretary of Transportation under President George H.W. Bush, and Secretary of Labor under President George W. Bush. She pointed to the personnel changes at the Department of Transportation (DOT) and the FAA. She recognized the service of retiring FAA leaders Peggy Gilligan, Ben DeLeon, and welcomed to the NAC, acting Associate Administrator for Airports, Winsome Lenfert.

She emphasized that the FAA's mission remains unchanged—to provide the safest, most efficient aerospace system in the world. She underscored Secretary Chao's top priorities for the DOT: safety, infrastructure and innovation. Next, she focused her comments on hiring at the FAA. She spoke to the current hiring freeze the FAA is currently operating under and commented that she was unaware as to how long the limits would be in place, but, they are already working with the DOT to ensure the FAA is able to hire for positions allocated for public safety.

Ms. Wassmer spoke to the regulation assessment constraints directed by the administration and the hiring restraints. She mentioned that the FAA was still receiving guidance on what these orders mean for the FAA, however, she stressed that the freeze would not prevent the FAA from addressing safety issues. She pointed to the FAA's efforts of issuing airworthiness directives and safety bulletins. Next, she accentuated the FAA's reputation as a smart regulator and underscored the efforts of Part 23. She also spoke to the cumbersome nature of the certification standards for small general aviation airplanes. She pointed to the efforts to replace them with a new rule that maintains safety and innovation; these actions received wide-spread industry support.

Next, she called to attention the FAA's efforts to continue to meet mission and the need to have the right tools and resources. Ms. Wassmer spoke to the FAA's efforts to play an active

role in the reauthorization efforts to build on the FAA's safety record, to modernize the air traffic control system and to integrate drones into our airspace. She then highlighted the work of the Drone Advisory Committee (DAC) by describing the composition of the DAC and how they are helping the FAA answer tough questions surrounding unmanned aircraft.

She summed this up by highlighting the importance of collaboration. She emphasized that collaboration is what brought the group together today and that it will help us achieve our goals. She stated that the NAC has been instrumental in driving consensus and that progress must continue. Ms. Wassmer commented on the ADS-B 2020 mandate. She applauded the work of the NAC and their efforts to ensure aircraft are equipped to participate in NextGen. She stated that the equipage deadline will not change and that operators and aircraft owners need to prepare.

Ms. Wassmer highlighted the efforts of groups like AOPA, AEA, EAA, GAMA, NBAA, and NASAO in supporting the "Equip ADS-B" efforts. She spoke to the FAA's efforts to work with DoD, civilian U.S. government agencies, and state-level agencies with aircraft fleets to ensure they are cognizant of the deadline and are taking steps to comply. Next, she underscored the FAA's efforts to expand outreach efforts through engaging airport operators and aircraft owners. She requested NAC support to reach across all of the aviation industry and spoke to the need for the supplier community to get out information for production plans and capacity.

She commented on the value of collaboration, the proper use of meaningful metrics to capture the performance of NextGen, and commented on the PBN Time, Speed, and Spacing recommendations received from the NAC in October. She highlighted how PBN is key to achieving long term trajectory based operations. She said that Jim Eck would brief the vision of NextGen. She stated the importance of Enhanced Surveillance as we move toward future opportunities and flexibility in oceanic airspace.

Ms. Wassmer concluded her report by highlighting the Caribbean Initiative and DataComm tower service successes. Committee members expressed their approval of an FAA produced video montage covering recent successes of DataComm Tower Services.

Discussion:

The Chairman provided amplifying remarks on the DataComm success and opened the meeting for comments and questions concerning NextGen in the NE Corridor.

A NAC Member spoke to the modernization efforts of JFK and the support of the Port Authority of New York/New Jersey. They underscored the complex approach to implementation and to the importance of gaining buy-in with local government officials.

He/she expressed that managing the expectations of the public "is doable", and stated that noise is always a local issue, a real issue.

The Chairman reinforced the Member's comments by mentioning the past and current outreach efforts of the NAC in dealing with noise.

A NAC Member spoke to the origination of the Wake ReCat initiative and how an implementation considered "benign," can make a huge impact. He/she conveyed how something that started as a simple conversation transitioned to a NAC conversation. He/she described how conversations transform into collaboration and eventual implementation.

The Chairman also emphasized how collaboration discussions at the small level can achieve great things like the NAC efforts toward the Northeast Corridor.

A NAC Member commented that they were excited about NextGen in New York and that business airports can gain improved capacity and emphasizing the need to be clear of what "fixing New York" is, and used the example of developing VFR capability in IFR conditions. He/she emphasized the need to talk specifics when we say, "fix it". The Committee member mentioned tempering the discussion by improving safety and decreasing the environmental footprint, and that the NAC cannot fix all of New York's issues.

The Chairman responded that the time is now to move forward with the Northeast.

A NAC Member asked what is clear when referencing the who, what, when, where, and why of NextGen, and asked if it was KPI's, measures of performance, or measures of effectiveness. He/she said that the NAC has pushed for a long time, and is stuck in a metrics and language discussion, stuck in technology, and that implementation must remain outcome-based.

Another NAC Member mentioned the importance of focus on the Northeast and the need to be clear with what the NAC is trying to accomplish.

The Chairman conveyed that the Northeast is an easy choice. He stated that the goal is to define the 5th priority, the 5th working group, and communicate the underlying vision statement. He re-emphasized the need to make the Northeast a 5th priority and asked whether or not this new effort should be worked as combination of all four NIWG's. He asked how this effort would be rolled out, and how is the NAC to capture the Northeast corridor implementation. He followed the remarks by requesting input from industry leaders and mentioned a possible Ad-Hoc group. He concluded with the need for FAA guidance and industry input.

A NAC Member stated that the Northeast Corridor was a worthy goal but that stakeholders need to be cautious because of the unique nature of this initiative and that other examples

do not exist. He mentioned that there may be a dip in production and challenges that may be faced. He concluded that everyone needs to be realistic and keep this in mind.

The Chairman encouraged the Member's comments and welcomed further comments.

A NAC Member stated that given the diversity of the NAC, a good first step would be for the FAA to level-set the situational awareness of all NAC members to ensure a common understanding.

The Chairman commented that 78% of all problems emanate from the Northeast Corridor and that bold improvements are needed, and that is what the NAC is trying to accomplish.

A NAC Member followed the Chairman's comments by mentioning the optics of metrics, the roll-out plan, and asked what has already been attempted in the Northeast.

Another NAC Member added that continuous improvement is needed instead of attempting to fix all of the problems.

The Chairman emphasized the need for continuous improvements along the way to gain momentum.

A NAC Member stated the importance of input from the NY/NJ Port Authority's political body when level-setting begins.

The Chairman commented on the possibilities associated with a new infrastructure bill and the momentum to follow.

A Member spoke to the challenges on New York and the close proximity and interdependence of all four airports.

The Chairman said that New York is unlike any other place and that collectively, the NAC can do it. He asked that NAC members submit input to RTCA and suggested that this initiative be called the 5th priority.

A Member urged the other NAC members to submit input to RTCA as to the proper mechanism within the NAC that is capable of moving this forward.

The Chairman commented that the infrastructure bill is a high priority for the new Trump Administration.

A NAC Member asked if the establishment of a 5th priority required a vote.

Another NAC member mentioned the importance of gaining consensus at the NAC by the showing of hands in support of a 5th priority. He/she recommended that the FAA formalize, study, and approve the decision.

Chairman Bronczek offered a motion in favor of a 5th priority and all NAC members voted in favor of a 5th priority covering an initiative in the NE Corridor.

NextGen Priorities Status, Steve Dickson, Sr. Vice President, Flight Operations, Delta Air Lines, and Melissa Rudinger, Sr. Vice President, Aircraft Owners and Pilots Association

Captain Dickson began the discussion by encouraging the NAC members to not lose focus when transitioning to the 5th priority. He stated that the NAC cannot do this in a vacuum and should look at big picture outcomes when it comes to NextGen. He spoke to job additions and growth, in addition to gates, surface, and operational improvements. He mentioned the NIWG's ability to track milestones of the four priorities and reminded the NAC of the previous transition period from programmatic milestones to implementation milestones and the need to address the detailed elements that affect the successful advancement in operational capabilities. He referenced the Task Force 5 efforts to identify capabilities that can be implemented that make a difference in operational performance. He also spoke to the importance of the JAT in the assessment of the implementations. Using the Atlanta Metroplex as an example, Cpt. Dickson highlighted the need to have a process for the FAA and the aviation users to review implementations and make adjustments as needed.

This is an example of the NIWG process maturing and reflecting real operations, while keeping safety and the customer at the forefront. Cpt. Dickson spoke to the importance of communities with implementations. He stressed the importance of the use of Decision Support and Traffic Management tools and emphasized that the industry is set up to respond to NIWG efforts. He said that work needs to be aligned within the NIWG to provide a vehicle to communicate with the NAC and industry. He emphasized that successful implementation requires leadership to continue to develop milestones.

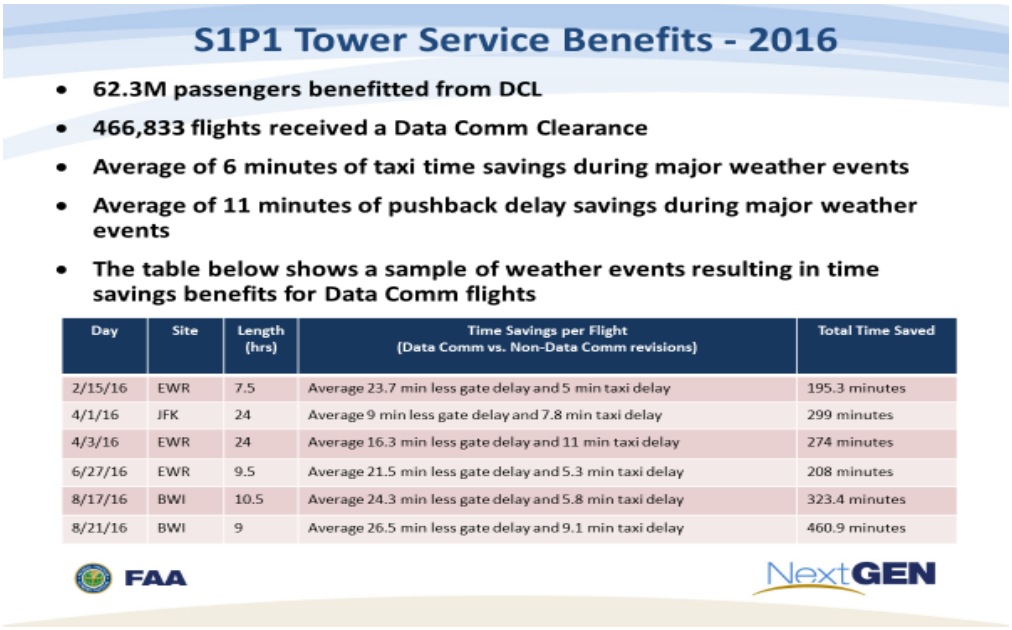
Cpt. Dickson spoke to the sea of change, reminding the NAC of the small number of airlines at the table in the beginning, and now FedEx Corporation's COO Dave Bronczek is ready to take the NAC to the next level with the Northeast Corridor initiative. He emphasized the need for a good feedback mechanism to respond to operational challenges.

The Chairman responded by commenting on Cpt. Dickson's knowledge and experience on the NIWG. He underscored the collective responsibility to communicate with other airline CEO's and his commitment to do so.

DataComm

FAA SMEs: Juan Narvid (ANG), Jessie Wijntjes (ATO)[1]
Industry Leads: John O'Sullivan (Harris Corporation), Chuck Stewart (United Airlines)

Mr. Wijntjes and Mr. Stewart provided an update to the DataComm Rolling Plan Milestones and the benefits being realized from the Controller Pilot Data Link Communication (CPDLC) Departure Clearance (DCL) in 2016. There are 2,681 Data Comm equipped aircraft operating in the NAS as of February 6, 2017, and 1,137 have been equipped through the FAA incentive program.



S1P1 Tower Service Benefits - 2016

- **62.3M passengers benefitted from DCL**
- **466,833 flights received a Data Comm Clearance**
- **Average of 6 minutes of taxi time savings during major weather events**
- **Average of 11 minutes of pushback delay savings during major weather events**
- **The table below shows a sample of weather events resulting in time savings benefits for Data Comm flights**

Day	Site	Length (hrs)	Time Savings per Flight (Data Comm vs. Non-Data Comm revisions)	Total Time Saved
2/15/16	EWR	7.5	Average 23.7 min less gate delay and 5 min taxi delay	195.3 minutes
4/1/16	JFK	24	Average 9 min less gate delay and 7.8 min taxi delay	299 minutes
4/3/16	EWR	24	Average 16.3 min less gate delay and 11 min taxi delay	274 minutes
6/27/16	EWR	9.5	Average 21.5 min less gate delay and 5.3 min taxi delay	208 minutes
8/17/16	BWI	10.5	Average 24.3 min less gate delay and 5.8 min taxi delay	323.4 minutes
8/21/16	BWI	9	Average 26.5 min less gate delay and 9.1 min taxi delay	460.9 minutes

FAA NextGEN

Mr. Stewart concluded the presentation by highlighting the risk and challenges associated with the DataComm program including:

Air-to-Ground interoperability

- Issue resolution between air and ground systems
- Latent avionics issues – Pegasus 1

Training

- Development and acceptance of training materials
- Timing of training to support initial En Route operations

[1] Highlighted names indicate the Team lead that presented to the NAC.

- Operator flight crew training to support waterfall

Operator support for the En Route waterfall

- Equipped aircraft needed to support Data Comm ARTCC site Initial Operating Capabilities (IOCs_
- Support for FAA air-to-ground interoperability site testing

Integration and test of the component subsystems

- ERAM/TDLS/DCNS/FTI/Aircraft

Site coordination

- Coordination across multiple facilities and with operators to support transition to Data Comm En Route Initial CPDLC Services

An issue for the EnRoute DataComm program is 771 Boeing 757/767 aircraft that equipped with the Pegasus 1 flight management system. The industry is working closely with Boeing and the FAA to determine a means to mitigate issues associated with this equipment for the EnRoute DataComm Program currently under development. Representatives from Boeing and Honeywell commented that they are working to accelerate an acceptable solution.

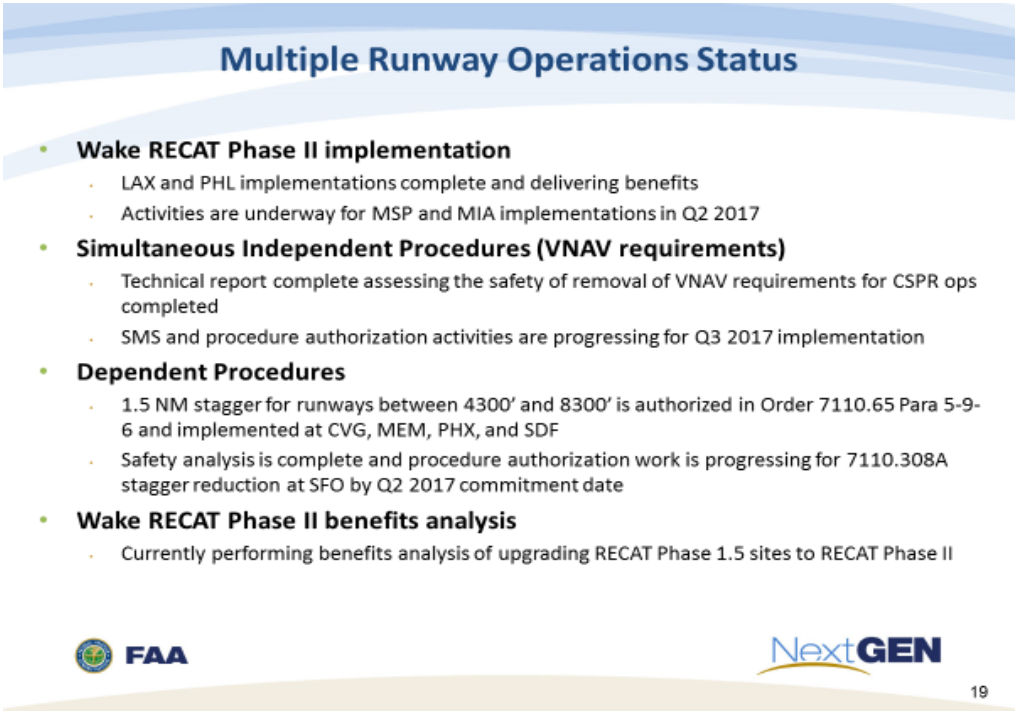
Responding to a question raised by a Committee member, the FAA committed to model benefits of the DCL comparing events prior to/after the implementation of DataComm services.

Multiple Runway Operations (MRO)

FAA SMEs: Jack Allen (ATO), Paul Strande (ANG)

Industry Leads: Glenn Morse (United Air Lines), Jon Tree (Jeppesen/The Boeing Company)

MRO Team leaders Glenn Morse and Jack Allen provided an update by highlighting the success of the Wake ReCat Phase II implementations at LAX and PHL airports. Mr. Allen said that Wake ReCat is delivering benefits at both airports. He added that the Joint Analysis Team has completed the ReCat assessments for IND and PHL, and they will require continued industry support. The status report is shown below:



Mr. Allen presented the Time-Based Separation (TBS) initiative at London's Heathrow airport and highlighted increased pressure on the runways generated by applying TBS in strong headwinds. Mr. Allen mentioned that the FAA is currently conducting research and assessing the TBS concept at US airports.

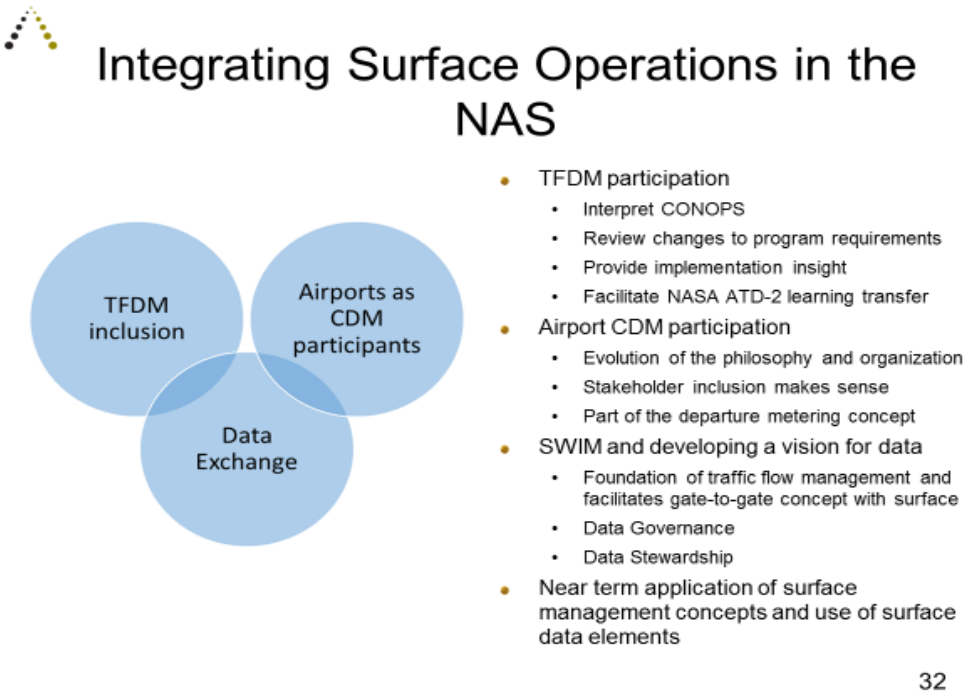
Surface

FAA SMEs: Mike Huffman (ATO), Susan Pfingstler (ATO)

Industry Leads: Rob Goldman (Delta Air Lines), Steve Vail (Mosaic ATM, Inc.)

Surface NIWG leaders Susan Pfingstler and Rob Goldman began their presentation by briefing the Surface team's pre-implementation commitment status. They then briefed the surface implementation commitments associated with the FAA's efforts to increase data sharing and provide surface surveillance to industry via FAA's System Wide Information Management (SWIM) in the fourth quarter 2017.

Mr. Goldman presented the Surface team's efforts to facilitate the integration of Surface Operations in the NAS. He highlighted the Terminal Flight Data Manager (TFDM) which is the surface management solution for NextGen that will provide an integrated tower flight data automation system to improve controllers' common situational awareness along with airports participating in Collaborative Decision Making (CDM).



A Committee member pointed out the need to develop a data dictionary for the 11 data elements that are being provided by the industry to the FAA and requested action by industry and the FAA. An action item is to identify the appropriate forum and begin the work.

Performance Based Navigation (PBN)

FAA SMEs: Donna Creasap (ATO), Josh Gustin (ATO)

Industry Leads: Steve Fulton (Sandel Avionics), Brian Townsend (American Airlines)

Donna Creasap and Steve Fulton provided a brief of the PBN efforts for the Atlanta Metroplex. They emphasized the importance of balancing the programmatic outcomes versus the measures of effectiveness outcomes experienced by the operators. They posed a key question for discussion, “Can Atlanta maintain the implementation of PBN procedures while maintaining pressure on the runway?” Next, they briefed the PBN Milestone updates for both the pre-implementation and implementation phase for CY 2016.

They concluded the discussion by talking about the challenges of change management, stating that the work is still very human-centric and filled with conflict; they used the DataComm flight plan implementation as a positive example of work and technology.

Discussion:

A Committee Member explained the concerns about "burn-in" by operators in Atlanta and confusion between pilots and controllers that has created uncertainty about using new procedures in busy times. He/she expressed the need to use Human in the Loop testing and increase the fidelity of the aspects of the implementation.

Representatives of controllers and the FAA both commented that work is underway to resolve the issues.

Another Member spoke to the challenges and issues in any post implementation phase, while one Member spoke to the safety benefits and values of consistency and predictability. He/she mentioned the new technological advances, implementations, changes, and constraints.

Rick Dalton, Director of Airspace for Southwest Airlines was invited to address the NAC and he offered that flow management is a foundational challenge as the industry and the FAA seeks to achieve transformational gains. The limits of metering have resulted in incremental gains, or at times, even no increase in performance, a degradation. He emphasized the need for leadership to effectively apply the industry and the FAA expertise and resources necessary to achieve improvements.

In response members offered the following:

- There is power of having someone at the table versus making changes for the sake of changes.
- Airlines must come together on this issue.
- Critical to know the who, what, when, where, and why before changing procedures and approaches.
- Changing procedures can have the unintended results of decreasing capacity due to limits of flow management capabilities.
- Operators are actively engaged and it is important that the FAA recognize implementation of procedures is not the end – must ensure they are functioning and achieving the intended results.
- And finally, a Member responded to the Atlanta Metroplex and the post-implementation phase and the need to review and analyze current procedures for effectiveness. The PBN NIWG Team took an action item to develop a process for the industry to identify an effective process addressing issues that are identified after the FAA has completed the launch of procedures during the "burn-in" period.

Airline C/N/S Fleet Plans, Supply Chain and ADS-B Update

Bret Peyton, of Alaska Air; Christian Kast, of UPS; Carl Esposito, of Honeywell Aerospace; Bruce DeCleene, of the FAA; and Ryan Hartman, of Insitu, Inc. presented briefings on their respective C/N/S fleet plans, provided a Supply Chain status, and a FAA and UAS ADS-B update. These briefings are an ongoing agenda item that provides the NAC Members with an understanding of aircraft and UAS operator equipage health.

Alaska Airlines: Alaska Airlines is on track for full 2020 compliance for ADS-B.

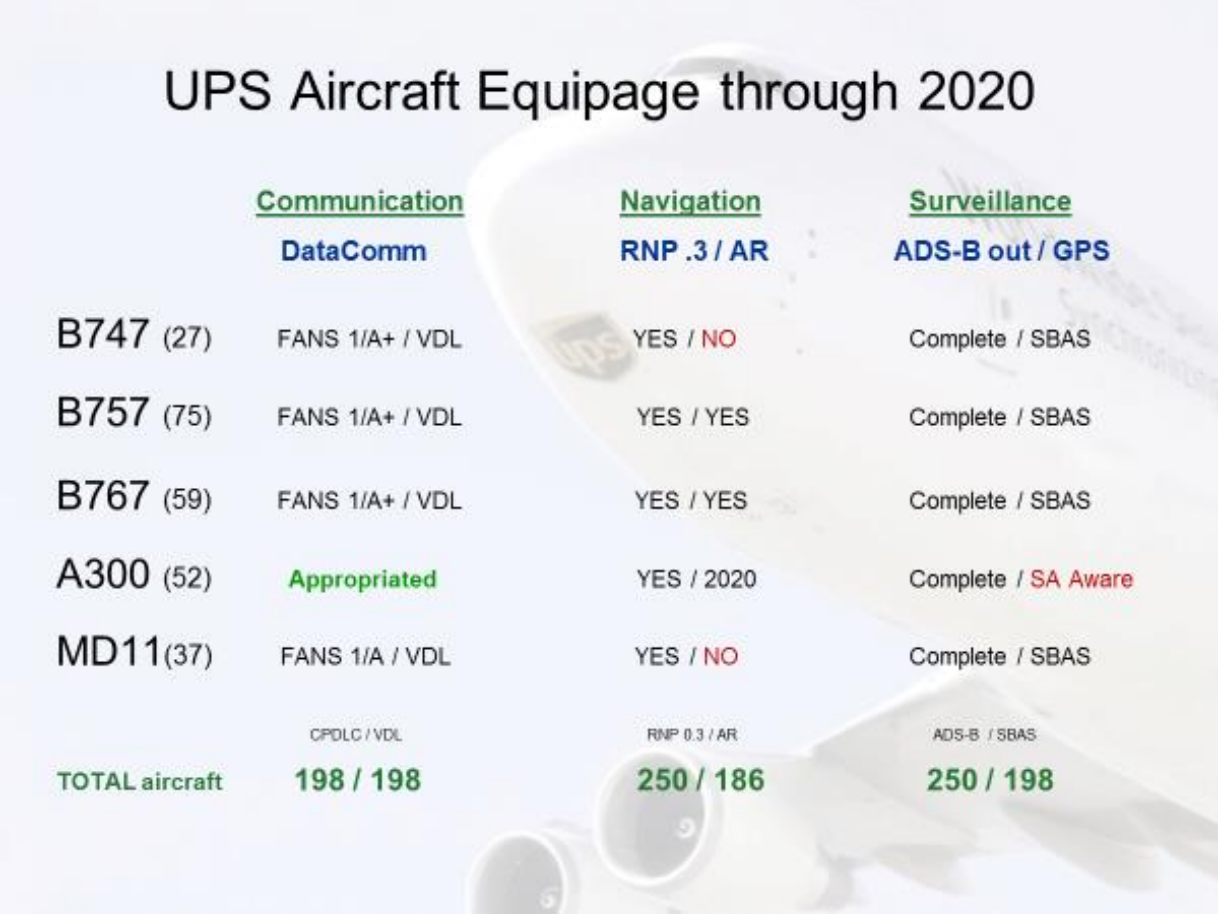
DataComm:

- IOC Sep 18, 2016
- Equipment initiative program participant
- 60+ aircraft now equipped
- 125 737-800/900ERs EOY 2018 - All deliveries before/after 2018 equipped
- Forward fit and retrofit - All FANS 1/A VDL M2/Iridium
- All RNP 4

Navigation:

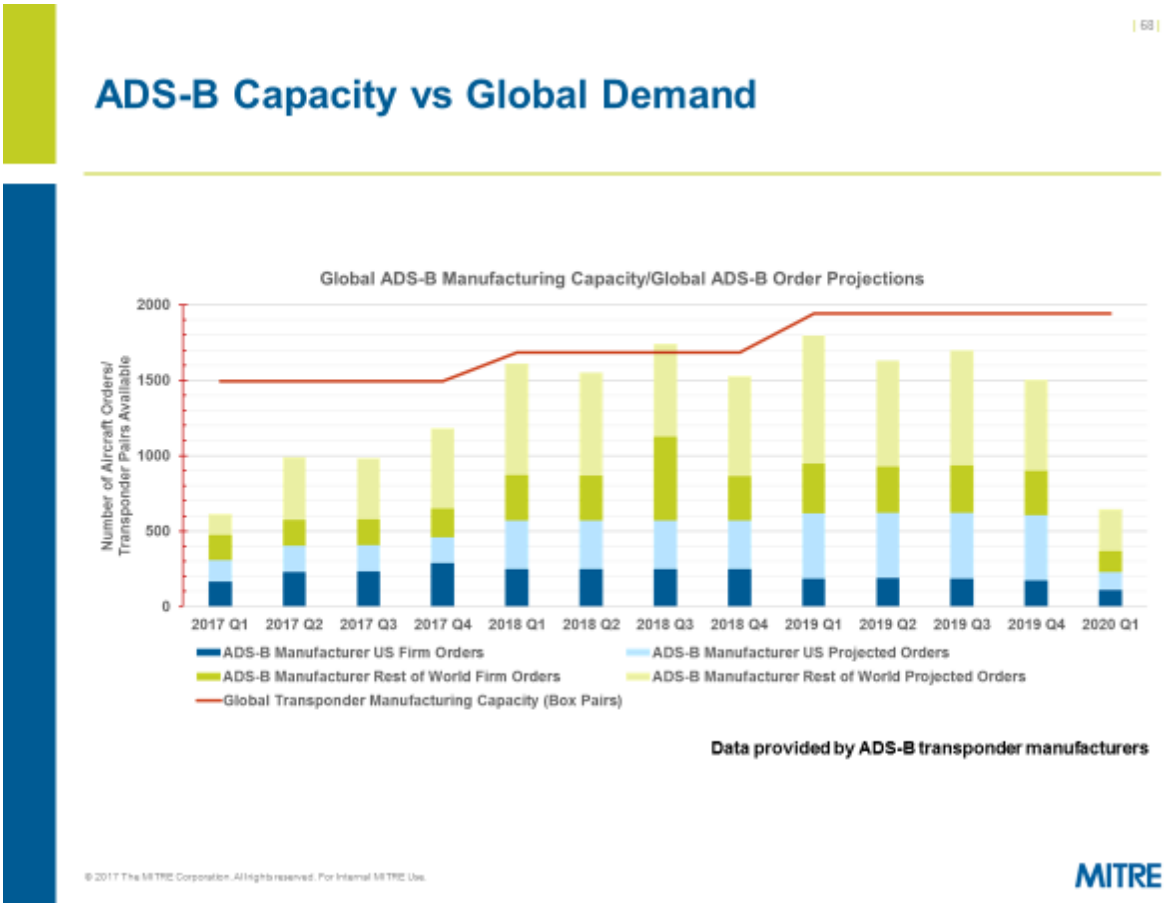
- All ASA pilots RNP AR qualified
- All ASA 737s RNP AR .1/.11
- 44 + 10 RNP IAPs and SIDs
- Promotes RNP use in NAS
- Continual improvement
    - RNP 1800 RVR
    - Linked RF

UPS: UPS is on track to meet the 2020 compliance mandate. The following chart outlines UPS equipage for Communications, Navigation and Surveillance.



Honeywell Equipment Manufacturer Snapshot: Original equipment manufacturers (OEMs) are supporting the current supply and demand. These are adding capacity to match future demands.

- **Sufficient production capacity exists to meet global demand**
  - Limited excess capacity to accommodate non-linear orders and installations
  - Majority of forecasted demand is from non-U.S. operators
- **3-9-month lead time needed for order fulfilment**
- **Part 91 market analysis is in work**



FAA Equip 2020 Update: Bruce DeCleene communicated to NAC members that there is low aircraft equipping, according to previously provided operator plans to equip. Mr. DeCleene requested Part 121 operators provide updated equipage plans to MITRE as well as answers to the question on whether installations will be done in-house or contracted out. Good installs (those meeting the performance and testing requirements) are the only ones being counted right now. General Aviation (GA) numbers are improving, but still moving into the danger zone—there will not be installation capacity to accommodate a large number of

requests near the deadline. Although the GA rebate has helped, the FAA will have more information on the federal fleet at the June NAC meeting.

Insitu, Inc. UAS ADS-B: Ryan Hartman provided an update of the UAS ADS-B status. Tracking is needed for UAS that operate in rule-covered airspace. There is a need to identify barriers to equipage and compliance, and look at the availability of ADS-B transponders, including size and weight requirements for UAS. He stated that Insitu will take the lead to study, and provide a briefing at the June NAC meeting of UAS related equipage plans.

NextGen Plan, Jim Eck, FAA Assistant Administrator for NextGen

NAC Member Florian Guillermet, Single European Skies Air Traffic Management (ATM) Research (SESAR) Joint Undertaking (JU), began the presentation by introducing the Second Edition of the NextGen – SESAR's State of Harmonization document to the NAC. This report was prepared by the Coordination Committee (CCOM) and was provided to all the NAC members.

Jim Eck then provided an overview of the history, context, and evolution of NextGen to the NAC. He discussed the collaborative efforts that began in 2007, and are continuing today. He mentioned that the target had not changed but that the path has been redefined through research, development and stakeholder engagement.

He continued on to Time Based Management (TBM) and Trajectory Based Operations (TBO) and commented that it is a concept based on the ability of aircraft to fly precise patterns in time and space. He mentioned that the TBO target is to balance airspace capacity with available runway capacity.

Mr. Eck also briefed on the "Keys to Success" slide, and emphasized the need for FAA NextGen to address people, infrastructure, policy/processes/procedures, and equipage. He spoke to the fundamental programs that we are building from the ground up, and said that technology can be transformative but that the transformation is in the people and the operations. He followed these comments by providing an overview of the accomplishments focusing on the infrastructure, people, equipage, and policy, processes, and procedures. He emphasized that NextGen activities were within 6 percent of planned cost and schedule metrics.

He presented the benefits of NextGen in the context of the four NAC priorities, and said that MRO efforts have reduced wake separation standards at twenty-eight airports. Regarding the future of the NAS, he spoke to being resilient, transparent, and building an agile NAS. Mr.

Eck presented a slide showing that fifty-five airport towers are currently equipped to support DataComm and presented the increased surveillance efforts through ADS-B and the lateral spacing improvements at the Atlanta Metroplex.

Value of NextGen Capabilities and NAC Ad Hoc Group Update: Ed Bolen, NBAA President & CEO

Ad Hoc Chair Ed Bolen presented an overview of the efforts of the Value of NextGen Capabilities and NAC Ad Hoc group and the definition of NextGen developed by the group:

"NextGen is the Aviation community working together to modernize technologies, policies and procedures in the national airspace system in order to increase capacity, reduce delays and cancellations, reduce our environmental footprint, and enhance safety, for all segments of aviation with bad weather performance equal to good weather performance"

He outlined the collaborative response to Senator Thune's letter and requested additional participation by airlines in the AdHoc meetings.

Joint Analysis Team (JAT) Final Report: Wake Recategorization IND & PHL International Airport, and Interim Report: Fuel Analysis North Texas Metroplex

JAT Co-Chairs, Ilhan Ince, American Airlines, and Dave Knorr, FAA, presented the findings of JAT that evaluated the implementation of Wake Recategorization at Indianapolis and Philadelphia International Airports, and fuel impacts related to the implementation of the North Texas Metroplex.

<u>Wake ReCat</u>

- Indianapolis: >$2M in annual savings
- Philadelphia: approximately $800K in annual savings

<u>North Texas Metroplex Fuel Analysis</u>

- Dallas-Ft. Worth arrivals saved $4.5-6.5M annually from reduced level outs, but slightly increased overall fuel cost for Dallas Love Field

The NAC subsequently approved the recommendation developed by the Joint Analysis Team.

Enhanced Surveillance Task Group Interim Report

The Enhanced Surveillance Task Group Co-Chair, Bart Roberts, Jet Blue, presented an Interim Report on the status of the Enhanced Surveillance analysis in U.S. controlled airspace that is evaluating the needs and benefits of enhanced surveillance for oceanic airspace controlled by the FAA.

Mr. Roberts spoke to the benefits of increased surveillance and added that initially, aircraft equipage was aligned with ground-based radar; but now, space-based receivers are being launched to track every equipped aircraft. He stated that controllers do not truly know the exact location of aircraft flying over the ocean, and that tactical control does not exist in oceanic airspace. He briefed that the Task Group is analyzing the cost-benefit of Enhanced Surveillance, and concluded that the interim analysis suggests that possible benefits include optimal routing, fuel savings, and potential increased capacity.

Issues Identified and Work Underway:

- Communications capability is a limiting factor for benefits

- The FAA provided benefits analysis for the Task Group, while the industry tasked Embry-Riddle to conduct analysis; it was a close match-up and additional work is underway
- ADS-B is consistent with increased use of GPS under NextGen
- Evaluating ADS-B and ADS-C for spacing improvements of 15/15 lateral/longitudinal
- Equipage requirements are driving the evaluation
- Mixed equipage is giving benefits to those who have equipped (ADS-B, FANS/CPDLC, RNP4, ADS-C)

The Enhanced Surveillance Group will work toward formulating a policy recommendation.

At the conclusion of the report, a Member asked why Traffic Collision Avoidance System (T-CAS) wasn't used as an equipage package. Mr. Roberts explained that separation is done by reporting, time based separation and surveillance.

Another Member mentioned the need for a cost-benefit analysis for all areas, to include the impacts on the Northeast Corridor.

Chairman Bronczek called for a motion to approve the interim report, and the NAC members concurred.

Summary of the Meeting and Next Steps

The NAC Secretary summarized the following actions and follow-up items from the meeting:

Action Item	Responsible Entity	Completion Date
Enhanced Surveillance – tasking to examine its application in US-controlled oceanic airspace from spaced-based ADS-B.	RTCA	Final June 2017
Chairman to maintain liaison role with other airline CEOs	Chairman Bronczek	June 2017 and future NAC meetings
Consensus to move forward on improvement of the New York/NE Corridor	FAA/RTCA	June 2017 and future NAC meetings as

Near-term steps: • RTCA distribute write-up from the discussion • Feedback requested from NAC members on how, what, when, and mechanism for moving forward with this initiative • FAA/RTCA will work on developing appropriate mechanisms for moving forward by April 2017 • April due date for scoping • Success Criteria to include Metric driven outcomes • Include NY/NJ Airport Authority		determined by the plan and tasking letter.

Equipage
 	
• ADS-B avionics supply chain being readied for 2020 mandate, to focus on Part 91 to augment February brief
• Civil UAS in "rule airspace"
  ○ Tracking needed for UAS that operate in rule covered airspace
  ○ Numbers
  ○ Possible risk to ADS-B network
  ○ Identification of barriers to equipage/compliance
  ○ Availability of ADS-B transponders – size, weight requirements for UAS, etc.
	RTCA
	
	Avionics- Honeywell, Rockwell Collins, Thales, etc.
	
	MITRE
	
	UAS- Insitu
		June 2017

Equip 2020 updates – Standing agenda item for update on operator equipage • For June: Updated Plan for Part 121 operators	FAA AVS	June 2017 and future NAC meetings

• For October: Installation facility capacity		
Value of NextGen Ad Hoc tasked with developing a unified, clear message – demonstrating the value of NextGen capabilities being deployed as a result of the government-industry collaboration on the NAC. Increase airline engagement in Ad Hoc.	RTCA	June 2017 Report/discussion
Follow-up to discussion and approval of the Time Speed Spacing Task Group recommendation	FAA ANG & NACSC	June 2017
Joint Analysis Team requested to perform additional analysis: • OPD – BOS and Gary, IN - June • DataComm Benefits Review - October • PBN -EOR DEN IMC - TBD	RTCA FAA/Industry Joint Analysis Team	June 2017 and future NAC meetings based on program plan
NextGen Integration Working Group • Industry will take lead on identifying operational use and reporting – NIWG leadership • Surface Data Exchange – develop "Data Dictionary" for 11 Data elements - NACSC to develop and request assistance from RTCA Tactical Operations Committee	RTCA	June 2017
Update to Integrated Noise Model Report/Study	FAA	June 2017

DFO and Chairman Closing Comments

Ms. Wassmer and Chairman Bronczek both thanked the members for their participation in the meeting. Ms. Wassmer thanked RTCA for leading the Senator Thune response effort.

Other Business

A Member requested an update to the FAA's Integrated Noise Model Study at the next NAC meeting.

Adjourn

By motion, Chairman Bronczek concluded the meeting at 2:43.

Next Meeting

The next meeting of the NAC is June 28, 2017, at the offices of FedEx in Memphis, TN.

Welcome to the Meeting of the NextGen Advisory Committee

February 22, 2017
The MITRE Corporation
McLean, VA

Welcome & Introductions

PUBLIC MEETING ANNOUNCEMENT
Read by: Designated Federal Official Victoria Wassmer
NextGen Advisory Committee
February 22, 2017

In accordance with the Federal Advisory Committee Act, this Advisory Committee meeting is OPEN TO THE PUBLIC.

Notice of the meeting was published in the Federal Register on:

February 7, 2017

Members of the public may address the committee with PRIOR APPROVAL of the Chairman. This should be arranged in advance.

Only appointed members of the Advisory Committee may vote on any matter brought to a vote by the Chairman.

The public may present written material to the Advisory Committee at any time.

RTCA

THE GOLD STANDARD FOR AVIATION SINCE 1935

Review and Approval of:
October 5, 2016 – Meeting Summary

RTCA

THE GOLD STANDARD FOR AVIATION SINCE 1935

Chairman's Report
David Bronczek, NAC Chair

NAC Agenda Topics

- FAA Report to NAC
- NextGen Priorities Status Reports & Rolling Plan – NextGen Integrated Working Groups
- Airline C/N/S Fleet Plans – Alaska Air & UPS,

  Supply Chain and ADS-B Update – Honeywell
- NextGen Plan – FAA
- Value of NextGen Capabilities Report – Ad Hoc Task Group
- Wake ReCat Indianapolis & Philadelphia Int'l Airports & Metroplex Fuel Analysis – Joint Analysis Team
- Enhanced Surveillance Interim Report – Enhanced Surveillance Task Group

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NextGen Integration Working Group Priorities and Reporting Status

Co-Chairs:
Steve Dickson, Delta Air Lines
Melissa Rudinger, AOPA

RTCA

THE GOLD STANDARD FOR AVIATION SINCE 1935

Data Comm

Industry Leads:
Chuck Stewart, United Airlines
John O'Sullivan, Harris Corporation
FAA SME:
Juan Narvid, ANG
Jesse Wijntjes, ATO

Data Comm – Rolling Plan Milestones

- ✓ **Tower Services Waterfall – Q4 2016**
  - Completed challenge waterfall in December 2016
  - Proceeding forward to deliver services at additional towers
- ✓ **Implementation Framework for non-VDL Mode 2 Media – Q1 2017**
  - FAA and Industry developed implementation framework collaboratively
  - Briefed and received concurrence on the framework to Performance-based Aviation Rulemaking Committee (PARC) Communications Working Group (CWG) in August 2016
  - Briefed and received concurrence on the framework to joint FAA-Industry Data Comm Implementation Team (DCIT) and Data Comm NIWG Team in November 2016
  - Moving forward implementation of the framework
- **Initial Operating Capability (IOC) for Initial En Route Services at first Air Route Traffic Control Center (ARTCC) – Q3 2019**
  - Coordinating deployment strategies
  - Started development, integration and test of Data Comm Initial En Route Services
- **Airlines to equip 1,900 aircraft – Q4 2019**
  - 2,681 Data Comm equipped aircraft operating in the NAS as of February 6, 2017 (includes FANS/VDL Mode 2, FANS/VDL Mode 0, business jets, and international aircraft)
  - 1,137 aircraft have been equipped through the equipage initiative

FAA NextGEN

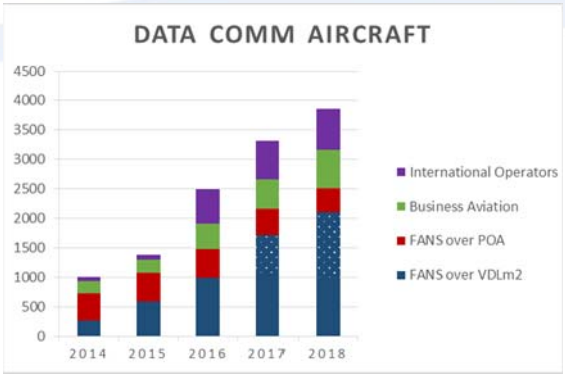
S1P1 Tower Service Additional Towers

Location	Source of Request	Major Carriers at Location
Southwest Florida International (RSW)	Service Area and Operator Requests	Southwest, Delta, American, JetBlue, United
Port Columbus International (CMH)	Operator Requests	Southwest, Delta, Republic Shuttle, American
Charleston International Airport (CHS)	Service Area Request	Alaska, American, JetBlue, Southwest, United, Military
Joint Base Andrews (ADW)	USAF/DoD	Military
Buffalo Niagara International (BUF)	Site Request	Southwest JetBlue, Delta, American, Endeavor
Reno-Tahoe International (RNO)	Site Request and NIWG/Operator Requests	Southwest, American, Horizon Air, United, Delta
Van Nuys (VNY)	NBAA Request	General Aviation

Key
Existing PDC Facility, Upgrading to DCL
No PDC Today, Upgrading to PDC and DCL

FAA NextGEN

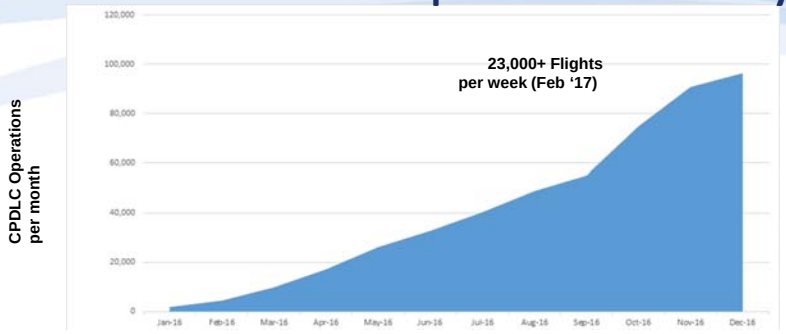
Data Comm - Equipage Status



- **2,681 Data Comm equipped aircraft operating in the NAS as of February 6, 2017**
  - Includes FANS/VDL-2, FANS/POA, business jets, and international aircraft
- **1,137 aircraft have been equipped through the Data Comm equipage initiative**

FAA NextGEN

S1P1 Tower Service - Operational Summary



10 US Mainline Air Carriers

American Airlines, UNITED, FedEx, Hawaiian Airlines, Southwest, DELTA, Alaska, ups, Virgin America, Kalitta Air

41 Aircraft Types

BOEING, AIRBUS, Bombardier, Gulfstream, DASSAULT FALCON

25 International Air Carriers

AirBridgeCargo, Air New Zealand, Air India, AirTahitiNui, Asiana Airlines, Austrian, norwegian, British Airways, brussels airlines, cargolux, Emirates, Etihad Airways, Aerolineas Argentinas, Finnair, Alitalia, Korean Air, SAS, Singapore Airlines, swissair, Qatar Airways, LATAM, KLM

Business Jet Operators

CJG Chicago Jet Group, Executive Jet Management, Execuflight, Executive Flightways, Kaiserair, Air Base, Reynolds Jet, NetJets, Jetlinx, Jet Aviation, Solairus Aviation

FAA

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S1P1 Tower Service Benefits - 2016

- **62.3M passengers benefitted from DCL**
- **466,833 flights received a Data Comm Clearance**
- **Average of 6 minutes of taxi time savings during major weather events**
- **Average of 11 minutes of pushback delay savings during major weather events**
- **The table below shows a sample of weather events resulting in time savings benefits for Data Comm flights**

Day	Site	Length (hrs)	Time Savings per Flight (Data Comm vs. Non-Data Comm revisions)	Total Time Saved
2/15/16	EWR	7.5	Average 23.7 min less gate delay and 5 min taxi delay	195.3 minutes
4/1/16	JFK	24	Average 9 min less gate delay and 7.8 min taxi delay	299 minutes
4/3/16	EWR	24	Average 16.3 min less gate delay and 11 min taxi delay	274 minutes
6/27/16	EWR	9.5	Average 21.5 min less gate delay and 5.3 min taxi delay	208 minutes
8/17/16	BWI	10.5	Average 24.3 min less gate delay and 5.8 min taxi delay	323.4 minutes
8/21/16	BWI	9	Average 26.5 min less gate delay and 9.1 min taxi delay	460.9 minutes

FAA

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Data Comm – Risks

- **Air-to-Ground interoperability**
  - Issue resolution between air and ground systems
  - Latent avionics issues – Pegasus 1
- **Training**
  - Development and acceptance of training materials
  - Timing of training to support initial En Route operations
  - Operator flight crew training to support waterfall
- **Operator support for the En Route waterfall**
  - Equipped aircraft needed to support Data Comm ARTCC site IOCs
  - Support for FAA air-to-ground interoperability site testing
- **Integration and test of the component subsystems**
  - ERAM/TDLS/DCNS/FTI/Aircraft
- **Site coordination**
  - Coordination across multiple facilities and with operators to support transition to Data Comm En Route Initial CPDLC Services

FAA NextGEN

Boeing Aircraft with Pegasus 1 FMS

- Pegasus 1 contains bugs impacting FANS 1/A Controller Pilot Data Communications (CPDLC)
  - Pegasus 1 unable to load routes for 2 out of 4 route messages (UM80 & UM83)
  - Messages (randomly) re-displayed from previous CPDLC session
  - Incorrectly loads routes that contain an airway-to-airway with no published waypoint
  - Printer does not correctly output route clearance
- Impact:
  - 771 US registered B757 & B767 Pegasus aircraft will not be able to receive re-route in EnRoute airspace
- Mitigations:
  - Upgrade to Pegasus 2 – requires hardware and software upgrade
  - Pegasus 1 fix (Airline preferred solutions)
  - Investigating potential ground mitigation options
- Next Steps:
  - Aircraft operators with B757 & B767 need reaching out to Boeing to push for push for a Pegasus 1 software fix

DISCUSSION

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THE GOLD STANDARD FOR AVIATION SINCE 1935

Multiple Runway Operations

Industry Leads:
Glenn Morse, United Airlines
Jon Tree, Jeppesen/Boeing
FAA SMEs:
Jack Allen, AJT
Paul Strande, ANG

Multiple Runway Operations Status

- **Wake RECAT Phase II implementation**
  - LAX and PHL implementations complete and delivering benefits
  - Activities are underway for MSP and MIA implementations in Q2 2017
- **Simultaneous Independent Procedures (VNAV requirements)**
  - Technical report complete assessing the safety of removal of VNAV requirements for CSPR ops completed
  - SMS and procedure authorization activities are progressing for Q3 2017 implementation
- **Dependent Procedures**
  - 1.5 NM stagger for runways between 4300' and 8300' is authorized in Order 7110.65 Para 5-9-6 and implemented at CVG, MEM, PHX, and SDF
  - Safety analysis is complete and procedure authorization work is progressing for 7110.308A stagger reduction at SFO by Q2 2017 commitment date
- **Wake RECAT Phase II benefits analysis**
  - Currently performing benefits analysis of upgrading RECAT Phase 1.5 sites to RECAT Phase II

FAA NextGEN

Multiple Runway Operations Industry Commitment Status

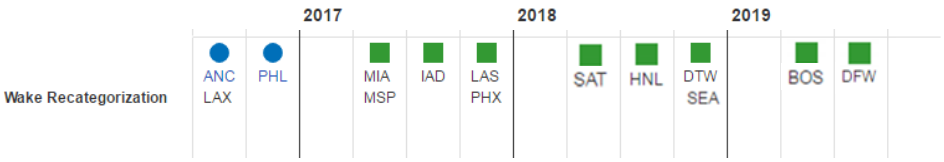
- Joint Analysis Team (JAT) Performance Analysis Participation completed for 2016 RECAT assessments
- JAT assessments of IND and PHL are in progress and will require continued industry support

MRO Action Items from NACSC

Move RECAT commitments out of the 4th quarter in 2018-2019

- **The working dates for RECAT implementations are below:**

Working Dates for Completion



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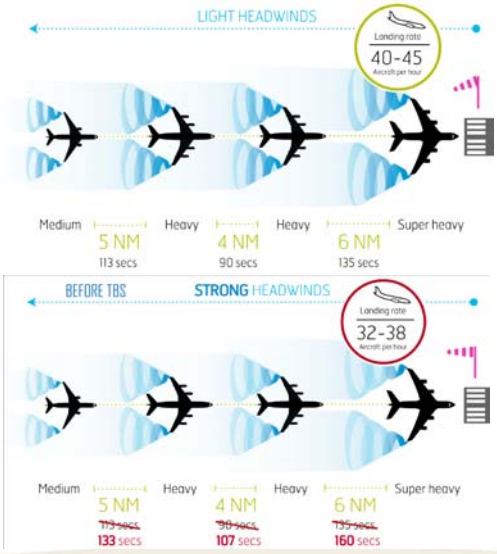
MRO Action Items from NACSC

Evaluate how to move assessment of Time Based Separation (TBS) up from Q4 2018

- **Background: What is TBS? Heathrow example**



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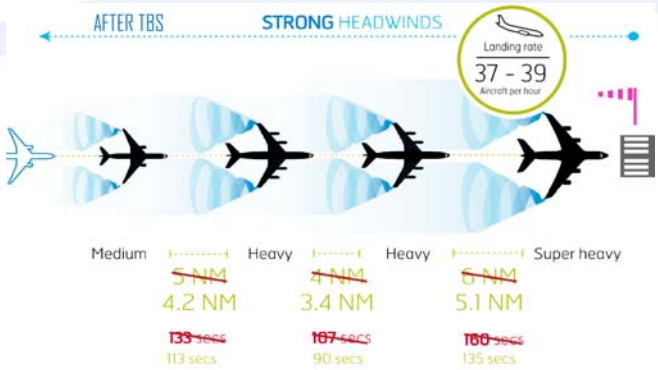
Images from Duffy and DeLuca, "One Year Assessment of TBS at LHR" presented at WakeNet USA, May 3, 2016.

MRO Action Items from NACSC (continued)

Evaluate how to move assessment of Time Based Separation (TBS) up from Q4 2018



- FAA is currently researching the applicability, shortfalls, and safety considerations for use of this TBS concept at NAS airports
- NAC pre-implementation commitment originally scheduled for Q4 2018

FAA NextGEN

Image from Duffy and DeLuca, "One Year Assessment of TBS at LHR" presented at WakeNet USA, May 3, 2016.

MRO Action Items from NACSC (continued)

Evaluate how to move assessment of Time Based Separation (TBS) up from Q4 2018

- **MRO Working Group members have discussed path forward to address NACSC action**
- **FAA will provide more insight into the activities that inform the assessment commitment. These will include:**
  - Analysis of headwind conditions and shortfall/potential benefits at NAS airports
  - Data collection and safety analysis to support separation reductions
  - Analysis of operational considerations for using TBS in the NAS
- **FAA will work through the MRO Working Group to accept industry input for consideration during this analysis**
- **ANG Wake Research Program is working, in partnership with AFS and ATO, to determine timelines for these activities and outputs that can be shared with the MRO WG and NACSC**

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Multiple Runway Operations Risks

- Program interdependencies with other FAA projects
- Collision and wake hazard safety analysis results
- Unforeseen runway issues
- Environmental concerns

FAA NextGEN

DISCUSSION

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Surface Team

Industry Leads:
Rob Goldman, Delta Air Lines
Steve Vail, Mosaic ATM, Inc.
FAA SMEs:
Susan Pfingstler, ATO
Mike Huffman, ATO

Surface Pre-Implementation Commitments

- **Completed Commitments:**
  - ✓ Plan to Deliver TFDM Capabilities to Key Sites as Early as Possible – Q3 2016
  - ✓ Plan to Move Up the TFDM Build that Subsumes DSP within the Overall TFDM Waterfall – Q3 2016
  - ✓ Restoration of Original FY18-20 Funding for the TFDM Program and Contract Award – Q3 2016
  - ✓ Identify Forum for On-Going Industry Engagement with FAA Throughout TFDM Deployment – Q4 2016
    - The first engagement with the Surface CDM Team was conducted on January 25, 2017
    - The first engagement with the Surface CDM Team was conducted on February 17, 2017

Surface Implementation Commitments Cont'd

- **Surface Departure Management Demonstration Charlotte (ATD-2) – Q4 2017**
  - Conducted 3rd HITL test integrating airspace and surface traffic simulators on January 19. This supported the integration of Surface Trajectory-Based Operation (STBO) system, its user interfaces, and its connection with Time-Based Flow Management (TBFM).
  - NASA delivered v2.1 of the Integrated Arrival/Departure/Surface (IADS) system on January 20. The release implements requirements identified during five shadow sessions conducted from July - November 2016.
  - The 6th shadow session with CLT ATCT, American Airlines Ramp controllers, and CLT airport occurred on January 24-26.
  - NASA presented an update on ATD-2 Phase 1 field demonstration at the Surface Collaborative Decision Making Team meeting, held in Washington, DC on January 25.

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Surface Implementation Commitments

- **FAA to Increase Data Sharing providing Surface Surveillance MLAT CAT 10 data (MA and Incidental NMA) to Industry via SWIM – Q4 2017**
  - First STDDS R3.3 software (including CAT10) planned installations:
    - Start – February 10, 2017
    - Last installation – August 2017
  - TRACONS targeted:

• Y90	• HCF	• M03	• T75
• SCT	• A90	• SDF	• PVD
• CLT	• PCT	• S46	• P50
• JAX	• MIA	• MKE	• PHL
• D10	• F11	• D01	• C90
• NCT	• M98	• BUF	
• HCF	• A80	• I90	
• N90	• D21	• S56	

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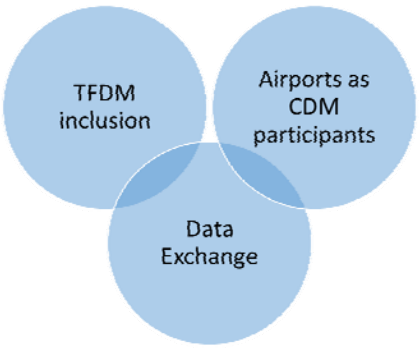
CDM User Status for TFMdata

USER	SWIM Consumer	TFMData Publisher	Target – OPS Cutover
Air Wisconsin Airlines	pre-Development		
American Airlines	Operational	Testing Complete	February 2017
ARINC	Operational	Kick-Off started	
AvFinity	Operational		
Colt International	Development		
Delta Airlines	Operational	Cutover to Ops	Complete
Endeavor Air	Development		
FedEx	Operational	Kick-Off started	
Flight Plan	Operational		
Hawaiian Air	Development		
Honeywell International	Operational		
Jet Blue Airways	Development	Kick-Off started	
Korean Airlines	Development	Kick-Off started	
Netjets	Operational		
Southwest Airlines	Operational	Kick-Off started	
United Airlines	Development		
United Parcel Service	Operational	Kick-Off started	
Virgin America	pre-Development	Kick-Off started	
Int'l ANSPs- Trinidad & Tobago	Development	In Testing	4th Quarter 2017

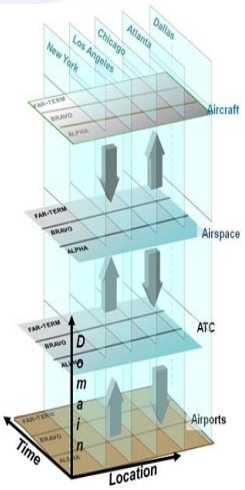
FAA NextGEN

Integrating Surface Operations in the NAS



- TFDM participation
  - Interpret CONOPS
  - Review changes to program requirements
  - Provide implementation insight
  - Facilitate NASA ATD-2 learning transfer
- Airport CDM participation
  - Evolution of the philosophy and organization
  - Stakeholder inclusion makes sense
  - Part of the departure metering concept
- SWIM and developing a vision for data
  - Foundation of traffic flow management and facilitates gate-to-gate concept with surface
  - Data Governance
  - Data Stewardship
- Near term application of surface management concepts and use of surface data elements

Surface – Risks

Domain Framework	Risk Category	Risk Description
	Aircraft	
	Airspace	
	Air Traffic	
	Airports	
	Cross Cutting	■ Stakeholder provision of surface data elements ■ CLT electronic flight strips capability required in time to support ATD-2 schedule

FAA

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DISCUSSION

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Performance Based Navigation

Industry Leads:
Steve Fulton, Sandel Avionics
Brian Townsend, American Airlines
FAA SMEs:
Donna Creasap, ATO
Josh Gustin, ATO

Atlanta Metroplex

- Implementation Challenges and Changes
  - After Action Response
  - Design Modifications
  - Lessons Learned
- Moving Forward
  - Post Implementation Actions

PBN NIWG Milestones: CY 2016

- **Implementation**
  - Time Based Flow Management (TBFM) Ground-based Interval Management – Spacing (GIM-S)
    - 3 sites
  - TBFM Integrated Departure Arrival Capability (IDAC)
    - 3 sites
- **Pre-Implementation**
  - Advanced Required Navigation Performance (RNP)
    - AC 90-105 published
  - Enhanced Flight Vision System
    - Final Rule published

FAA NextGEN

PBN NIWG Milestones: Q1 and Q2 2017

- **Implementation**
  - Metroplex
    - Charlotte (Q1)
    - Las Vegas; design start (Q1)
- **Pre-Implementation**
  - Advanced RNP Advisory Circular 90-105: Design guidance (Q1)
  - EoR Seattle (SEA) Review (Q1)
  - EoR Feasibility Assessments for Independent Duals and Triples Operations (Q1)
  - New Vertical Guidance Criteria and Location Guidance (Q1)
  - EoR Independent Operations Safety Analysis (RF Duals and Triples) (Q2)
  - EoR Independent/Dependent Operations Capacity Analysis (Q2)
  - RNP-1 Departures (Q2)
    - Burbank (BUR) and Santa Ana/John Wayne (SNA)

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PBN Risks

- User acceptance and ability to build the transition between current operational methods and time-based methods.
- Common understanding of milestones and project expectations.

FAA NextGEN

DISCUSSION

BREAK

Airline C/N/S Fleet Plans, Supply Chain and ADS-B Update

Presenters:
Bret Peyton, Alaska Air
Christian Kast, UPS
Carl Esposito, Honeywell

NextGen Strategy at Alaska Airlines

Captain Bret Peyton
Alaska Airlines Technical Pilot

February 2017

Today's Discussion

Our Company

Communication

- Data Comm at Alaska

Navigation

- RNP-Our history and our future

Surveillance

- ADS-B equipage update

Our NextGen Skunkworks

- NASA and TASAR

Alaska Airlines

Fast Facts
Revenue: $5.9 billion
Destinations: 116 destinations
Daily Departures: 990
Employees: 15,600 total employees
Fleet: 156+ Aircraft, all Boeing 737
Passengers: 32 million

Horizon Air

Fast Facts
Established: 1981 *purchased by Alaska Air Group, Inc. in 1986
Number of Passengers: 7.9 million (2015)
Average Stage Length: 291 miles
Employees: 3,634 total employees
Fleet: 76 Aircraft, all Bombardier Q400 *33 Embraer E175s ordered in 2016

Virgin America

Fast Facts
Revenue: $1.6 Billion
Destinations: 24 Destinations
Daily Departures: 197
Employees: 3,200 total employees
Fleet: 64 Aircraft, all Airbus
Passengers: 8 million

CNS

Communication—Data Comm at Alaska

- IOC Sep 18 2016
- Equipment initiative program participant
- 60+ aircraft now equipped
- 125 737-800/900ERs EOY 2018
  - All deliveries before/after 2018 equipped
- Forward fit and retrofit
  - All FANS 1/A VDL M2/Iridium
  - All RNP 4

CNS

Communication—Data Comm at Alaska

ASA7 JFK-SEA

CNS

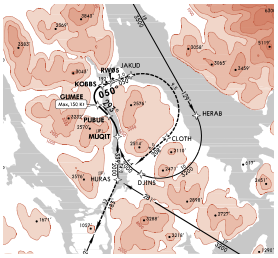
Navigation—Our RNP program history

- Fully committed to PBN in 1995
- RNP AR pioneer out of necessity
- Seamless blend into NexGen vision
- Springboard to $16M savings/yr due to in-house RNP procedures

CNS

Navigation—Our RNP program today

- All ASA pilots RNP AR qualified
- All ASA 737s RNP AR .1/.11
- 44 + 10 RNP IAPs and SIDs
- Promotes RNP use in NAS
- Continual improvement
  - RNP 1800 RVR
  - Linked RF



CNS

Surveillance—ADS-B

- Our 737 fleet today for 2020 mandate
  - 38 mandate-complaint aircraft
- On track for full 2020 compliance
  - Gen I MMR + SA-On replacement in full swing
    - ✓ Last 7 retrofits in Q4 2019
  - All new deliveries until 2018 MMR II + SA-Aware
  - 2018 deliveries MMR III + GBAS/SBAS
  - Requested Ex12555 as a contingency
  - SAPT not planned

Skunkworks: Integrating NextGen

NASA TASAR Evaluation

- Traffic Aware Strategic Aircrew Requests
  - Real-time route and fuel optimizer
  - ADS-B In, WX, SUA displayed
  - EFB accessed fine tuning of both time and fuel
- Tailored to NextGen
  - Fully optimized 4D trajectories
  - Seamless integration w/SWIM
  - Gate-to-gate potential
- NASA/Alaska partnership
  - Trial on 3 aircraft in 2017
  - Minimal equipment enhancements required

NextGen Strategy at Alaska Airlines

Thank You

DISCUSSION

Air-Ground Interface

UPS carries 6% of the US GDP…..and …... 3% of the World's GDP

Package cars worldwide

- Total number- 105,000 and more than 7,700 alternative fuel advanced technology vehicles
- Cost per 5-minute of delay- $105M/year

UPS Notable NextGen Milestones

UPS Airline Certified

UPS launches ADS-B development

Congress funds the Louisville Technology Initiative producing:
- New TRACON automation
- ASDE-X
- ADS-B on all UPS A/C
- CDTIs on most UPS A/C
- Surface Management Sys

Surface Management System deployed

UPS-First Airline to connect to SWIM

Louisville TRACON Implementation of:
- ADS-B Fusion
- RNAV SIDs & STARs
- RECAT
- Departure Fix Changes
- Parallel Runway Ops

1988-1995	1995-2000	2000-2005	2005-2010	2010-2015	2015-2020	2020+

DataComm Enroute trials

West runway built for Louisville

UPS Worldport opened

ADS-B Merging & Spacing Trials
SafeRoute

UPS- First Airline to connect to DCL

UPS Aircraft Equipage through 2020

	Communication	Navigation	Surveillance
	DataComm	RNP .3 / AR	ADS-B out / GPS
B747 (27)	FANS 1/A+ / VDL	YES / NO	Complete / SBAS
B757 (75)	FANS 1/A+ / VDL	YES / YES	Complete / SBAS
B767 (59)	FANS 1/A+ / VDL	YES / YES	Complete / SBAS
A300 (52)	Appropriated	YES / 2020	Complete / SA Aware
MD11 (37)	FANS 1/A / VDL	YES / NO	Complete / SBAS
	CPDLC / VDL	RNP 0.3 / AR	ADS-B / SBAS
TOTAL aircraft	198 / 198	250 / 186	250 / 198

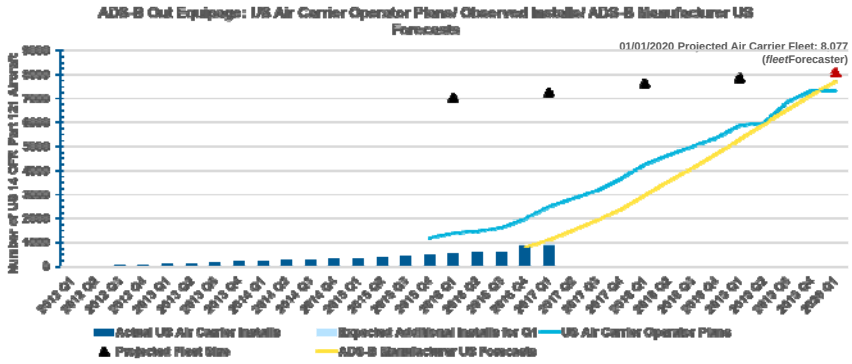
DISCUSSION

ADS-B Equipage Snapshot Feb 2017

Art Branch, Sean McCourt, Quang Nguyen, Todd Stock, Doug Vandermade

MITRE

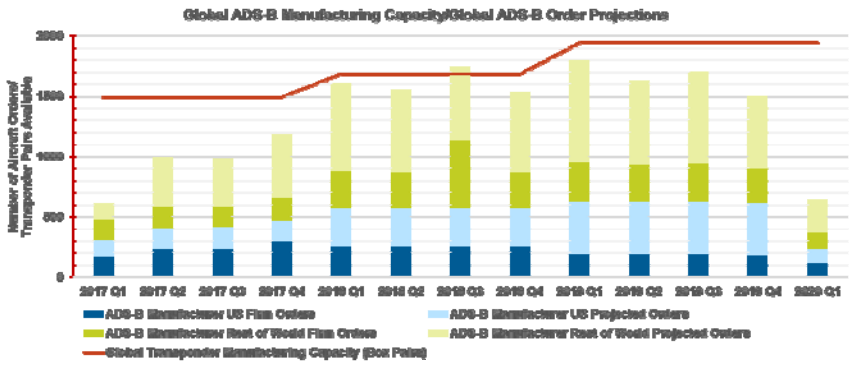
US Air Carrier Operator Installation Plans and ADS-B Manufacturer Order Forecasts



Data provided by ADS-B transponder manufacturers and Air Carrier Operators

MITRE

ADS-B Capacity vs Global Demand



Data provided by ADS-B transponder manufacturers

MITRE

Notes and Conclusions

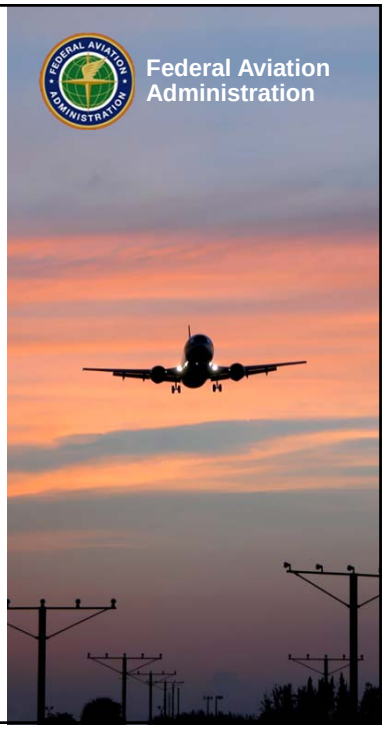
- **Sufficient production capacity exists to meet global demand**
  - Limited excess capacity to accommodate non-linear orders and installations
  - Majority of forecasted demand is from non-U.S. operators
- **3-9 month lead time needed for order fulfilment**
- **Part 91 market analysis is in work**

– **121 Air Carrier fleet size is a projection based on *fleet*Forecaster**

– **Air Carrier plans based on data provided in 2016 – new data is needed to account for differences between observed installs and plans**

MITRE

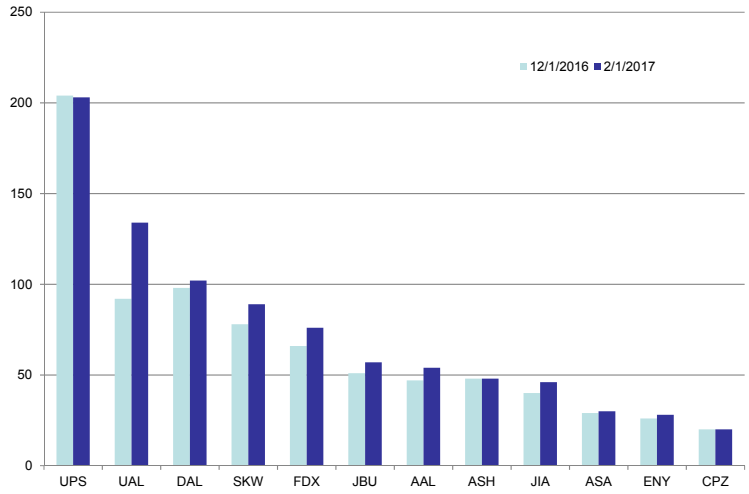
Equip 2020
FAA Update



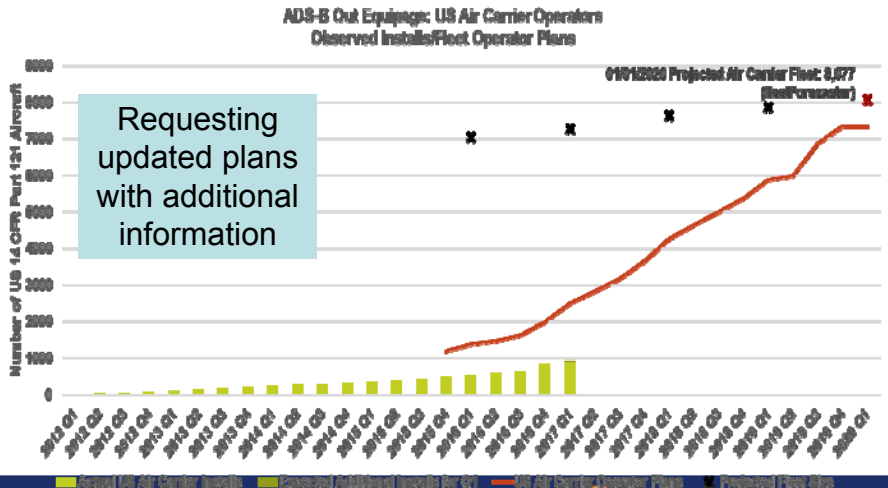
Bruce DeCleene, Flight Standards Service

Date: February 22, 2017

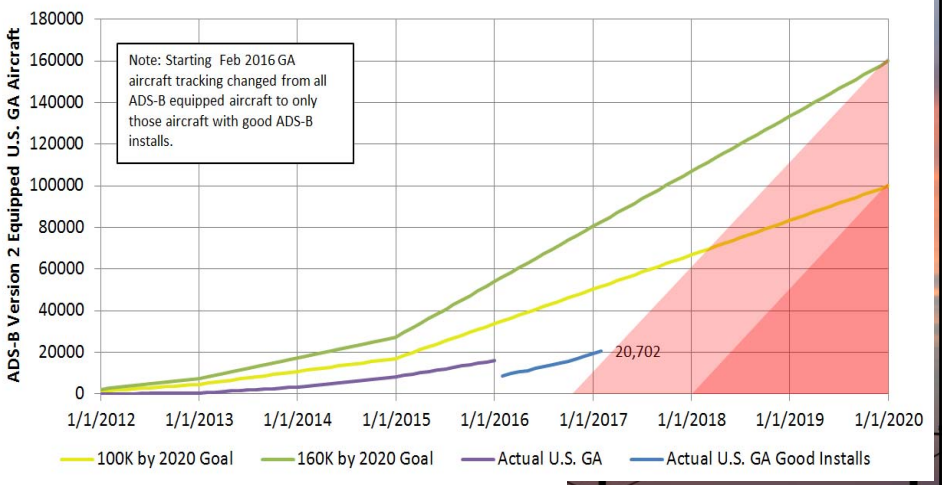
Equipage Status – U.S. Air Carrier



US Air Carrier Operator Installs and Plans

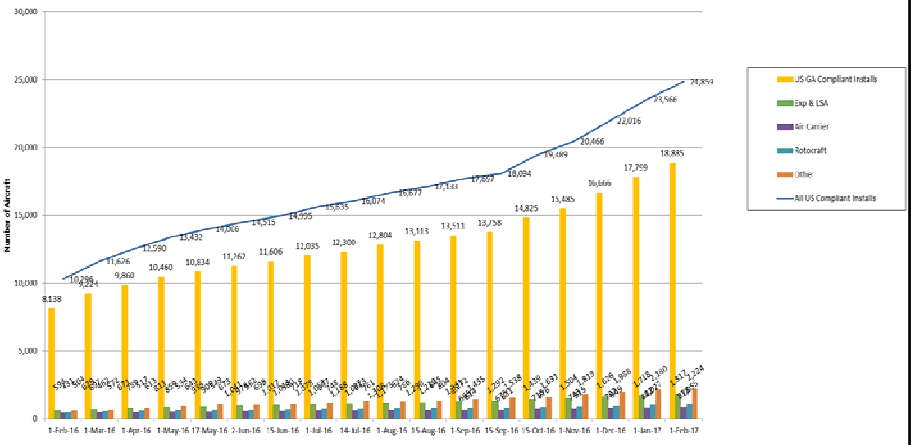


ADS-B Out Version 2 Equipage U.S. General Aviation (good installs) (including Exp & LSA aircraft) Actuals vs 100K and 160K by 2020 Goals



Summary of All Aircraft Installation Status

US ADS-B Compliant Install Breakdown



Equip 2020 Update

- **Air Carrier Community Highlights**
  - Evaluating performance of GPS-inertial integrated solutions
  - Advocating for completion of modernized GNSS receiver standards
  - Maturing Service Availability Prediction Tool
- **General Aviation Community Highlights**
  - Updating information on target aircraft for equipage
  - AEA conducting survey of repair station capacity
  - Resolving aerobatic aircraft performance
  - Pursuing standard Light Sport Aircraft (LSA) solutions
  - Addressing privacy and proposal for broadcast of traffic to all aircraft
- **Next Meeting: March 29th at HAI**

U.S. Government Fleet: Current Known ADS-B Equipage Status

	DoD [1]	Intel/Law Enforcement	Civil [2]	FAA
Size of Fleet	12,417	??	Approx. 700	46
Current Equipage	107	??	76	8
Equipage Expected by 2020	–	??	–	46

[1] ATO PMO will coordinate with DoD/USCG to update this information. Current equipage reflects DoD aircraft status as confirmed by performance monitor.

[2] ATO Flight Program Operations will coordinate through the GSA ICAP to update this information for aircraft reportable in FAIRS (other than armed forces or intelligence/law enforcement agencies). Current size of fleet includes subset of aircraft operated internationally.

FAA ADS-B Aircraft Equipage Plan

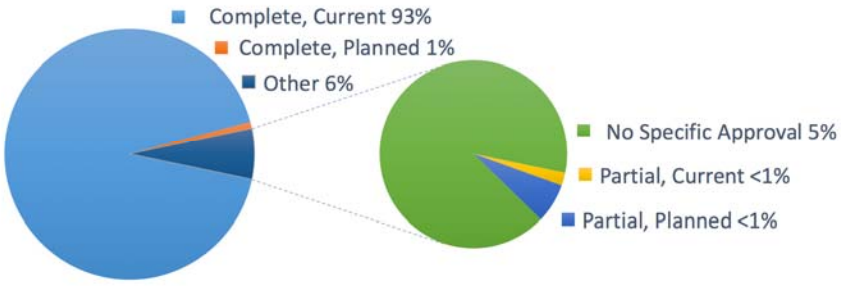
- FAA operates 46 owned/exclusive-use leased aircraft under the FAA Flight Program.
- Equipage of all 46 aircraft with ADS-B avionics is planned by the end of 2018.

Status	Planned	Total Equipped
Aircraft Currently Compliant:	–	8
Total Equipped by End of 2017	22	30
Total Equipped by End of 2018	16	46

Data as of Feb 14, 2017

Detailed Information

Availability of ADS-B Out Solutions Mapped to IFR Flight Plan Derived Fleet



- **Suppliers that provided data for second round data collection:**
  - ACSS, Aspen Avionics, CMC, CMD, Embraer, FreeFlight Systems, Garmin, Gulfstream, Honeywell, Prostar L-3/Lynx, Rockwell Collins, Textron Aviation, United, Universal Avionics, UPS
- **Current solution database contains 5,549 solutions mapping to 2,031 unique make model combinations**

Data current as of 09/16/2016

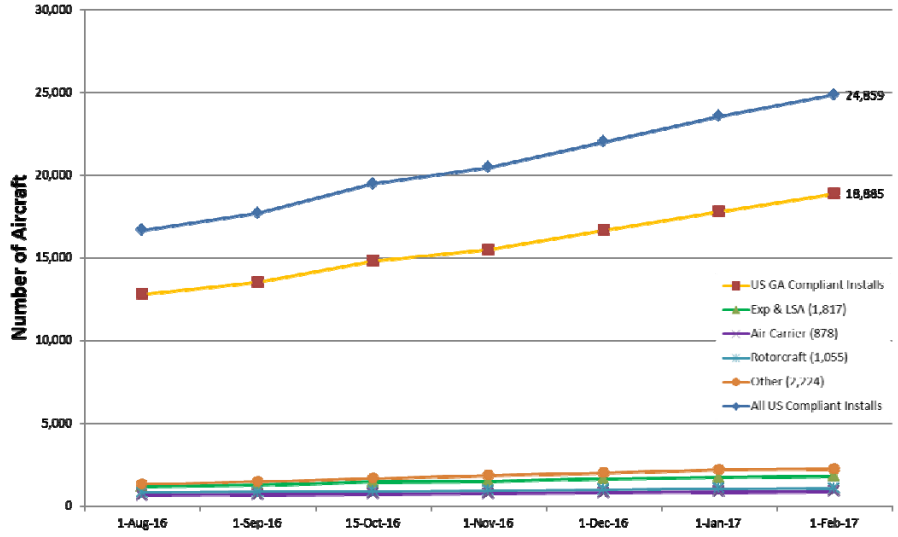
Feb 2017 Equipage Monitoring

V2 ADS-B Out equipped aircraft with compliant performance detected by FAA network

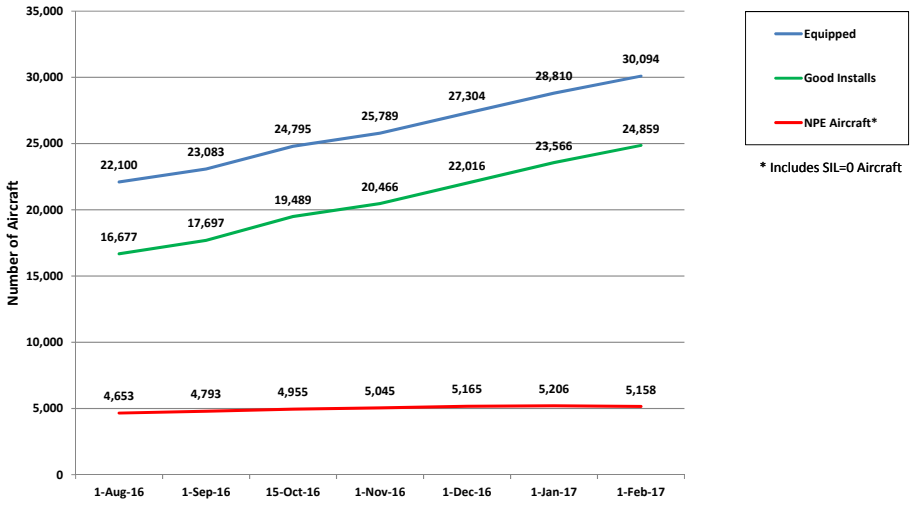
Category	As of 1-Jan-2017 (ATAT)	As of 1-Feb-2017 (ATAT)	Monthly Increase		% of estimated fleet equipped^, as of 1-Feb-2017
All Link Version 2	23,566	24,859	1,293	5.49%	
1090ES	17,648	18,828	1,180	6.69%	
UAT	5,079	5,074	-5	-0.10%	
Dual	838	957	119	14.20%	
US General Aviation (includes EXP & LSA)	19,517	20,702	1,185	6.07%	12.9% - 20.7%
US Air Carrier	842	878	36	4.28%	14.6% - 17.6%
Intl General Aviation*	1,535	1,588	53	3.45%	
Intl Air Carrier	580	594	14	2.41%	
U.S. Military & U.S. Special Use	29	27	-2	-6.90%	

- http://www.faa.gov/nextgen/equipadsb/equipment/monitoring/
- *Aircraft incorrectly reporting outside US ICAO block are included in Intl GA count.
- ^percentage range based on estimates of 5,000-6,000 US air carrier aircraft and 100K-160K US general aviation aircraft
- ATAT – The ATAT was used to generate these numbers starting on June 1, 2016

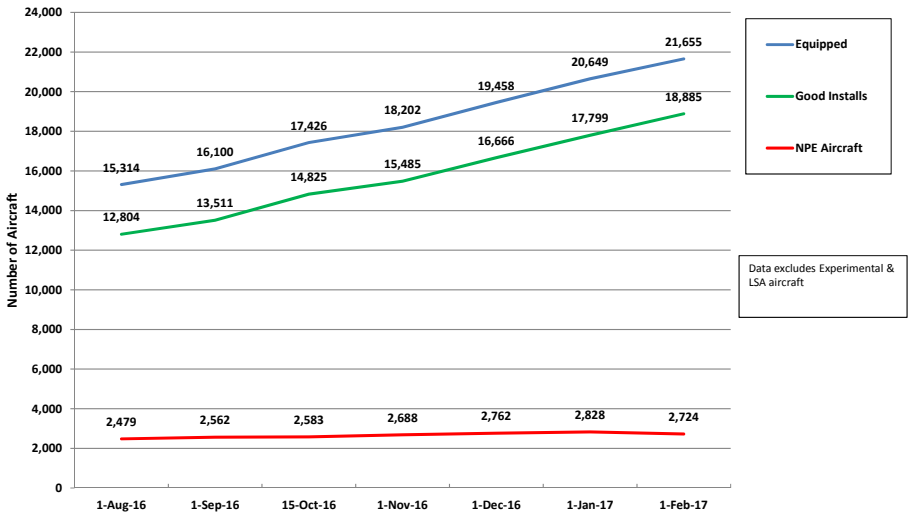
US ADS-B Compliant Install Breakdown



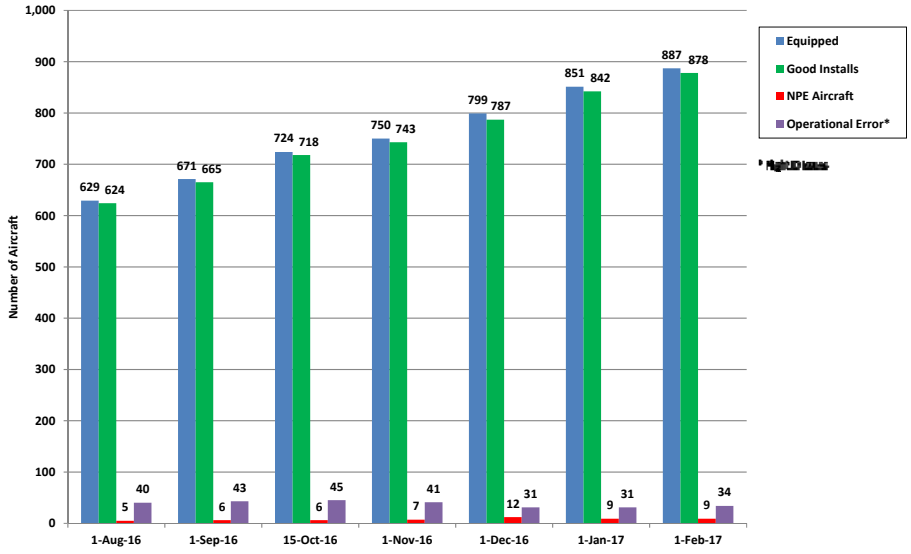
All US Aircraft Equipage & Avionics Performance



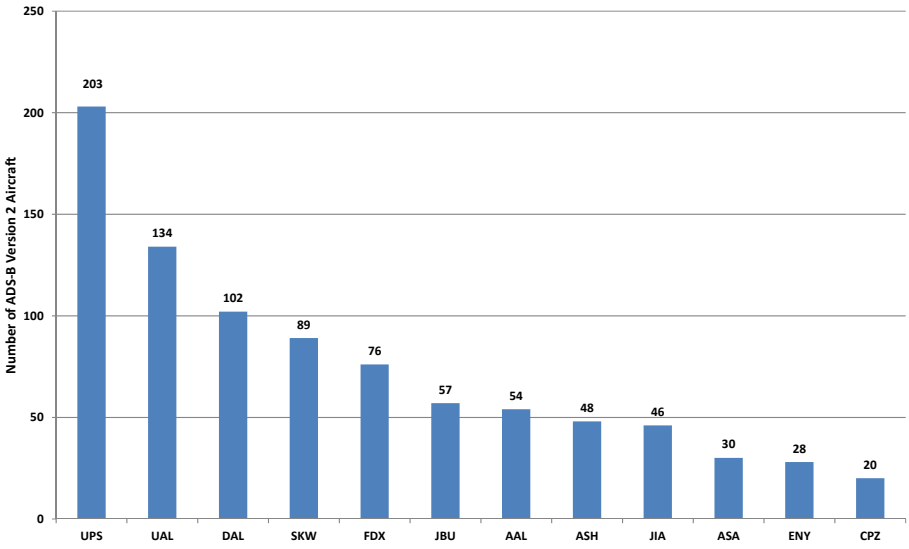
US GA Fixed-Wing Equipage and Avionics Performance



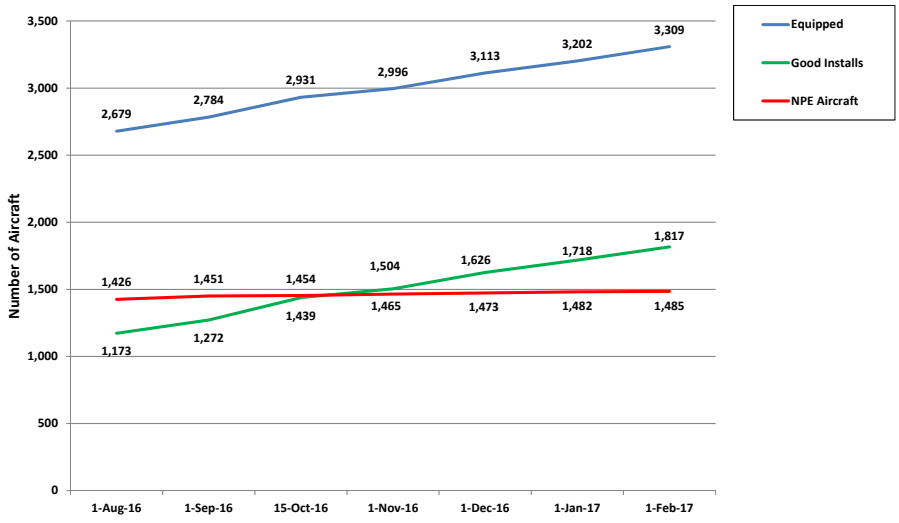
US Air Carrier Equipage & Avionics Performance



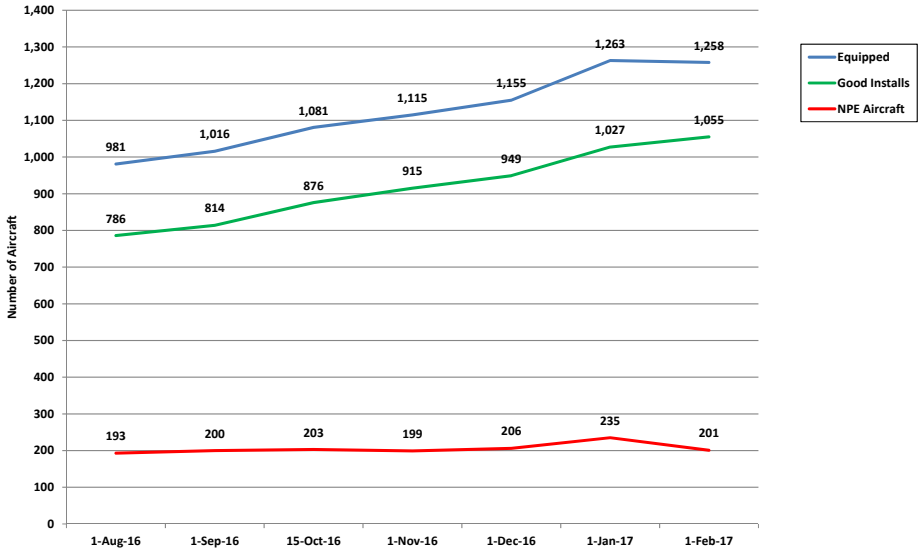
Equipage Status - U.S. Air Carrier Feb 1, 2017



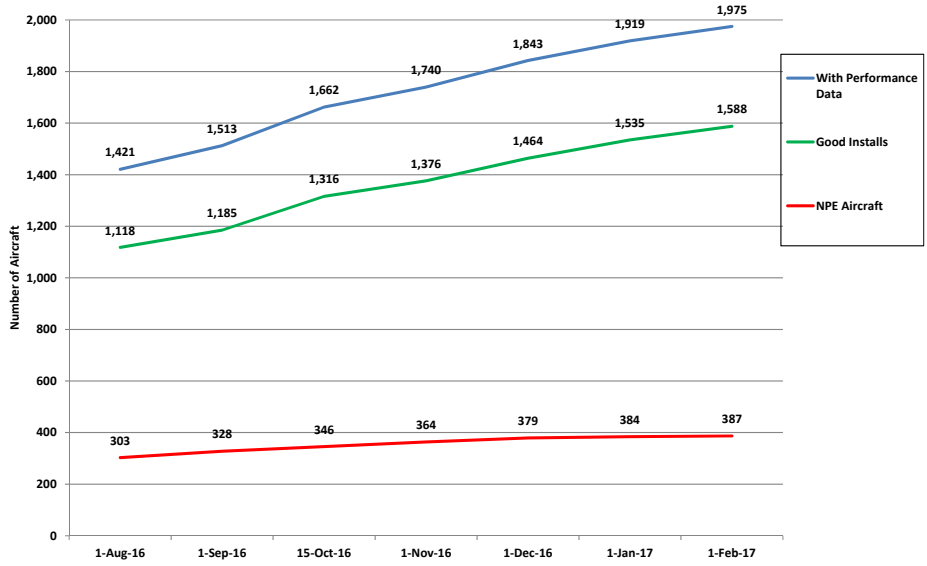
USA Exp and LSA Aircraft Equipage and Avionics Performance



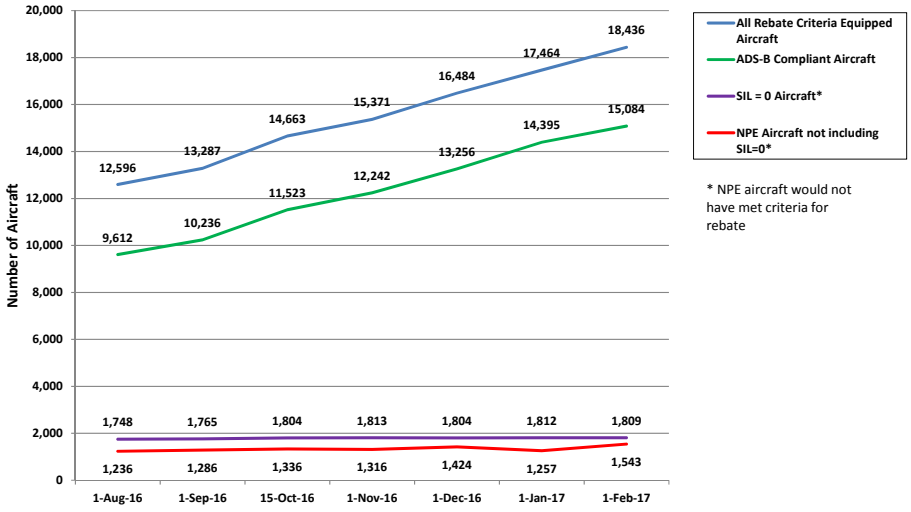
US Rotorcraft Equipage & Avionics Performance



International GA Equipage & Avionics Performance

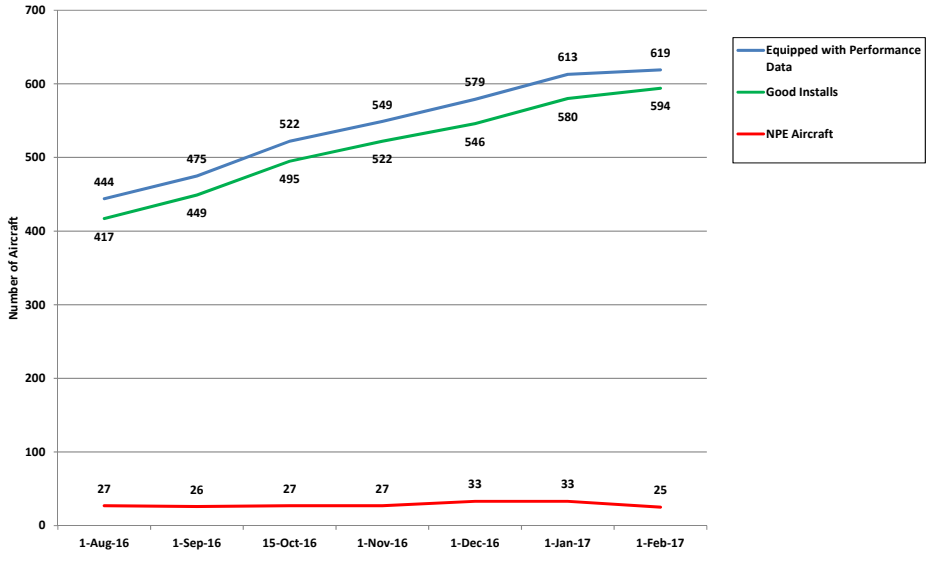


US Fixed-Wing Single-Engine (rebate-eligible) Aircraft Equipage & Performance

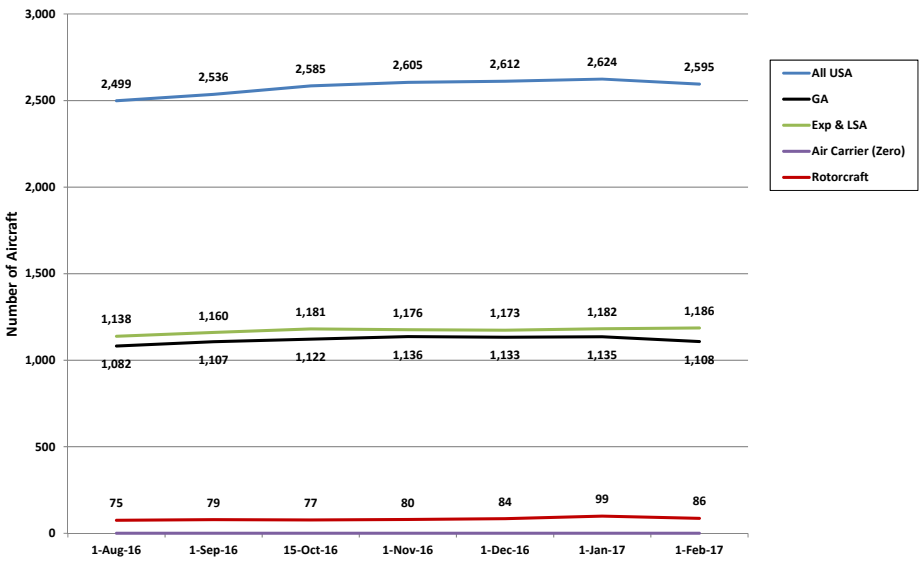


* NPE aircraft would not have met criteria for rebate

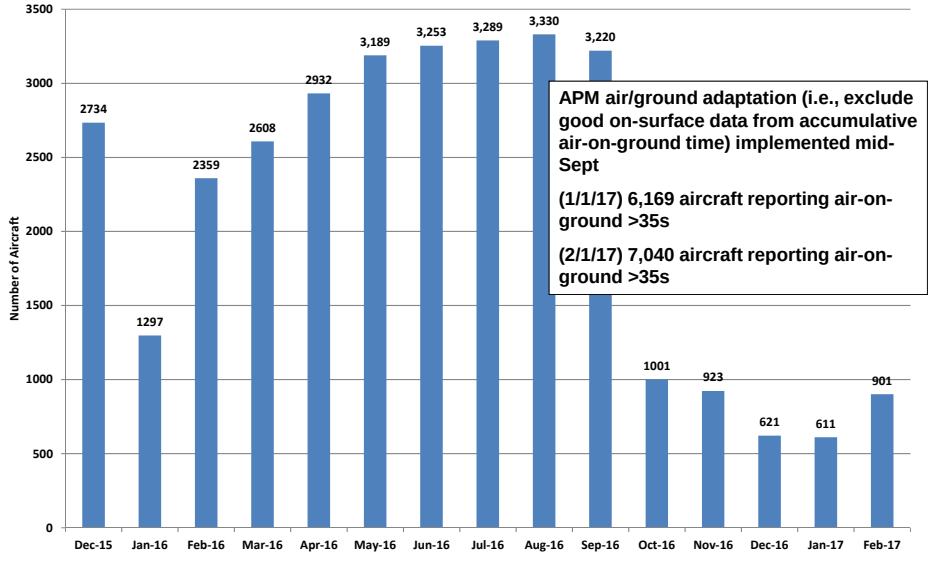
International Air Carrier Aircraft Equipage and Avionics Performance



US Aircraft with SIL = 0



Number of Aircraft with Air-Ground Issues (>600s)



APM air/ground adaptation (i.e., exclude good on-surface data from accumulative air-on-ground time) implemented mid-Sept

(1/1/17) 6,169 aircraft reporting air-on-ground >35s

(2/1/17) 7,040 aircraft reporting air-on-ground >35s

U.S. Government Fleet

- **U.S. Government Fleet includes three primary groups of aircraft:**
  1. DoD Aircraft (includes United States Coast Guard (USCG)).
  2. Intelligence/Law Enforcement Agency Aircraft.
  3. Executive Agency (civil) aircraft, other than groups 1 & 2 above.
     - Inventory/cost data for civil aircraft must be reported through the GSA Federal Aviation Interactive Reporting System (FAIRS).

U.S. Government Fleet: ADS-B Equipage Points of Contact

- **ATO Flight Program Operations is working through the GSA Interagency Committee on Aviation Policy (ICAP) to collect equipage plans/status information for civil fleet.**
  - ICAP includes Senior Aviation Management Officials from executive agencies that own/operate aircraft.
  - Emphasis item during next ICAP meeting on March 26-28 in Washington DC.
- **ATO PMO will continue to coordinate with DoD to determine equipage plans/status of DoD fleet.**
  - Working with ANG on outreach efforts.
- **ATO recommends ASH take the lead on coordination with intelligence/law enforcement agencies.**

DISCUSSION

UAS and ADS-B

- Tracking needed for UAS that operate in rule covered airspace
  - Numbers
  - Possible risk to ADS-B network
- Identification of barriers to equipage/compliance
- Availability of ADS-B transponders – size, weight requirements for UAS
- Insitu to conduct research & present briefing at June NAC

RTCA

THE GOLD STANDARD FOR AVIATION SINCE 1935

NextGen Plan

Presenter:
Jim Eck, FAA, Assistant Administrator for NextGen, ANG

NextGen Evolution

JPDO Vision and ConOps

- ConOps developed through multi-agency initiative
- Scope: curb-to-curb air transportation system
- Intended to drive long-term research
- End state is an ATM system founded on an aircraft's ability to fly precise paths in time/space and ANSPs ability to strategically manage and optimize trajectories throughout the operation
- Timeframe 2025

FAA NextGen Midterm ConOps Future of the NAS

- ConOps developed by the FAA
- Scope: gate-to-gate air traffic management (ATM) system (subset of the JPDO vision)
- Intended to drive NextGen implementation
- End state is an ATM system founded on an aircraft's ability to fly precise paths in time/space and ANSPs ability to strategically manage and optimize trajectories throughout the operation
- Timeframe 2025

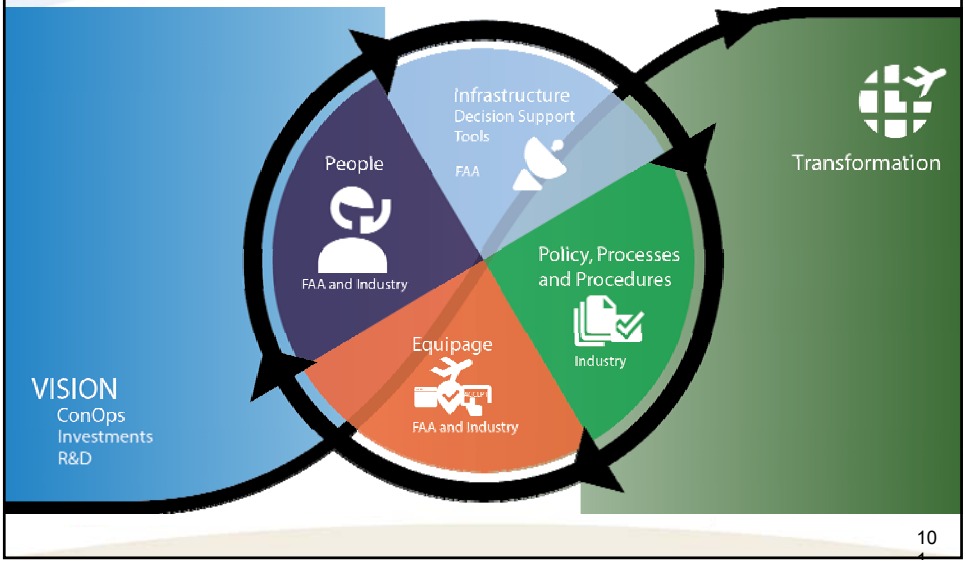
FAA ATM Transformation

Time Based Management and Trajectory Based Operations

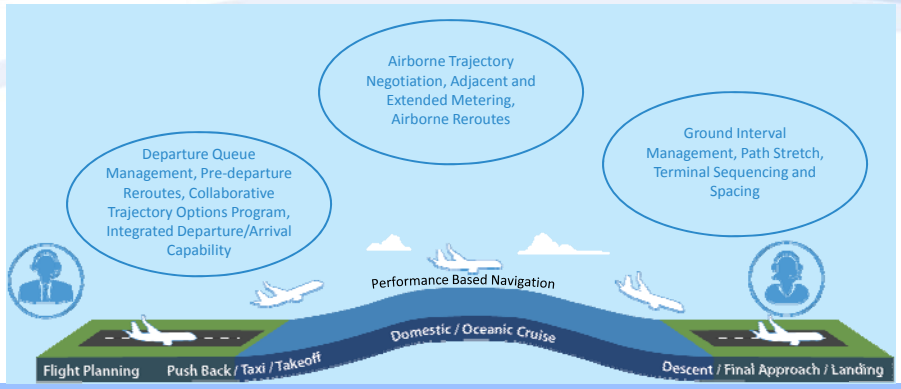
Past Practices	NextGen Improvements
• Controllers and operators do not have same information to inform decisions	• Shared information (e.g., weather, traffic, system status) for collaborative decision-making
• Future time and position of the aircraft not known by all parties*	• Future intended time and position of aircraft known for optimal flight and traffic flow
• Routing limited by ground-based navigational infrastructure	• More efficient flight routes and aircraft performance based procedures using GPS navigation
• Controllers communicate by voice to each individual aircraft	• Controllers communicate via digital messages to multiple aircraft at a time
• Operational choke points across phases of flight	• Operations integrated across phases of flight for gate-to-gate efficiency
• Tactical and reactive air traffic control	• Strategic air traffic management

*Operators, aircrews, pilots, dispatchers, controllers, operations centers and traffic managers

Keys to NextGen Success



Delivering NextGen Improvements



Communication, Navigation, Surveillance, Information Sharing, Weather

National Airspace System (NAS) Voice System (NVS), Data Communications (Data Comm), Automatic Dependent Surveillance-Broadcast (ADS-B), System Wide Information Management (SWIM), Common Support Services-Weather (CSS-Wx), NextGen Weather Processor (NWP)

Foundational Infrastructure

Terminal Flight Data Manager (TFDM)*, Time Based Flow Management (TBFM) Traffic Flow Management System (TFMS), Terminal Automation Modernization and Replacement (TAMR), En Route Automation Modernization (ERAM)

* TFDM is the only foundational infrastructure program fully funded by NextGen

Accomplishments Overview

Infrastructure

- En Route Automation Modernization
- Automatic Dependent Surveillance–Broadcast
- Data Communications Tower Services
- System Wide Information Management
- Surface Operations and Data Sharing
- Terminal Flight Data Manager
- Time Based Flow Management

People

- Customer-Focused Air Traffic Management
- Community Outreach
- Controller and Pilot Training — New Technology, Airspace, and Procedures

Equipage

- Automatic Dependent Surveillance–Broadcast
- Data Communications
- Performance Based Navigation

Policy, Processes and Procedures

Optimizing Airspace:

- Performance Based Navigation
- Time Based Flow Management
- Traffic Flow Management System
- Separation Management

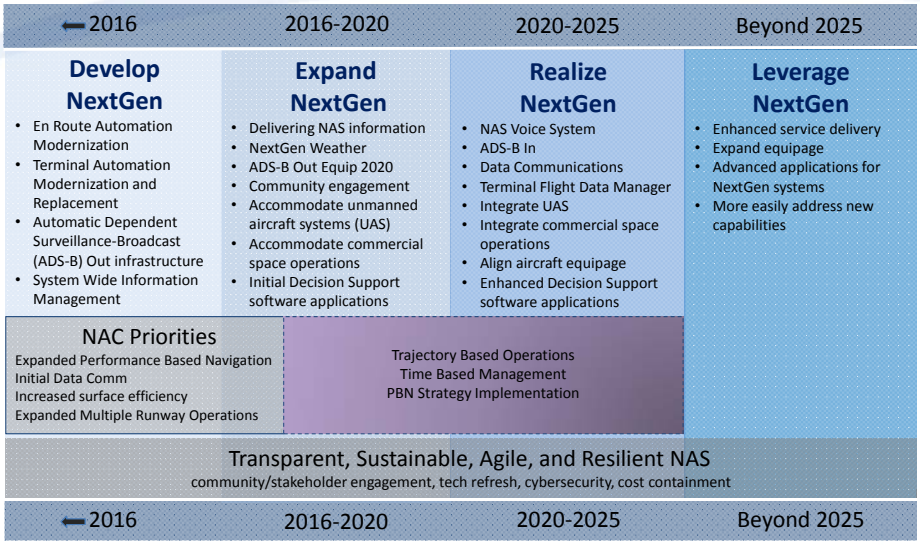
Collaborative Progress:

- RTCA Task Force 5
- NextGen Advisory Committee (NAC)
- NAC Priorities Joint Implementation Plan
- Airspace Technology Demonstrations
- SESAR Harmonization
- Mini Global Demonstrations
- Equip 2020
- PBN NAS Navigation Strategy

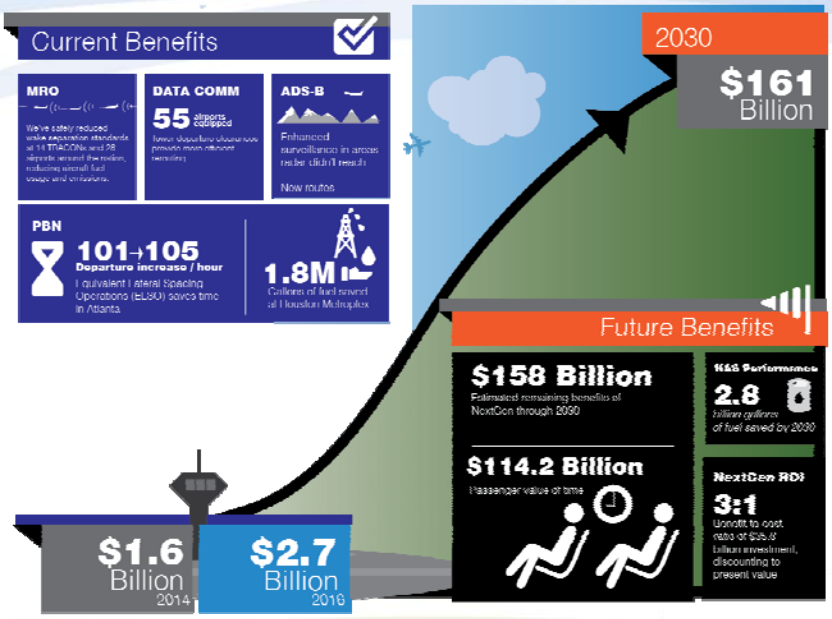
Safety and Environment:

- Aviation Safety Information Analysis & Sharing
- Engine, Aircraft Technologies
- Environmental Design Tool

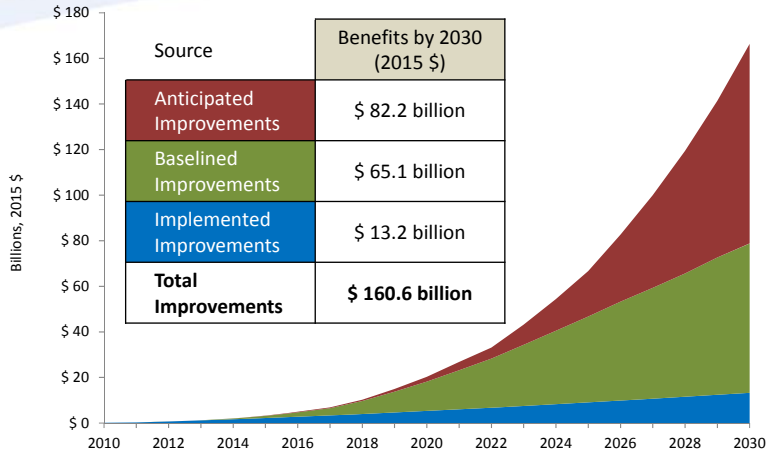
Building the Future NAS



NextGen Benefits



Cumulative Projected Benefits of NextGen Improvements



Source	Benefits by 2030 (2015 $)
Anticipated Improvements	$ 82.2 billion
Baselined Improvements	$ 65.1 billion
Implemented Improvements	$ 13.2 billion
Total Improvements	**$ 160.6 billion**

Current budget estimates to achieve the benefits: $21 billion FAA; $15 billion industry

FAA NextGEN

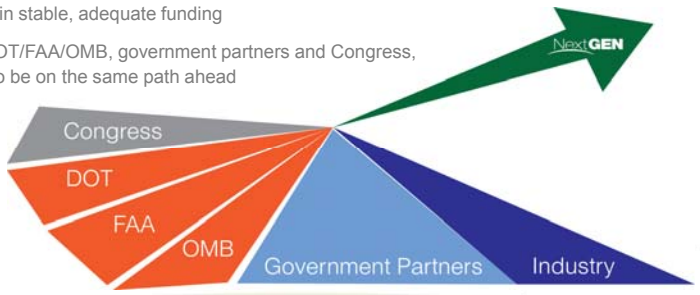
Summary of NextGen Benefits and Costs by Implementation Phase

Billions, 2015 $	Past (2007-2014)	Future (2015-2030)	**Total (2007-2030)**
Implemented Improvements	Costs $ 0.8 Benefits $ 1.6	Costs $ 0.5 Benefits $ 11.7	**Costs $ 1.3** **Benefits $ 13.2**
Baselined Future Improvements	Costs $ 5.0	Costs $ 12.0 Benefits $ 65.1	**Costs $ 17.0** **Benefits $ 65.1**
Anticipated Future Improvements	Costs $ 1.4	Costs $ 16.1 Benefits $ 82.2	**Costs $ 17.5** **Benefits $ 82.2**
Total Improvements	**Costs $ 7.2** **Benefits $ 1.6**	**Costs $ 28.6** **Benefits $ 159.0**	Costs $ 35.8 Benefits $ 160.6

FAA NextGEN

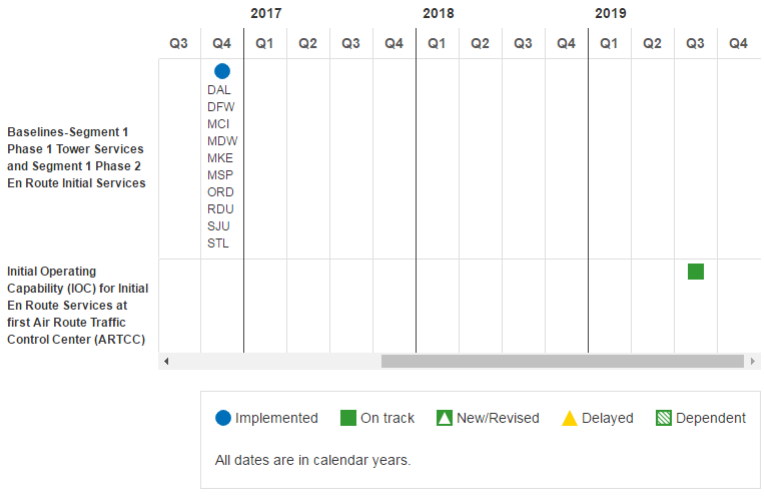
Challenges Ahead

- Training, cultural and human factors change of operational workforce (e.g., controllers, pilots, traffic flow managers)
- Maintain community consensus (e.g., noise)
- Operational integration of all air-ground capabilities to achieve full benefits
- Continue to build stakeholder buy-in (e.g., airline equipage, usage of new capabilities)
- Remain agile to accommodate changing needs (e.g., cybersecurity, new entrants such as unmanned aircraft and commercial space)
- Counter oversight criticisms (e.g., cost, schedule, management)
- Maintain stable, adequate funding
- The DOT/FAA/OMB, government partners and Congress, need to be on the same path ahead

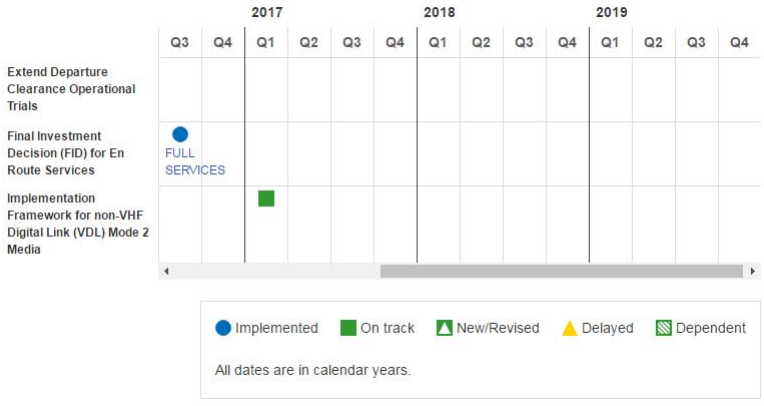


NextGen Priorities Performance Snapshots Report Backup

Data Comm Implementation Commitments

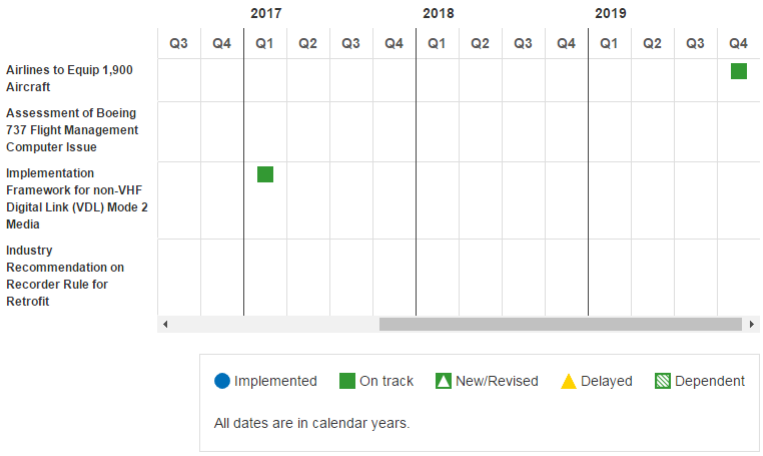


Data Comm Pre-Implementation Commitments



FAA NextGEN

Data Comm Industry Commitments



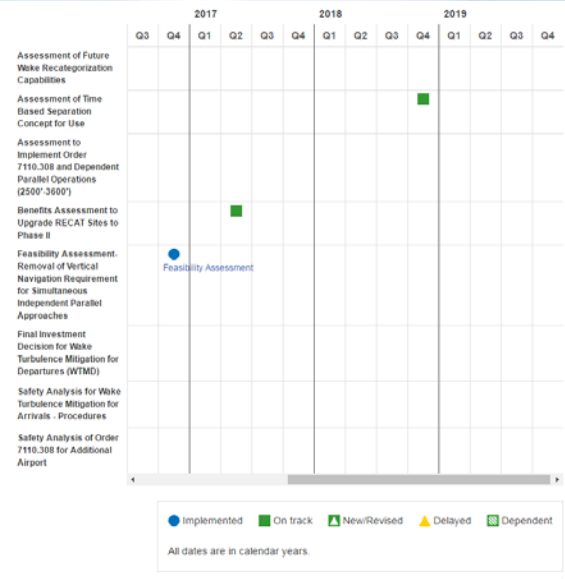
FAA NextGEN

MRO Implementation Commitments

FAA

NextGEN

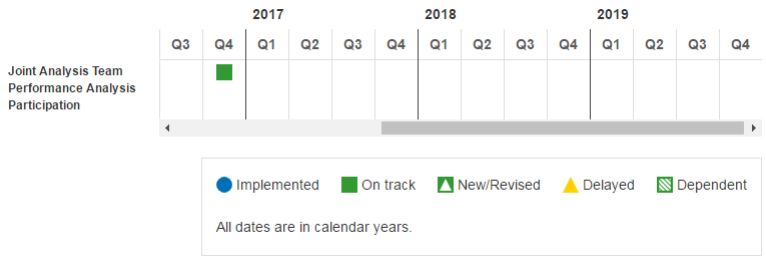
MRO Pre-Implementation Commitments



FAA

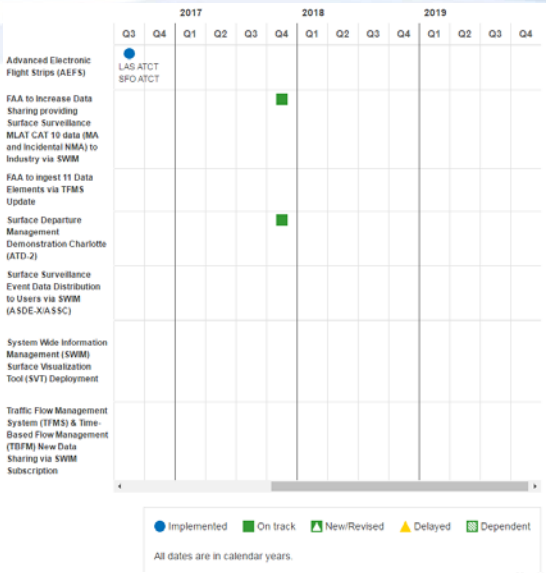
NextGEN

MRO Industry Commitments



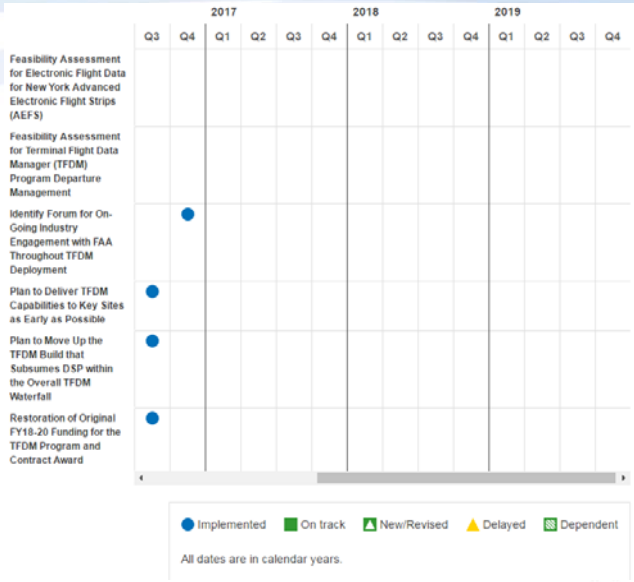
FAA NextGEN

Surface Implementation Commitments



FAA NextGEN

Surface Pre-Implementation Commitments



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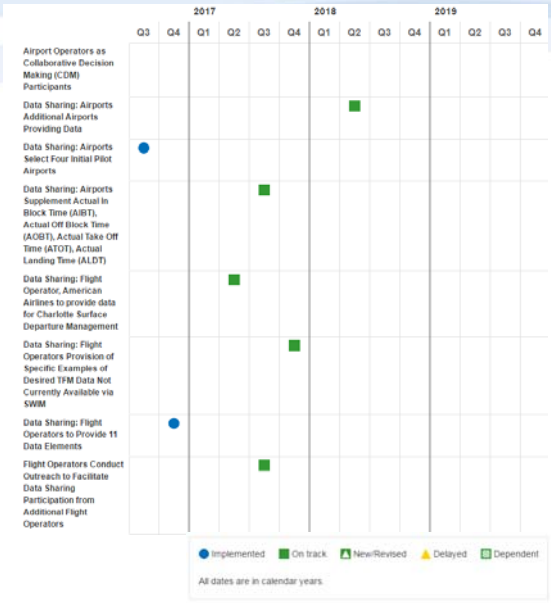
Surface Industry Commitments



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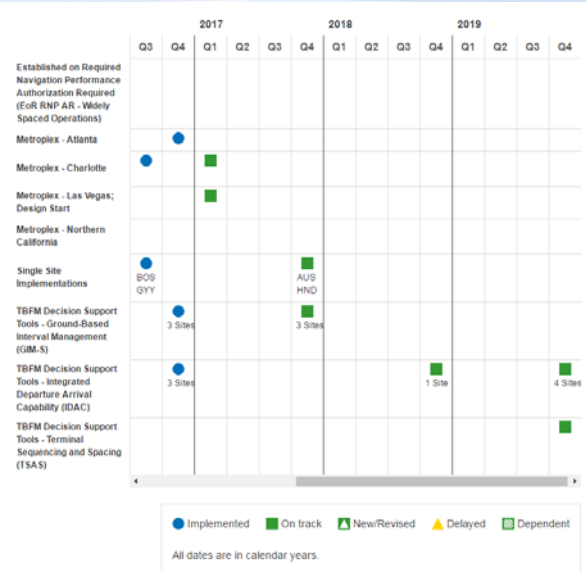
PBN Implementation Commitments



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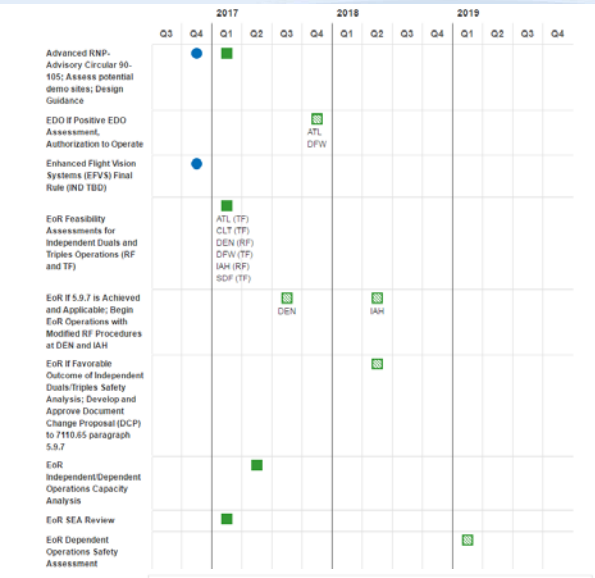
PBN Pre-Implementation Commitments (Part 1)



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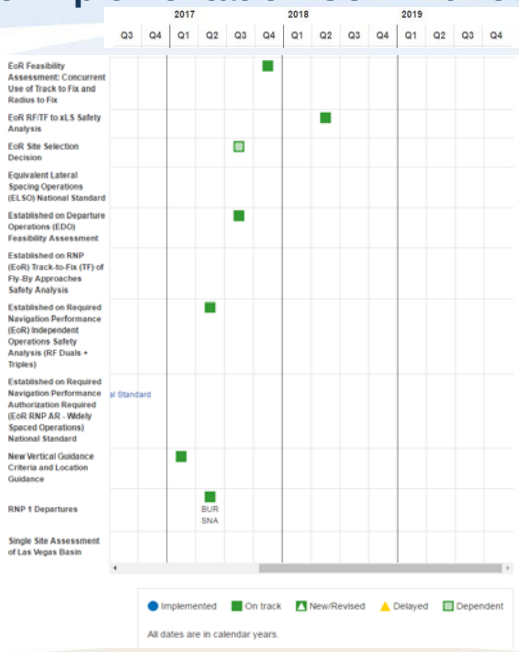
PBN Pre-Implementation Commitments (Part 2)



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PBN Industry Commitments (Part 1)

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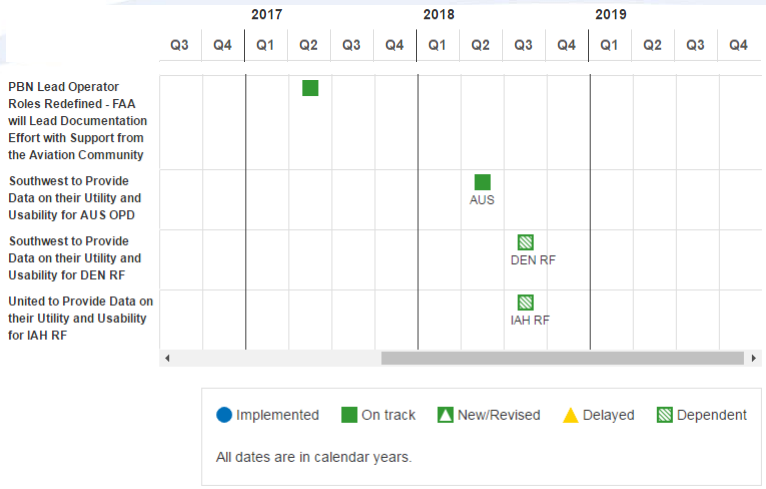
PBN Industry Commitments (Part 2)



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DISCUSSION

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The Value of NextGen Ad Hoc Group Report

Ad Hoc Group Chair:
Ed Bolen, NBAA

NextGen

"NextGen is the Aviation community working together to modernize technologies, policies and procedures in the national airspace system in order to increase capacity, reduce delays and cancellations, reduce our environmental footprint, and enhance safety, for all segments of aviation with bad weather performance equal to good weather performance"

What is NextGen (NG)?

- NextGen is a 20 year (2030), nearly $30B industry-wide initiative (both industry and the FAA) with milestones is the largest and most complex modernization of the world's largest and most important air traffic management (ATM) system.
- The NG program, in coordination with other technological, regulatory, and procedural improvements recently completed or underway by FAA and industry alike, is akin to converting the US ATM from "analog to digital".
- While NG is a program with specific time, cost, and benefits, it is the most visible demonstration of the necessity for continuous, conscientious, and prudent enhancement of our nation's ATM.

FAA Response to Sen Thune

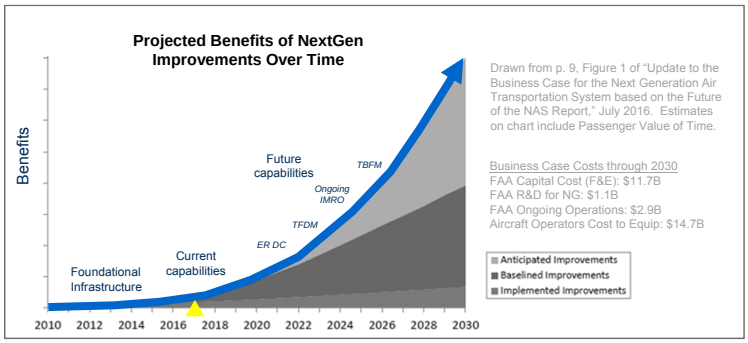
- NextGen FAA & Industry Wide effort – references throughout to NAC involvement as industry advisory body to help set priorities and develop a common language of metrics and milestones
- Time frame – while NextGen pre-dates 2010, that year marked a turning point with the establishment of the NAC
- Honest assessment - acknowledge success and areas where “we have stumbled” and have had the flexibility to work with stakeholders to learn lessons, reassess, and regroup
- Risk factors beyond FAA control - done our (FAA) best to stay on track and to prepare more thoroughly for similar risks in the future

FAA Response to Sen Thune (cont)

- Emphasizes Performance Goals - provides advanced procedures, technologies, and tools that allow more commercial aircraft carrying passengers and cargo to depart on schedule, fly more direct paths, and arrive on time at their destinations, burning less fuel and producing fewer emissions
- Business Case - through 2016 translated into $2.72 billion in savings in passenger time and occupant safety, as well as reduced fuel and aircraft operating costs
  - Included examples of Memphis Wake RECAT and Denver PBN
- Future Benefits - by 2030 total benefits of planned NextGen improvements are expected to be $160.6 billion, at a cost of $35.8 billion to the FAA and the aviation industry

The Hockey Stick Context

- NextGen is 1/3 into 20 year implementation with benefits expected to follow hockey stick model



DISCUSSION

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Joint Analysis Team

Co-Chairs:
Ilhan Ince, American Airlines
Dave Knorr, FAA

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Wake Recategorization
Final Report – IND & PHL International Airports

Co-Chairs:
Ilhan Ince, American Airlines
Dave Knorr, FAA

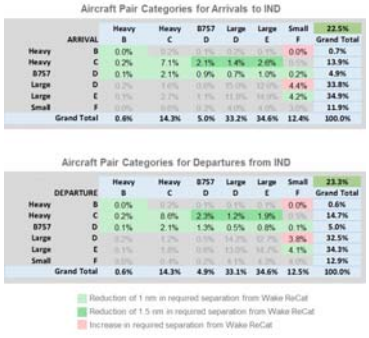
2017 JAT Tasks

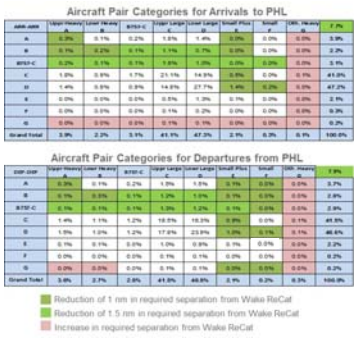
Topic	OI Date	Target NAC Meeting
NTX Metroplex Fuel Burn Changes	N/A	Feb 24 2017
IND & PHL* ReCat	Mar 2016	
BOS OPDs	May 2016	Jun 30 2017
LAX* ReCat	Sep 2016	
GYY OPDs	Jul 2016	Oct 6 2017
DataComm Benefits Review	Ongoing	

* Proposing PHL as an alternate RECAT 2.0 site. JAT will continue to evaluate LAX as data permits.

Analysis of IND/PHL ReCat

- ReCat methodology has now been applied to
  - Multiple sites (1.5 & 2.0) with different aircraft categorizations
  - Using multiple data sources (ASDE-X, Threaded Track)





Comparison of ReCat Impacts

Impacts \ Airports	IND		PHL		CLT		ORD		MDW	
	Arrs	Deps	Arrs	Deps	Arrs	Deps	Arrs	Deps	Arrs	Deps
Separation Requirements										
Decreased	22.5%	23.3%	7.7%	7.9%	2.6%	3.3%	4.4%	4.7%	1.1%	1.1%
Unchanged	73.1%	72.9%	91.9%	91.8%	97.4%	95.6%	95.6%	94.7%	98.9%	91.3%
Increased	4.4%	3.8%	0.4%	0.3%	0.0%	1.1%	0.0%	0.6%	0.0%	7.6%
Benefits Impact *(including 757 impact)*										
Time Savings (hrs)	127	1035	215	112	71	29	233	183	-0.8	-16
Cost Savings ($000s)	321	2033	545	220	180	57	590	360	-2	-32
Total Savings	$2.4 million		$765K		$237K		$950K		-$34K	

IND/PHL ReCat – Summary of Findings

- ReCat estimated to reduce taxi queues and airborne delay in IND resulting in savings of $2.4 million with 757 impact
  - Approximately $1.5 million annually without 757 impact
- Savings in PHL approximately $765K per year, including 757 impact
  - Approximately $329k annually without 757 impact
- Impacts of ReCat by airport dependent upon fleet mix, volume of scheduled operations and pressure

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Interim Report - Joint Analysis Team
Fuel Analysis
North Texas Metroplex

Co-Chairs:
Ilhan Ince, American Airlines
Dave Knorr, FAA

Key North Texas Metroplex Findings

Approved at October 2016 NAC Meeting

- Many external factors challenged pre vs. post metroplex analysis
  - Converging Runway and Over-the-Top Ops are segregated from NTX analysis
    - DAL – Eliminating OTT added 7.5nmi for 11% of flights (~$1.7M)*
    - DFW – Eliminating CRO added 5.5nmi for impacted flights (~$2.2M)*
      - AAR reduced by 12/hr or about 10%
  - DFW/AAL re-banking, Wright amendment at DAL, use of flow metering, change in wind patterns, and WN Cost Index change (speed increase)
- Metroplex has…
  - Slightly increased flight distance within 300nm but slightly reduced time for DFW
  - Reduced level segments and increased continuous descents for DFW
  - Provided beneficial airspace/procedural infrastructure for NextGen capabilities (TBFM, TSS) and reduced controller workload
- Additional work required: need to determine a joint approach to measure fuel impacts/changes

*Costs include both fuel, crew, and maintenance

Fuel Estimation Modeling Approach

- Utilizing MITRE fuel burn model along with detailed trajectory normalization process
  - Account for aircraft type, corner post to runway combination, city pair, pressure, IMC/VMC
  - Sample track set predictions compared vs. industry manufacturer models and results deemed acceptable
  - Cross-checked with ANG-B developed simplified fuel calculator using BADA
- In discussion with MITRE regarding future distribution of fuel model to industry as well developing a simplified fuel calculator for joint use

Estimation of Fuel Impact of North Texas Metroplex

- Reduced level segments and increased continuous descents in DFW saving $4.5-6.5 million in fuel annually
- DFW climb rates decreased resulting in a fuel increase
  - Weight, temperature, fleet mix and to a limited extent Metroplex has affected the change
- In addition to OTT, DAL analysis shows an increased distance flown resulting in annual fuel cost of $0.8M

Metroplex efforts should continue to ensure they are cognizant of overall impacts on flight time, distance and fuel

*Fuel cost $2.85/gallon

DISCUSSION
and
Consideration for approval of Final and Interim Report

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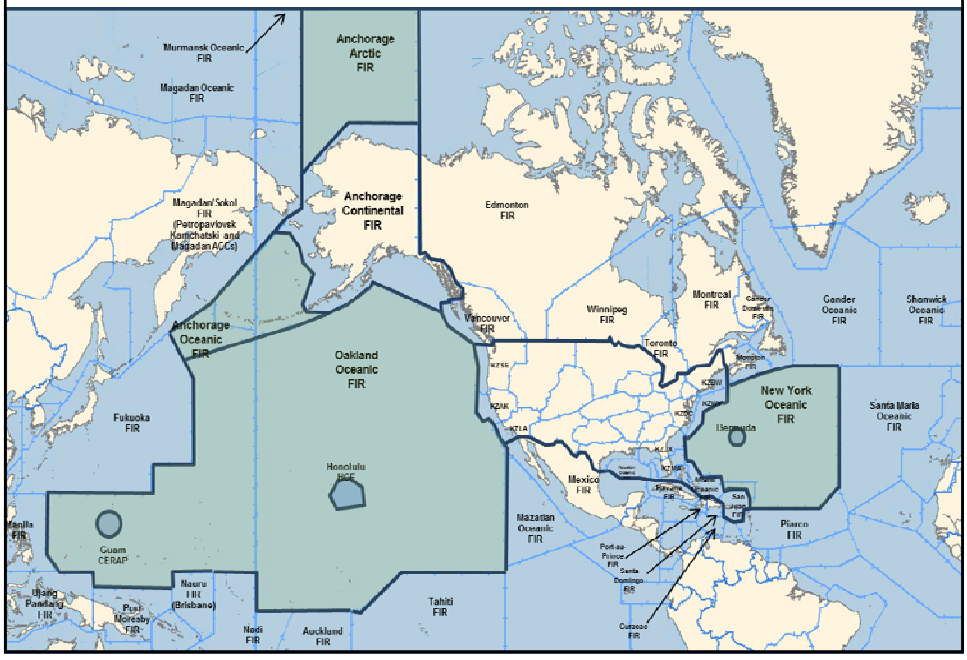
Enhanced Surveillance Task Group

Co-Chairs:
Steve Brown, NBAA
Bart Roberts, JetBlue

Tasking: Request from the FAA

- Evaluate the need and benefit of enhanced surveillance capabilities
  - Examine the potential benefits to operators of reduced oceanic separation minima using space-based ADS-B or other improvements to surveillance
  - Potential funding mechanisms might be used and at what cost
- Evaluate the business case
  - Input to help capture the benefits of services possible, above and beyond current operations
  - US-controlled airspace
  - Challenges being solved
- Timeline:
  - Interim Report February 2017
  - Final Recommendations June 2017

United States Delegated Airspace



FAA Controlled Oceanic Airspace Unique Characteristics

- Large volume of airspace
- Communications is an important limiting factor
  - No “push to talk”
  - Cannot directly intervene in a timely manner
- Airspace is not managed in the same tactical manner as domestic airspace
- “Timing” as a separation basis is an important safety mechanism

Conducting the Task Group

- Strong operator participation
- Operation and Benefits Subgroup formed to allow operators and the FAA to open conversation about benefits, specific ConOps/goals for recommendation
- Task Group has identified industry reps to begin drafting of recommendation: overall statement/principles, equipage and benefits
- Leveraging FAA SMEs - but recommendation from industry to FAA
- Data from Embry Riddle
- Briefings
  - Aireon/Harris
  - FAA – Concept Opns
  - Inmarsat
  - IATA
  - NAV Canada
  - UK NATS
  - Various Operators

Enhanced Task Group Members & SME Organizations

- ALPA
- Airbus
- Aireon, LLC
- Airlines for America
- Alaska Airlines
- American Airlines
- DFW
- Delta Air Lines
- FAA
- FedEx Express
- GAMA
- Harris Corporation
- Honeywell
- INMARSAT
- IATA
- Iridium Satellite LLC
- JetBlue Airways
- L-3 Communications
- Leidos
- NATCA
- NBAA
- NAV CANADA
- Northrop Grumman
- Rockwell Collins
- RTCA, Inc.
- Sensurion Aerospace
- SESAR
- Thales Group
- The Boeing Company
- MITRE
- United Airlines
- UPS

Assumptions

- Reduced separation is the predominant goal.
- Any changes in Oceanic services should provide safety enhancements, reduced risk to aviation, enhanced capacity and improved operational efficiency that are cost and environmentally beneficial to the aviation community.
- Delivery of performance based separation (or ATM) capabilities should maximize the use of current equipage that is compliant with current FAA C/N/S standards with no broad-based fleet upgrades required, although minor upgrades to systems could be considered to make it more robust.
  - ADS-B
  - FANS/CPDLC
  - RNP4
  - ADS-C

Assumptions (cont.)

- Deployment of enhanced surveillance services over the ocean will not affect the current FAA ADS-B Out 2020 mandate, and not add to the mandate.
- A clear statement of requirements (e.g. desired separation standards, etc.) should be established with appropriate performance references to guide the assessment of implementation alternatives.
- Delivery of benefit may require comprehensive training of controllers, pilots and dispatchers, updating automation, and decision support tools.
- Enhanced surveillance enable global tracking is also provided for both normal and distress.

Guiding Principles

- The resulting set of recommendations will be transparent and objective, clearly laying out the methodology that the group employed to reach consensus on the specific recommendations.
- The final recommendation must address closing the business case for operators and the FAA.
- US operators should not be financially or operationally penalized (inability to operate) under the final recommendation.
- Transitions between air service providers should be considered as part of the integration.

Guiding Principles (cont.)

- Enhanced Surveillance services will be introduced by regions or routes based on a assessment of needs, benefits and costs.
- FAA implementation of recommendations might require reducing budget allocation for lower priority initiatives or capabilities.
- Provider/Supplier input is important in the process of information gathering and understanding of issues, operational concepts, technologies and potential benefits, but entities with a direct financial gain are limited to serve as SMEs and not in the development of the final recommendation as well as any meetings/data sharing of specific cost/benefits calculations.

Interim Report
Enhanced Surveillance Task Group

- Findings: In some FAA controlled oceanic airspace areas, benefits may be attractive pending assessment of the currently unknown cost of the service to the operator.
- Benefits – optimal routings, fuel savings, potential increased capacity
  - Communications capability limiting factor of benefits
  - FAA Benefits analysis for Task Group – Industry tasked Embry-Riddle to conduct analysis – close match-up, additional work underway
  - ADS-B Consistent with increased use of GPS under NextGen
- Evaluating ADS-B & ADS-C for spacing improvements of 15/15 lateral/longitudinal
  - Equipage requirements driving the evaluation
- Mixed equipage – give benefit to those equipped (ADS-B, FANS/CPDLC, RNP4, ADS-C)

Remaining Actions

- Complete policy recommendation for Surveillance Capability
- Build on Initial Benefits Analysis performed by the FAA
  - Industry Analysis – capture value of benefits
  - Ensure opportunity for dialogue on benefits mechanisms – groupings, what is the goal of the opportunity, way in which we are describing how the benefits are achieved (i.e. optimal altitudes)
- Potential funding mechanisms and costs – who and how much?

DISCUSSION
and
Consideration for approval of Interim Report

Back-up

Separation Standard	Aircraft Requirements				
Lateral	**Surveillance**	**RSP***	**Communication**	**RCP***	**RNP**
50 NM	Significant waypoint	400	HF Voice to third party radio operator	400	10
30 NM**	ADS-C - Waypoint change - Lateral deviation	180	VHF Voice or CPDLC	240	4
23 NM	ADS-C - Waypoint change - Lateral deviation	180	VHF Voice or CPDLC	240	4
15 NM (not approved by ICAO)	Space-based ADS-B - TBD ADS-C - TBD	TBD	TBD	TBD	TBD
Longitudinal					
10 minutes	Significant waypoint	400	HF Voice to third party radio operator	400	-
50 NM (w/ ADS-C)	ADS-C periodic - RNP 10: 27 minutes - RNP 4: 32 minutes	180	VHF Voice or CPDLC	240	10
50 NM (w/out ADS-C)	Position report every 24 minutes	180	VHF Voice or CPDLC	240	10
5 minutes	ADS-C periodic - 14 minutes	180	VHF Voice or CPDLC	240	10
30 NM	ADS-C periodic - ZOA: 12 minutes - ZNY: 10 minutes - ZAN: 10 minutes	180	VHF Voice or CPDLC	240	4
23 NM (not approved by ICAO)	ADS-C - TBD	TBD	TBD	TBD	TBD
15 NM (not approved by ICAO)	Space-based ADS-B – TBD ADS-C - TBD	TBD	TBD	TBD	TBD

Blue – Current standards implemented in U.S. oceanic airspace

Red – Proposed standards in ASEPS concept. Note: Only 23 NM lateral has been approved by ICAO.

*RCP and RSP requirements to be published in Doc 4444 as of 10 November 2016

** There are no RSP or RCP requirements for this standard; listed RSP/RCP are recommendations only.

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Summary of Meeting and Next Steps

DFO and NAC Chairman Closing Comments

Concluding Items

- Action Items
- Other Business
- 2017 Meetings
  - June 28th, hosted by FedEx, Memphis, TN
  - October 4th, hosted by United Airlines, Chicago, IL

Adjourn

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RTCA Paper No. 277-16/NAC-045

October 19, 2016

Meeting Summary, October 5, 2016

NextGen Advisory Committee (NAC)

The nineteenth meeting of the NextGen Advisory Committee (NAC) was held on October 5, 2016 at JetBlue University, Orlando, FL. The meeting discussions are summarized below.

List of attachments:

- Attachment 1 – Attendees
- Attachment 2 – Presentations for the Committee meeting - (containing much of the detail on the content covered during the meeting)
- Attachment 3 – Approved June 17, 2016 Meeting Summary
- Attachment 4 – Approved Terms of Reference (effective October 2016)
- Attachment 5 – Approved Terms of Reference (effective November 2016)
- Attachment 6 – NAC Chairman's Report
- Attachment 7 – FAA Report from The Honorable Michael Huerta, FAA Administrator and Victoria Wassmer, Acting FAA Deputy Administrator
- Attachment 8 – PBN Time, Speed, Spacing Task Group – Final Report
- Attachment 9 – Joint Analysis Team – Final Report: Performance Based Navigation Procedures: North Texas Metroplex, Denver Established on RNP

Welcome and Introductions

Chairman Anderson opened the meeting at 8:33 a.m. by thanking JetBlue for hosting the meeting and welcoming the NAC members and others in attendance and introduced one new Committee member:

- Angie Heise, President of Civil, Leidos (formerly Lockheed Martin)

All other NAC members and attendees from the public are identified in Attachment 1.

Designated Federal Official Statement

The DFO, Victoria Wassmer (Acting FAA Deputy Administrator) read the Federal Advisory Committee Act notice, governing the public meeting.

Approval of June 17, 2016 Meeting Summary and Revised Terms of Reference

Chairman Anderson asked for consideration of the written Summary of the June 17, 2016 meeting. By motion, the Committee approved the Summary (Attachment 3). By motion, the Committee also approved two versions of the revised Terms of Reference for the Committee – one effective for October 2016 that revises the FAA's DFO to Ms. Wassmer (Attachment 4) and the other effective November 2016 that establishes Dave Bronczek, President, FedEx Express, as the Chair of the Committee (Attachment 5).

Chairman's Remarks

The following is a summary of the remarks made by Chairman Anderson (Attachment 6):

He thanked the FAA and Administrator Michael Huerta for the foresight to establish the NAC in 2010. Since its inception, the NAC has provided numerous recommendations that have and can lead to demonstrable improvements in the efficiency and capacity of the aviation system.

Collaboration and Commitments – there is a need to continue to build on the strong foundation of collaboration with the FAA - 8 years (Task Force 5 and NAC); it is important for FAA and industry to commit to specific dates and locations.

Goal – the NAC has set an overarching goal of NextGen to achieve VMC performance in IMC conditions, leading to increased predictability along with reduced delays and flying time.

Keep it simple – a simple, quick, transparent measurement system for NextGen implementation must be in place for all undertakings, and this must be focused on the system delivering operational benefits and not simply tracking program milestones.

Risk Management, Safety Assessments – the NAC needs to do a better job of managing risk associated with the introduction of new operational capabilities into the NAS.

Next Big Thing – for NextGen to succeed, we need to solve New York - nothing will move the needle on performance like fixing New York; if we don't have northeast regional undertaking, we are not deploying NextGen.

Going Forward – we need to follow through on current taskings, setting priorities and continuing with some stretch goals and evaluating implementations – Joint Analysis Team. Crucial to communicate the successes, reporting results and communicating builds support for work that should be funded, proof of success will be required to garner confidence.

Concluding his remarks, Chairman Anderson emphasized the need to continue close, consensus based, transparent collaboration between the FAA and the aviation industry, with investment priorities being driven by the operators. "Stay at the NAC table, make change

happen. RTCA's collaborative, consensus-building process is the best approach to modernizing the Air Transportation System."

FAA Report – Michael Huerta, Administrator; Victoria Wassmer, Acting Deputy Administrator; Lynn Ray, Vice President Mission Support, Air Traffic Organization

The following captures points from Mr. Huerta and Ms. Wassmer's remarks. The details are contained in the FAA report (Attachment 7).

Administrator Huerta introduced Victoria Wassmer as the Acting Deputy Administrator/Chief NextGen Officer and thanked Chairman Anderson for his leadership as his two-year term concludes. Ms. Wassmer emphasized the business of NextGen – delivering benefits from technology and capabilities and the importance of industry-FAA collaboration in this effort.

Lynn Ray, Vice President Mission Support, Air Traffic Organization, presented the Agency's response to the Community Outreach recommendation stating that overall, the FAA concurred with the NAC recommendation approved during the June 2016 NAC meeting. She emphasized the focus on cultural change, including how the FAA and the aviation community engage the broader community and partner differently inside and outside the aviation industry. The bottom line is that communication will occur earlier in the process and more frequently. There is also a concentration on communicating with the public in a manner that is understandable and relevant to their interests and concerns. Community workshops is part of the strategy that the FAA is implementing to address this area. This includes the use of visuals that translate technical issues and explanations of why aircraft operate in a specific manner.

Ms. Wassmer commented that it is important for the industry to be involved, "it is not just about the FAA" for PBN to be successfully implemented.

The Administrator introduced Dave Bronczek, President, FedEx Express, who will assume the chair role in November 2016 for the 2017/2018 term. Mr. Bronczek commented that he is looking forward to working with the professionals at the FAA and the industry in continuing to move forward with implementing NextGen capabilities and the work of the NAC.

Value of NextGen Capabilities Ad Hoc

Ed Bolen, President and CEO, National Business Aviation Association, explained that the purpose of the Ad Hoc is to develop high-level messaging that conveys the value of NextGen

capabilities being deployed. A part of this is to determine why current messaging is not resonating as we would like.

The Committee discussed the draft working definition:

"NextGen is the Aviation community working together to modernize technologies, policies and procedures in the national airspace system in order to increase capacity, reduce delays and cancellations, reduce our environmental footprint, and enhance safety, for all segments of aviation with bad weather performance equal to good weather performance"

Committee members commented that there is a need to cover the bigger picture, the "higher calling," the macro goals of NextGen so that those outside the industry, including Congress, can understand. The discussion also covered the challenges associated with a long-term program. One suggestion was to link statements of progress with the value achieved and the potential for the future.

Members of the Committee stressed the need for this topic to be a reoccurring agenda item and agreed that Unmanned Aircraft Systems (UAS) should be a part of this initiative representing a new user and perspective.

The Ad Hoc will report back to the Committee at the next meeting.

Airline C/N/S Fleet Plans—United, American, SkyWest

Tracy Lee, Vice President Network Operations, United Airlines; Tim Campbell, Senior Vice President Air Operations, American Airlines; and Chip Childs, President & CEO, SkyWest, presented a briefing on their respective C/N/S fleet plans--ADS-B, PBN and DataComm. These briefings are an on-going agenda item for the Committee to better understand aircraft operator equipage. Alaska Airlines and UPS are being requested to present at the next meeting.

United Airlines overall principle for equipage:

United Airlines NextGen Vision

Our focus is to modernize our fleet using technologies which will safely and efficiently improve schedule integrity and reliability

- **Equipage should benefit our customers with a goal of delivering ceiling and visibility performance approaching that of clear weather days**
- **CNS projects and programs must deliver financial value and effectively utilize United's capital resources while complying with mandates**
- **United actively leverages manufacturers, suppliers, and industry partners to accelerate the demonstration of technology and reduce time to market and adoption**

Goal: Turn bad days into good days

35

UNITED

American Airlines overall principle for equipage:

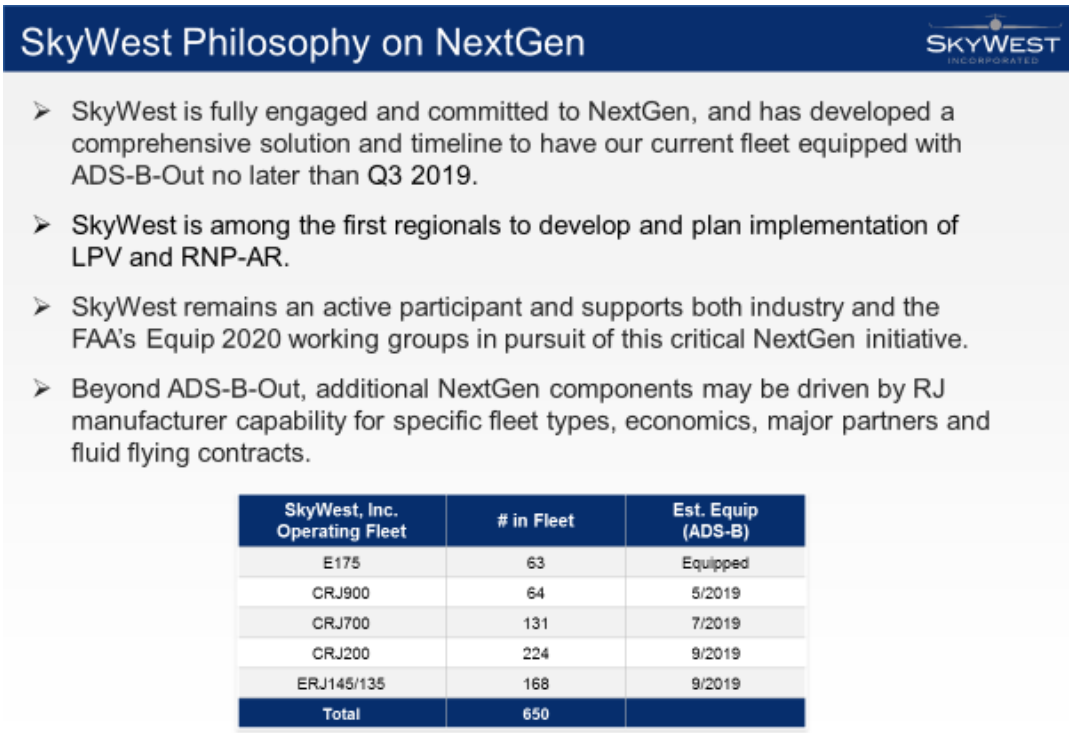
Guiding Principles for NextGen Equipage for AA

1. Ensure our fleet is ready to capture the safety and efficiency benefits of NG capabilities that are cost justified
2. Continue to demonstrate willingness to partner with FAA and suppliers on proof-of-concept proposals
   - A330 ADS-B IN demo with with CAVS FAA and ITP
   - 737 FANS program with Harris Corp
3. Advocate for leveraging existing avionics and infrastructure to its fullest before considering fleet changes
4. Encourage FAA to expand, wherever possible, use of performance based standards to meet requirements vs. hardware-specific mandates, e.g. Equip 2020 (2025)
5. Ensure impacts to regional partners are fully included in all equipage impact analyses
6. Promote new and creative uses of EFB's or related portable, certified devices to minimize the cost and time associated with fleet modifications

NAC Briefing 2016-10.05 FINAL

10/05/2016 NAC Meeting 24

SkyWest's overall principle for equipage:



SkyWest Philosophy on NextGen

- SkyWest is fully engaged and committed to NextGen, and has developed a comprehensive solution and timeline to have our current fleet equipped with ADS-B-Out no later than Q3 2019.
- SkyWest is among the first regionals to develop and plan implementation of LPV and RNP-AR.
- SkyWest remains an active participant and supports both industry and the FAA's Equip 2020 working groups in pursuit of this critical NextGen initiative.
- Beyond ADS-B-Out, additional NextGen components may be driven by RJ manufacturer capability for specific fleet types, economics, major partners and fluid flying contracts.

SkyWest, Inc. Operating Fleet	# in Fleet	Est. Equip (ADS-B)
E175	63	Equipped
CRJ900	64	5/2019
CRJ700	131	7/2019
CRJ200	224	9/2019
ERJ145/135	168	9/2019
Total	650	

Following the presentation, in response to Chairman Anderson's question, Mr. Merritt affirmed that United should be able to meet its internal deadline to have its fleet fully equipped with ADS-B by the 3rd qtr. of 2019. An FAA representative expressed a broader concern about the availability of repair station capacity to perform ADS-B installation as the 2020 deadline for equipping approaches. Currently there is not an issue, but this could change as the date becomes closer. It was also requested by the Committee that the status of repair station capability be included in future NAC ADS-B Equip 2020 reports. While most large air carriers have internal capabilities to perform installations, repair station availability is crucial for regionals, other air carriers and the business/general aviation community.

Regarding the regional operators, Mr. Childs stated that 75% of RAA member airlines have submitted equipage plans to MITRE accounting for 89% of the total regional fleet. He explained the broader equipage outlook for their industry is complicated to project because of the variables of partnerships with major carriers, availability of pilots, fixed revenue structures that require additional planning for economic feasibility and the need for larger carrier partner collaboration.

ADS-B Update

Bruce DeCleene, Manager, Flight Technologies and Procedures Division, FAA, gave a status update about the latest equipage statistics and reinforced (along with Administrator Huerta) that the 2020 deadline is firm. The focus of the Equip 2020 activity is to obtain information from the regional operators and other air carriers that have not yet provided compliance plans.

A Committee Member noted that there is a need to determine ADS-B requirements and an equipage path for Unmanned Aircraft Systems (UAS). It was suggested that this be an initial request of the new Drone Advisory Committee (DAC) because ADS-B equipage is crucial for integrating UAS into the NAS. It was noted that the Drone Advisory Committee (DAC) will not be able to address this for some time. The Committee requested that UAS ADS-B equipage for the 2020 mandate be evaluated, tracked and reported back to the NAC.

Mr. DeCleene stated there may have been some initial miscommunication or mixed messaging regarding the FAA ADS-B equipping incentive program; the intent was to incentivize repair stations to increase capacity and throughput. In response to a question from a committee member, Mr. DeCleene stated that there would not be an extension of the 60-day window for general aviation aircraft equipage approval, explaining how the reservation system for repair stations was expected to work.

There was a discussion related to repair stations and the need to ensure the entire supply chain could provide the needed equipment and associated support necessary to make the 2020 goal. The Committee requested that Embraer, Bombardier, Honeywell, Rockwell Collins, Thales and other OEMs make presentations from the manufacturer and supply chain perspectives. The briefings should address the standards, technologies and pathways for the retrofit of existing aircraft.

NextGen Integration Working Group (NIWG) 2017-2019 Rolling Plan

The NIWG Executive Team Members Teri Bristol, FAA Air Traffic Organization, Steve Dickson, Delta Air Lines, Jim Eck, FAA NextGen, and Melissa Rudinger, AOPA, opened the NIWG discussion noting that the NextGen Priorities Joint Implementation Plan was developed in response to the NAC's June 2016 recommendations.

The Industry-FAA Teams developed recommendations for implementing NextGen capabilities at specific sites in the 2017-2019-time frame for:

- DataComm
- Multiple Runway Operations – Wake ReCat
- PBN
- Surface

The FAA plan contains additional details on implementing the joint FAA-Industry recommendations approved in June. Both Ms. Bristol and Mr. Dickson acknowledged the hard work and collaboration of the NIWG teams to reach agreement on the commitments for the next three years. Mr. Dickson noted that initial NIWG plans (in 2014) were program milestones, but now they are more focused on stretch goals and implementation of capabilities. Industry has been forced to become more cohesive and continues to want to help the FAA prioritize implementations, leveraging existing equipment while encouraging continued equipage. NIWG teams will focus on where they need the NAC's help for setting priorities, getting resources, making decisions, and providing guidance.

The Industry Leads and the FAA Subject Matter Experts (SMEs) for each of the four focus areas presented reports on the existing commitments (the names of the presenters are highlighted):

DataComm

FAA SMEs: Paul Fontaine (ANG), Jessie Wijntjes (ATO)

Industry Leads: John O'Sullivan (Harris Corporation), Chuck Stewart (United Airlines)

Mr. Wijntjes reported that the Departure Clearance Services are operational at nearly 50 towers and the program is 24 months ahead of schedule. The Full Services baseline was achieved with a reduced number of services. The DataComm Team is now pivoting to focus on En Route Services. Mr. Stewart shared that as of 9/7/16, 1,792 DataComm aircraft were operating in the National Airspace System.

The FAA and industry provided a sample of weather events resulting in time savings benefits for DataComm flights. Time saved per flight is determined by comparing DataComm flights that received revisions to Non-DataComm flights that received revisions.

Day	Site	Length (hrs.)	Time Savings per Flight: Data Comm vs. Non Data Comm	Total Time Saved
2/16/2016	KEWR	7.5	Average 23.7 min less gate delay and 5 min less taxi delay	195 minutes
4/1/2016	KJFK	24	Average 9 min less gate delay and 7.8 min less taxi delay	299 minutes
4/3/2016	KEWR	24	Average 16.3 min less gate delay and 11 min less taxi delay	274 minutes
6/28/2016	KEWR	9.5	Average 21.5 min less gate delay and 5.3 min less taxi delay	208 minutes
6/29/2016	KEWR	9	Average 8.2 min less taxi delay	63 minutes
7/28/2016	KJFK	24	Average 6 min less taxi delay	60 minutes
8/13/2016	KBWI	9	Average 26.5 min less gate delay and 9.1 min less taxi delay	398 minutes
9/10/2016	KIAH	7	Average 2.3 min less gate delay and 1.5 min less taxi delay	38 minutes
9/19/2016	KLAX	31	Average 2.8 min less gate delay and 10.7 min less taxi delay	105 minutes

Multiple Runway Operations (MRO)

FAA SMEs: Jack Allen (ATO), Paul Strande (ANG)

Industry Leads: Glenn Morse (United Air Lines), Jon Tree (The Boeing Company)

Mr. Allen and Mr. Morse reviewed the status and the plan commitments including:

- Amend Dependent Runway Separation Order 7110.308A (SFO)
- Amend Dependent Runway Separations for Runways Greater than 4,300 Feet (CVG, MEM, PHX, SDF)
- Amend Standards for Simultaneous Independent Approaches, Triples (ATL, IAD)

They noted that the FAA is working to amend the national standards for vertical navigation (VNAV) for simultaneous independent parallel approaches as quickly as possible to allow operators to achieve even more benefits in capacity and arrival/departure rates. A Committee Member asked if the FAA's noise model is being updated for NextGen improvements and separation improvements made under Wake ReCat and the concentrated tracks for PBN. In response, Ms. Ray commented that the thresholds for measuring noise remain the same. Administrator Huerta requested that NIWG teams receive a noise briefing from FAA aviation noise measurement Subject Matter Experts.

Surface

FAA SMEs: Mike Huffman (ATO) and Susan Pfingstler (ATO)

Industry Leads: Rob Goldman (Delta Air Lines), Steve Vail (Mosaic ATM, Inc.)

Ms. Pfingstler and Mr. Goldman provided an update on Terminal Flight Data Manager (TFDM) which is the surface management solution for NextGen that will provide an integrated tower flight data automation system to improve controllers' common situational awareness. The FAA awarded the contract to Lockheed Martin (Leidos) with Saab Sensis as a

sub-contractor on June 29th. The FAA has also accepted the NAC recommendation for ongoing industry engagement throughout the various stages of the TFDM deployment which will be a combination of the Surface Collaborative Decision Making (S-CDM).

In response to a question, Mr. Goldman explained that data sharing is crucial to achieve benefits. The FAA and American, as the lead operator, will provide the lessons learned from data sharing under the Airspace Technology Demonstration 2 (ATD-2) project demonstration in Charlotte, NC. Ms. Pfingstler stated that there must be a critical mass of operator participants for a predictive tool to be effective.

A Committee Member shared that in Europe better databases of surface information is helping Euro control more effectively manage traffic flows and balance capacity.

Other members agreed that in the US, it is critical to ensure that regional partners participate in the exchange of data, pointing out that in some airports the regional operators represent a majority of the operations. Chairman Anderson requested that American, Delta and United support their regional partners need to be accounted for and participate in data exchange to achieve the benefits of surface departure management.

A discussion ensued about the importance of keeping this simple and avoiding attempts to gather too much data that is not being used. Operator representatives emphasized the use of existing data that would result in benefits in the near-term and lay the foundation for future expansion as more participate and the FAA's ability to use the information expands. It was also noted that expanding airport participation in CDM and their providing data is a critical step.

The Surface Team was asked to include metrics and lessons learned in early data exchange via the Traffic Flow Management System at the next NAC Subcommittee meeting (December 2016) to inform predictability performance analyses.

Performance Based Navigation (PBN)

FAA SMEs: Donna Creasap (ANG), Josh Gustin (ATO)
Industry Leads: Steve Fulton (Sandel Avionics), Brian Townsend (American Airlines)

Mr. Fulton described the work of the PBN Team since the approval of the recommendation by the NAC in June as "spirited but useful" conversations that led the PBN Team to agreement on the new milestones in the NextGen priorities plan. The Team worked to identify specific time frames that were TBD in the June document. The next two years have a heavy emphasis on pre-implementation commitments and implementation of Established on

Required Navigation Performance (EoR). During a discussion about the engagement of the industry in the PBN implementation process, a NAC member noted that the maintenance community has used lead operators in studies and demonstration projects for some time and that the operators might benefit from the lessons learned from this community as they worked on their NextGen commitments. Ms. Creasap committed to follow-up with the FAA's Aviation Safety organization to better understand FAA-Industry collaboration used for development of minimum equipment lists (MELs).

PBN Time, Speed, Spacing Task Group

The Task Group Co-Chairs Dan Allen, FedEx Express, and Steve Fulton, Sandel Avionics, presented the final report based on the following Key Policy Statements:

- A transition to a time-based system is necessary to enable higher percentages of PBN operations with the goal of keeping aircraft on an optimal path.
- VMC in IMC conditions
- Large cultural change for controllers, pilots, dispatchers and others involved in the operation of aircraft
- Decision support tools for air traffic controllers are critical
- Implementation must be integrated

The specific recommendations are that the FAA:

- Create an agency-wide vision for changing to a time-based system and develop and implement a plan to communicate the vision.
- Incorporate the roadmap outlined throughout this document for 2016-2020; 2021-2025; and 2026-2030 for decision support tools and aircraft capabilities.
- Adopt change management principles as part of their implementation process to gain the acceptance and culture change to realize the benefits of time-based enhancements.

Mr. Allen presented the following overview of the three times frames requested to be covered by the FAA:

- Near-Term (2020)
    - Policy, procedures and training to enable initial PBN capabilities and using existing tools and systems for a better integrated system

        - Infusing time-based metering into the culture; deploying traffic flow management decision support tools for controllers
- Mid-Term (2021-2025)
    - Focuses on continued deployment of available NextGen capabilities consistent with meeting the goal of PBN TSS in an integrated manner
    - Begins the process of integrating aircraft trajectory data with ground systems
- Far-Term (2026-2030)
    - Further enhances, increasing resilience of ground-based tools
    - Integrates the stand-alone capabilities described in the mid-term
    - Leverages FIM demonstration for potential full NAS implementation
    - Based on experiences from Near- and Mid-Term, begins implementing advanced DataComm capabilities defined by Special Committee (SC)-214, Standards for Air Traffic Data Communication Services

Following the presentation of the final report, a Committee Member emphasized the criticality of industry commitment to successfully transition to a time-based system. Chairman Anderson expressed the need for a coordinated, integrated plan for Time, Speed, Spacing, and the other components of NextGen – including the NIWG priority areas to answer what NextGen means. Several members stated that there will be challenges to replace the current system with a time-based system, but it is essential for the industry.

This was followed by a discussion of the need for analyzing the safety issues associated with a transition to a time-based system. Others stated that this will be done in phased manner and several operators explained that this will require changes for pilots. Modeling and human in the loop analysis are an important part of this process. It was also noted that this transition should help to optimize the ATC system.

A Committee Member emphasized that in Europe, simulation and flight trials are underway to evaluate impacts. The goal under SESAR is to intensify sharing of trajectory by the aircraft with the ground.

During the discussion, it was noted this plan doesn't have to be completed tomorrow; "walk before you run". Benefits can be realized along the way but the real benefits are farther out.

Chairman Anderson asked for a motion to consider the PBN Time, Speed, Spacing Task Group – Final Report that was subsequently approved by the NAC (Attachment 8). The Committee also requested that the FAA's NextGen office provide a presentation of the larger Integrated

Plan for NextGen as a follow-up to the discussion that will improve the understanding of the more comprehensive implementation plan and provide context for each piece.

Enhanced Surveillance Task Group

The Task Group Co-Chaired by Steve Brown, NBAA and Captain Bart Roberts, JetBlue Airways, was established to evaluate the need and benefit of enhanced surveillance capabilities for oceanic airspace controlled by the FAA.

Mr. Brown reviewed the work to date and discussed the following emerging issues that must be addressed to develop the final report by June 2017:

- Three Unique Geographic Areas
    - North Atlantic
    - WATRS
    - Pacific
- Operator Equipage
- Clearly Defining Benefits
- Costs and Who Pays

Chairman Anderson encouraged Mr. Brown to request any additional resources or other assistance from the NAC necessary for the Task Group to complete its work.

PBN Implementation-Feature location: Denver, CO

Gary McMullin, Southwest Airlines, and Ron Renk, United Airlines, discussed the history of Denver approaches and usage rates that are being derived from the use of Established on Required Navigation Performance approaches. The overall Benefits of RNP reviewed are:

- Operator Benefits:
    - Fuel Reduction in IMC
    - Time Reduction in IMC
    - Schedule Reliability: The schedule is not affected when operations change from VMC to IMC because the same path is flown.
    - Safety

        - Pilot workload relocation (move work to EnRoute).
        - Increased pilot situational awareness.
        - Stabilized instrument approaches vs visual approaches.
- ATC Benefits:
    - Reduction in pilot-controller communications (cleared for approach on downwind)
    - Repeatable, reliable ground tracks in both VMC and IMC
        - No excursions through final approach coarse (FAC)
        - No need to get on 30-degree intercept
    - Safety
        - Controller workload – Monitor vs Active Commands
        - Stabilized instrument approaches vs visual approaches.

According to information presented by Mr. McMullin, participating airlines are saving two minutes and approximately 100 pounds of fuel at Denver through the user of Established on RNP in visual conditions. The additional benefits that can be derived using the procedures in IMC was evaluated by the Joint Analysis Team and was discussed following this briefing.

A Committee Member emphasized the importance of publicizing the availability of RNP approaches using the Automatic Terminal Information Services (ATIS) to enhance greater utilization of these high-value procedures. This is a recommendation made previously by the NAC. Mr. McMullin agreed that the ATIS message has had a big impact on pilots utilizing RNP.

Joint Analysis Team (JAT) – Final Report: Performance Based Navigation Procedures: North Texas Metroplex, Denver Established on RNP

The Co-Chairs, Ilhan Ince, American Airlines, and Dave Knorr, FAA, reviewed the findings of the analysis of PBN in Denver and the Metroplex in North Texas.

<u>Established on RNP (EoR) in Denver</u>

- EoR increased utilization of RNP AR approaches from 5.8% of arrivals to 6.6% of arrivals to Denver, an increase of 12%
    - Time saved from efficient approaches increased from 211 to 282 hours annually

- If an additional waiver is granted, EoR is expected to enable an increase up to 7.1% of arrivals executing RNP AR approaches.
    - Time saved expected to increase to 360 hours annually
- EoR is an important enabler to future growth of utilization of efficient PBN approaches.

North Texas (NT) Metroplex

- Many external factors challenged pre-vs post Metroplex analysis
    - DFW/AAL re-banking, CRO, over-the-top elimination, Wright amendment at DAL, use of flow metering, change in wind patterns, and WN Cost Index change (speed increase)
- Changes in city pair block times driven by winds, not by the implementation of procedures due to Metroplex
- The Team recognized the importance of system impacts of the Metroplex and, after analysis, determined to focus on flight trajectory changes within 300 nm as it best approximates effects of the North Texas Metroplex and allows for better isolating external factors pre/post implementation
- Metroplex has…
    - Segregated arrival routes between DFW and DAL
    - Added route structure where flights previously vectored off-route
        - Enabler for increased TBFM forecasting accuracy, infrastructure for new tools and improved safety per SMEs
    - Slightly increased flight distance within 300nm but slightly reduced time
    - Clearly reduced level segments and increased continuous descents, particularly for DFW

The lessons learned based on the analysis are:

EoR

- EoR, in conjunction with terminal sequencing tools and growing aircraft equipage, should further grow the percent of arrivals executing efficient PBN approaches

Metroplex

- Developed a robust Metroplex methodology that effectively accommodates for variety of pre/post implementation changes and may be used in future
- Additional work required: need to document the Metroplex analysis process and determine a joint approach to measure fuel impacts/changes

- Metroplex efforts should continue to ensure they are cognizant of impacts on flight time and distance

Chairman Anderson asked for a motion to approve the Joint Analysis Team – Final Report: Performance Based Navigation Procedures: North Texas Metroplex, Denver Established on RNP that was subsequently approved by the NAC (Attachment 9). The JAT will complete its fuel analysis.

Based on a request made by Ms. Bristol, the NAC also requested the JAT to perform additional analysis as requested in the original tasking of the following areas:

- Fuel Analysis for North Texas
- PBN
    - EOR DEN IMC
    - Optimized Profile Descents - Boston, MA and Gary, IN
- Wake ReCat 2.0
    - Los Angeles, CA
    - Indianapolis, IN
- DataComm Benefits Review

The time frames and priority will be developed in conjunction with the NACSC.

Summary of the Meeting and Next Steps

The NAC Secretary summarized the following actions from the meeting and follow-up items:

Action Item	Responsible Entity	Completion Date
Enhanced Surveillance – tasking to examine its application in US-controlled oceanic airspace from spaced-based ADS-B.	RTCA	Interim February 2017 Final June 2017
Present a report from an operator of a local PBN implementation to highlight benefits of implementation and what occurred – "what worked, what didn't and what can we do going forward?" Set up a plan going forward to have PBN briefings at subsequent NAC meetings.	FAA/RTCA TBD	February 2017 and future NAC meetings
Equipage • ADS-B avionics supply chain being ready for 2020 mandate – • Manufacturer(s) briefing on NextGen equipage plans – standards, technologies and	RTCA Avionics-Honeywell, Rockwell Collins, Thales, etc. Manufacturers-	February 2017 and future NAC meetings

pathways for the retrofit of existing aircraft	Embraer, Bombardier	
Equip 2020 updates – Standing agenda item for update on operator equipage For February include: • UAS applicability and compliance path • Installation facility capacity	FAA AVS	February 2017 and future NAC meetings
Ad Hoc tasked with developing a unified, crystalized message – demonstrating the value of NextGen capabilities being deployed as a result of the government-industry collaboration on the NAC. • Add Ryan Hartman, Insitu, representing UAS perspective	RTCA	Final February 2017
Presentation of the Integrated Plan for NextGen – follow-up discussion and approval of the Time, Speed, Spacing Task Group recommendation	FAA ANG & NACSC	February 2017
Briefing for the Committee on Airline C/N/S fleet plans—ADS-B, PBN, DataComm Using standard template for equipage.	RTCA Alaska, UPS	February 2017 and future NAC meetings
Joint Analysis Team requested to perform additional analysis as requested in the original tasking	PBN - EOR DEN IMC, OPD – BOS and Gary, IN Wake ReCat 2.0 – LAX/ IND DataComm Benefits Review	February 2017 and future NAC meetings based on program plan
Surface Data Exchange – regionals, other non-CDM members (i.e. airports and other operators) as well as examining benefits from the provision of data by operators	RTCA/ANG-1 Surface NIWG	February 2017

DFO and Chairman Closing Comments

Ms. Wassmer and Chairman Anderson both thanked the members for their participation in the meeting. Ms. Wassmer also thanked Chairman Anderson for his leadership of the Committee.

Other Business

No items were requested or discussed.

Adjourn

By motion, Chairman Anderson concluded the meeting of the Committee at 1:58 p.m.

Next Meeting

The next meeting of the NAC is February 22, 2017 location TBD.

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NextGen Advisory Committee Membership – February 2017

Domain	Member
Designated Federal Official	Victoria Wassmer, Acting Deputy Administrator, FAA
Chair	David Bronczek, President & COO, FedEx Corporation
Operators	Mark Baker, President & CEO, Aircraft Owners & Pilots Association Ed Bolen, President & CEO, National Business Aviation Association Russell "Chip" Childs, President, SkyWest, Inc. (Regional Airline Association Chairman) Steve Dickson, Senior Vice President, Flight Operations, Delta Air Lines Craig Drew, Senior Vice President Air Operations, Southwest Airlines Tracy Lee, Vice President Network Operations, United Airlines Jeff Martin, Executive Vice President of Operations, JetBlue Airways Kimball Stone, Vice President, Flight, American Airlines
International	Florian Guillermet, Executive Director, SESAR Joint Undertaking Frank Brenner, Director General, Eurocontrol
Airports	Mario Diaz, Director of Aviation, City of Houston Department of Aviation Ginger Evans, City of Chicago
DOD	Rowayne Schatz, Associate Deputy Chief of Staff, Operation, United States Air Force
FFRDC	Lillian Ryals, Senior Vice President, MITRE Corporation/General Manager, MITRE CAASD
RTCA	Margaret Jenny, President, RTCA
Labor	Tim Canoll, President, Air Line Pilots Association Paul Rinaldi, President, National Air Traffic Controllers Association Michael Perrone, President, Professional Aviation Safety Specialists
Aircraft Manufacturer	Per Noren, VP of Customer Solutions, Digital Aviation, The Boeing Company T. Allan McArtor, Chairman, Airbus Americas, Inc. Pete Bunce, President & CEO, General Aviation Manufacturers Association
ATC Automation	David Melcher, President, Aerospace Industries Association Pete Dumont, President, Air Traffic Control Association Angie Heise, President of Civil, Leidos John Harris, Vice President, Raytheon International. Inc
ATC Infrastructure	Carl D'Alessandro, President, Critical Networks, Harris Corporation
Avionics	Carl Esposito, Vice President, Honeywell Aerospace
Environment	Brad Pierce, President, NOISE – Aurora City Council

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Domain	Member
FAA	Teri Bristol, Chief Operating Officer, Air Traffic Organization Jim Eck, Assistant Administrator, NextGen John Hickey, Deputy Associate Administrator for Aviation Safety Winsome Lenfert, Acting Associate Administrator for Airports Jennifer Solomon, Assistant Administrator for Policy, International Affairs & Environment
Unmanned Aircraft Systems	Ryan Hartman, President and CEO of Insitu
NASA	Dr. Jaiwon Shin, Associate Administrator, National Aeronautics and Space Administration

NextGen Advisory Committee Chairman Dave Bronczek, President & COO of FedEx Corporation
NAC Meeting – February 22, 2017

Opening

- Thank Committee members: Lillian Ryals, The MITRE Corporation, for hosting the meeting, and Angie Heise, Leidos, for sponsoring the dinner last night.
- Honor to work with newly appointed DOT Secretary Elaine Chao, Michael Huerta, Victoria Wassmer, and the trust and commitment to continue the critical collaboration between the FAA and the industry to implement NextGen. Want to ensure smooth transition of on-going NAC work under the new administration.
- Thanks to all my industry colleagues on the NAC; the investment of your time and the resources of your organization is vital to this effort. Consensus among the industry must continue for success.
- Welcome new members: Steve Dickson, Delta Air Lines, Craig Drew, Southwest Airlines, Tracy Lee, United Airlines (pulling double duty as NAC Subcommittee Co-chair), Wayne Schatz, DoD, and Kimball Stone, American Airlines. New FAA members: Winsome Lenfert, Office of Airports, and Jennifer Solomon, Policy, International Affairs and Environment.

Accomplishments

- The NAC was formed in 2010 because of the historic industry work of Task Force 5 that defined the business case for delivering NextGen capabilities that is crucial to the successful modernization of the nation's air traffic control system.
- The work of the Committee can be generally organized in three time frames that reflect how the FAA and the industry have matured in the collaborative effort to implement NextGen.
    - 2010-2012 - Validate concepts of Time Based Operations, DataComm roadmap, setting policies, performance metrics, city-pairs, and locations for NextGen implementations
    - 2012-2014 - Performance Based Navigation – identifying solutions to removing barriers for PBN implementation, environmental review process, prioritizing NextGen capabilities
    - 2014-2016 - Top 4 NextGen priorities of DataComm, Multiple Runway Operations, PBN and Surface – Initial implementation 2014 and the updating of that plan through 2018, performance metrics, operator equipage, community outreach for NextGen procedures and connecting to longer term vision of NextGen
- Moving from here – layout goals and priorities for the next two years.

Goals & Priorities

- Overall - Need to continue building on strong 8-year foundation of collaboration with FAA (Task Force 5 and NAC).
- Continue the overarching goal of NextGen to achieve VMC performance in IMC conditions leading to increased predictability along with reduced delays and flying time as well as reduced emissions.
- The ATC system should operate the same as a VFR day when the weather conditions are CAT I IFR. If we could accomplish this goal, we will have vastly improved the ATC system efficiency.
- Continue important FAA-Industry collaborative effort in the implementation of the four identified priority areas (DataComm, Multiple Runway Operations, PBN and Surface), and look to identify and prioritize other areas for operational improvement as appropriate.
- Concentrate on near-term operational implementations and benefits – while needing to be intentional that these support the longer-term NextGen vision – while ensuring that what we implement can serve as a foundation for continued modernization.
- Wake ReCat is example of capability that provides immediate benefits and sets a path for longer term efficiency as other capabilities, like PBN are implemented.
    - At FedEx's hub in Memphis, RECAT has saved over 17M gallons of fuel. That's the equivalent of operating our entire network for 14 days or taking 31,400 cars off the road.
    - Next step will be enhancing time based spacing.
- Decision support tools – ground-based time, speed and spacing metering tools as demonstrated yesterday during the MITRE lab tour, are essential for the successful implementation of PBN and expediting deployment is crucial.
- Harness NextGen capabilities at focused implementation site(s). For example integrate solutions/implementations in specific geographic area.
    - Focus on New York – make it a priority, given that 78% of delays emanate across the system from this area.
    - If we don't have North East regional undertaking, we are not deploying NextGen.
    - Recognize challenges up front and work to mitigate them.
    - Goals – Improve efficiency, reduce emissions, decrease delays.
    - **WE CANNOT CONTINUE TO, OR EVEN BE PERCEIVED AS CONTINUING TO FOCUS SOLELY ON LOW HANGING FRUIT, AVOIDING THE REAL CHALLENGES TO NEXTGEN.** We have the right venue, the right people, the motivation, here and now, to tackle the big challenges and prove the benefits of NextGen. 10 years into the program, we cannot still be saying fixing NY is too hard. We are ready to roll up our sleeves, educate the Hill that we are taking on some stretch goals and we might not achieve them all, but we are going to try.
- Evaluate and assess NextGen implementations – focus on metrics
    - Short term wins/successes based on measurements
    - Sets path for longer term payoff

- Ensure policy, procedures, FAA flight standards alignment is analyzed for benefit equally alongside new aircraft equipage. Use what we have installed for quick wins.
- Accountability – critical to evaluate performance against performance improvements

Today's Meeting

- The Committee will hear reports from Four Priority Teams working on implementations of DataComm, Multiple Runway Operations, Performance Based Navigation and Surface and Data Management.
    - Important for us to support these efforts by offering important perspectives on the issues the Teams identify as they work through the process of implementation.
- The Joint Analysis Team that is assessing performance improvements attributable to the implementation of select NextGen capabilities will report on Wake Recategorization at Indianapolis International Airport and fuel impacts related to implementation of the North Texas Metroplex initiative.
- An interim report will be provided on a capability enhancement to oceanic airspace that is being offered by several Air Navigation Service Providers in other parts of the world. The Enhanced Surveillance Task Group is evaluating the needs and benefits of enhanced surveillance for oceanic airspace controlled by the FAA.
- The Committee will also receive briefings and discuss FAA's NextGen Plan and equipage plans from several air carriers, as well as the avionics industry supply chain to support NextGen equipage.
- We must also continue communicating the work of the industry and the FAA and we will be discussing this today as well.

Conclusion

- Thank you again for your commitment to implementing NextGen.
- I urge you to continue participating in the close, consensus-based, transparent collaboration between the FAA and the aviation industry, with investment priorities being driven by the operators. Stay at the NAC table, make change happen.
- RTCA's collaborative, consensus-building process is the best approach to modernizing the Air Transportation System.
- 2017 will be a banner year for all of us on the NAC.

U.S. Department
of Transportation

**Federal Aviation
Administration**

Office of the Administrator

800 Independence Ave., S.W.
Washington, D.C. 20591

December 15, 2016

The Honorable John Thune
Chairman, Committee on Commerce, Science,
and Transportation
United States Senate
Washington, DC 20510

Dear Chairman Thune:

Thank you for your December 1 letter and the opportunity to update you on the modernization of our Nation's air traffic system. The Next Generation Air Transportation System (NextGen) is at the heart of ensuring that our Nation has the safest, most efficient airspace possible for decades to come, a commitment that is shared by all of us. In this important endeavor, I appreciate the partnership with your Committee.

This letter provides an initial framework for understanding and evaluating our approach to NextGen and outlines the path forward developed with comprehensive stakeholder collaboration.

NextGen has been and will continue to be an extremely worthy public investment. Modernizing the safest and most complex air traffic management system in the world remains one of the Nation's, as well as the Federal Aviation Administration's (FAA), highest priorities. The tremendous benefits of undertaking this mission can be measured in economic activity, jobs, and the safe mobility of our citizens and visitors from around the world.

All of us engaged in this process owe it to the American taxpayers and the flying public to succeed with the modernization of our air transportation system. It is essential infrastructure that supports a vital part of the U.S. economy. We benefit by collaboration with and oversight by your Committee and others who review our approach and our progress. To be sure, there are varying points of view from those who review our work, and we are always willing to share candidly the progress we are making the adjustments we believe are needed and the path forward as we see it. In that spirit, I offer you the following overview and response to your specific requests.

Executive Summary

Your letter provides an opportunity to reflect on where we've been, where we are today, and where we are heading in the future.

Although NextGen pre-dates 2010, that year marked a turning point. By that point, we had long recognized the need to identify clear measures of success, to prioritize NextGen deliverables into

segments that could deliver benefits quickly, and to track costs both on individual segments and overall. Perhaps most importantly, we recognized we could do none of those things alone. Accordingly, we established the NextGen Advisory Committee (NAC) as an industry advisory body to help us set priorities and develop a common language of metrics and milestones.

Six years later, our efforts at collaboration and prioritization have borne fruit. The unprecedented collaboration with the aviation industry has informed the construction of the flexible, resilient and sustainable infrastructure that NextGen relies upon today. The concrete data shows that we are delivering benefits to industry and the public on time, on budget, and in quantifiable segments. Where we have stumbled, we have had the flexibility to work with our stakeholders to learn lessons, reassess, and regroup. And where we have faced risk factors beyond our control, we have done our best to stay on track and to prepare more thoroughly for similar risks in the future.

Looking ahead, we have a clear path for adding more and more capabilities that will transform the way air traffic is managed and more rapidly provide NextGen benefits. As a result, we are on track to meet our original high-level air traffic management objectives for NextGen by 2025.

Measures of Success

Today, using the measurements upon which we and the aviation community agreed, NextGen is delivering real benefits. NextGen improves the way air traffic flows from gate to gate. It provides advanced procedures, technologies, and tools that allow more commercial aircraft carrying passengers and cargo to depart on schedule, fly more direct paths, and arrive on time at their destinations, burning less fuel and producing fewer emissions. Air traffic controllers communicate with the cockpit digitally, which reduces gate and taxi delays, especially during severe weather events, increasing throughput and efficiency, enhancing safety, and reducing emissions. More aeronautical, traffic and weather information in the flight deck for pilots enhances safety. Airlines, airports and other airspace users access real-time information, contributing to better and more timely decisions on the ground and in the air.

These changes have produced tangible benefits for airlines, pilots and other users in our airspace, as well as for the flying public. For example, airlines are saving an average of 9 minutes and 800 pounds of fuel per flight flying into Denver International Airport on new Performance-Based Navigation procedures. Similarly, there is a 17 percent capacity gain at Memphis International Airport for FedEx due to new wake re-categorization procedures, amounting to more than 100,000 metric tons of carbon dioxide emissions avoided and 10.7 million gallons of jet fuel saved to date. That's the equivalent of taking 21,000 cars off the road.

Overall, through 2016, our multi-faceted airspace improvements already have translated into $2.72 billion in savings in passenger time and occupant safety, as well as reduced fuel and aircraft operating costs. We project that by 2030, the total benefits of planned NextGen improvements are expected to be $160.6 billion, at a cost of $35.8 billion to the FAA and the aviation industry.

Segmented Approach

I believe that while it is fair to say those most engaged with us now see the initial benefits they have helped achieve, it is also fair to say that the path we have traveled and the path we are on are full of complexities, assessments, and re-assessments that are not easily communicated or broadly understood. Airline business models also frequently adapt to the external environment (such as fuel prices and mergers), thereby impacting the FAA's ability to anticipate airline community priorities. That said, although there may be different points of view on the implementation approach for NextGen, the industry-embraced rollout is deliberate. It considers need, affordability, and the interdependency of automation systems, enabling technologies, and capabilities. It takes into account the dynamic nature of airspace, operations and the rapidly evolving needs of a growing set of airspace users. A segmented approach enables the agency to make decisions based on the most up-to-date information and to leverage rapidly changing technological advances. This approach was adopted both to achieve near-term successes and to reduce risk over the long term. While our long-term plans are well documented, investment decisions are presented to the FAA's internal investment review committee for approval in useful segments.

I am confident that we are on the right path and making solid progress; at the same time, the commitment to collaboration affords us the opportunity to review and evaluate varying points of view from our oversight bodies, our stakeholders and other interested parties. Some of this feedback leads to outcome-improving adjustments to initial approaches.

Cost Calculations

Frequently, questions have arisen about NextGen's cost and schedule when progress has been measured against our original concept planning dates, rather than the baseline commitment timelines established at each program's final investment decision.

In fact, when our programs are measured properly against a positive cost-benefit analysis and our commitment to invest, we are now on or ahead of schedule with many of our large investment programs. Examples include Data Communications (Data Comm), System Wide Information Management (SWIM), and the ground portion of Automatic Dependent Surveillance-Broadcast (ADS-B). Today, Data Comm delivers tower clearance services at 55 airports, 29 months ahead of schedule and within budget. With SWIM segment 1, we completed all milestones on time and within the cost baseline and completed two milestones ahead of schedule. ADS-B segments 1 and 2 and its baseline services were completed on time and on budget.

Overall, NextGen cost estimates are within the original estimated range. And, for all programs active in 2015, we are only 6.4 percent over cost compared to the initial cost anticipated when they were approved by our investment committee. We are less than 6 percent behind schedule compared to the initial plan when the programs were approved. Additionally, since NextGen cost estimates were baselined, the implications of emerging new entrants to the air traffic control system (unmanned aircraft systems (UAS) and commercial space launches) have become clearer to FAA and all stakeholders. Accommodating these evolving requirements in the budget and schedule continues to be a challenge. The FAA has established the Drone Advisory Committee as a stakeholder feedback and consensus mechanism modeled after the NextGen Advisory

Committee (NAC) to help prioritize and align UAS-related efforts across government and industry.

Lessons Learned

Without question, NextGen program development and implementation have provided us with many lessons learned. With a transparent and collaborative process, we have shared efforts that fell short and then redesigned our approach. For example, the FAA has had to be agile with the rollout of certain capabilities at a number of locations due to changing stakeholder (e.g., airline and airport) priorities. We learned an important lesson about bringing our subject matter experts in early while we were developing En Route Automation Modernization (ERAM), a foundational system on which NextGen is built. In 2003, when the program began, the project scope did not include a robust plan to obtain input on its design and implementation from our air traffic controllers. This problem set the project back in both time and cost. In 2010, we made course corrections. ERAM was fully deployed in 2015 and is now up and running nationwide. The FAA and the National Air Traffic Controllers Association developed a constructive and collaborative relationship aimed at advancing NextGen.

Performance Based Navigation (PBN) initiatives also provided important lessons. With new and more advanced routes outnumbering traditional procedures, training pilots and air traffic controllers to fully realize the benefits presented a challenge. Thus, we have worked closely with airspace users to highlight the opportunities to maximize these time- and money-saving enhancements.

Another important lesson learned from PBN involved the way we included neighboring communities in implementation of NextGen procedures. Over the last two decades, we have made significant progress in reducing aircraft noise for people living around airports. Advances in aircraft technology, operational procedures, and programs with airports all have worked together to mitigate noise. While NextGen procedures generally have provided noise relief for a majority of communities, they sometimes have resulted in flight pattern changes that can concentrate noise for some residents who live directly under those flight paths. We have seen an increasing level of public debate, political interest, concerns expressed by members of Congress, and even litigation. In response, the FAA has greatly increased its public engagement efforts to work with communities to educate them about how we develop procedures and measure noise, and to listen to residents' concerns. We have been working closely with airports, airlines, and the officials who represent these communities to figure out how we can best balance our pursuit of safer and more efficient flight paths with the needs of the communities over which we operate. This new approach can have cost and schedule implications that we will need to manage. However, it is our hope that increased engagement will lead to fewer problems as we implement. As we strive continually to balance the need for timely project delivery with the need to engage communities meaningfully, we appreciate the guidance and collaboration of this Committee.

Risk Factors

As with any agency, certain circumstances impacting our initiatives remain outside of our control. NextGen investments benefit from stable funding and long-term authorization. Past interruptions in stability in these areas prompted even closer collaboration with stakeholders to consider together how NextGen improvements should be prioritized to ensure near-term benefits.

Budget and planning uncertainty due to sequestration, continuing resolutions and short-term reauthorizations made long-term planning and budgeting more complex in the past, and some of these factors must be considered risk factors for the future. Given the challenges of the past and the progress we are making, I do believe we have demonstrated an important degree of nimbleness and flexibility that should serve us well going forward.

Collaboration

Our main vehicle for communicating and collaborating with stakeholders is the NAC. The NAC includes representation from all major groups of airspace users from air carriers to pilots of small general aviation aircraft, and now, new entrants like UAS. Through the NAC, the FAA receives critical input on the value of planned improvements as well as metrics for enhancements that have already been implemented. Many NextGen successes to date are due to this very close collaboration with the aviation industry. This engagement is necessary because NextGen relies on the interoperability of air and ground systems, along with synchronized equipage and other joint investments. However, our stakeholders are varied and not all benefit to the same degree in the same locations, or with the same enhancement across all NextGen investments. In this regard, our responsibility is to balance the complex needs of the entire aviation community. In doing so, we are mindful of how the aviation community evolves at an increasingly rapid pace and seek to chart a course to best serve present and future needs. Again, in this effort the NAC has given us a venue to enhance trust among all parties, to consider appropriate flexibility based on an evolving aviation environment, and to weigh options that serve the entire national airspace system to the best of our ability.

Our approach has proven successful. By focusing together with the aviation community on milestones related to the four prioritized capabilities that were part of our joint implementation plan, we achieved a combined 96 percent completion rate in 2015 and 2016. Further, the FAA's operational and tactical decision making resulted in many milestones being delivered earlier than planned.

Since establishing the NAC in 2010, we have proceeded with a more aggressive and transparent process of engagement with aviation leaders, and we have come a long way. As was my hope, the plan for NextGen is now viewed as a broader aviation community plan being guided and managed by the FAA. Today, many consider NextGen much more than an FAA program and view it an industry-wide undertaking that requires synchronized investment from government and industry related to equipage, training, cultural and operational changes, and integration.

Working with the community we have assessed priorities, made corrections and worked to provide benefits as soon as practicable while operating the largest, safest and most efficient airspace system in the world. Today, critical elements of NextGen are fully embraced by the aviation community because of the role they played in shaping the initiatives and the results they are seeing. We focus on "metroplexes" where the highest concentration of air traffic operates. We have a commitment by commercial air carriers to invest in equipment that will allow them to take advantage of advanced surveillance and navigation as well as communication. We enjoy more efficient departure re-routing around weather due to digital flight plan clearance delivery enabled at 55 airports. We also take advantage of sequenced departures that are making for far more efficient fuel saving procedures for moving traffic at peak times at our largest airports.

All of this progress provides the foundation for agreements reached on the path forward. We remain committed to a transparent process where issues are resolved through engagement designed to advance the program and reduce the risk factors posing challenges to success.

Path Forward

We are in the midst of one of the safest periods in commercial aviation in the United States, achieving an extremely low fatality rate currently equivalent to transporting more than 5 billion passengers without a single life lost. This record is possible only because this and past Administrations have worked with Congress to build, maintain and modernize our air traffic control system. Additionally, it is possible because of the unprecedented degree of collaboration between those who operate in the national airspace and the Agency that regulates and provides air traffic control services for that airspace.

With the help of the Congress and of the aviation community, we have come a long way since 2010. Decisions have been made about future priorities that will provide greater benefits by the end of the decade. In these times of rapid technological change, modernization of systems as complex as our air traffic management system will not come without challenge. The path traveled, however, has taught us that with an ongoing commitment and open collaboration, we can achieve the goals envisioned.

Continuing the work on air traffic modernization while safely and efficiently operating our air transportation system remains my highest priority. Enclosed you will find detailed responses to the specific questions and requests contained in your letter. I hope your letter and this response mark a reinvigorated dialogue around the best ways to achieve our important objectives.

We stand ready to brief you and your staff in greater detail and welcome further opportunities to provide additional information or request direct industry input to the Committee. I look forward to continuing to work with you and the members of the Committee as we move forward.

If I can be of further assistance, please contact me or Kate Howard, Acting Assistant Administrator for Government and Industry Affairs, at (202) 267-3277.

Sincerely,

Michael P. Huerta
Administrator

Enclosures

cc: The Honorable Bill Nelson, Ranking Member
The Honorable Calvin L. Scovel III, Inspector General
U.S. Department of Transportation

1. For each of the four NAC priority programs discussed above, please provide a summary of implementation progress made both by the FAA and industry partners, including a gap analysis that compares currently available technologies, standards, and procedures to those that were expected to be available by now when the NAC priority program was initially proposed. Please also provide a timeline for expected completion of the implementation of these programs, including the date that the FAA estimates each program will achieve a positive return on investment for the government and users.

It is important to note that the NextGen Advisory Committee (NAC) NextGen Priorities are not programs themselves. They are the early local operational opportunities that the Federal Aviation Administration (FAA) and the aviation stakeholders agreed to commit getting done for near term benefits enabled by maturing NextGen programs and their ongoing roll outs (e.g. Performance Based Navigation (PBN), Data Communications (Data Comm), Wake Recategorization (Wake Recat), Time Based Flow Management (TBFM), System Wide Information Management (SWIM), etc.). In this context, the NAC NextGen priorities do not have independent return on investments (ROIs), but the underlying enabling NextGen programs do. The FAA and the industry have agreed to measure the benefits derived from the local milestones achieved through the work of the Joint Analysis Team (JAT) under the NAC Subcommittee.

In 2013, the FAA asked the NAC to define their top priorities for NextGen capabilities which led to the top four priorities. FAA has been working closely with industry ever since, to define locations, dates and capabilities with milestones. For each of the four NextGen Priorities focus areas the community has enjoyed substantial success by both the FAA and Industry Partners. Through 2016, the FAA and industry have a combined 96.2 percent (102 of 106) success rate on meeting the expected commitments and delivered the agreed upon outcomes for each commitment. Additionally, 60 of the commitments were completed ahead of time. This success underscores the importance of working together and demonstrates the FAA's ability to deliver.

The highlights below summarize the implementation progress of each of the four NAC NextGen priorities:

Multiple Runway Operations (*Accomplished 27 of 29*) – improve access to airports with multiple runways (to our busiest airports, including those with closely spaced runways) through safety analysis built on NextGen research and better aircraft navigation equipage.

- Wake RECAT Phase 1: Now implemented at 23 airports and 12 Terminal Radar Approach Control Facilities (TRACONs).
- Wake RECAT Phase 2: Recently completed.
- Missed Milestone: FAA Delayed San Francisco (SFO) by 6 months from 2015 to 2016 due to winter weather traffic flow, training requirements from the Super Bowl, and

deconflicting facility implementations. The FAA did not complete the Boston Dependent Staggered operations (7110.308) due to community noise concerns.

- Gap Analysis: There is no longer a gap; the focus area is delivering against those commitments expected and defined in the *NextGen Priorities Joint Implementation Plan.*

Performance Based Navigation (*Accomplished 10 of 10*) – FAA published the *PBN NAS Navigation Strategy* in 2016 which seeks to take advantage of better aircraft navigation capability by designing smoother transition profiles from upper airspace to runway, shorter more direct flight paths, and increased access to airports near obstacles and terrain.

- Completed final publication milestone at Northern California and Atlanta Metroplex; Charlotte will be completed next year.
- The plan maximized the use of existing aircraft equipage, while providing incentives to equip additional aircraft.
- Explored new work with Required Navigation Procedures (RNP) Established on RNP (EoR) to allow more aircraft to fly more advanced procedures. Completed Established on RNP Track to Fix Safety Analyses. The FAA worked with Denver Airport, United Airlines, and Southwest Airlines to implement a national standard for EoR. This paved the way for additional advanced procedures.
- Completed Enhanced Lateral Spacing Operation (ELSO) National Standard.
- Completed a Single Site Las Vegas Assessment for future implementation.
- Gap Analysis: There is no gap; the focus area is delivering against those commitments expected and defined in the *2014 NextGen Priorities Joint Implementation Plan* through 2016. The updated 2017-2019 plan includes stretch goals for PBN; the systemic benefits of wide-spread use of PBN across the National Airspace System (NAS) and the corresponding benefits are a large focus of the NAC and industry and the FAA will continue to take incremental steps. By implementing PBN automation decision support tools, it will greatly aid in optimizing the use of PBN and corresponding performance benefits.

Surface Operations (*Accomplished 15 of 17*) - Some of the greatest efficiencies can be gained while an aircraft is still on the ground and at the gate, and when connecting the surface to the En Route airspace. The FAA commits to implementing near-term surface improvements, sharing more data with stakeholders, and completing feasibility assessments of some other capabilities of interest. The goal of these enhancements is to measurably increase predictability and provide actionable and measurable surface efficiency improvements.

- Measurably increasing predictability in the surface area.

- Committed to sharing more data with our stakeholders and to make the operation into and out-of the airport more efficient.

- Received approval for Airports to participate in the collaborative decisionmaking process in the future.

- Successfully sharing the FAA's Time Based Flow Management (TBFM) and Traffic Flow Management System (TFMS) information to stakeholders via SWIM.

- Missed Milestone: Surface Surveillance Event Data at San Francisco (SFO): FAA put the Airport Surface Surveillance Capability (ASSC) roll out on hold until the safety issue related to non-cooperative targets was addressed. That has been resolved and FAA has declared Initial Operating Capability (IOC) at SFO and is proceeding with the ASSC waterfall.

- Missed Milestone: Industry to provide 11 Data Elements: Industry delayed their commitment from June 2016 and is still working to deliver these data elements to the FAA.

- Gap Analysis: To close the two gaps on the above requirements, the FAA is sharing data at current ASSC implemented locations and is working with industry to help them close their requirement to deliver data elements.

Data Communications (*Accomplished 50 of 50*) - Data Comm will provide direct digital communications services between pilots and air traffic controllers and enhance air traffic control information to airline operations centers. The capabilities will enhance safety by reducing communication errors, increasing controller productivity, increasing airspace capacity and efficiency while reducing delays, fuel burn and carbon emissions at towers nationwide.

- Initiated data communications services between pilots and air traffic controllers as well as enhanced air traffic control information to airline operations centers.

- Completed 55 air traffic control towers across the NAS as of December 2016; completed implementation of Data Comm tower services capability is 29 months ahead of the baseline plan.

- Completed the Final Investment Decision (FID) for Initial and Full En Route Data Communications services (the decision was delayed a few times due to affordability).

- The program is coordinating the implementation strategy with all stakeholders to deliver the first Air Route Traffic Control Center (ARTCC) by 2019.

- Gap Analysis: There are no gaps, Data Comm is meeting or exceeding all commitments.

The following provides a timeline for expected completion of the implementation of these programs:

As noted above, the *NextGen Priorities Joint Implementation Plan* is updated bi-annually. It is a three year rolling plan. The plan was recently updated and published in 2016 for the years 2017 to 2019. This plan reflects the current priorities of the industry stakeholders that the FAA and industry are jointly committed to meeting and we are already meeting commitments for FY 2017. Per stakeholder requests, the process is dynamic, incremental and accommodates changing industry priorities and desires. It is intended that this process will continue to the end of the NextGen Program to help guide the rollout of capabilities critical to NextGen success. This plan and its updates are governed and managed by the NextGen Advisory Committee's Subcommittee and the NextGen Integration Working Group (NIWG), respectively.
The FAA and industry continue to develop new commitments in the four focus areas by the way of procedures, pilot programs, assessments and successes development. This allows the FAA and industry to learn from assessments, pilot programs, and demonstrations in order to identify changes, improvements and innovations. For example, for Wake RECAT, the FAA and industry worked together to swap implementations where a facility was not ready for implementation and where industry wanted a higher priority sites (Honolulu (HNL) and Indianapolis (IND)). Moreover, additional industry commitments are included in the three-year plan as these priorities are defined by industry stakeholders.

While there is no separate return on investment calculated, the four NextGen Priorities focus areas are providing benefits today with little industry investments.

Benefits of Performance Based Navigation (PBN) include:

- Shorter and more direct flight paths, improved airport arrival rates, enhanced controller productivity, increased safety due to repeatable and predictable flight paths, fuel savings, reduced emissions and a reduction in aviation's adverse environmental impact.

- Charlotte Metroplex projects annual benefits to include $9.4 million in fuel savings, 3.3 million gallons of fuel, and 28.0 thousand metric tons of carbon emission savings.

- Atlanta Metroplex projects annual benefits to include $6.3 million in fuel savings, 2.2 million gallons of fuel, and 18.8 thousand metric tons of carbon emission savings.

- Las Vegas Metroplex projects annual benefits include $7.5 million in fuel savings, 2.6 million gallons of fuel, and 24.8 thousand metric tons of carbon emission savings These annual benefits are expected to accrue upon completion of the NextGen near-term procedural improvements implemented by the FAA's Metroplex program.

- The benefits are based on the FAA's preliminary assessment of proposed airspace improvements compared to operations in a year before any improvements were made. The value of the projected fuel savings is based on a $2.85 per gallon rate; the data estimates are current as of March 2016.

Benefits of Multiple Runway Operations (MRO) include:

- No investments from industry on aircraft equipage.
- Decreased arrival and departure spacing during peak periods and result in increased throughput and time savings.
- Wake RECAT was implemented at Atlanta and produced cost savings as reported by Delta Air Lines. The average daily operations increased by 6.8 percent and the overall peak arrival throughput was increased by 5 percent. The taxi-out times decreased by 1.1 to 1.6 minutes and the average flight time within the TRACON decreased by 29 seconds.
- In Atlanta, Delta approximated their annual OpEx savings at $13.9 to $18.7 million.
- RECAT procedures were also implemented at Louisville where United Parcel Service, Inc. (UPS) reported positive impacts to arrival / taxi-out times, and fuel savings. UPS estimated annual savings at Louisville to be 1.5 million gallons with positive emissions impact of 14,300 CO2.
- RECAT procedures were implemented at Memphis with FedEx reporting 4.1 million gallons and 39,992 CO2 saved per year.

Benefits of Data Communications (Data Comm) include:

- Provides a digital link between ground automation and flight deck avionics for air traffic control, instructions, traffic flow management, and flight crew requests.
- Reduce delays and provide more efficient routes for aircraft; improve controller and pilot efficiency leading to increased system throughput.
- Enhance safety by reducing operational errors associated with voice communications.
- Reduce the impact of ground delays due to congestion and adverse weather.
- April 2016, John F. Kennedy Airport (JFK) Data Comm saved 299 minutes in gate and taxi delay over a 24 hour period during an adverse weather event.
- Saved time, which equates to monetary/fuel savings, at Newark (June 2016) 217 minutes of delay time, Baltimore (August 2016) 323 minutes, at Denver (August 2016) 175 minutes.

- Estimated to save operators more than $10 billion over the lifecycle of the program and save the FAA approximately $1 billion in operating costs.

Benefits of Surface include:

- Reduced fuel burn through departure queue management; improved pushback planning.
- Increased opportunity for flight prioritization; improved data sharing between ATC and flight ops.
- Improved off-time compliance related to controlled departure times.
- Efficiency, cost avoidance and safety lifecycle benefit FY 2016-FY 2048, Risk Adjusted (RA) FY 2015 totals $2,154 million.
- Non-monetized emission savings is 3.0 M metric tons of CO2 ($191 million)[1]; controller time saving is more than1,000,000 hours and 390 reduced operational incidents.

2. In an April 2013 report, the Government Accountability Office (GAO) made five recommendations to improve the FAA's ability to implement NextGen programs. For each recommendation, please provide a summary of new policies that you have implemented since 2013 to address GAO's concerns.

FAA provides the following summary of new policies implemented to address the GAO's concerns for each recommendation.

Recommendation 1: Work with airlines and other users to develop and implement a system to systematically track the use of existing PBN procedures;

FAA Response:

- The Performance Based Navigation (PBN) Dashboard, developed by MITRE Center for Advanced Aviation System Development (CAASD), provides advanced reporting capabilities for the analysis and operational assessment of PBN. This analytical suite is being used to support the development of new PBN and integrated airspace design. The Dashboard also provides critical metrics on the actual use of PBN operations. This information includes use of PBN operations by aircraft categories, types, and carriers as well as tracking aircraft equipage levels. This information is accessible to internal and external users via a web site and provides an extensive range of tools, graphs, charts, and diagrams for analysis. The PBN Dashboard data helps define the baseline metrics of conventional procedures such as utilization rates prior to

[1] Valuation of emissions using US interagency guidance but not currently approved for FAA Business Case.

implementing new PBN procedures. Post implementation data monitoring provides the performance metrics and usage information.[2]

- A limited public version of the PBN Dashboard is available on NextGen Website as of May 24, 2013.
  (http://www.faa.gov/nextgen/pbn/dashboard/)

- A Federal Aviation Administration (FAA)-internal management version of the dashboard, designated Dashboard-FAA Observer, is available via the AJV-14 Website on mMFAA as of August 1, 2013. It a requires username and password, which can be obtained on the logon. It provides more information than the current public version to include individual procedure, route, and transition usage per segment of flight as well as more detailed operator equipage and airport utilization statistics.
  (https://pbn.mitre.org/pbnservices/pbn/FaaObserver.html)

The Observer functionality fully meets the target to develop and implement a system to systematically track the use of existing PBN procedures.

Recommendation 2: Develop processes to proactively identify new PBN procedures for the NAS, based on NextGen goals and targets, and evaluate external requests so that FAA can select appropriate solutions;

FAA Response:

As part of the NextGen program, a PBN portfolio was established to facilitate more effective integration of PBN-related activities across the agency. The Portfolio Management Team (PfMT) includes members from multiple organizations from different lines of business (LOB) within the FAA that contribute to the overall transition of the National Airspace System (NAS) to PBN. NextGen PBN Operational Improvements are planned and tracked by the PfMT to ensure activities are effectively coordinated. In addition, a PBN Capture Team has been established to provide a more focused forum to define all activities, work assignments, dependencies, and assumptions needed to complete the following objectives: (1) assess the means available for users to request new PBN procedures, (2) assess the processes used to select and prioritize procedures for implementation to ensure the right procedures are delivered where needed, (3) define measures for verifying benefits for PBN procedures, and (4) describe the NextGen operational service environment so that operational requirements and an implementation strategy can be developed.

Recommendation 3: Require consideration of other key operational improvements in planning for NextGen improvements, including PBN projects at Metroplexes such as the Optimization of

[2] Report of the Federal Aviation Administration Under Section 213 of the FAA Modernization and Reform Act of 2012 - H.R. 658

Airspace and Procedures in the Metroplex program (formerly known as OAPM), as well as the identification of unused flight routes for decommissioning;

FAA Response:

- For Core airports, additional procedures will largely fall into the Metroplex program's scope or that program's successor. Some of the Metroplex projects have already developed a number of procedures. These procedures have been included in the plan and publication has begun for some of the sites. Other Metroplex projects are either in the process of procedure development or projects have not yet commenced. Collaborative Metroplex teams determine the types and number of procedures which will then be captured in the PBN implementation plan. Any other PBN procedures at non-Metroplex Core airports will also be determined collaboratively with industry.

- The PBN Dashboard is designed with the capability to determine usage levels for routes throughout the NAS. This scalable usage data will be used for the initial selection of decommissioning-eligible routes. The routes will then be assessed with non-quantitative measures, to include providing improved access and overall NAS benefits, to thoughtfully arrive at final disposition decisions.

    - A limited public version of the PBN Dashboard is available on NextGen Website as of May 24, 2013. (http://www.faa.gov/nextgen/pbn/dashboard/)

    - A FAA-internal management version of the dashboard, designated Dashboard-FAA Observer, is available on the AJV-14 Website on MyFAA as of August 1, 2013. It requires username and password, which can be obtained via the logon. It provides more information than the current public version to include individual procedure, route, and transition usage per segment of flight as well as more detailed operator equipage and airport utilization statistics. (https://pbn.mitre.org/pbnservices/pbn/FaaObserver.html)

    - The Observer functionality fully meets this target to provide data for consideration for PBN planning. The Dashboard-Full will enhance this data.

Recommendation 4: Develop and implement guidelines for ensuring timely inclusion of appropriate stakeholders, including airport representatives, in the planning and implementation of NextGen improvement efforts.

FAA Response:

The FAA has identified capability readiness across the airborne, airspace, air traffic and airport domains to provide an additional perspective to support harmonized implementation of NextGen capabilities across each of the domains which are incorporated into the NextGen planning

process support tools to include the *NextGen Implementation Plan (NGIP)* and *NAS Segment Implementation Plan (NSIP).*

The agency has in place a variety of processes to facilitate stakeholder involvement into the NextGen planning and implementation process. As an example, a robust process guide within the required Procedure Tracking Tool incorporates multiple instances where PBN project design and implementation efforts are mandated to incorporate outside stakeholders into the process.

FAA has also included internal and external stakeholders in the development of new NAS procedural designs conducted at major metropolitan airports such as Seattle (SEA), Houston (IAH) and Denver (DEN). This engagement at the conceptual level of new procedure design incorporates vital input from airport representatives and airlines prior to the implementation of these new procedures in the NAS. This initiative started in 2015 and is ongoing.

Recommendation 5: Assure that NextGen planning documents provide stakeholders information on how and when operational improvements are expected to achieve NextGen goals and targets.

FAA Response:

Flexibility, responsiveness, and accessibility influence the driving philosophy of NextGen to plan for and deliver NAS improvements. The long term mixed equipage state of aircraft in the NAS challenges the ability of NextGen to develop an environment that meets all needs. The inherent limitations associated with today's system highlights the need to continue advancements of NextGen capabilities.

The FAA annually publishes the NGIP. Developed by a cross-agency working group, the NGIP provides an overview of the FAA's ongoing transition to NextGen and synthesizes the FAA's planning documents in a format that is accessible to our varied stakeholders.

The FAA's NAS Enterprise Architecture (NAS EA) is the blueprint for transforming the current NAS to the NextGen system. It contains the integrated technical decisions, synchronized investments and the interdependencies across policies, operations, systems and technologies.

The FAA's NSIP is the FAA's NextGen planning document. It describes how the FAA plans to implement NextGen capabilities through 2025 and is organized into portfolios of related operational improvements (OIs).

In 2014, the FAA integrated the NSIP and the NAS EA, which provides an additional level of detail and connectivity and maps interdependencies between OIs. This integrated planning resource illustrates operational and performance impacts and facilitates traceability between OI and NextGen goals. The FAA established an initial set of NextGen goals and associated quantitative targets, aligned with the International Civil Aviation Organization (ICAO) Key Performance Areas and will continue to expand this set and begin to align the OI with the goals.

The FAA completed the updated OI descriptions in the NSIP and revalidated the implementation portfolios. The updated NSIP fully integrates into the NAS EA Portal as of February 2014.

The *PBN NAS Navigation Strategy* was signed by the FAA Administrator on September 28, 2016. This report is the product of collaboration between the FAA and aviation stakeholders, along with input from the NextGen Advisory Committee and the Performance Based Operations Aviation Rulemaking Committee. The Strategy is divided into near-, mid, and far-term objectives over the next 15 years, providing stakeholders with valuable information on operational improvements and achievement goals and targets.

3. The FAA lists the En Route Automation Modernization (ERAM) computer system, which was completed in March 2015, as a NextGen program. ERAM, however, has received funding since 2003, well before NextGen first appeared in the FAA budget in 2007. For each line item included in the Administration's NextGen budget request for FY 2017, please indicate whether the program had received funding prior to 2007. In addition, please state how each program relates to the goals and expected outcomes of NextGen, including how it will contribute to a measurably safer and more efficient ATC system.

The attached spreadsheet in Appendix A lists all the 2017 budget items that are directly identified as NextGen investments. For the column labeled "Did it exist prior to 2007," we determined whether there was an existing acquisition baseline system/program that received funding for those years. The column "Did it exist in 2007" highlights the addition of programs in the first year of identified NextGen funding. The final column highlights how each budget line is represented in the *Capital Investment Plan (CIP)* with relationship to the Agency's major performance objectives.

4. In its November 2016 report, the OIG highlighted the fact that "FAA considers the $2.7 billion ERAM program to be the backbone for NextGen that allows controllers to better manage flights from gate to gate." Despite your announcement of completion of the program, however, the OIG identified serious integration issues with more than half of the NextGen transformational programs and ERAM. The OIG concluded that modifications to ERAM are necessary before the expanded capabilities of the transformational programs can be realized in the National Airspace System (NAS). In fact, the OIG explained that the FAA already has plans to spend millions of dollars to further modify ERAM in order to address some of these integration issues. Please outline the expanded capabilities that ERAM currently allows for in the NAS beyond the legacy system. In addition, provide an estimate for the total cost of ERAM, including the estimated costs of the modifications necessary to fully integrate ERAM with the NextGen transformational programs and deliver the benefits associated with full NextGen capabilities.

The FAA believes that there is a misunderstanding/misconception concerning planned enhancements to En Route Automation Modernization (ERAM). The characterization provided by the Office of the Inspector General (OIG) stating "that the Federal Aviation Administration (FAA) already has plans to spend millions of dollars to further modify ERAM in order to address some of these integration issues," supposes that ERAM is broken and needs to be fixed to work with planned NextGen capabilities. The facts are that ERAM is operating 24/7 in the National Airspace System (NAS) today doing what is was designed to do, replace the HOST system which was becoming increasingly obsolete, and serve as the backbone, the chassis for automation capabilities in the En Route environment.

The FAA's plans to incorporate NextGen capabilities onto ERAM always required planned enhancements to ERAM, not to fix integration issues with ERAM, but to provide the additional needed capabilities (not able to be fielded on the legacy HOST system). To date the ERAM program has developed software to enable the following capabilities (enhancements) in the NAS (beyond the basic ERAM required capabilities):

- Pre-Departure Re-Route and Airborne Re-Route capabilities (PDRR/ABRR)
- Ground Interval Management – Spacing capability (GIM-S)
- Data Communications (Data Comm): tower datalink services, En Route datalink capabilities under development

There are numerous planned NextGen capabilities in the future that will require additional enhancements to ERAM. These do not indicate that there are integration issues with ERAM, but rather that there are additional planned needs that require additional ERAM software to enable the capability. In fact the agency is about to baseline a new ERAM enhancement segment (Final Investment Decision (FID) December 2016) which will provide capabilities including – automated handoffs with NavCanada, improvements to conflict probe processing to include the R-side capability, enhanced usage of International Civil Aviation Organization (ICAO) flight plan elements, improvements to trajectory modeling algorithms, capability to begin to integrate Unmanned Aerial Vehicles (UAVs) into the NAS, among others.

The base ERAM program has been successfully completed as of March 2015 as the FAA previously indicated. Continuing software development on ERAM should be viewed as indicative of executing the concept of seamlessly integrating new capabilities into the NAS onto the ERAM infrastructure as previously planned NextGen capabilities mature.

The table below includes baselines, technical refreshes, and improvements as required by regular operational system maintenance. The cost for implementing NextGen transformational programs are ascribed to the individual programs as outlined in their benefits case and not to the ERAM program.

En Route Automation Modernization (ERAM)			
	Baseline Date	Description	Current Estimate at Completion or Actual (Millions)
En Route Automation Modernization (ERAM)	Jun-03	Deployed a replacement of the En Route air traffic control system used by air traffic controllers in the 20 En Route centers.	$2,579.5
ERAM System Enhancements and Tech Refresh (SETR)	Sep-13	Tech refresh of ERAM hardware and software	$152.9
ERAM Tech Refresh 2 - *Pending FID approval*	Jan-17	Tech refresh of ERAM hardware and software	$279.2
ERAM System Enhancements 2 (Sector, Segment 1) - *Pending FID approval*	Jan-17	Improve the efficiency and effectiveness of En Route sector operations.	$253.6
Total ERAM			**$3,265.2**

5. In its January 2016 report, the OIG made three recommendations that would improve the FAA's ability to manage acquisition for NextGen programs and to implement reforms fully. For each recommendation, provide a summary of the actions the FAA has taken or intends to take to fulfill the recommendation.

FAA provides the following summary of actions taken and/or intends to take to fulfill the OIG recommendations.

Recommendation 1: Identify and implement Agency-wide cost-saving initiatives and develop appropriate timelines and metrics to measure whether the initiatives are successful.

FAA Response:

The Federal Aviation Administration (FAA) already includes Agency-wide cost savings in its Organizational Success Measures and will continue to identify and implement Agency-wide cost-saving initiatives. These initiatives are tracked and reported to the FAA's Chief Financial Officer on a monthly basis.

This recommendation is resolved but remains open and is pending closure. The Office of the Inspector General (OIG) is reviewing the Fiscal Year (FY) 2016 Performance and Accountability Report (PAR) before closing.

Recommendation 2: When reporting on major acquisitions, identify the current estimated costs for each acquisition system, including all segments. Separately identify cumulative amounts for acquisition costs, technical refresh, and other enhancements in order to identify the total baselined/rebaselined costs for each system and account for the way funds are being used when reporting to managers, Congress, and other stakeholders.

FAA Response:

The FAA already provides much of the information recommended by the OIG in the Annual FAA System Acquisition Baseline Performance Report. However, per the recommendation, the Agency enhanced the report to include the recommended acquisition information as of the 2015 FAA System Acquisition Baseline Performance Report. The OIG closed the recommendation based upon the FAA's actions to address the recommendation.

Recommendation 3: Review and identify Federal and industry best practices and guidance from OMB and the Federal CIO that may be incorporated into AMS for acquiring major capital investments and IT systems, including the use of successive contracts that are separately priced and the use of modular concepts when planning and purchasing IT, and determine which are appropriate for incorporation into AMS.

FAA Response:

The FAA is reviewing Federal and industry best practices for acquiring major capital investments and Information Technology systems. This review includes the use of successive contracting and the use of modular concepts. Based on the review findings, the FAA will determine what changes, if any, to incorporate into the Acquisition Management System.

The recommendation is resolved but open remains open. FAA's corrective action is sufficient but it has not been fully implemented. The FAA intends to update the Acquisition Management System in 2017 based on the review of government and industry best practices.

6. The OIG has identified insufficient outreach to stakeholders as a NextGen implementation obstacle. Have you implemented any policy changes aimed at improving stakeholder outreach so that NextGen's costs, benefits, and expected return on investment are more easily quantifiable and stakeholders can make more informed business decisions? If so, please describe these policy changes. In your response, please also provide specific dates by which system users can expect a return on their investments for each program listed in the FAA's budget as a NextGen program and the date by which taxpayer investments in these NextGen programs are expected to result in actual savings for taxpayers.

The Office of the Inspector General (OIG) observation is inaccurate. NextGen implementation progress is at an all-time high. The infrastructure is nearly complete and the effectiveness of the

NAC NextGen Priorities success rate have provided some operators with highest system predictability rates ever posted. *"Industry is operating at unprecedented levels of reliability." - Richard Anderson, Delta Airlines*

On the heels of the publication of the original concept for the NextGen program in 2007, the FAA reached out to its key operational stakeholders with the establishment of Task Force 5. Industry worked to refine NextGen to a more evolutionary, integrated endeavor, identifying all the components that must be addressed for the Federal Aviation Administration (FAA) and the operators to realize the intended Return on investment (ROI).

Upon receiving Task Force 5 recommendations, the FAA established the NextGen Advisory Committee (NAC) to continue critical collaboration with industry on this highly-integrated initiative. The FAA launched the NAC in 2010 to help steer the implementation of NextGen considering Task Force 5 recommendations. The FAA and industry have been working in close collaboration since 2010. The NAC has developed comprehensive recommendations supported by all segments of the aviation community to address NextGen issues, strategies, plans, implementations and tools to measure the effectiveness of implementations.

In 2013-14, the FAA reached out to the stakeholders and the NAC provided the FAA with their list of the top priorities. The FAA has continued to work with industry through the NAC to focus on implementing their top four priority capabilities.

FAA has met nearly all the milestones agreed to with the NAC NextGen Priorities (see response to question 1). Industry is seeing some benefits at some locations, but not at others. FAA had some early snags coordinating with Industry on schedule changes when the FAA had to reschedule San Francisco (SFO) Wake RECAT because of facility training necessary to plan for the Super Bowl. FAA learned from that, adjusted, and increased their coordination at the working group to discuss changes before they are implemented. Industry has pushed the FAA to set some higher-risk, stretch goals. Industry does not expect all of those to show as green throughout the life-cycle. "If all milestones are green, FAA and Industry teams aimed too low." The implementation of the Data Communications (Data Comm) program has been managed in full collaboration with industry through the Data Communications Implementation Team (DCIT). Terminal Flight Data Manager (TFDM), under the Surface area, will implement a similar construct throughout the deployment of TFDM for meaningful engagement with Industry.

The FAA, through numerous communication venues with the stakeholders, communicates on the progress and implements changes to the NAC NextGen Priorities. In 2014 along with the *NextGen Priorities Joint Implementation Plan*, the FAA published a robust *NextGen Priorities Joint Implementation Plan Oversight Process.* The *NextGen Priorities Joint Implementation Plan Oversight Process* outlines the process for managing the FAA/industry commitments. Inside this plan, the FAA outlines the outreach and communication that is to take place as part of

the implementation and management of the NAC NextGen Priorities. Since the implementation of the plan, the FAA has made the NAC NextGen Priorities a regular agenda item at the NAC and NextGen Advisory Committee Subcommittee (NACSC); both committees are widely attended by industry stakeholders in which the FAA discusses and reports on the NAC NextGen Priorities. Additionally, the individual four focus groups meet regularly with industry stakeholders to communicate specific program information and to update/add stakeholder priorities to the goals.

For example, the Data Comm program has worked with both internal and external stakeholders throughout the lifecycle of the program, vetting plans for both the Tower and En Route phases with stakeholders in multiple forums. This has resulted in an approach which has been validated and supported every step of the way by industry. Additionally, the program remained flexible, incorporating stakeholder requests at key decision points throughout the deployment. The FAA works with industry to measure the cost versus benefits of delivering services to specific tower locations to ensure that the entire stakeholder community realizes the benefits of the tool within the NAS. Industry has already realized significant cost savings as a result of the deployment of Data Comm technologies into the National Airspace System (NAS) and these benefits will continue to grow as the program transitions into En Route airspace.

In addition to the four focus groups, the NACSC created a Joint FAA/Industry Assessment Team (JAT) to evaluate key NextGen implementations with the goal of producing a common statement of facts regarding benefits to system users. The JAT includes operational and analytical experts from the FAA and industry operators. To date the JAT has evaluated and reached consensus on the benefits of three NextGen capabilities: Wake Recategorization at Charlotte and Chicago, Required Navigation Procedures (RNP) at Denver, and the North Texas Metroplex. In 2017 the JAT will analyze additional RECAT sites, Performance Based Navigation (PBN), and Data Comm. The JAT work has already influenced future priorities for RECAT and Established on RNP (EoR). For example, as a result of the JAT analysis on EoR, the team reported to the NAC that EoR is an important enabler to further future growth of utilization of efficient PBN approaches. At Denver, EoR increased utilization of fuel-saving PBN approaches by 12 percent and increased time savings for these approaches by 33 percent. The JAT has helped improve the understanding and transparency of FAA benefit projections for NextGen programs. The JAT team and the four focus groups meet regularly to provide continuous feedback for future prioritizations.

NextGen is delivering improvements in every phase of flight to system users and the flying public. The FAA is not able to provide ROI data for every NextGen budget line item (BLI), as several of these lines fund early development activities and new airspace/procedures development not associated with specific acquisition programs. The budget lines that correspond with acquisition programs, and have entered full-scale development, will have acquisition program baselines. These "baselined" programs have approved business cases which include breakeven dates. The table below lists all FY 2017 NextGen budget items, and includes for

baselined programs the dates when the programs are expected to achieve a positive return on investment, as reported in their individual business cases.

The FAA has also created an overall NextGen business case which captures all costs and benefits for the program, including those accruing to the government, airspace operators, and the flying public (https://www.faa.gov/nextgen/media/BusinessCaseForNextGen-2016.pdf). Non-acquisition activities (Budget Activity 1) are included in this overall business case. The business case benefits are developed using program-level inputs in a system wide model of the NAS. The model simulates future traffic levels and delay changes based on airport and airspace capacity improvements, fuel burn, and cancellation reductions.

The FY 2016 NextGen Business Case projects a breakeven point in FY 2021 and a net present value (NPV) of $54.5B. This NPV is calculated using NextGen cost and benefit streams from 2007 to 2030. Total benefits through 2030 are $160.6B and costs are $35.8B (both FY 2015). Through 2016 NextGen has already delivered $2.7B in benefits, including $0.9B in direct benefits to airspace users (additional benefits come from time savings to the flying public).

Acquisition program business cases do not typically include projections for when airspace operators will break even on their equipage investments. However, using data from the NextGen Business Case, benefits for system users from reduced flight time, fuel burn, and cancellations amounts to $39.8B through 2030. This compares with equipage costs for operators of $15.2B. The NPV for system users is estimated to be $10.3B with a breakeven point in 2022.

Finally, in 2015 the FAA worked with McKinsey & Co. to develop business cases for seven airlines (United, Delta, American, Southwest, JetBlue, Alaska, and Republic) and two cargo carriers (Federal Express (FedEx) and United Parcel Service, Inc. (UPS)). These operator-specific business cases were derived from the latest overall NextGen Business Case, but included only the costs for each carrier to equip with Automatic Dependent Surveillance – Broadcast (ADS-B) Out and Data Comm, and the benefits to the operators associated with these two capabilities. The pay-back period for these equipage investments ranged from 2 to 6 years for the passenger carriers, and 5 to 12 years for the cargo carriers.

The following table represents planned investments and their ROIs.

NextGen FY17 Budget Line Items

BLI	Program	Estimated ROI Breakeven Date	Final Investment Decision Date
	Activity 1 - Engineering, Development, Test and Evaluation		

1A05	**Separation Management Portfolio**	NA	
1A06	**Improved Surface/TFDM Portfolio**	NA	
1A07	**On Demand NAS Portfolio**	NA	
1A08	**Improved Multiple Runway Operations Portfolio**	NA	
1A09	**NAS Infrastructure Portfolio**	NA	
1A10	**NextGen Support Portfolio**	NA	
1A11	**Performance Based Navigation & Metroplex Portfolio**	NA	
	Activity 2 - Air Traffic Control Facilities and Equipment		
	a. En Route Programs		
2A01	**En Route Automation Modernization (ERAM) - System Enhancements and Tech Refresh**	NA*	September 2013
2A11	**System-Wide Information Management**		
	System-Wide Information Management (SWIM) - Segment 1A	FY 2010	June 2007
	System-Wide Information Management (SWIM) - Segment 1B	FY 2021	July 2009
	System-Wide Information Management (SWIM) - Segment 2A	FY 2016	July 2012
	System-Wide Information Management (SWIM) - Common Support Services Weather (CSS - Wx)	FY 2020	March 2015
	System-Wide Information Management (SWIM) - Segment 2B	FY 2025	October 2015
2A12	**ADS -B NAS Wide Implementation**		
	ADS -B NAS Wide Implementation - Segment 1 and 2	FY 2032**	May 2012
2A14	**Collaborative Air Traffic Management Technologies**		
	Collaborative Air Traffic Management Technologies - WP2	FY 2015	September 2008
	Collaborative Air Traffic Management Technologies - WP3	FY 2022	January 2010
2A15	**Time Based Flow Management Portfolio**		
	Time Based Flow Management (TBFM) WP2	FY 2013	April 2010
	Time Based Flow Management (TBFM) WP3	FY 2026	April 2015
2A17	**NextGen Weather Processors**		
	NextGen Weather Processors (NWP) - Work Package 1	FY2022	September 2014
2A18	**Airborne Collision Avoidance System X (ACASX)**	NA***	
2A19	**Data Communications in Support of NG Air Transportation System**		
	Data Communications - Segment 1 Phase 1	FY 2028	May 2012
	Data Communications - Segment 1 Phase 2	FY 2025	October 2014
	Data Communications - Segment 1 Phase 2 Full En Route Services	FY 2026	August 2016
	b. Terminal Programs		
2B13	**National Airspace System Voice System (NVS)**	NA*	September 2014
2B18	**Improved Surface/TFDM Portfolio**		
	Terminal Flight Data Manager (TFDM)	FY 2047**	June 2016
2B22	**Flight and Interfacility Data Interface (FIDI) Modernization**	NA	2017

	Activity 3 - Non-Air Traffic Control Facilities and Equipment		
	a. Support Equipment		
3A09	**System Safety Management Portfolio**	NA	
	b. Training, Equipment and Facilities		
	Activity 4 - Facilities and Equipment Mission Support		
	a. System Support and Services		
4A09	**Aeronautical Information Management Program**	NA	
	Aeronautical Information Management (AIM) Segment 2	FY 2026	August 2014
4A10	**Cross Agency NextGen Management**	NA	

* These programs are replacements or technology refreshments. No quantitative business cases were produced.

** These programs provide infrastructure that enable future capabilities and benefits. The incremental costs and benefits are captured in the overall NextGen Business Case.

*** This program is a non-material solution not requiring a quantitative business case.

7. GAO has identified cybersecurity as another area of challenge for NextGen implementation. This is a serious matter given the high degree of interconnectivity inherent in NextGen technologies. In an April 2015 report, GAO stated that the FAA currently has no plans to produce a cybersecurity threat model and that without such a model, the agency may be improperly allocating resources to defend NextGen aircraft and facilities against the most serious cybersecurity threats. The FAA Extension, Safety, and Security Act of 2016 requires the FAA to research and assess the creation of an agency-wide cybersecurity threat assessment model. What are the FAA's current plans for complying with the Act's directive? Will the FAA consider whether a threat model should include threats specific to NextGen programs? What is the estimated date of completion for the FAA's threat model research?

The Federal Aviation Administration (FAA) concurred with the Government Accountability Office's (GAO) recommendations regarding cybersecurity of NextGen programs. The three GAO recommendations have been implemented including the recommendation which called for creation of a plan to create a National Airspace System (NAS) level threat model. The FAA has been executing on this plan and intends to have the initial NAS level threat and risk modeling completed in June 2017. It is FAA opinion that the cyber threat and risk models should not be limited to the NextGen Programs alone. The NextGen programs do not exist in isolation within the NAS. Several programs change legacy infrastructure directly or the NAS integrated with NextGen capabilities exhibits new behavior. Considering this, a holistic approach to NAS

cybersecurity is necessary to understand the risk to the FAA mission. Therefore, the Agency's threat and risk modeling efforts are aimed at the entirety of the NAS.

8. How do multilateral and bilateral commitments and agreements, including with the International Civil Aviation Organization, impact implementation timelines for NextGen programs?

Concurrent timing in development and implementation of NextGen and international Air Traffic Modernization (ATM) programs is optimal for harmonization of operations and benefits. However, timing of international standards development and promulgation, business, operational and budget drivers make that difficult and may impact domestic timelines.

Understanding the impacts of our commitments and agreements with multilateral and bilateral partners, the FAA has placed a higher emphasis on global leadership as one of the Administrator's Strategic Initiatives. As part of this initiative, the FAA is moving and developing resources to ensure the harmonization and interoperability of international ATM modernization efforts with NextGen. This is being promulgated through strategic planning of resources and budgets as well as prioritized work at the International Civil Aviation Organization (ICAO) and with our bilateral partners. The main FAA thrust is to ensure global harmonization through NextGen alignment to the *Global Air Navigation Plan* and the *Aviation System Block Upgrade Roadmap*. To further ensure global harmonization for future development, the FAA has formal agreements with the European Commission, Japan, and Singapore to collaborate on air traffic management development and direction. Accomplishments and progress under the United States – European Commission agreement are documented in a biannual State of Harmonisation Report. The next report will be released the week of December 12, 2016, and will cover the harmonization efforts between the NextGen and Single European Sky ATM Research (SESAR) programs since mid 2014.

While the prioritization on international harmonization through the Global Leadership Initiative is positive and is providing results, there is ongoing work the FAA must do to ensure NextGen initiatives are globally harmonized where required. This necessitates additional coordination with critical global partners. Decisions at the ICAO and with bilateral partners can impact NextGen implementation, and have the potential to force rework of NextGen programs. Alternatively, the United States can deviate from global timelines and decisions in favor of our NAS requirements, but the FAA must take additional care to communicate this to Congress, industry and the public to prevent a false sense that NextGen is behind or not fulfilling stated objectives and commitments.

9. Has the FAA conducted an analysis to identify potential risks to NextGen interoperability with other Air Navigation Service Providers? If so, does the agency anticipate NextGen implementation delays due to interoperability concerns?

The FAA has not conducted a detailed gap analysis for interoperability with the multiple international Air Traffic Modernization (ATM) programs; however a risk assessment was added to the FAA systems engineering process to support ongoing harmonization efforts. Also, similar assessments have and continue to take place as part of bilateral agreements and work at the International Civil Aviation Organization (ICAO). Continuous assessment is a significant aspect of the cooperation with Europe under the Single European Sky ATM Research (SESAR) annex. These assessments look at timing and need for specific standards and procedures and are flexible to evolving information standards and operational changes such as advanced Performance Based Navigation (PBN) procedures and most recently, Unmanned Aircraft Systems (UAS).

Additionally, as part of the ICAO Standards Roundtable and updates to the *Global Air Navigation Plan,* the FAA has identified those minimum standards that need to be addressed globally to assure movement to a global system that is harmonized and interoperable with NextGen.

FAA also encourages that Radio Technical Commission for Aeronautics (RTCA) to develop performance standards that serve as a basis for regulations jointly with our European counterpart, the European Organisation for Civil Aviation Equipment (EUROCAE). Most of the standards critical to future phases of NextGen are being developed jointly with EUROCAE. Industry encourages FAA to support efforts to have the resulting standards adopted by ICAO and referenced in ICAO Standards and Recommended Practices (SARPS) where appropriate.

It is important for the FAA to harmonize to the greatest extent practicable. It is also important to recognize that the US NAS is unique in the extent of existing infrastructure, the capabilities of our workforce, the pace of operations, and the frequency of visual weather conditions. Our programs are structured for the NAS, while considering interoperability as a factor (for aircraft equipage and for flight crew operations).

The FAA does not believe that a detailed analysis for every global initiative is warranted given the ongoing work bilaterally and through ICAO. This work is dynamic and evolves around frequent changes in the international system due to business, budget, standards and technology updates and changes. While a gap analysis may provide an accurate snapshot of program interoperability today, those circumstances may quickly change in the near future.

10. In 2014, the National Academies issued a report highlighting challenges the FAA may face in developing and retaining a workforce with the appropriate skills needed to manage a large, complex initiative such as NextGen. What actions have FAA officials taken to implement this report's recommendations?

In 2015, the FAA met jointly with the National Academies of Sciences and the National Air Traffic Controllers Association (NATCA) to collaborate on controller staffing model review and

validation. These meetings also provided an opportunity to review the July 2014 National Airspace System (NAS) report findings and recommendations, and to develop a path forward. The FAA is continuing to consult with the National Academy and NATCA regarding controller staffing models, scheduling practices, and the execution of hiring plans.

Overall, the FAA believes that the current aptitudes it seeks for controller candidates -- such as deductive and visuospatial reasoning, concentration, and stress tolerance -- will continue to be applicable for the foreseeable future. This has proven true for the controllers who have adapted to the use of the Advanced Technologies and Oceanic Procedures (ATOP) system to manage the oceanic airspace, in what is the first continual use of time-based management.

The National Academies report highlighted the need to involve controllers in the development, testing, and implementation of NextGen products and procedures. More recently, the NextGen Advisory Committee emphasized that in order to move to time-based management throughout the NAS, Air Traffic Control (ATC) will need well-developed training and operational acceptance and adoption by both pilots and controllers.

The FAA knows that controllers' acceptance of automation and decision support tools significantly increases our ability to make air traffic management more efficient, and thus are focusing on building that trust during testing, training, and early implementation. In 2015-2016, we've had more than 250 controllers involved with development of more than 30 programs.

For example, the En Route Automation Modernization (ERAM) program has increased its reliance on controller expertise and involvement as it works on future releases. The FAA and NATCA have used cadres of controller subject matter experts (SMEs) in the early development of air traffic control functionality behavior on the glass, in order to maximize the likelihood that the products will meet the operational needs identified. This is in addition to the testing SMEs used in the development and operational evaluation testing at FAA's William J. Hughes Technical Center labs and at key sites.

The FAA also worked to improve how we introduce new programs, capabilities, and procedures into specific facilities. For example, the ERAM and Terminal Automation Modernization and Replacement (TAMR) programs deliver advanced test and training capabilities at each facility, which allow us to build scenarios that represent the local operations and train to those with new NextGen technologies integrated into the automation. This high-fidelity training, on operational equivalent systems, improves the speed of adoption.

Likewise, our Metroplex projects use checklists tailored to each location that detail the actions required to successfully implement the Performance Based Navigation (PBN) procedures. The FAA develops site-specific controller training to ensure familiarity with the pending new procedures, and when they go operational, controller "Go-Teams" are placed on-site as a ready resource to troubleshoot the implementation and to promote cultural acceptance.

Our Program Management Office was established to, among other things, oversee a coordinated approach to planning and deploying systems into the NAS. The FAA accounts for SME requirements as part of its investment planning and analysis. These impacts are incorporated in various business cases and to date have not resulted in major impacts to our current or projected controller staffing levels.

By developing programs with workforce input throughout the process, and by designing training and implementation activities in a manner that actively reduces barriers to acceptance, we are increasing our chances of success, which is evidenced by its use in programs such as Data Communications (Data Comm), which has implemented its tower services component two years ahead of schedule.

Looking ahead, the FAA is engaging with outside experts as it explores future training enhancements. The Agency's new Center of Excellence (CoE) for Technical Training and Human Performance established 5-year (with a 10-year option) cooperative agreements with sixteen universities on September 28, 2016. These agreements focus on researching and developing improvements to the technical training of air traffic controllers, aviation safety inspectors, engineers, technicians and pilots. The CoE's goal is to enhance and advance the teaching of these specialists through part-task training, immersive simulation and adaptive learning technologies that are standard in other technical workforces. The CoE will analyze human performance factors, including academic best practices and changes in learner expectations, as well as innovative training methods for a new generation of learners and NextGen technologies.

Additionally, the FAA has tasked the Aviation Rulemaking Advisory Committee (ARAC) to provide recommendations on how the agency can use external training providers for its new-hire air traffic controller training program. The Air Traffic Controller Basic Qualification Training Working Group (ATCWG) will provide the ARAC with analysis and recommendations on options for external training provider solutions that restructure the FAA Air Traffic Controller candidate pipeline in FY 2017 and FY 2018.

11. In an August 2016 report, the OIG highlighted that the FAA has not yet established a structure to coordinate research and development (R&D) transfer with all NextGen partner agencies, potentially resulting in missed opportunities to build upon past R&D efforts at other agencies or the potential for duplication of efforts across agencies. What steps is the FAA currently taking to increase interagency coordination to better leverage the R&D being conducted at NextGen partner agencies?

The FAA has significant coordination with its interagency partners and collaboration is strong. The FAA is fulfilling much of what has been described in the question through other means while formalizing additional processes and products for long-term research and development

(R&D). Our work with the *National Aviation Research Plan (NARP), The Future of the NAS, NAS Enterprise Architecture (NAS EA)*, et al., will continue to inform and provide a solid foundation for the future. Additionally, the FAA has made great strides in expanding NextGen interagency collaboration and facilitation efforts, through facilitating interactions and collaboration in such key areas as aviation cybersecurity and NextGen weather.

The FAA is meeting the intent of the question by conducting several regular and recurring activities/engagements that occur between the FAA and the NextGen partner agencies to support the evaluation of interagency planned and ongoing research efforts. The FAA believes that the level of interaction and current engagement with the NextGen partner agencies meets the evolving needs and implementation plan for NextGen.

The National Aeronautics and Space Administration (NASA) is vested with the mission for conducting long-term Air Traffic Management (ATM) research, and thus interactions with the FAA are key to ensuring effective NextGen R&D coordination. The FAA is fully engaged in NASA's annual review of its aeronautics research as well as its review of individual research projects, such as Airspace Technology Demonstrations (ATD)-1, 2, and 3. These recurring reviews ultimately lead to full engagement through the Research Transition Team (RTT) process. RTTs help ensure that R&D needed for NextGen implementation is identified, conducted, and effectively transitioned to the implementing agency, and they provide a structured forum for researchers and implementers to work together on a continual basis. RTTs help ensure that planned research results can be fully utilized and will be sufficient to enable implementation of NextGen Operational Improvements.

The RTT process was established in 2008, and has been referenced as a best practice in multiple Government Accountability Office (GAO) and Inspector General (IG) reports. Several highly-visible technologies have been transitioned using this process. For example, the Efficient Flow into Congested Airspace (EFICA) RTT involved joint collaboration with industry partners for near-term efficient and reduced environmental impact of arrival operations under constrained airspace conditions. As part of this RTT, NASA transitioned the Efficient Descent Advisor/3D-Path Arrival Management (EDA/3D-PAM) technology to the FAA in November 2011. It has the potential to reduce local noise and emissions, reduce flight time and save $300 million per year in jet fuel. In addition, the EFICA RTT transitioned the Terminal Sequencing and Spacing tool to FAA in July 2014. This tool is currently scheduled to be deployed in the NAS as part of Time Based Flow Management program Work Package 3 and will expand time based metering into the terminal environment. Other transitions include the Precision Departure Release capability (transitioned in August 2013) and the Multi-Sector Planning capability (transitioned in July 2011). There are six active RTTs, and additional RTTs are being considered for the future. As identified in the August 2016 OIG Report, the FAA is updating the RTT Charter to update the guidance and improve its usefulness for other agencies. Additionally, the RTT process has been expanded to include other partner agencies beyond the FAA and NASA as appropriate, with regular reporting to the Interagency Planning Office for NextGen's (IPO) Executive Board.

To ensure the overall coordination between the FAA and NASA, NASA's Aeronautics Research Mission Directorate (ARMD) and the FAA's NextGen Organization conduct quarterly meetings to discuss R&D efforts, RTTs, ATD-1/2/3 progress, discussion on NASA and FAA key strategic documents, as well as other related topics. These quarterly engagements serve as an executive-level review of the strong collaboration between both agencies.

FAA's NextGen Office has expanded the National Airspace System Enterprise Architecture (NAS EA) to identify key partner agency R&D and activities. In addition, the FAA added a New Entrants Roadmap to the NAS EA, which includes Unmanned Aircraft Systems (UAS) and Commercial Space. The intent of the New Entrants roadmap is to provide a single, consolidated timeline of all activities and investments, both active and planned, required to integrate UAS and Commercial Space into the NAS. At the NextGen portfolio level, FAA program managers regularly engage with partner agency counterparts to collaborate on R&D, program needs, and/or equities as appropriate.

Elements of the *NextGen Segment Implementation Plan (NSIP)* annually undergo an assessment of implementation readiness based on feasibility, affordability, dependencies, potential benefits and technical maturity. Ongoing research directly influences these factors. Operational increments may be rescheduled in time or deleted based on these factors and all changes are documented. With respect to technological opportunities that lead changes in standards and guidance, the research is individually documented as part of the individual research projects.

The Interagency Core Cyber Team (ICCT) is tri-chaired by the FAA, Department of Defense (DoD), and Department of Homeland Security (DHS). The ICCT coordinates with the FAA Cyber Steering Committee, and promotes and enables consistent multiagency coordination on aviation cybersecurity topics. The ICCT has identified ongoing or completed R&D projects by DoD and DHS that have the potential to address Aviation Cybersecurity needs and gaps. In 2016, the ICCT began working with the principal investigators of these R&D projects for future cooperation; dialogue began with a DoD research facility (Air Force Research Laboratory) for additional opportunities for R&D collaboration. Some examples include: Mission Assurance Technologies for Net-Enabled Architectures (MATNA)-Sensors Directorate; New Intrusion-Resistant Virtualized Adaptive Network Architecture (NIRVANA); and Security Optimization and Fault-Tolerance in Cloud Architecture (SOFTCloud). Additionally, the ICCT is coordinating with NASA on an initiated effort to conduct research on a secure net-centric aviation communications (SNAC) infrastructure.

Beginning in 2015, the FAA participated in CYBER GUARD, a massive exercise led by United States Cyber Command (CYBERCOM) focused on "whole of nation" solutions to protect, prevent, mitigate and recover from cyber-attacks against U.S. critical infrastructure. Additionally, the FAA leads the Cybersecurity Incident Response Processes (IRP) Exercise with involvement of DoD, DHS, and others to examine the FAA's Security Operation Center (SOC) incident response processes, the internal escalation procedures and triggers for escalation.

The FAA's Aviation Weather Division assures the development and integration of productive weather information into Air Traffic management (ATM) decisions by pilots, controllers, flight operations, and airport operators. To this end, the FAA coordinates and works with FAA operations, safety and standards organizations, the National Weather Service (NWS)—a component of the National Oceanic and Atmospheric Administration (NOAA)—and the commercial sector to improve and integrate weather information into operational aviation decision making. The FAA, as the responsible agency for aviation research, engages with NWS and its other stakeholders through its Aviation Weather Research Program (AWRP) process to review its planned and proposed research, especially those efforts which will transition to NWS, and provides concept development and engineering for Weather ATM integration. The IPO will continue to support the NextGen Executive Board, to better document ongoing engagements that may influence long-term R&D decisions of NASA/FAA and FAA/NWS.

The FAA facilitates the NextGen Executive Weather Panel (NEWP), which is comprised of weather executives from the FAA, DoD, Department of Commerce (DOC), and NASA. The NEWP collaborates on NextGen weather-related R&D, policy, and implementation activities. The NEWP also serves as a forum to discuss and monitor the Ceiling and Visibility research-to-operations/operations-to-research (R2O/O2R) process, which uses a similar structure to RTTs in order to effectively guide research transfer. The NEWP will be instrumental in evaluating potential future NextGen weather-related R2O/O2R candidates.

The FAA will continue to leverage partner agencies R&D efforts to assist in successful execution of NextGen.

12. The OIG has observed that, according to the FAA's data, only 651 out of 7,000 commercial aircraft have been equipped with rule-compliant avionics as of August 2016. Furthermore, industry has raised concerns regarding both the availability of ADS-B avionics and repair station time slots to install the avionics in time to meet the 2020 mandate. Please provide an update on the steps the FAA is taking to ensure that the 2020 ADS-B equipage mandate is met.

The FAA has actively collaborated with industry, operators, airlines, pilots, and government through the NextGen Advisory Committee (NAC), Equip 2020 Working Group, and other forums to identify and address barriers delaying operators from equipping with Automatic Dependent Surveillance Broadcast (ADS-B) Out avionics by the 2020 deadline.

The projected fleet in 2020 for Part 121 operators is currently 6000-7000 aircraft, of which 787 are currently equipped. Through the NAC efforts the Equip 2020 collaborative initiative has received equipage plans from airlines that account for 88 percent of the projected fleet meeting the 2020 mandate. FAA continues to work with airlines to address the remaining aircraft, which

include new deliveries, additional retrofits, and aircraft that may be shifted outside the US market.

The FAA and aviation industry, through the Equip 2020 Working Group, have worked together since the October 2014 ADS-B Call to Action to ensure ADS-B equipage solutions are available for all aircraft types, both commercial and general aviation. The FAA's ADS-B equipage solution database contains 5,549 approved solutions mapping to 2,031 unique make model combinations and is available to search on the FAA's Equip ADS-B website: https://www.faa.gov/nextgen/equipadsb/adsb_ready/. For the remaining aircraft, the FAA has also allowed the installation data of an ADS-B Out system in the database to be re-used without requiring any specific approval.

Other key accomplishments of the Equip 2020 Working Group to date include:

- Recommendations for operational accommodation for air carrier operators who were early adopters for initial generations of Global Navigation Satellite System (GNSS) receivers. Airlines for America petitioned for an exemption based on those recommendations, and the FAA has approved that exemption for all similarly-situated operators. These operators must have ADS-B Out systems installed prior to the mandate, and will be accommodated during brief GPS satellite outages if their performance falls below the required level. This accommodation ends on January 1, 2025.

- Updated and streamlined installation and operational use guidance.

- Single ADS-B information source FAA Website (www.faa.gov/nextgen/equipadsb).

Through Equip 2020, the FAA is beginning to monitor the wait time for repair stations. Commercial operators often have dedicated maintenance facilities and contracts to assure company objectives, but there is a risk that the general aviation community will wait too long to equip and be unable to schedule the alteration before the deadline. The FAA has launched the General Aviation ADS-B Incentive program, to encourage this community to equip early, to gain insight on the repair station capacity, and to educate the community about the rule and the risks of waiting too long to equip.

FAA will continue to work with industry to address any barriers to complying with the 2020 rule through the NAC, Equip 2020, and other arenas, to ensure the aviation community meets the 2020 mandate.

Appendix A

FY 2017 BLI	BLI Name	FY 2017 Cong Submit	FY 2017 Senate Mark	FY 2017 House Mark	Did this exist in 2007?	Did this exist Prior to 2007?	Benefit Categories	Source NAS CIP FY2017-2021
	Facilities and Equipment							
	Activity 1 - Engineering, Development, Test and Evaluation							
1A05	Separation Management Portfolio	25,800.000	25,800.000	27,800.000	No	No	1. Capacity 2. Capacity	1. Maintain an average daily capacity for Core airports of 57,975, or higher, arrivals and departures. 2. Safely and efficiently integrate new types of operations, such as commercial space and unmanned aircraft, into the NAS and enable the benefits these operations will provide
1A06	Improved Surface/TFDM Portfolio	0.000	0.000	0.000				
1A07	On Demand NAS Portfolio	8,500.000	8,500.000	11,500.000	No	No	1. Capacity 2. Safety	1. Maintain an average daily capacity for Core airports of 57,975, or higher, arrivals and departures. 2. Reduce the commercial air carrier fatalities per 100 million persons on board by 24 percent over 9 year period
1A08	Improved Multiple Runway Operations Portfolio	6,500.000	6,500.000	6,500.000	No	No	1. Capacity	1. Maintain an average daily capacity for Core airports of 57,975, or higher, arrivals and departures.
1A09	NAS Infrastructure Portfolio	17,660.000	17,660.000	17,660.000	No	No	1. Capacity	1. Maintain an average daily capacity for Core airports of 57,975, or higher, arrivals and departures.
1A10	NextGen Support Portfolio	12,000.000	12,000.000	12,000.000	No	No	1. Cost Saving/Capacity	1. Achieve documented cost savings and cost avoidance of $50.27 million in FY 2016.
1A11	Performance Based Navigation & Metroplex Portfolio	17,500.000	17,500.000	17,500.000	No	No	1. Capacity 2. Capacity	1. Maintain an average daily capacity for Core airports of 57,975, or higher, arrivals and departures. 2. Optimize airspace and Performance Based Navigation (PBN) procedures to improve efficiency an average of 10 percent across Core airports by 2018.
	TOTAL ACTIVITY 1	87,960.000	87,960.000	92,960.000				
	Activity 2 - Air Traffic Control Facilities and Equipment							
	a. En Route Programs							
2A01	En Route Automation Modernization (ERAM) - System Enhancements and Tech Refresh	78,000.000	78,000.000	78,000.000	Yes	Yes	1. Capacity	1. Maintain an average daily capacity for Core airports of 57,975, or higher, arrivals and departures
2A11	System-Wide Information Management	28,800.000	28,800.000	28,800.000	Yes	No	1. Capacity 2. Cost Saving/Capacity	1. Maintain an average daily capacity for Core airports of 57,975, or higher, arrivals and departures. 2. Achieve documented cost savings and cost avoidance of $50.27 million in FY 2016
2A12	ADS -B NAS Wide Implementation	154,800.000	181,400.000	154,800.000	Yes	No	1. Capacity 2. Capacity	1. Maintain an average daily capacity for Core airports of 57,975, or higher, arrivals and departures 2. Achieve a NAS on-time arrival rate of 88 percent at Core airports and maintain through FY 2018.
2A14	Collaborative Air Traffic Management Technologies	13,820.000	13,820.000	13,820.000	Yes	Yes	1. Capacity	1. Maintain an average daily capacity for Core airports of 57,975, or higher, arrivals and departures
2A15	Time Based Flow Management Portfolio	50,600.000	50,600.000	50,600.000	Yes	Yes	1. Capacity	1. Maintain an average daily capacity for Core airports of 57,975, or higher, arrivals and departures
2A17	NextGen Weather Processors	27,800.000	27,800.000	27,800.000	No	No	1. Capacity	1. Achieve a NAS on-time arrival rate of 88 percent at Core airports and maintain through FY 2018.
2A18	Airborne Collision Avoidance System X (ACASX)	8,900.000	8,900.000	8,900.000	No	No	1. Safety	1. Reduce the commercial air carrier fatalities per 100 million persons on board by 24 percent over 9 year period (2010-2018). No more than 6.2 in 2018.
2A19	Data Communications in Support of NG Air Transportation System	232,000.000	232,000.000	232,000.000	No	No	1. Capacity	1. Maintain an average daily capacity for Core airports of 57,975, or higher, arrivals and departures
	Subtotal En Route Programs	594,720.000	621,320.000	594,720.000				
	b. Terminal Programs							
2B13	National Airspace System Voice System (NVS)	48,400.000	48,400.000	48,400.000	Yes	No	1. Capacity	1. Maintain an average daily capacity for Core airports of 57,975, or higher, arrivals and departures

Appendix A

FY 2017 BLI	Facilities and Equipment BLI Name	FY 2017 Cong Submit	FY 2017 Senate Mark	FY 2017 House Mark	Did this exist in 2007?	Did this exist Prior to 2007?	Benefit Categories	Source NAS CIP FY2017-2021
2B18	Improved Surface/TFDM Portfolio	44,200.000	44,200.000	44,200.000	No	No	1. Capacity 2. Cost Saving/Capacity	1. Maintain an average daily capacity for Core airports of 57,975, or higher, arrivals and departures. 2. Achieve documented cost savings and cost avoidance of $50.27 million in FY 2016
2B22	Flight and Interfacility Data Interface (FIDI) Modernization	15,000.000	15,000.000	15,000.000	No	No	1. Capacity	1. Sustain adjusted operational availability at 99.7 percent for the reportable facilities that support the Core airports.
	Subtotal Terminal Programs	107,600.000	107,600.000	107,600.000				
	c. Flight Service Programs							
	d. Landing and Navigational Aids Program							
	e. Other ATC Facilities Programs							
	TOTAL ACTIVITY 2	702,320.000	728,920.000	702,320.000				
	Activity 3 - Non-Air Traffic Control Facilities and Equipment							
	a. Support Equipment							
3A09	System Safety Management Portfolio	17,000.000	17,000.000	17,000.000	No	No	1. Safety	1. Reduce the commercial air carrier fatalities per 100 million persons on board by 24 percent over 9 year period (2010-2018). No more than 6.2 in 2018.
	Subtotal Support Equipment	17,000.000	17,000.000	17,000.000				
	b. Training, Equipment and Facilities							
	Subtotal Training, Equipment and Facilities	0.000	0.000	0.000				
	TOTAL ACTIVITY 3	17,000.000	17,000.000	17,000.000				
	Activity 4 - Facilities and Equipment Mission Support							
	a. System Support and Services							
4A09	Aeronautical Information Management Program	10,400.000	10,400.000	10,400.000	No	No	1. Safety	1. Reduce the commercial air carrier fatalities per 100 million persons on board by 24 percent over 9 year period (2010-2018). No more than 6.2 in 2018.
4A10	Cross Agency NextGen Management	2,000.000	2,000.000	2,000.000	No	No	1. Cost Saving/Capacity	1. Achieve documented cost savings and cost avoidance of $50.27 million in FY 2016.
	TOTAL ACTIVITY 4	12,400.000	12,400.000	12,400.000				
	Activity 5 - Personnel and Related Expenses							
	Activity 6 - Sustain ADS-B services and Wide Area Augmentation Services (WAAS) GEOs							
6A01	ADS-B services and WAAS GEOs	0.000	0.000	0.000				
	SUB-TOTAL ALL ACTIVITIES	819,680.000	846,280.000	824,680.000				
	NG Pre-Imp	91,780.000	91,780.000	96,780.000				

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THE GOLD STANDARD FOR AVIATION SINCE 1935

Approved by the NextGen Advisory Committee February 2017

Joint Analysis Team: Performance Assessment of Wake ReCat in Indianapolis and Philadelphia and Fuel Analysis for North Texas Metroplex

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Report of the NextGen Advisory Committee in Response to Tasking from the Federal Aviation Administration

February 2017

Joint Analysis Team: Wake ReCat in IND/PHL & Fuel Analysis in North Texas

Contents

Introduction/Background

The NextGen Advisory Committee (NAC) has been instrumental in helping the Federal Aviation Administration (FAA) move forward with NextGen implementation. In 2014, the Committee approved a recommendation for a set of integrated plans on four focus areas of NextGen capabilities (DataComm, Multiple Runway Operations, PBN, and Surface).

These plans were developed by a joint FAA-Industry team, the NextGen Integration Working Group (NIWG), operating under the NAC. The goal of the NIWG is to identify implementation priorities that deliver measurable benefits by certain dates, and, thereby, increase the community's confidence in NextGen.

In June 2015, the NAC considered and approved six high level performance metrics intended to measure performance impacts attributable to the deployment of the four key NIWG capabilities outlined in the "NextGen Priorities Joint Implementation Plan" of October 2014. The set of metrics are intended for the FAA and industry to collaboratively monitor performance to understand the impact of implementations. The six metrics (detailed in Appendix B) are:

1. Actual Block Time
2. Actual Distance Flown
3. Estimated Fuel Burn

} Measured by city pairs

4. Throughput – Facility Reported Capacity Rates
5. Taxi-Out Time
6. Gate Departure Delay

} Measured at airports

Subsequently, the NAC formed the Joint Analysis Team (JAT) which includes operational and analytical experts from the FAA and industry. The JAT was formed to reach a common statement of fact regarding performance impacts and benefits that can be attributed to implementation of NextGen capabilities. To accomplish this goal, the JAT has analyzed data, metrics, methods and tools typically used by each of the parties in this type of assessment. This has included analyses of other measures deemed appropriate beyond the six metrics noted above.

The JAT has previously evaluated the following capabilities at the following locations:

- Wake ReCat Implementations at Charlotte Douglass International Airport (CLT), O'Hare International Airport (ORD) and Chicago Midway International Airport (MDW)
- Performance Based Navigation (PBN) Metroplex Implementation in North Texas
- PBN Established on RNP (EoR) in Denver International Airport (DEN)

This report includes findings on Wake ReCat implementation in Indianapolis International Airport (IND) and Philadelphia International Airport (PHL).

Methodology

The JAT is comprised of data and analysis experts from the FAA as well as the aviation industry, and the team conducted a series of meetings to discuss and review ongoing analysis. This team utilized a methodology previously agreed upon by the JAT to evaluate the impacts of ReCat. Analysis of ReCat in IND included an additional challenge that runway on and off times from Airport Surface Detection Equipment, Model X (ASDE-X) were not available. As an alternative, the JAT utilized MITRE Threaded Track data to select a common point in the air by runway to approximate on and off times. For arrivals, the analysis uses the time at which the aircraft was 1 nautical mile (NM) from the runway threshold along the final approach course. For departures, the analysis uses the time at which the aircraft was 2.25NM from the opposite runway threshold along the take-off path. The JAT believes this approximation was sufficient to conduct the ReCat impact analysis.

The working dynamic between the FAA and industry team members remains a positive and professional one in which capable analysts from different perspectives challenged one another's perspectives. The final product of this body is the result of strong collaboration and sharing of data and ideas between the FAA and industry. The JAT continues to build trust and confidence amongst members throughout this process.

Summary of Findings

- The JAT analysis methodology for ReCat has been applied to multiple ReCat 1.5 implementation sites (CLT, ORD, MDW, IND) and a ReCat 2.0 site (PHL) using different aircraft pair separation matrices. Additionally it has been applied using ASDE-X and Threaded Track data. The methodology is robust as it has been applied successfully in all of these cases.
- Fleet mix and overall demand levels continue to be critical drivers of ReCat impact. Busy airports with a higher presence of Heavy, 757 and Small aircraft are expected to see the greatest impacts.
- Airborne or taxi out savings can be expected when ReCat impacted flights operate to an individual runway that is experiencing pressure. As long as pressure remains, savings accrue for all subsequent aircraft.
- Throughput improvement can be expected when ReCat-impacted flights operate in peak demand. Modeled throughput based on actual separation changes indicates improvement.
- JAT's ReCat methodology may be leveraged to prioritize future implementations of ReCat.

Summary of Data Analysis Results

The JAT has now conducted ReCat analysis for five airport sites: IND, PHL, CLT, ORD and MDW. Results are summarized in the table below. A full set of analysis details may be found in Appendix C.

Implications of Wake ReCat		*Airports*				
		IND	**PHL**	**CLT**	**ORD**	MDW
Percent of eligible pairs[1] of flights at the airport potentially impacted by ReCat (% with decreased separation / % with increased separation)	**Arrivals**	22.5% / 4.4%	7.7% / 0.4%	2.6% / 0.0%	4.4% / 0.0%	1.1% / 0.0%
	Departures	23.3% / 3.8%	7.9% / 0.3%	3.3% / 1.1%	4.7% / 0.6%	1.1% / 7.6%
Estimated total savings in Airborne and Taxi Out Time due to ReCat[2]	**Airborne**	$321K	$545K	$180K	$590K	-$2K
	Taxi Out	$2,033	$220K	$57K	$360K	-$32K
	Total	***$2,400K***	***$765K***	***$237K***	***$950K***	***-$34K***

Fuel Analysis in North Texas

Previous JAT analysis on the impact of the North Texas Metroplex demonstrated the need for additional work to determine a joint FAA-industry approach to estimate the fuel impacts from the Metroplex activity. The final results of this effort are included in Appendix C to this report.

[1] Eligible pairs of flights are sequential flights on the same runway that are the same type of operation (both arrival or both departure), are within 5 minutes of each other and operate during the study's reporting hours.
[2] The JAT used queueing models to estimate impacts on taxi time. Estimated savings impact includes value from rule change for 757s published in 7110.65W in December 2015.

Appendix A: Members of the Joint Analysis Team

John Heimlich	Airlines for America
Christopher Oswald	Airports Council International (ACI North America)
Ilhan Ince	**American Airlines, Inc. (Co-Chair)**
Balaji Nagarajan	American Airlines, Inc.
Denise Neumann	American Airlines, Inc.
Brian Will	American Airlines, Inc.
Stephen Smothers	Cessna Aircraft Company
Colin Rice	City of Houston, Texas
Eugene Maina	Dallas/Fort Worth International Airport
Steve Tobey	Dallas/Fort Worth International Airport
Patrick Burns	Delta Air Lines, Inc.
Thomas Carroll	Delta Air Lines, Inc.
Steve Dickson	Delta Air Lines, Inc.
Barrett Nichols	Delta Air Lines, Inc.
Ken Speir	Delta Air Lines, Inc.
Martin Durbin	Federal Aviation Administration (FAA)
Paul Eckert	Federal Aviation Administration (FAA)
Pamela Gomez	Federal Aviation Administration (FAA)
Shane Hart	Federal Aviation Administration (FAA)
Leslie Higgins	Federal Aviation Administration (FAA)
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Brian Kravitz	Federal Aviation Administration (FAA)
Lauren Lloyd	Federal Aviation Administration (FAA)
Dan Murphy	Federal Aviation Administration (FAA)
Juan Narvid	Federal Aviation Administration (FAA)
Lawrence Pugh	Federal Aviation Administration (FAA)
Almira Ramadani	Federal Aviation Administration (FAA)
LaVada Strickland	Federal Aviation Administration (FAA)
Dan Allen	FedEx Express
Bradley Ammer	FedEx Express
Matt Duty	FedEx Express
Kyle Smith	FedEx Express
Joe Bertapelle	JetBlue Airways
Ken Elliott	Jetcraft Avionics LLC
Lee Brown	Landrum-Brown
Mark McKelligan	National Air Traffic Controllers Association (NATCA)
David Brukman	PASSUR Aerospace
Chris Maccarone	PASSUR Aerospace

Rob Golden	QED Consulting, LLC
Andy Cebula	RTCA, Inc.
Margaret Jenny	RTCA, Inc.
Trin Mitra	RTCA, Inc.
Brandi Teel	RTCA, Inc.
Bill Sperandio	Southwest Airlines
Tass Hudak	The MITRE Corporation
Bobby Kluttz	The MITRE Corporation
Pete Kuzminski	The MITRE Corporation
Debby Pool	The MITRE Corporation
Jeff Shepley	The MITRE Corporation
Marc Brodbeck	United Airlines, Inc.
Alex Burnett	United Airlines, Inc.
Glenn Morse	United Airlines, Inc.
Kevin Swiatek	United Parcel Service (UPS)

Appendix B: NAC Performance Metrics

		Metric	Reported Values	Comments[1]
Measured on applicable existing *104* city-pairs:	1.	Actual block time	Mean and std dev or 60% percentile	• Actual time from Gate-Out time to Gate-In time for a specified period of time by city pair • GA: I FR flight time from ramp taxi to ramp park
	2.	Actual distance flown	Mean and std dev or 60% percentile	• Actual track distance between key city pairs for a specified period of time • GA: IFR flight distance from take-off to TOC & from TOD to touch down
	3.	Estimated Fuel burn	Mean and std dev	• Actual fuel burn for a specified period of time
Measured at applicable airports	4.	Throughput - facility reported capacity rates *	Mean and peak capacity rates	• Facility Airport Arrival Rates (AAR) & Arrival Departure Rate (ADR) Airlines (recommend: http://www.fly.faa.gov/ois/ however, the working group is open to alternate measurements that meet the requirements) • GA: measured as access events - Radar vector and not SID as OUT event and Ground based nav and not GPS / WAAS-LPV as IN event
	5.	Taxi-out Time *	Mean and std dev or 60% percentile	• Actual time from Gate-Out to Wheels-Off time by airport (minutes/flight) • GA: IFR flight taxi time from ramp taxi to take off
	6.	Gate Departure Delay	Delays/100 act depts. And total delay minutes	• Difference in actual Gate-Out time and scheduled Gate-Out time, Not measured for GA

*** - Identified by FAA**
1 GA data may not currently be collected

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Appendix C: Further Detail on Methodology and Analysis

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Joint Analysis Team

ReCat in IND and PHL – Final Report

Fuel Analysis for North Texas Metroplex – Final Report

Ilhan Ince, American Airlines

Dave Knorr, FAA

2017 JAT Tasks

Topic	OI Date	Target NAC Meeting
NTX Metroplex Fuel Burn Changes	N/A	Feb 24 2017
IND & PHL ReCat	Mar 2016	
BOS OPDs	May 2016	Jun 30 2017
LAX ReCat	Sep 2016	
GYY OPDs	Jul 2016	Oct 6 2017
DataComm Benefits Review	Ongoing	

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Joint Analysis Team

ReCat in IND and PHL

Final Report

Analysis of IND/PHL ReCat

- ReCat methodology has now been applied to
  - Multiple sites (1.5 & 2.0) with different aircraft categorizations
  - Using multiple data sources (ASDE-X, Threaded Track)

Aircraft Pair Categories for Arrivals to IND

	ARRIVAL	Heavy B	Heavy C	B757 D	Large D	Large E	Small F	22.5% Grand Total
Heavy	B	0.0%	0.2%	0.1%	0.2%	0.1%	0.0%	0.7%
Heavy	C	0.2%	7.1%	2.1%	1.4%	2.6%	0.5%	13.9%
B757	D	0.1%	2.1%	0.9%	0.7%	1.0%	0.2%	4.9%
Large	D	0.2%	1.6%	0.6%	15.0%	12.0%	4.4%	33.8%
Large	E	0.1%	2.7%	1.1%	11.8%	14.9%	4.2%	34.9%
Small	F	0.0%	0.6%	0.2%	4.0%	4.0%	3.0%	11.9%
Grand Total		0.6%	14.3%	5.0%	33.2%	34.6%	12.4%	100.0%

Aircraft Pair Categories for Departures from IND

	DEPARTURE	Heavy B	Heavy C	B757 D	Large D	Large E	Small F	23.3% Grand Total
Heavy	B	0.0%	0.2%	0.1%	0.1%	0.1%	0.0%	0.6%
Heavy	C	0.2%	8.6%	2.3%	1.2%	1.9%	0.5%	14.7%
B757	D	0.1%	2.1%	1.3%	0.5%	0.8%	0.1%	5.0%
Large	D	0.2%	1.2%	0.5%	14.2%	12.7%	3.8%	32.5%
Large	E	0.1%	1.8%	0.6%	13.0%	14.7%	4.1%	34.3%
Small	F	0.0%	0.4%	0.2%	4.1%	4.3%	4.0%	12.9%
Grand Total		0.6%	14.3%	4.9%	33.1%	34.6%	12.5%	100.0%

Reduction of 1 nm in required separation from Wake ReCat
Reduction of 1.5 nm in required separation from Wake ReCat
Increase in required separation from Wake ReCat

Aircraft Pair Categories for Arrivals to PHL

ARR-ARR	Uppr Heavy A	Lowr Heavy B	B757-C	Uppr Large C	Lowr Large D	Small Plus E	Small F	Oth. Heavy G	7.7%
A	0.3%	0.1%	0.2%	1.8%	1.4%	0.0%	0.0%	0.0%	3.9%
B	0.1%	0.2%	0.1%	1.1%	0.7%	0.0%	0.0%	0.0%	2.2%
B757-C	0.2%	0.1%	0.1%	1.6%	1.0%	0.0%	0.0%	0.0%	3.1%
C	1.8%	0.9%	1.7%	21.1%	14.9%	0.5%	0.0%	0.1%	41.0%
D	1.4%	0.8%	0.9%	14.8%	27.7%	1.4%	0.2%	0.0%	47.2%
E	0.0%	0.0%	0.0%	0.5%	1.3%	0.1%	0.0%	0.0%	2.1%
F	0.0%	0.0%	0.0%	0.1%	0.2%	0.0%	0.0%	0.0%	0.3%
G	0.0%	0.0%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%	0.2%
Grand Total	3.9%	2.2%	3.1%	41.1%	47.3%	2.1%	0.3%	0.1%	100.0%

Aircraft Pair Categories for Departures from PHL

DEP-DEP	Uppr Heavy A	Lowr Heavy B	B757-C	Uppr Large C	Lowr Large D	Small Plus E	Small F	Oth. Heavy G	7.9%
A	0.3%	0.1%	0.2%	1.5%	1.5%	0.1%	0.0%	0.0%	3.7%
B	0.1%	0.3%	0.1%	1.2%	1.0%	0.1%	0.0%	0.0%	2.8%
B757-C	0.1%	0.1%	0.1%	1.3%	1.2%	0.1%	0.0%	0.0%	2.9%
C	1.4%	1.1%	1.2%	18.5%	18.3%	0.9%	0.0%	0.1%	41.5%
D	1.5%	1.0%	1.2%	17.8%	23.9%	1.0%	0.1%	0.1%	46.6%
E	0.1%	0.1%	0.0%	1.0%	0.9%	0.1%	0.0%	0.0%	2.2%
F	0.0%	0.0%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%	0.2%
G	0.0%	0.0%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%	0.2%
Grand Total	3.6%	2.7%	2.8%	41.5%	46.8%	2.1%	0.2%	0.3%	100.0%

Reduction of 1 nm in required separation from Wake ReCat
Reduction of 1.5 nm in required separation from Wake ReCat
Increase in required separation from Wake ReCat

Comparison of ReCat Impacts

Impacts \ Airports	IND		PHL		CLT		ORD		MDW	
	Arrs	Deps	Arrs	Deps	Arrs	Deps	Arrs	Deps	Arrs	Deps
Separation Requirements										
Decreased	22.5%	23.3%	7.7%	7.9%	2.6%	3.3%	4.4%	4.7%	1.1%	1.1%
Unchanged	73.1%	72.9%	91.9%	91.8%	97.4%	95.6%	95.6%	94.7%	98.9%	91.3%
Increased	4.4%	3.8%	0.4%	0.3%	0.0%	1.1%	0.0%	0.6%	0.0%	7.6%
Benefits Impact *(including 757 impact)*										
Time Savings (hrs)	127	1035	215	112	71	29	233	183	-0.8	-16
Cost Savings ($000s)	321	2033	545	220	180	57	590	360	-2	-32
Total Savings	$2.4 million		$765K		$237K		$950K		-$34K	

IND/PHL ReCat – Summary of Findings

- ReCat estimated to reduce taxi queues and airborne delay in IND resulting in savings of $2.4 million with 757 impact
  - Approximately $1.5 million annually without 757 impact
- Savings in PHL approximately $765K per year, including 757 impact
  - Approximately $329k annually without 757 impact
- Impacts of ReCat by airport dependent upon fleet mix, volume of scheduled operations and pressure

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Joint Analysis Team

Fuel Analysis for North Texas Metroplex

Final Report

Key North Texas Metroplex Findings

Approved at October 2016 NAC Meeting

- Many external factors challenged pre vs. post Metroplex analysis
  - Converging Runway and Over-the-Top Ops are segregated from NTX analysis
    - DAL – Eliminating OTT added 7.5nmi for 11% of flights (~$1.7M)*
    - DFW – Eliminating CRO added 5.5nmi for impacted flights (~$2.2M)*
      - AAR reduced by 12/hr or about 10%
  - DFW/AAL re-banking, Wright amendment at DAL, use of flow metering, change in wind patterns, and WN Cost Index change (speed increase)
- Metroplex has…
  - Slightly increased flight distance within 300nm but slightly reduced time for DFW
  - Reduced level segments and increased continuous descents for DFW
  - Provided beneficial airspace/procedural infrastructure for NextGen capabilities (TBFM, TSS) and reduced controller workload
- Additional work required: need to determine a joint approach to measure fuel impacts/changes

*Costs include both fuel, crew, and maintenance

Fuel Estimation Modeling Approach

- Utilizing MITRE fuel burn model along with detailed trajectory normalization process
  - Account for aircraft type, corner post to runway combination, city pair, pressure, IMC/VMC
  - Sample track set predictions compared vs. industry manufacturer models and results deemed acceptable
  - Cross-checked with ANG-B developed simplified fuel calculator using BADA
- In discussion with MITRE regarding future distribution of fuel model to industry as well as developing a simplified fuel calculator for joint use

Estimation of Fuel Impact of North Texas Metroplex

- Reduced level segments and increased continuous descents in DFW saving $4.5-6.5 million in fuel annually
- DFW climb rates decreased resulting in a fuel increase
  - Weight, temperature, fleet mix and to a limited extent Metroplex has affected the change
- In addition to OTT, DAL analysis shows an increased distance flown resulting in annual fuel cost of $0.8M

Metroplex efforts should continue to ensure they are cognizant of overall impacts on flight time, distance and fuel

*Fuel cost $2.85/gallon

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Approved by the NextGen Advisory Committee February 2017

Enhanced Surveillance Capabilities in FAA Controlled Oceanic Airspace: Operational Need and Added Benefits

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Interim Report of the NextGen Advisory Committee in Response to a Tasking from The Federal Aviation Administration

February 2017

Background/Introduction

In July 2016, the Federal Aviation Administration (FAA) requested the NextGen Advisory Committee (NAC) to assist in developing recommendations regarding the operational need and added benefits of Enhanced Surveillance in oceanic airspace.

The FAA mandated Automated Dependent Surveillance-Broadcast (ADS-B) upgrades for all aircraft operating in certain airspace by 2020. The limitations of the current reporting system require much larger air traffic control separation distances in oceanic airspace. The improvements in technology and enhanced surveillance capabilities may reduce these distances. Enhanced surveillance capability may increase the overall safety, efficiency, fuel-savings, and reduce emissions for aircraft in flying in U.S. controlled oceanic airspace.

To that end, the FAA is developing a business case for reduced separation minima in U.S. controlled oceanic airspace. The FAA requires input from operators that ultimately improves understanding and contributes to the development to solutions-sets for improved oceanic operations. The NAC provides the credible forum to work through complex issue sets and produce consensus derived recommendations.

Accordingly, the FAA tasked the NAC with the following:

1. Evaluate the need and benefit of enhanced surveillance capabilities
2. Evaluate the business case

Provide an in-progress review by February 2017 and deliver a final report at the June 2017 NAC meeting.

Summary

The Enhanced Surveillance Task Group began meeting shortly after the tasking letter was received. The Task Group includes a cross section of entities that operate aircraft in oceanic airspace. The Task Group members are drawing on the expertise from the FAA and providers of services, and automation technology to gather information and develop an understanding of issues, operational concepts, technologies, and potential benefits. The Task Group created a Subgroup of operators to have discussions and review analysis that does not include those with a direct financial gain in the outcome.

The overall findings:

In some FAA controlled oceanic airspace areas, benefits may be attractive pending assessment of the currently unknown cost of the service to the operator.

Benefits – optimal routings, fuel savings, potential increased capacity

- Communications capability is a limiting factor of benefits due to the nature of oceanic airspace in comparison to the “push to talk” access in domestic airspace.
- The FAA provided a benefits analysis for the Task Group and the Industry tasked Embry-Riddle Aeronautical University to conduct an additional analysis. There is a close match between both assessments and additional work is underway.
- ADS-B utilization is consistent with increased use of GPS under NextGen.

The Task Group is evaluating ADS-B & ADS-C for improvements of 15/15 lateral/longitudinal spacing. This evaluation will be driven by the assumption that there will be no additional equipage required for the enhanced surveillance capability.

There is an emphasis on giving operational benefits to those equipped with the following capabilities:

- ADS-B
- FANS/CPDLC
- RNP4
- ADS-C

The full briefing provided to the NextGen Advisory Committee at the February 22, 2017 meeting follows.