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NextGen Integration Working Group Final Report

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

October 2014

MESSAGE FROM THE CO-CHAIRS

A New Engagement Model to Move Beyond the Tipping Point

By Captain Stephen Dickson, Senior Vice President of Flight Operations, Delta Air Lines and Melissa Rudinger, Vice President of Government Affairs, AOPA

We are extremely proud of the professionalism, dedication and commitment of the NextGen Integration Working Group (NIWG) leadership and their teams, who have worked with FAA subject matter experts to develop a set of recommendations and implementation actions in four of the highest priority NextGen operational capabilities over a 1-3 year timeframe: (1) Closely Spaced Parallel Runways/Multiple Runway Operations, (2) DataComm-enabled Controller-Pilot DataLink Communications (CPDLC) and pre-departure clearances, (3) Performance Based Navigation (PBN), and (4) Surface and Data Sharing. These recommendations are provided in this report.

The work has been accomplished within a very short timeframe, beginning in earnest as a result of a FAA Tasking of the NextGen Advisory Committee (NAC) in late summer 2013, and follow-on discussions in early 2014. The four top priority capabilities were agreed upon in February 2014 and the four industry teams began their work. At all points throughout the process, industry Stakeholders worked very closely with FAA subject matter experts, in a collaborative and dynamic fashion which we have not seen since the RTCA NextGen Mid-term Implementation Task Force (commonly referred to as Task Force 5), back in 2009. We believe the recommendations associated with this effort signal the beginning of a new level of industry-FAA collaboration, which will open the door to more rapid progress and system performance improvement, which will lead, in turn, to a more effective transition to NextGen.

So, how did we get here? Certainly the planning and much of the investment for NextGen goes back many years, to the Free Flight days in the 90's, moving to Next Generation Air Transportation System (NGATS) in the early 2000's and culminating in NextGen later in the last decade. Task Force 5 (TF5) was a watershed event, because it showed that the industry can come together and build the consensus necessary to provide concrete, actionable and operationally beneficial *implementation* recommendations to the FAA. Additionally, it provided us with two other benefits. First, it began to change how we think about NextGen, evolving from a set of Federally-managed technology programs, toward a set of real operational capabilities that require a more integrated approach and continual stakeholder collaboration to implement. Second, the FAA requested that RTCA form the NAC, where industry leaders have been able to come together on a regular basis, to debate and make consensus recommendations on policy and important industry priorities. In fact, since the NAC was established in 2010, the industry has provided nearly 30 sets of consensus recommendations to the FAA. So we are moving together from planning to implementation.

Having said this, when we step back a bit and cast a critical eye on our track record over the past five years, the record of accomplishment is mixed at best. We are seeing tangible progress in some areas. RNAV departures "off-the-ground" are becoming commonplace and are now the standard at large hub airports. The Optimization of Airspace Procedures in the Metroplex (OAPM) projects are bringing Stakeholders together to redesign hub operations so they are more efficient and reliable. Some critical pieces of operational infrastructure, such as En route Automation Modernization (ERAM) and the ADS-B ground network are in place and even being utilized in the daily operation. But implementation is hard work—much more difficult than planning—and requires the sustained engagement and focus of many Stakeholders inside and outside the government. Furthermore, the NAC process, as successful as

it has been in bringing the industry together, resulted in many requests and recommendations still being batted back and forth between the FAA and industry, without clear implementation priorities and transparent plans.

It is against this backdrop that in mid-2013 the NAC, led by Chairman Bill Ayer, began to engage FAA leadership on the value the NAC could provide in helping the FAA set clear implementation priorities. In Bill's words, we had reached a "tipping point." Either the industry and FAA would be able to leverage the RTCA/NAC process to set clear priorities and build on the TF5 foundation, or we'd just go back to work on "tactical" airspace and performance improvement projects at the local level. For his part, Administrator Huerta was faced with mounting budget pressures and the potential impact of sequestration. Accordingly, in July 2013 Administrator Huerta sent a request to RTCA for the NAC to develop recommendations for the FAA to set priorities for its NextGen investments. The NAC turned that request around in record time, providing its response back to the FAA on September 19th, 2013. Subsequent discussions at the February 2014 NAC led to the four focus areas described above, and the establishment of the NIWG. This was our "last, best chance" to get implementation back on track. Based on the collaborative efforts outlined in this report, as well as the blueprint for continued industry/FAA collaboration described below, we believe the industry and FAA have met this challenge.

The substance of the industry recommendations is provided in this report and we will not review them here. Suffice to say that the recommendations themselves provide for tracking and reporting of specific milestones as well as implementation locations, within a 1-3 year timeframe. There are also pre-implementation activities that will support additional performance improvements beyond the three-year timeframe but need to be underway within the 1-3-year timeframe. These items will be tracked within the FAA and reported to industry Stakeholders at the NAC and other venues on a regular basis, with the expectation that work accomplished in the early portion of the three-year window will not stop, but lead to further improvements that continue to add momentum to the "flywheel" of success.

But just as important as the substance of the recommendations is the new dynamic engagement model that the NIWG provides for continued FAA and industry collaboration. Even though the work for this report has been completed, we will not sunset the NIWG leadership teams, including both industry and FAA participants. The FAA will continue regular internal tracking and reporting, and will report out to industry periodically through the RTCA venue. On the industry side, we will keep the leadership engaged so that we are able to react in a more agile fashion as time moves forward, to overcome barriers and take advantage of opportunities that present themselves along the way. There is a lot we do not know and will not know until we implement. But one thing we do know is that the world, and the environment we are working in, will continue to change. This new, dynamic engagement model will allow us to deal with the obstacles in our path and take advantage of various implementation alternatives that may become available. This really is the "NowGen building block" approach to NextGen.

We would like to thank the FAA leadership team for their commitment to continued industry engagement and collaboration. Without this commitment and alignment across all lines of business in the FAA, we would be unable to accomplish the necessary enabling elements to achieve improved operational capabilities. These elements include policies, procedures, operational approval processes, certification, regulatory guidance, training, criteria, standards and the change management leadership that will be required to execute in the daily operation. The dedication and focus of the entire agency, including ANG, ATO and AVS has been and will continue to be critical to our success.

Because of the success of this NIWG process, we are optimistic about the future direction of NextGen. Together with the FAA, we will apply the lessons from this most recent work. We will continue to roll up our sleeves and build the aviation community's confidence in our ability to work together as we implement beneficial NextGen capabilities.

NextGen Integration Working Group

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Background/Introduction

In July 2013, the FAA requested the NextGen Advisory Committee (NAC) develop recommendations related to the Agency's NextGen investments.[1] This was done in light of budget pressures and possible sequestration impacts. A report was approved by the Committee on September 19, 2013 based on a review of current FAA plans and activities that have an effect on the implementation of NextGen. This resulted in a prioritized list of Tier 1 (consensus on activities that should continue no matter what) and Tier 2 (consensus on activities that should continue, resources permitting) NextGen investments that are intended to help shape the future of NextGen and ensure its long term viability.

Since then, the industry and the FAA, under the NextGen Integration Working Group (NIWG), have been conducting deep dives of four capabilities to identify what it takes to deploy them at specific sites. The NIWG Teams developed plans for the implementation of the four, top priority capabilities:

- Closely Spaced Parallel Runways/Multiple Runway Operations
- DataComm-enabled Controller-Pilot DataLink Communications (CPDLC) and pre-departure clearances
- Performance Based Navigation (PBN)
- Surface and Data Sharing

The purpose of this initiative is to deliver tangible benefits and increase the community's confidence in NextGen by deploying these four capabilities in the next 1-3 years.

Executive Summary

The NextGen Integration Working Group developed Teams based on the top priority capabilities. The Teams then developed industry recommendations for the four focus areas, as well as associated FAA actions with milestones that cover near-term implementations. In some cases the action is an assessment that, depending on the outcome, will require the development of a subsequent implementation plan. Each of the actions includes metrics and commitments by the industry and the FAA that will be tracked and reported.

The areas covered under each of the focus areas are:

- Closely Spaced Parallel Runways/Multiple Runway Operations (MRO) – Wake Recategorization replaces the existing weight based wake turbulence separation category with approved wake turbulence categories; MRO to improve access to parallel runways including closely spaced parallel runways in less than visual approach weather minimums.
- DataComm – Surface DataComm pre-departure clearances; and En route Controller-Pilot DataLink Communications (CPDLC).
- Performance Based Navigation (PBN) – Metroplex (Optimization of Airspace Procedures in the Metroplex); Established on RNP; Equivalent Lateral Spacing Operations; and Single Site PBN location.
- Surface and Data Sharing – Airport participation in Collaborative Decision Making and access to surface data; Airport Surface Departure Metering; Providing Real-Time Traffic Management

[1] Letter from Michael Huerta (FAA Administrator) to Margaret Jenny (RTCA President) dated July 12, 2013.

Updates to New York ATCTs, flight and aircraft operators; and Utilize Earliest Off Block Time for short range flights.

Assumptions and Guiding Principles

At the outset, the leadership of the Working Group laid out a number of assumptions and guiding principles that guided the work of the participants.

The overall purpose of the NextGen Integration Working Group was to develop specific recommendations to translate FAA programs in the four identified areas to specific deliverables. These will deliver operational capabilities that provide benefits on a defined time line.

Assumptions

- Near-term delivery of capabilities will maximize the use of existing aircraft equipage, with no broad-based fleet upgrades required.
- The business case justification for NextGen equipage will be strengthened by the near-term delivery of capabilities. Aircraft operators continue to invest in updated aircraft/equipage based on a positive ROI and anticipate the removal of barriers to gain their return on investment in these new capabilities.
- Mixed equipage will remain for many capabilities – it is an on-going process and a reality that must continually be addressed.
- Implementation timelines are deliverables in the 1-3 year time frame (with the exception of CPDLC and possible enablers for other capabilities that could take longer to deploy).
- These recommendations build onto those made by TF5, the NAC and other implementation recommendations made by the aviation community.
- These recommendations are for the delivery of operational capabilities. The essential components of these capabilities span multiple programs and will require an integrated set of solutions that address the following Pacing Items:
    - Locations and Timelines
    - Industry Commitments and Milestones
    - Metrics
    - Change in Roles
    - Technology/Equipage Required
    - ATM/TFM Automation
    - Decision Support tools needed by controllers and TFM specialists
    - Training
    - Airspace changes
    - Procedures
    - Policies
    - Technical Standards
    - Certification
    - Ops Approvals
    - Political risks
    - Environmental and noise-related risks
    - Others

Guiding Principles

- The Working Group recommendation is not a planning exercise, but will identify operational implementation dates linked to specific milestones at identified locations.
- Dates for deliverables matter—if committed dates slip, new dates that can be met should be quickly established and communicated.
- The FAA and the industry will make commitments necessary to the successful implementation and delivery of capabilities. Success will build trust and confidence in NextGen.
- Projects should be carefully scoped to balance complexity and benefits with near-term completion dates acceptable to the teams. "Scope creep" should be minimized.
- A policy to escalate and quickly solve team disagreements should be established.
- NextGen should leverage the purchase of new generation aircraft and the equipage modernization underway by aircraft operators.
- Delivering tangible, measurable benefits in a defined time-frame is crucial to encouraging NextGen investments.
- The successful delivery of capabilities will require the assignment of appropriate Responsibility, Accountability and Authority (RAA), as well as the investment of financial and personnel resources from the FAA Air Traffic Organization (operations account), the NextGen Organization (facilities and equipment) and the Safety and Regulatory Organization (AVS). Funding must include all necessary resources to accomplish all enabling non-infrastructure tasks critical to achieving benefits, including the Pacing Items listed above.
- The resulting set of recommendations will be as transparent and as objective as possible, clearly laying out the methodology that the group employed to reach consensus on the specific recommendations.
- The rationale for the recommendations is delivered along with the recommendations.
- There are FAA programs (enablers) currently underway that are fundamental to NextGen, such as ERAM and ADS-B.
- Follow-up, post the release of the recommendations, is critical and should include the tracking and reporting of progress on the specific integrated plan developed by the Working Group, identification of issues and barriers and working together to overcome those barriers. User community Stakeholders must be active participants in the planning, implementation and measurement of these recommendations after the recommendations are delivered in October 2014.

Methodology

The overall approach to this effort has been a unique collaboration between the FAA and the industry. Ed Bolton, Teri Bristol and Peggy Gilligan from the FAA have worked closely with Steve Dickson, Melissa Rudinger and Margaret Jenny from the industry to lead the effort to develop plans that will result in the delivery of tangible benefits and increase the community's confidence in NextGen by deploying these four capabilities in the next 1-3 years. The members of the NAC Subcommittee also played an important role in the process by applying its expertise in the details associated with the specific capabilities.

The Teams were led by industry representatives from the aircraft operator and automation/technology provider. The FAA was represented on each of the Teams as subject matter experts from the NextGen and Air Traffic Organizations, as well as staff from the Office of Aviation Safety.

Each of the four Teams was established based on responses to a letter from RTCA President Margaret Jenny, soliciting participation from RTCA members. In addition, the leadership reviewed the list of

industry volunteers to ensure that the appropriate entities, organizations and individuals were included on the Teams. This included a cross section from the industry of air traffic controllers, airports, aircraft operators and technology providers.

Throughout the project, the FAA provided relevant subject matter experts that worked very closely with the Team Leaders and Members to inform the teams on planning milestones and costs for capabilities.

Specific Recommendations by four NextGen Focus Areas

Multiple Runway Operations (MRO) [Closely Spaced Parallel Runway Operations (CSPO)] and Separation Management (Wake Recategorization)

Background

With an increased demand for air travel, the need for increased peak throughput performance at the busiest airports and in the busiest arrival/departure airspace is paramount. Improved flow capability via new procedures, reduced spacing and separation requirements, and more efficient flow management into and out of busy metropolitan airspace is needed to maximize traffic volume and airport usage.

Ripple effects of delay throughout the NAS happen when closely spaced parallel runways are not utilized effectively. This happens in less than visual flight conditions. With new technology in the cockpit and a concerted effort to examine safety standards of closely spaced parallel runways in the last 5 years, the FAA has made significant progress in providing new procedures and tools to better utilize runways. With these new procedures and recategorization of aircraft wake turbulence characteristics, we now have the ability to implement this suite of Multiple Runway Operations capabilities to maximize arrival and departure rates.

Multiple Runway Operations (MRO) was selected as a Tier 1 NextGen capabilities effort because it is delivering tangible benefits today and is expected to be available at specific locations within 1 to 3 years to provide additional improvements. The methods employed are uniquely capable of delivering benefits to the NAS in this timeframe as long as resources remain available for implementation and no unforeseen issues arise during the safety assessment and implementation processes.

The impetus and foundation for the MRO capabilities evolved from specific Task Force 5 recommendations on “Runway Access” and other longstanding FAA wake turbulence research and development activities.

Capabilities

NextGen Multiple Runway Operations capabilities improve access to parallel runways including closely spaced parallel runways while wake recategorization can increase basic runway capacity and throughput. Improved access will enable more arrivals and/or departures in less than visual approach weather conditions, which will increase efficiency and reduce flight delays.

The capabilities in this portfolio will enable the use of simultaneous approaches (two or more aircraft arriving side-by-side) during periods of reduced flight visibility, decrease the required separations between aircraft on dependent approaches (staggered aircraft arrivals on parallel runways) and with respect to wake turbulence, ensure the necessary minimum separation between aircraft is applied based on separation standards updates that resulted from data analysis conducted over the past several years.

It is expected that improvements in Performance Based Navigation (PBN) capabilities, specifically for Required Navigation Performance (RNP) and the work of the NextGen Integration Working Group (NIWG) PBN Team, will have a direct and lasting positive impact on airport capacity. FAA should consider the relationships between MRO and PBN Teams (as well as the DataComm and Surface Teams) in future planning efforts. The combined benefits of MRO and PBN will further enhance the efficiency and capacity of the NAS. This circumstance was recognized during the Task Force 5 deliberations about "Established on RNP (EOR)" and documented in the final report.

Great strides are being made in these areas, but this capability is beyond the scope of the MRO activities at this time.

Implementation Plan

The MRO Team identified 34 locations with runway configurations that could potentially take advantage of one or more of the proposed MRO (CSPO) procedures. These sites (listed alphabetically) are as follows:

- ATL, ANC, BOS, CLE, CLT, CVG, DEN, DFW, DTW, EWR, FLL, HNL, HOU, IAD, IAH, IND, JFK, LAS, LAX, LGA, MCO, MDW, MIA, MEM, MSP, ORD, PDX, PHL, PHX, PIT, SEA, SDF, SFO, SLC, STL

The following criteria were used to determine which of these sites would benefit from a new specific procedure to supply a site implementation plan:

- Potential benefits (increased throughput, and reduced delays, taxi times and terminal travel times)
- Runway layout and fleet mix (e.g., aircraft equipage, percentage of heavy/757's)
- Existing and future traffic demand
- Available and future site hardware/software (i.e., EFSTS, FDIO, TAMR, etc.)
- Facility staffing and other constraints (OAPM or other training requirements)
- Airspace constraints (e.g., Noise Sensitivity, Multiple Airport Proximity, etc.) or other risks

The Wake Recategorization recommendations did not use the criteria above as they are not dependent on runway layout for implementation or benefits to the NAS. The initial sites identified for implementation of wake recat procedures are:

- CVG, ATL, IAH, CLT, JFK, EWR, ORD, SFO, LAX, HNL, MIA, IND, IAD

The FAA and industry will both have a role in monitoring the implementation of MRO capabilities and the realization of associated benefits in the NAS, and the industry is committed to support this monitoring.

Implementation Metrics: The FAA will measure progress through implementation metrics that track the following milestones:

- Safety Analysis and Safety Case Completion
- Site implementation waterfalls – The FAA will monitor and report on the authorization and operational use of procedures at the agreed upon sites.

Operational Performance Metrics: This plan does not identify any new metrics for the effectiveness of the initiatives. The effectiveness of these implementation plans will be measured through two key public FAA websites currently available:

- FAA Metrics Web Page at: http://www.faa.gov/about/plans_reports/operational_metrics/ and
- NextGen Performance Snapshots (NPS) at: http://www.faa.gov/nextgen/snapshots

On the FAA's Metrics Web pages, the FAA publishes NAS-wide operational, externally reported metrics that measure the performance of our NAS. Many of these metrics were previously identified by the NAC and are being reported by the FAA to ensure that the metrics tracked are meaningful.

- Airport Throughput, Airport Throughput during IMC, Average Daily Capacity – The FAA will perform post-implementation analyses of flight data to assess the impact of MRO and Wake Recategorization procedures on airspace capacity and throughput at the implementing airports as well as NAS-wide.[2]

Industry partners, specifically air carriers, may have access to additional metrics that should be considered during the assessment of MRO and Wake Recategorization procedures. These metrics may include a comparison of pre-implementation to post-implementation data, and are not limited to the following:

- Taxi times
- Fuel burn
- Gate delays

Locations and Timelines

- A function of existing and planned runway configurations, current and future demand and delay, safety case, procedure development, and navaid reconfiguration, if required, may also require staffing adjustments.

Industry Commitments and Milestones

- Nothing major is required for most OIs; if unique RNAV procedures are required, benefits may be increased if all operators are capable.

Scope

The Multiple Runway Operations Integration Working Group (MRO IWG) was tasked with assessing a select portfolio of FAA's Multiple Runway Operations and Separation Management (Wake Recategorization) Operational Improvements (OIs) and making recommendations to the FAA, as appropriate, regarding the schedules and locations for implementation based on expected benefits and other criteria. The assessment included the proposed schedules for safety analyses of blunder and wake encounter risks, procedure development and authorization, and implementation of the capabilities at applicable locations throughout the NAS in a three year timeframe. The following NextGen Operational Improvement Increments are included in the plan:

Increment [3]	Increment Title	Increment Description

[2] The FAA has access to additional metrics which, if necessary, can be used in support of site specific analyses of benefits.

[3] Increment 102141-23, Simultaneous Independent Closely Spaced Approaches – High Update Rate (HUR) Surveillance Required, was considered by the MROWG during initial deliberations; however, it was determined that there will be limited availability of HUR in the 3 year timeframe established for this work, and it was therefore excluded from the final capabilities list.

102140-99	Wake Turbulence Mitigation for Departures (WTMD): Wind-Based Wake Procedures	When wind conditions allow, WTMD permits any aircraft to depart from the 'upwind' runway without waiting 2 or 3 minutes after a Heavy or B757 departs the 'downwind' runway.
102141-11	Additional 7110.308 airports	Allow reduction in required wake separations for dependent operations for runways spaced less than 2500' when small or large aircraft are leading in the dependent pair. Note: BOS implementation is dependent on approval of separation minima and environmental approval of RNAV approach.
102141-13	Amend Independent Runway Separation Standards in Order 7110.65 (including Blunder Model Analysis)	Allow dual simultaneous operations for runways spaced greater than 3600'. Note: This increment has been authorized in the 7110.65 controller handbook.
102141-15	Enable Additional Approach Options for New Independent Runway Separation Standards	Allow dual simultaneous operations for runways spaced greater than 3600' where ILS is unavailable by extending the analysis of SIPIA runway separation standards performed for increment 102141-13 to include the use of GPS-based approach options with vertical guidance (e.g. LNAV/VNAV, RNP and RNP AR). Note: This increment has been authorized in the 7110.65 controller handbook.
102141-14	Amend Dependent Runway Separation Standards in Order 7110.65	Reduce the dependent stagger separation from 1.5NM to 1.0NM for runways greater than 2500' and less than 3600'.
102141-22	Amend Standards for Simultaneous Independent Approaches – Dual with Offset	Allow dual simultaneous operations with the use of an offset for runways spaced greater than approximately 3000' (the exact value for this boundary will be determined by AFS analysis).
102141-24	Amend Standards for Simultaneous Independent Approaches – Triple	Allow triple simultaneous operations for runways spaced greater than approximately 3900' (the exact value for this boundary will be determined by AFS analysis).
102144-11	Wake Turbulence Mitigation for Arrivals – Procedures (WTMA-P) for Heavy/B757 Aircraft	Allow reduction in required wake separations for dependent operations for runways spaced less than 2500' when Heavy or B757 aircraft are leading in the dependent pair. Note: Safe separation reduction has not yet determined for each site. Implementation is dependent on positive benefit.
102154-11	Wake Recategorization Phase 1 -- Aircraft Recategorization	Replace the previous weight based classes with approved wake turbulence categories that more optimally group aircraft based on their wake turbulence characteristics and the current fleet mix for US (and European) airports
102154-21	Wake Recategorization Phase 2 -- Static Pair-wise Wake Separation Standards	Define pair-wise wake separation standards for each aircraft leader-follower pair. Implementation of these standards can then uniquely address the needs of a given airport based on the local fleet mix to increase site-specific benefits beyond Recat Phase 1 categories.
No OI increment	Reduced separation for dependent approaches greater	Reduce the dependent stagger separation from 2.0NM to 1.5NM for runways greater than 4300' and less than

yet	than 4300'	approximately 7300' (the exact value for this boundary will be determined by AFS analysis)

Expected Benefits

The Multiple Runway Operations and Separation Management capabilities recommended in this report will provide benefits via increased arrival and/or departure capacity and throughput, particularly during less than visual approach weather conditions, and will establish new standards for future parallel runway construction. This will lead to reduced delays, more flight opportunities and better reliability and predictability for the traveling public. These procedures will also reduce cancellations by allowing the airport to maintain visual approach capacity in marginal and poor weather conditions.

Additionally, the increased capacity available with Wake Recategorization, which is usable regardless of weather conditions, may enable air carriers to provide additional service to the traveling and shipping public without a degradation of service quality and will provide air traffic controllers with an additional separation tool.

This potential capacity is unrealized today due to legacy separation standards that do not consider advancements in navigation and surveillance, or the improved understanding of wake turbulence transport and decay. These more conservative standards have been used to maintain the target levels of safety and to mitigate collision and wake encounter risk. The MRO and Separation Management capabilities discussed in this report will provide operational benefits to the NAS without requiring additional aircraft equipage and with minimal cost to FAA when compared to other large NextGen programs.

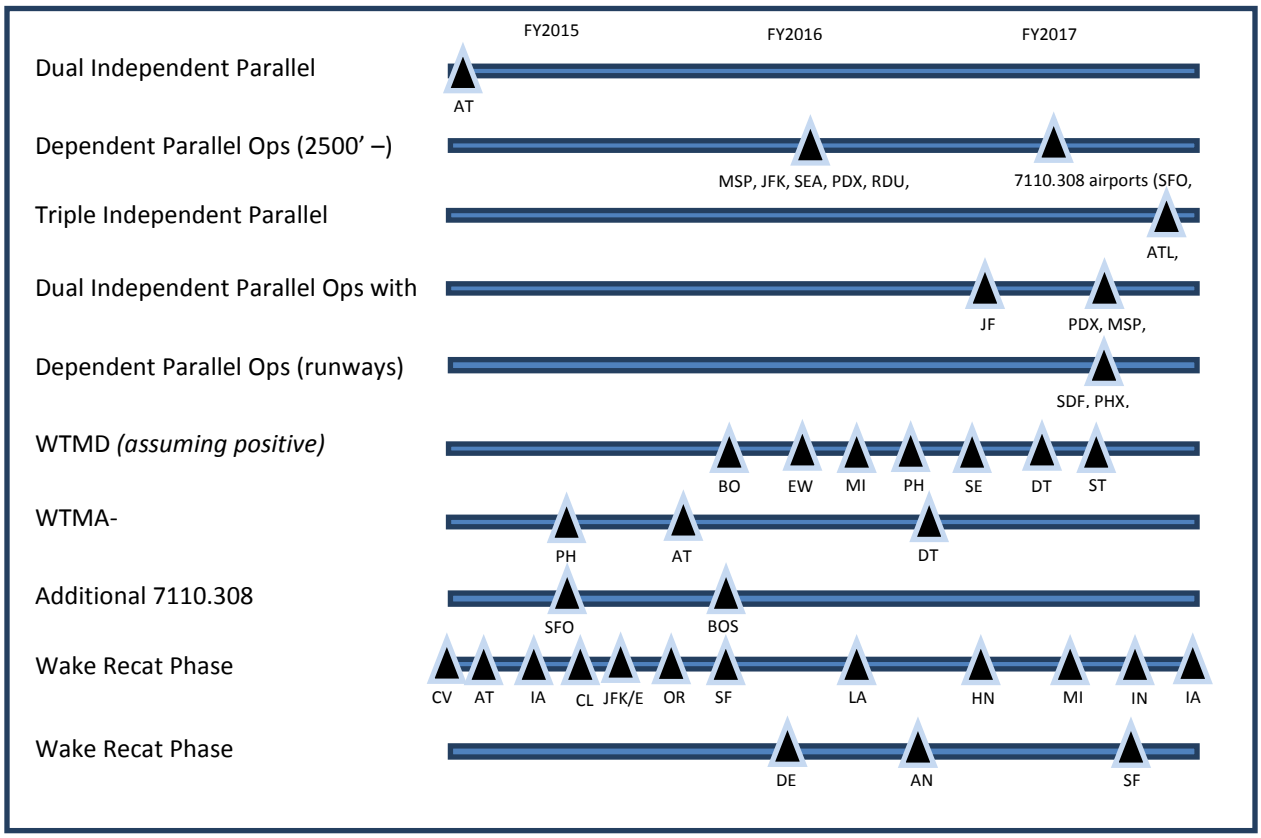
Additionally, several of the recommendations will support simultaneous parallel operations at runway spacing's that do not require High Update Rate surveillance. This will allow FAA to decommission or relocate these facilities to airports where there will be incremental benefits. These reductions in separation, in combination with other future Air Traffic Control (ATC) equipment upgrades (TAMR), which include high resolution monitors with alert algorithms such as FMA, will make new airports eligible for higher capacity configurations with existing runway layouts, or in the future with reduced land acquisition requirements. Note, however, that advanced equipage or decision support tools are not a requirement to realize operational efficiencies associated with these operational improvements. Lastly, as noted above, reduced separation standards for parallel operations will minimize the cost of future runway and taxiway infrastructure improvements at airports around the country.

Implementation Plan – Overview

- The implementation plan for the selected Multiple Runway Operations and Separation Management capabilities is a function of safety case and procedure development maturity, applicable runway configurations and expected benefits, and in the case of Wake Recategorization, FAA implementation bandwidth. The diagram below provides an overview of where the Multiple Runway Operations capabilities are to be deployed and when.[4] In some instances, individual safety case analysis is required to determine airport/runway specific separation standards or requirements (e.g., 7110.308 or WTMA-P). In others, application of the new standards can take effect immediately at locations that meet the new criteria (e.g., reduction of dependent separation from 1.5nm to 1.0nm). With respect to Wake Recategorization, benefits at the initial implementation sites (MEM, SDF) were so significant, the MRO IWG asked the NAC to recommend that FAA increase the number of locations in FY 2014

[4] Completion of safety analyses may have an impact on the applicability of the planned procedures at certain sites.

and FY2015. FAA's positive response and full support of this recommendation is reflected in the table below. The MRO IWG recommends that FAA continue to expedite the implementation of Wake Recategorization (Phase I and/or II) beyond the time table below. It is clear that Wake Recategorization is one of the most mature NextGen initiatives and therefore will provide near-term and immediate benefits to the NAS at very low cost.



National FAA Activities

The implementation plan described in the section above can only begin once the FAA has completed a number of milestones. For each new procedure, the FAA must first complete a safety analysis to determine that the separation reductions are safe within the standards of the FAA Safety Management System (SMS). Once that analysis is complete, it is utilized by a Safety Risk Management Panel (SMP) to complete a safety case for approval by ATO Safety before the reduction in separation criteria can be implemented. The separation reduction is then officially made available via revision to FAA Order 7110.65 or the publication of an individual order authorizing the use of the new separation standards.

The table below provides an overview of when each of these milestones will be achieved for the MRO and Wake Recategorization capabilities. As can be seen in the table, several of the capabilities have completed the safety case process and are already implemented, available for use and providing real benefits to the NAS. Additional milestones and notes are included in the far right column of the table, where needed, to aid in understanding when the capability may be available.

Capability	Safety Analysis Complete	Safety Case Complete	Procedure Authorized	Additional Milestones/Notes
WTMD	Completed - FY12	Completed - FY13	Completed - FY13	Final investment decision to implement at up to 7 more airports planned for FY15.
Additional 7110.308 airports	Completed - FY08	Completed – FY08	Completed – FY08	Safety case and procedure must be updated for each additional site. Note: See site specific section.
Dual Independent Parallel Ops	Completed - FY12	Completed - FY12	Completed - FY13	
Dependent Parallel Ops (2500'-3600')	Completed - FY13	FY15 Q3	FY16 Q1	
Dependent Parallel Ops (runways >3600')	FY14 Q4	FY16 Q2	FY16 Q4	This capability currently has no OI increment. Addition of increment is planned for NSIP update in FY15.
Dual Independent Parallel Ops with Offset	FY14 Q4	FY16 Q2	FY16 Q4	Most runway pairs will require the development of an offset procedure to realize benefits.
Triple Independent Parallel Ops	FY14 Q4	FY16 Q2	FY16 Q4	
WTMA-P	FY14 Q4	FY14 Q4	FY15 Q1 for first site (PHL)	Safety case and procedure will be updated for each unique site. Note: See site specific section.
Wake Recat Phase 1	Completed - FY12	Completed - FY12	Completed - FY12	One additional approval completed in FY13 and two completed in FY14; FAA proceeding with additional locations in FY15 based on NAC recommendation.
Wake Recat Phase 2	FY14 Q4	FY15 Q1	FY15 Q3	

National Industry Activities

Multiple Runway Operations and Separation Management capabilities are made up primarily of ATC procedures. Operational benefits can be achieved without the need for any aircraft equipage or special flight procedures, although where authorized or necessary, RNAV may be used in lieu of legacy ILS. Upon implementation of these MRO or Separation Management capabilities at a specific location, industry, in concert with the FAA, will begin tracking operational performance as described above. MRO OIs will provide benefits as a function of the weather experienced after implementation, while Wake Recategorization should show immediate benefits at both the airport and individual operator levels.

These operational metrics are an essential part of a closed-loop system that will enable internal flexibility for FAA to make modifications to implementation schedules and locations based on

demonstrated benefits and changing requirements. Through effective collaboration with all Stakeholders we can adjust implementation plans to improve the efficiency of the NAS within the available resources.

Site-Specific FAA Activities

For each MRO and Separation Management capability, controller training and familiarization will be required prior to implementation. This may be as simple as announcing via bulletin or other means the change in required separation for the dependent approach procedures, or it may involve more extensive classroom training and simulations for procedures new to the facility. Runways without ILS will require the development of appropriate RNAV procedures. Finally, as determined by individual site studies, glide slope angles, or other procedural adjustments (missed approach procedures, etc.) may be needed to support the new capability.

For Wake Recategorization and WTMD, some new hardware and/or software may be needed to support the capability: for Recat, site adaptation of EFSTS or FDIO will be performed; for WTMD, deployment of the WTMD decision support tool will be completed.

FAA Order 7110.308 specifies dependent separation requirements for parallel runways spaced less than 2500 feet apart and WTMA-P requires site specific safety case and procedure authorizations that identify any needed instrument approach or other infrastructure modifications. Addendums to the safety cases must be completed and the applicable Air Traffic Order must be updated to authorize the additional sites. The table below provides an overview of the specific milestones for each of the recommended locations; however, it does not reflect the actual implementation dates of the procedures because other procedural changes or training will be needed.

Capability	Site	Safety Analysis Complete	Safety Case Addendum Complete	Procedure Authorized
7110.308	BOS	Completed - FY13	FY15 Q3	FY15 Q4
7110.308	SFO	FY14 Q4	FY14 Q4	FY15 Q1
WTMA-P	PHL	FY14 Q4	FY14 Q4	FY15 Q2
WTMA-P	ATL	FY15 Q2	FY15 Q2	FY15 Q3
WTMA-P	DTW	FY14 Q4	FY14 Q4	FY16 Q3

Site-Specific Industry Activities

The Multiple Runway and Wake Recategorization capabilities recommended here do not require specific operational approvals or pilot training, but pilots should be made aware of changes in legacy wake turbulence and parallel approach procedure separations. Incorporation of the new standards and procedures in the AIM and air carrier briefings to flight crews explaining the new separation standards will ensure smooth implementation of the new procedures and accelerate NAS benefits. Early availability of FAA SAFO and InFO documents describing the new procedures and standards will support the implementation process. Industry organizations and flight operations departments should be made aware of anticipated changes and the initiation/timing of new procedures at specific locations to ensure a smooth introduction of the new standards. At locations where RNAV procedures are required or authorized for use of a specific capability, benefits will be increased if all operators and pilots can participate; however an interim mixed equipage scenario does not negate the long term and enduring benefits of basic reductions in separation for multiple runway operations.

Recommendations
Industry supports FAA MRO and Separation Management Implementation Plan, including locations and timelines. Wake Recategorization is a high benefit-low cost NextGen initiative that should be given a high priority. Industry acknowledges FAA commitment to increase Wake Recat implementation in FY15 and beyond (June 2014 NAC Recommendation). Once implemented, new separation standards and procedures will support new runway construction and other delay reduction opportunities. Implementation plans should be flexible to accommodate changing priorities.

The MRO Team identified 35 locations with runway configurations that could potentially take advantage of one or more of the proposed MRO (CSPO) procedures. These sites are as follows (listed in alphabetical order):

- ATL, ANC, BOS, CLE, CLT, CVG, DEN, DFW, DTW, EWR, FLL, HNL, HOU, IAD, IAH, IND, JFK, LAS, LAX, LGA, MCO, MDW, MIA, MEM, MSP, ORD, PDX, PHL, PHX, PIT, SEA, SDF, SFO, SLC, STL

The following criteria were used to determine which of these sites would benefit from a new specific procedure to supply a site implementation plan:

- Potential benefits (increased throughput, and reduced delays, taxi times and terminal travel times)
- Runway layout and fleet mix (e.g., aircraft equipage, percentage of heavy/757's)
- Existing and future traffic demand
- Available and future site hardware/software (i.e., EFSTS, FDIO, TAMR, etc.)
- Facility staffing and other constraints (OAPM or other training requirements)
- Airspace constraints (e.g., Noise Sensitivity, Multiple Airport Proximity, etc.) or other risks

The Wake Recategorization recommendations did not use the criteria above as they are not dependent on runway layout for implementation or benefits to the NAS. The initial sites identified for implementation of Wake Recat procedures are:

- CVG, ATL, IAH, CLT, JFK, EWR, ORD, SFO, LAX, HNL, MIA, IND, IAD
- Separation standards reductions have great value to the NAS
- Meeting planned safety case and procedure authorization milestones critical for realizing benefits

Risks and Other Considerations
During the assessment of the Multiple Runway Operations and Separation Management OIs, the following risks and assumptions were considered as part of the recommended action plan:

- All reductions in separation are dependent on successful completion of the requisite safety analyses which show that the proposed procedures meet the target level of safety that is the foundation of safe operations in the NAS Where noted, any proposed objectives for separation reductions included in this plan are subject to change based upon the results of the safety analyses.
- The FAA safety process is the critical first step toward the authorization of new procedures and separation standards. The MROWG recommends that every effort be made to ensure that the safety process milestones presented in this report are met, but we recognize that the process cannot be bypassed or compromised in any way.

- Assessment of the MRO capability deployment timelines against future runway construction and the deployment of other ATO programs (TAMR, OAPM) is still underway. Identification of conflicts could lead to the need for schedule adjustments. There is an expectation that any required schedule changes would be coordinated with industry through the NIWG.
- Implementation of MRO capabilities are dependent upon available R, E&D, F&E, and Ops funding in future and approved appropriations. There is an expectation that the FAA will budget support for full implementation of the MROWG recommendations. Significant budget cuts in any of these accounts may impact the capability waterfall described in this report.
- Implementation of some increments (102141-22, 102141-24) will be dependent on the availability of a high resolution FMA display. The TAMR waterfall as currently planned will support this capability at all planned sites, but any delays to TAMR deployment could have an impact on the timeline for these MRO capabilities.
- There may be some environmental risks if the impacts of new procedures exceed FAA threshold criteria for significance; however, this is not expected to be a major impediment to implementation. Most of the procedures use existing flight tracks or offer offsetting environmental benefits (reduced delays and emissions).

MRO & CSPO Appendix A – Pacing Items

The following pacing items were developed as the elements critical to the successful implementation for each MRO and CSPO Capability:

Pacing Items	Description
Change in Roles	No.
Technology/equipage Required	No. Improvements in aircraft RNAV or RNP capability may enhance benefits.
ATM/TFM Automation	No. Planned FAA programs will support, but are not a requirement; ATPA may enhance capabilities and benefits.
Decision Support tools needed by controllers, and TFM specialists	Yes. May reduce controller workload and increase throughput; may be needed to support Wake Recat Phase II.
Training	Yes. Required for controllers; not expected for pilots beyond situational awareness bulletins and revised operations manual information via AIM updates.
Airspace changes	Maybe. Some may be required to accommodate longer or offset finals, but nothing major expected.
Procedures	Yes. New approach procedures may be required to support safety case (offset or glide slope changes; RNAV/RNP where ILS does not exist, or is not feasible).
Policies	Yes. ATC Handbook policy changes will be required to support separation changes.
Technical Standards	No. Established as part of safety case approvals; not required for aircraft.

Certification	No.
Ops Approvals	None required for flight crews.
Political risks	Maybe. May exist in terms of new separation standards and SMS process or if environmental issues arise.
Environmental and noise-related risks	No. Some may exist but not expected to be significant.
Other	Congested airspace may make implementation of some procedures difficult (NY); TCAS implications, although expected to be dealt with as part of safety case.

MRO Appendix B

11 - MT PAs with High Update

	Change in Roles	Technology / Equipage Required	Technology / Equipage Available	Decision Support Tools Required	Need Policy Changes	Need Procedures	Implementation Bandwidth	Need Airspace Changes	Standards Required	Ops Approval Required	Cert Required	Political Risk	Links to Planning Documents	Training	Other Challenges	Environmental Process and Policy	Safety	Experimentation Readiness	Mitigating Factors
Pilot/ Operator	None	None	N/A	N/A	No	No	N/A	No	No	No	No	Alteration of first come first served could be	N/A	Pilot awareness of management factors affecting sequence	None significant	None significant	None significant		N/A
AOC	None	None	N/A	N/A	No	No	N/A	No	No	No	No	N/A	N/A	N/A	May limit AOC ability to manage slots once TFM program is in place	N/A	N/A	N/A	N/A
ATC	None	ATC automation changes	N/A	Controller DST to identify wake generating aircraft and where they should fit in the arrival flow for best efficiency	May need to adjust first come first served to adjust sequence	yes	Depends on maturity. May be included with surface traffic management for outbound	No	No	N/A	YES	Controller Acceptance & Procedures							N/A
TFM																			
FSS	None	None	N/A	N/A	No	No	N/A	No	No	No	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

MRO Appendix C

12- NT 7110.308

	Change in Roles	Technology / Equipage Required	Technology / Equipage Available	Decision Support Tools Required	Need Policy Changes	Need Procedures	Implementation Bandwidth	Need Airspace Changes	Standards Required	Ops Approval Required	Cert Required	Political Risk	Links to Planning Documents	Training	Other Challenges	Environmental Process and Policy	Safety	Experimentation Readiness	Mitigating Factors
Pilot/ Operator	None	None	N/A	N/A	No	No	N/A	No	No	No	No	None Significant	N/A	Pilots would need to be aware of .308 airports. Extensive training not required.	None significant	None significant	None significant	Procedure is already being implemented at several locations.	N/A
AOC	None	None	N/A	N/A	No	No	N/A	No	No	No	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ATC	None	None	N/A	If multiple values of dependent separation are required, controller DST may simplify training and improve performance. For example, if analysis shows that B757 or Hvy leading requires dependent separation greater than 1.5 nm to achieve same wake risk as single runway ops.	Need changes / extensions to 7110.308 to authorize procedure at more places and/or remove restrictions. Enable B757 and Hvy as leaders. Changes to 7110.65 to permit parallel operations using ILS / LPV (or other precision type) will enable more runway pairs to be considered (e.g. BOS)	No	Safety case analysis	Possible airspace adjustment if new parallel operations are being considered	No	No	No	Controller Acceptance & Procedures	http://www.faa.gov/documentLibrary/media/Order/JO%207110.308.pdf	Training for Parallel Dependent Ops where not performed today. Elimination/reduction of restrictions (e.g. configuration), would simplify	Safety Risk Management Process in its current state takes too long. Safety analysis resources may not match demand SRM process will be an issue across the board. AOV has determined not to participate directly in SRM process, but rather to be an independent assessor of the SRM products.	None if implemented where parallel operations already performed. May be required if parallel ops are not currently performed.	Safety Risk Management Process	Procedure is already being implemented at several locations for Large and Small leading. Additional data on B757 and Hvy wakes is being collected and analyzed.	N/A
TFM	None	None	N/A	Potential decision support aid for accuracy of indicating the called rate. Not required for expanding the WTMA capabilities	No	No	N/A	No	No	No	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FSS	None	None	N/A	N/A	No	No	N/A	No	No	No	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

MRO Appendix D

13 - NT Blunder

	Change in Roles	Technology/ Equipage Required	Technology / Equipage Available	Decision Support Tools Required	Need Policy Changes	Need Procedures	Implementation Bandwidth	Need Airspace Changes	Standards Required	Ops Approval Required	Cert Required	Political Risk	Links to Planning Documents	Training	Other Challenges	Environmental Process and Policy	Safety	Experimentation Readiness	Mitigating Factors
Pilot/ Operator	None	None	N/A	No	No	No	Yes	No	No	No	No	Safety Risk Management Process, Acceptance of	N/A	No	Pilot Acceptance/ TCAS RA	N/A	Aircraft operating closer together in IMC	N/A	N/A
AOC	None	None	N/A	No	No	No	N/A	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ATC	None	Same as required for simo independent operations today	N/A	No	Yes. Changes to requirements for independent simuls in 7110.65. Also may be policies changes related to new/modified TERPS (e.g., for changes in NTZ, offset ILS requirements, etc.)	No	Currently being worked by FAA CSPO WG (see links)	Possible minor impacts due to changes in NTZ/Offset ILS.	Revised Blunder Analysis, revised standards for airport design, final approach procedure design	N/A	No	Safety Risk Management Process, Acceptance of Revised Blunder Analysis	http://www.faa.gov/about/office_org/headquarters_offices/avs/offices/afs/afs400/afs440/cspo/enabling/	Likely training on new procedures, updates to 7110.65. Elimination of offset ILS requirements would significantly simply these procedures.	Controller acceptance, Safety Risk Management Process	N/A	Blunder Analysis	OKC AFS-440 July HITLS	N/A
TFM	None	None	N/A	No	No	No	N/A	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FSS	None	None	N/A	No	No	No	N/A	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

MRO Appendix E

14 - NT Mlat

	Change in Roles	Technology/Equipage Required	Technology/Equipage Available?	Decision Support Tools Required	Need Policy Changes	Need Procedures	Implementation Bandwidth	Need Airspace Changes	Standards Required?	Ops Approval Required	Cert Required	Political Risk	Links to Planning Documents	Training	Other Challenges	Environment	Safety	Mitigating Factor
Pilot/Operator	No Pilot follows PRM procedures during PRM operations	Yes additional MLAT sensors will be required beyond the ASDE-X units at the airport if the airport is ASDE-X equipped. If the airport is not ASDE-X equipped then it would require a	Yes The sensors are available. They are the same sensors that are used on the ASDE-X program. If it is a greenfield installation then the MLAT system is available and is the same as the MLAT	No	No	PRM-A procedures are identical to those in use for existing/classic PRM operations Airport specific approaches may be required;	Yes The pilot training exists	No	Yes DO-181	Pilot requires training. PRM must be contained in Ops Specs & MMELs	No	Yes (environmental and/or funding)	ATMAC Documentation	No (limited training requirements) The Pilot must be trained for PRM operations	SMS Acquisition Management Additional training for controllers Spectrum Mgt Staffing	Environmental issues may be encountered when siting the sensors that comprise the infrastructure	None	The initial implementation of PRM-A will be at DTW on 7/02/09
ATC	Yes Dedicated PRM position required (Final Approach Monitor)	Yes PRM automation system with a dedicated position/display required in the TRACON	Yes, FAM position capability is part of the STARS suite and can be added at facilities with ART3 displays	No The tools exist but would need to be deployed to the site in question	No	PRM-A procedures are identical to those in use for existing/classic PRM operations. PRM facilitates reduced separation for Closely Spaced Parallel Operations (CSPO) with rapid update surveillance (MLAT) capability Airport specific approaches may be required	Yes The technology and supporting policy is already developed and only requires resources to implement at the site(s) in question	Class B or C airspace may require modification. Runway usage and configurations may require modification to existing airspace in order to contain air carrier aircraft within wholly controlled ATC airspace. Rule making action may be required.	No	Controller requires training and currency rqmt	The system infrastructure require certification, the aircraft require no special equipage other than a transponder	Yes (funding and availability of appropriate automation systems at a given site)		No (limited training requirements) The controller must be trained for PRM operations			Current PRM blunder procedures are cumbersome. Should consider RNAV overlay of ILS procedure to improve capability and pilot acceptance	The initial implementation of PRM-A will be at DTW on 7/02/09
ATC: Split into tower, terminal, en route?	Yes Possibly, different delegation of controller responsibilities among controller team	Yes, additional Final Approach Monitor Frequencies with Tower override capability are required	Yes, but ASDE-X system design & maintenance require upgrading to a 'Critical' vs 'Advisory' system	New decision support tools not required, but data comm could be combined with other en route and tower automation tools to enhance benefits	No	It may in some cases to support the new policies and special routes. Eg. Taylored Arrivals, OPDs, and RNAV/RNP approaches.	FAA bandwidth is primarily ground automation (e.g., ERAM). Need to ensure implementation dates can meet near term benefits objectives.		Confusion exists over which standard, FANS 1A+, DO-280/DO-290, Incomplete RTCA 214 standards	Normal Ground system procedures	Ground systems may need to meet certain safety levels for AIR approval.	Controller acceptance	TBD	Controller training will be required				
Operator's Flight Planning/Operations /Dispatch	No	No	No	No	No	No		No	No	No	No	No	No	TBD				
TFM	VMC arrival rates maintained in IMC during PRM operations	No		No	No	No	Integration of TFM functionality with Data Comm capabilities desired	No	No					TBD	To achieve the most benefits, ATCSCC and SOCs (through CDMnet) will coordinate slots for non PRM capable flights in accordance with FAAH 7210.3			

MRO Appendix F

32-RNAV RNP SID & STAR

	Change in Roles	Technology/Equipage Required	Technology/Equipage Available?	Decision Support Tools Required	Need Policy	Need Procedures	Implementation Bandwidth	Need Airspace Changes	Standards Required?	Ops Approval Required	Cert Required	Political Risk	Links to Planning Documents	Training	Other Challenges
Pilot/Operator	No		Yes, RNAV and RNP equipage	No	Yes. New developments should meet benefits such as: predictable paths, environmental, reduced delays, reduced transmissions, atc benefits, reduced flight miles, as examples.		Procedure design and development should be done through tiger teams, which require subject matter expertise. The SMEs must help train others to avoid a bandwidth issue.	Overall this is site specific and cannot be answered categorically	Standards for RNP<1 with RF are needed so that this tool can be used	Ops approvals can be time-consuming and expensive. Streamlining ops approval is a high priority need	Cert/approvals can be time-consuming and expensive. Streamlining cert/approval is a high priority need	No	Mutually beneficial procedures for operators and ATC should be the focus as opposed to the volume of procedures completed.	No	Environmental issues
ATC	Reduced sep would need additional tools. Mixed equipage. Various aircraft capabilities. ATC tools to better understand aircraft/operator capability	Reduced separation would need additional tools. Mixed equipage. Various aircraft capabilities. ATC tools to better understand aircraft/operator capability	Enhancements to current automation systems may be necessary. New tools are not necessary to move ground tracks.	Reduced separation would need additional tools. Mixed equipage. Various aircraft capabilities. ATC tools to better understand aircraft/operator capability	Criteria on flight standards side	Yes. Beneficial that provide the benefits for all and for ATC	Procedure design and development should be done through tiger teams, which require subject matter expertise. The SMEs must help train others to avoid a bandwidth issue.	Overall this is site specific and cannot be answered categorically	Standards for RNP<1 with RF are needed so that this tool can be used	Ops approvals can be time-consuming and expensive. Streamlining ops approval is a high priority need	Cert/approvals can be time-consuming and expensive. Streamlining cert/approval is a high priority need	No	Mutually beneficial procedures for operators and ATC should be the focus as opposed to the volume of procedures completed.	Training may vary based on the level of re-design	
SOC	No		n/a	n/a											
TFM	Use of a decision tree when determining the performance level needed to meet the objective for each specific scenario is critical. Example: If RNP <1.0 and RF legs are not required to meet the objectives, then don't use them. Keep in mind the deeper you go into RNP, the greater the chance for less participation and the more stringent the requirements become.	Enhanced tools to provide for spacing and merging	Enhancements to current automation systems may be necessary. New tools are not necessary to move ground tracks.	Reduced separation would need additional tools. Mixed equipage. Various aircraft capabilities. ATC tools to better understand aircraft/operator capability											
FSS	No														

DataComm-enabled Controller-Pilot DataLink Communications (CPDLC) and pre-departure clearances

Introduction

Evolving the National Airspace System (NAS) to meet the goals of NextGen requires the implementation of advanced DataCommunications (DataComm) between flight crews and air traffic controllers. Continuous communication among controllers and pilots is essential to safely coordinate the thousands of airplanes in the NAS at any given time. Today, controllers and pilots communicate verbally using analog radios, but voice communication is labor intensive, time consuming, has a propensity for miscommunication and human error and limits the ability of the NAS to meet future traffic demand. The investment in DataCommunications is critical to enhancing the NAS and modernizing air traffic operations.

In an effort to ensure that DataComm capabilities are delivered and the benefits are realized, the RTCA DataComm NextGen Integration Working Group (NIWG) thoroughly reviewed FAA programs and developed a consensus on timelines, locations and services to which both industry and the FAA would commit. To that end, NIWG endorses:

- An accelerated timeline for deployment of tower DataComm services at 56 airports, the first of which would become operational in the third quarter of Government Fiscal Year 2015.
- Development of a baseline of initial En route services, to be deployed at all 20 CONUS Air Route Traffic Control Centers, beginning in 2019, that include transfer of communication, initial check in, altimeter setting, airborne reroutes and crossing restrictions.

The business case for DataComm will be strengthened by this delivery of near-term benefits. Operators continue to invest in DataComm based on a positive return of investment. The NIWG did however identify several barriers that, if not addressed, will delay DataComm from becoming a bed rock capability of the NAS. Acceptance of the following recommendations would significantly increase the number of near term participating aircraft:

- Recorder Rule for Retrofit: The NIWG recommends that Industry members participate through the Performance-based Operations Aviation Rulemaking Committee (PARC) Comm Working Group (CWG) to develop recommendations and supporting rationale for revision or other means of compliance of the recorder rule by September 2014, that the FAA give priority to the recommendations and make appropriate changes to the regulations or guidance.
- VDL Mode 0: In June 2012, the FAA provided accommodations of Future Air Navigation Systems (FANS 1/A) over Plain Old ACARS (POA) for tower departure clearance services. Through monitoring and operator provided guarantee of performance, the NIWG recommends similar accommodations be granted for En route services.
- FANS 1/A+: The FAA requires FANS 1/A+ for En route services in order to mitigate a latent message hazard. For some aircraft equipped with legacy FANS installations, the business case for an upgrade to FANS 1/A+ will not close. The NIWG recommends that FAA work with these operators on an alternate suitable means of mitigation.

Industry and the FAA collectively believe that, while En route trials would benefit the FAA's DataComm Program, they are not required for the successful deployment of En route Services. As long as the collaborative and consultative requirements, capture and issue resolution methodology, is carried

forward into En route systems and procedure development, comprehensive trials are not necessary for En route.

A limitation exists in the ability of the B737's flight management computer to process airway-to-airway without a published intersection point. Although this limitation is addressed in the voice communication environment through pilot and flight plan filing procedures, it is a hazard in a DataComm environment because an unacceptable route could be inadvertently loaded. Until this limitation is addressed, the NIWG recommends that FAA not uplink airway-to-airway without a published intersection point to B737 aircraft. The NIWG also recommends that industry and the FAA accelerate a thorough examination of the operational impact of this issue.

Background

The DataCommunications Program will provide DataCommunications services between pilots and air traffic controllers as well as enhanced Air Traffic Control (ATC) information to Airline Operations Centers and other flight following providers. DataComm will provide a direct link between ground automation and flight deck avionics for safety-of-flight ATC clearances, instructions, traffic flow management, flight crew requests and reports. DataComm is critical to the success of NextGen, enabling efficiencies not possible with the current voice system.

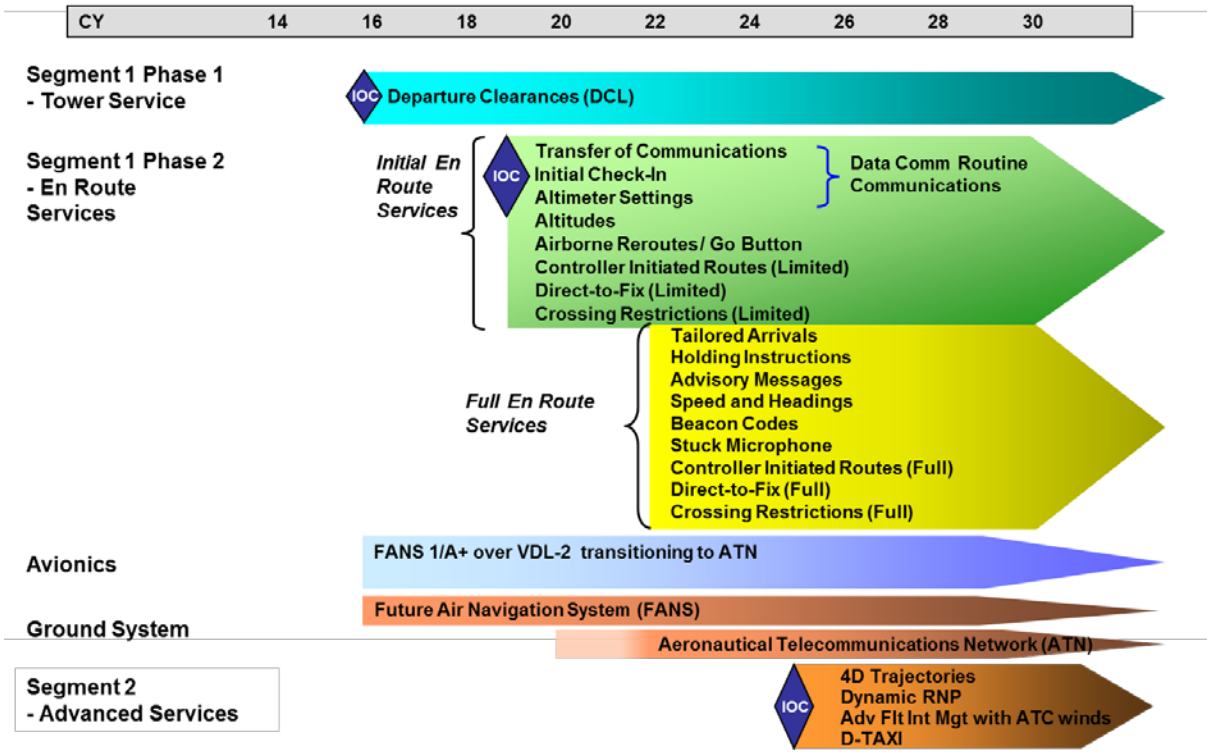
The operational benefits of the DataComm Program are:

- Enhanced safety by reduced communication errors
- Reduced communication time between controllers and pilots which increases controller productivity
- Increased airspace capacity and efficiency
- Reduced delays, fuel burn, and carbon emissions
- Improved re-routing around weather and congestion
- Increased flexibility and accommodation of user requests
- Enables NextGen services, such as enhanced re-routes, trajectory operations

These improvements to the NAS will be realized through the execution of the DataComm Program in two primary segments. Segment 1 will deliver the initial set of DataCommunications services integrated with ground automation support tools in designated ATC Towers (Segment 1 Phase 1), followed by deployment of En route Services (Segment 1 Phase 2). Phase 2 will further build upon the Departure Clearance and En route services by supporting more advanced NextGen capabilities not possible using voice, such as optimized profile descents and advanced flight interval management, as well as supporting addition of Aeronautical Telecommunications Network (ATN) Baseline 2 service. The focus of the activities of this working group is on Segment 1 Phases 1 and 2.

The DataComm services phasing strategy of the program is shown graphically below in Figure 1.

Figure 1 DataComm Services Strategy



Departure Clearances (DCL) – Segment 1 Phase 1 (S1P1)

In S1P1, the DataComm program will deliver DCL at 56 airports including revisions with full route clearances transmitted directly to the aircraft on the airport surface. DCL services will expedite the delivery of departure clearances to aircraft, streamline clearance delivery operations and enable quicker recovery from changes in the operational configuration of runways and airspace that are caused by weather and other events. DCL will improve efficiency, reduce ground delays, and result in more effective tactical management of NAS resources.

The major elements of Segment 1 Phase 1 implementation are:

- Tower Data Link Services (TDLS) software and hardware enhancements to legacy Pre-departure Clearances (PDC) functionality to enable Departure Clearance (DCL) services in the Towers.
- En route Automation Modernization (ERAM) software and hardware enhancements to include logon and session establishment.
- DataCommunications Network Service (DCNS) which will provide the air/ground communications network services infrastructure.
- Avionics Equipage Initiative which will provide incentives for operators to equip aircraft with Future Air Navigation Systems (FANS) 1/A+ avionics and VHF Data Link Mode 2 (VDL-2) radios.

En route Services – Segment 1 Phase 2 (S1P2)

S1P2 will leverage the S1P1 infrastructure to deliver services to the En route domain, to include Controller Pilot Data Link Communications (CPDLC) and airborne weather and other reroute capabilities. En route services will include airborne reroutes, controller and pilot initiated downlinks, altitude and altimeter settings, tailored arrivals, issuing crossing restrictions, holding restrictions and will automate

routine communications such as advisory messages, beacon codes, and transfer of communications and initial check-in. The En route services will be delivered in two stages, Initial Services and Full Services. The DataComm En route services will contribute to a reduction in flight delays, more efficient routes for aircraft resulting in increased operational efficiency, and enhanced safety all while reducing operational costs for airspace users. As DataComm becomes fully operational, the majority of pilot-controller exchanges will be handled by DataComm for appropriately equipped operators.

The major elements of the Segment 1 Phase 2 implementation are:

- ERAM software enhancements for En route Controller-Pilot Data Link Communications (CPDLC) applications.
- DataComm Network Service (DCNS) expanded coverage and capacity.
- TDLS software enhancements to provide additional services to Tower controllers.

Assumptions and Guiding Principles

At the outset of this effort the leadership of the Working Group established a number of Assumptions and Guiding Principles that structured the work of the participants.

The overall purpose of the NextGen Integration Working Group DataComm Team is to develop specific industry recommendations for the FAA's DataComm program. These recommendations when established in the NAS will deliver operational capabilities that provide benefits on a defined timeline.

Implementation timelines and deliverables go beyond the 1-3 year time frame and include En route services that will begin in 2019.

DataComm Capabilities

The NIWG reviewed and validated the FAA strategy for delivery of DataComm capabilities to the NAS, for both Segment 1 Phase 1 and Segment 1 Phase 2. The group also validated the qualitative benefits expected for both S1P1 and S1P2, as well as identifying categories of metrics to be tracked to measure program success.

In S1P1, the DataComm program will deliver the Departure Clearances capability at 56 airports including revisions with full route clearances transmitted directly to the aircraft on the airport surface. DCL services will enhance safety and expedite the delivery of departure clearances to aircraft, streamline clearance delivery operations and enable quicker operational recovery from adverse operational events such as weather. DCL will improve controller and pilot communications efficiency, reduce ground delays, and result in more effective tactical management of NAS resources.

S1P2 will leverage the S1P1 infrastructure to deliver services to the En route domain, to include Controller Pilot Data Link Communications airborne weather and other reroute capabilities. En route services will include airborne reroutes, controller and pilot initiated downlinks, altitude and altimeter settings, tailored arrivals, issuing crossing restrictions, holding restrictions and will automate routine communications such as advisory messages, beacon codes, and transfer of communications and initial check-in. The En route services will be delivered in two stages, Initial Services and Full Services. The DataComm En route services will contribute to a reduction in flight delays, more efficient routes for aircraft resulting in increased operational efficiency, and enhanced safety all while reducing operational costs for airspace operators. As DataComm becomes fully operational, the majority of pilot-controller exchanges will be handled by DataComm for appropriately equipped operators.

The detailed results of the NIWG capabilities review were captured in the Operational Improvement spreadsheets for both DCL and En route services. The updated spreadsheet for DCL is attached in Appendix C, and the updated spreadsheet for En route services is attached in Appendix D.

Expected Benefits

DataCommunications will revolutionize ATC communication between the ground and the cockpit, increasing the capacity, flexibility, and productivity of the National Airspace System. DataCommunications provides services which will enhance safety, airspace throughput, flight times, and other efficiencies in both the Terminal and En route environments. It will reduce air traffic control communications workload which will reduce air traffic delay and increase efficiency through an increase in controller flexibility. DataCommunications will allow complex routing communications that will make better use of available NAS resources such as airspace and airports. This improvement will occur for routine operations and be even more critical during system disruptions such as weather. DataCommunications is a key transformational program under NextGen that will enable advanced capabilities, such as Trajectory Based Operations, Optimized Profile Descents, Advanced Flight Interval Management, Enhanced Surface Movement, and Dynamic Required Navigation Performance (RNP). DataCommunication will also reduce operational errors, enhancing the safety and efficiency of the NAS.

DCL Services at the Tower (S1P1) will improve operations in the following manner:

- Improve communication accuracy and safety with digital communication (i.e., reduced read/hear back errors, reduced loss of communications events)
- Improve recovery from service disruptions, mitigate propagated delay, improve schedule reliability, and enable NextGen capabilities
- Improve controller efficiency
- Reduce environmental impact due to less fuel burn and emissions
- Direct operating cost savings from reduced delay enabled by a reduction in communication time for revised departure clearances

CPDLC Services in En route (S1P2) will improve operations in the following manner:

- Improve communication accuracy and safety with digital communication (i.e., reduced read/hear back errors, reduced loss of communications events)
- Improve controller and flight crew efficiency by providing automated information exchange
- Improve rerouting capabilities
- Allow more efficient routes for aircraft
- Decrease congestion on voice channels and provide an alternative communications capability
- Improve NAS capacity and reduced delays associated with congestion and weather
- Reduce environmental impact due to less fuel burn and emissions
- Direct operating cost savings from increased throughput/efficiency realized through reduced delays and improved communications
- Direct operating cost savings from reduced distance flown enabled by more precise airborne re-routes

The FAA's business case indicates that the S1P1 and S1P2 services to be provided by DataComm are conservatively estimated to save operators more than $10 billion over the 30-year lifecycle of the program and save the FAA approximately $1 billion in operating costs.

Metrics

The working group recommended the following operational metrics for the program:

- DataComm Usage - This category of metric tracks whether the system is being used operationally and therefore whether the system and procedures are operationally suitable and performing as designed.
- Minutes of Comm Time Saved - This category of metric tracks how many controller/pilot communications minutes have been saved by the implemented DataComm functions. The metric is broadly covered by comparing known voice communication times with the communication times observed during DataComm exchanges.
- Ground Delays - This category of metric tracks the impact on taxi time changes, on taxi-time variability, and airport recovery which translates into schedule predictability for aircraft operators.
- Airspace Throughput - This category of metric tracks the impact on peak departure rates, by airport, for both routine operations and weather or other disruption events.
- Efficiency - This category of metric tracks the impact on taxi-time, gate delay and number of cancelled flights.
- Fuel Burn - This category of metric tracks the impact on the amount of fuel burned during ground operations and during the departure phase of flight.
- Implementation - Industry will jointly track with the FAA the operational milestones published by the program.

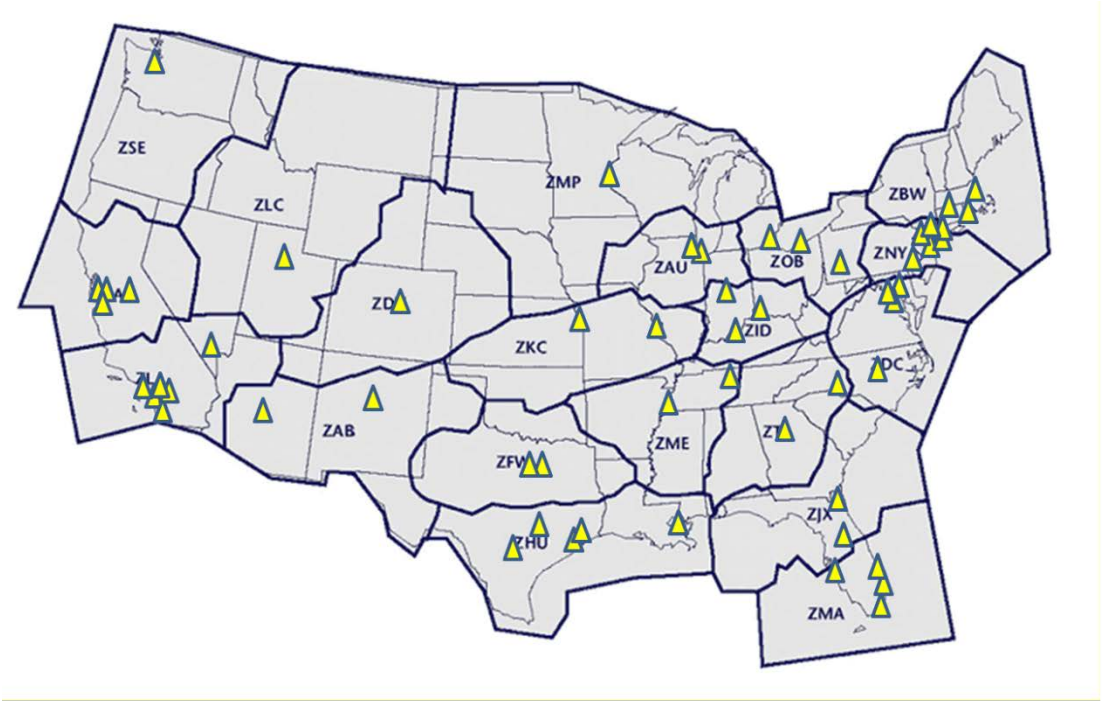
Implementation Plan

The DataComm Program S1P1 is currently baselined for cost, schedule, and technical requirements to deliver the Departure Clearance (DCL) service. This plan includes schedule milestones and metrics to ensure the program is delivering its capabilities on time.

The program has also developed an initial plan, schedule, and budget to deliver S1P2 En route services to include Controller Pilot Data Link Communications and Weather Reroutes. The FAA plans to baseline this phase of the program in Q4 CY 2014.

Revised Departure Clearances DCL - Segment 1 Phase 1
The revised departure clearance service will be implemented at the 56 Tower Data Link Services (TDLS) airports, shown below in Figure 2.

Figure 2 DataComm Tower Implementation Sites



The program has baseline implementation dates of 2016-2019, however the program plan is to work to an accelerated schedule to implement service at all 56 sites in 2015-2016. Those implementation dates for specific sites are shown below in Figure 3. This accelerated implementation approach and waterfall was brought to the DataComm NIWG and was reviewed and validated. It is important to note that these dates represent accelerated milestones for the program but that the baseline dates remain in effect. An accelerated deployment is beneficial to the FAA and the operators and all Stakeholders will work towards these accelerated milestones with the realization that there are implementation risks which will continue to be coordinated through the Program Office and the DataComm Implementation Team (DCIT).

Figure 3 DataComm Tower Implementation Waterfall

Key Sites (3 Towers)			
Site Name	Site ID	ARTCC ID	IOC (CY)
KS 1: Salt Lake City	SLC	ZLC	Q3 2015
KS 2: Houston Intcl	IAH	ZHU	Q3 2015
KS 3: Houston Hbby	HOU	ZHU	Q3 2015
NAP – NAP Compl	NA	ZLC/ZTL	Q4 2015
IOA Compl			Q4 2015
In-Service Decision			Q4 2015

Group A (19 Towers)			
Site Name	Site ID	ARTCC ID	IOC (CY)
New Orleans	MSY	ZHU	Q1 2016
Austin	AUS	ZHU	Q1 2016
San Antonio	SAT	ZHU	Q1 2016
Los Angeles	LAX	ZLA	Q1 2016
Las Vegas	LAS	ZLA	Q1 2016
San Diego	SAN	ZLA	Q2 2016
John Wayne	SNA	ZLA	Q2 2016
Bob Hope	BUR	ZLA	Q2 2016
Ontario	ONT	ZLA	Q2 2016
San Francisco	SFO	ZOA	Q2 2016
Oakland	OAK	ZOA	Q2 2016
San Jose	SJC	ZOA	Q3 2016
Sacramento	SMF	ZOA	Q3 2016
Phoenix	PHX	ZAB	Q3 2016
Albuquerque	ABQ	ZAB	Q3 2016
Seattle	SEA	ZSE	Q3 2016
Dallas Love	DAL	ZFW	Q4 2016
Dallas FTW	DFW	ZFW	Q4 2016

Group B (17 Towers)			
Site Name	Site ID	ARTCC ID	IOC (CY)
Louisville	SDF	ZID	Q1 2016
Indianapolis	IND	ZID	Q1 2016
Cincinnati	CVG	ZID	Q1 2016
Memphis	MEM	ZME	Q2 2016
Nashville	BNA	ZME	Q2 2016
Denver	DEN	ZDV	Q2 2016
Atlanta	ATL	ZTL	Q2 2016
Charlotte	CLT	ZTL	Q2 2016
Jacksonville	JAX	ZJX	Q2 2016
Orlando	MCO	ZJX	Q3 2016
Miami	MIA	ZMA	Q3 2016
Fort Lauderdale	FLL	ZMA	Q3 2016
Tampa	TPA	ZMA	Q3 2016
Palm Beach	PBI	ZMA	Q3 2016
St Louis	STL	ZKC	Q4 2016
Kansas City	MCI	ZKC	Q4 2016
Minn-St Paul	MSP	ZMP	Q4 2016

Group C (18 Towers)			
Site Name	Site ID	ARTCC ID	IOC (CY)
Boston	BOS	ZBW	Q1 2016
Providence	PVD	ZBW	Q1 2016
Bradley	BDL	ZBW	Q1 2016
Newark	EWR	ZNY	Q2 2016
J F Kennedy	JFK	ZNY	Q2 2016
La Guardia	LGA	ZNY	Q2 2016
Philadelphia	PHL	ZNY	Q2 2016
Teterboro	TEB	ZNY	Q2 2016
Westchester	HPN	ZNY	Q2 2016
Detroit	DTW	ZOB	Q3 2016
Cleveland	CLE	ZOB	Q3 2016
Pittsburgh	PIT	ZOB	Q3 2016
Balt/Wash	BWI	ZDC	Q3 2016
Dulles	IAD	ZDC	Q3 2016
Reagan	DCA	ZDC	Q3 2016
Raleigh/Durham	RDU	ZDC	Q4 2016
Chicago Midway	MDW	ZAU	Q4 2016
Chicago O'Hare	ORD	ZAU	Q4 2016

En route Services – S1P2
The CPDLC services and airborne weather reroutes will be implemented in the En route airspace in all 20 Continental United States (CONUS) Air Route Traffic Control Centers (ARTCC). The services will be delivered in two stages: Initial En route Services and Full En route Services.

Initial En route Services will be delivered beginning in 2019, and will consist of the following CPDLC services:

- Transfer of Communications
- Initial Check-In
- Altimeter Settings
- Altitudes
- Airborne Reroutes
- Controller Initiated Routes (Limited)
- Direct-to-Fix (Limited)
- Crossing Restrictions (Limited)

Full En route Services will be delivered beginning in 2022, and will consist of the following CPDLC services:

- Tailored Arrivals
- Holding Instructions
- Advisory Messages
- Speed and Headings
- Beacon Codes
- Stuck Microphone
- Controller Initiated Routes (Full)
- Direct-to-Fix (Full)
- Crossing Restrictions (Full)

A site implementation waterfall for the ARTCCs has not been finalized at this time.

Implementation Activities
In order to implement the DataComm services into the NAS both the FAA and industry will be required to complete a variety of activities. Some of these activities are national activities to be completed centrally, whereas some activities will be completed at the specific tower and ARTCC sites. These activities will require close coordination between FAA and industry to successfully deliver the DataComm capabilities to the NAS.

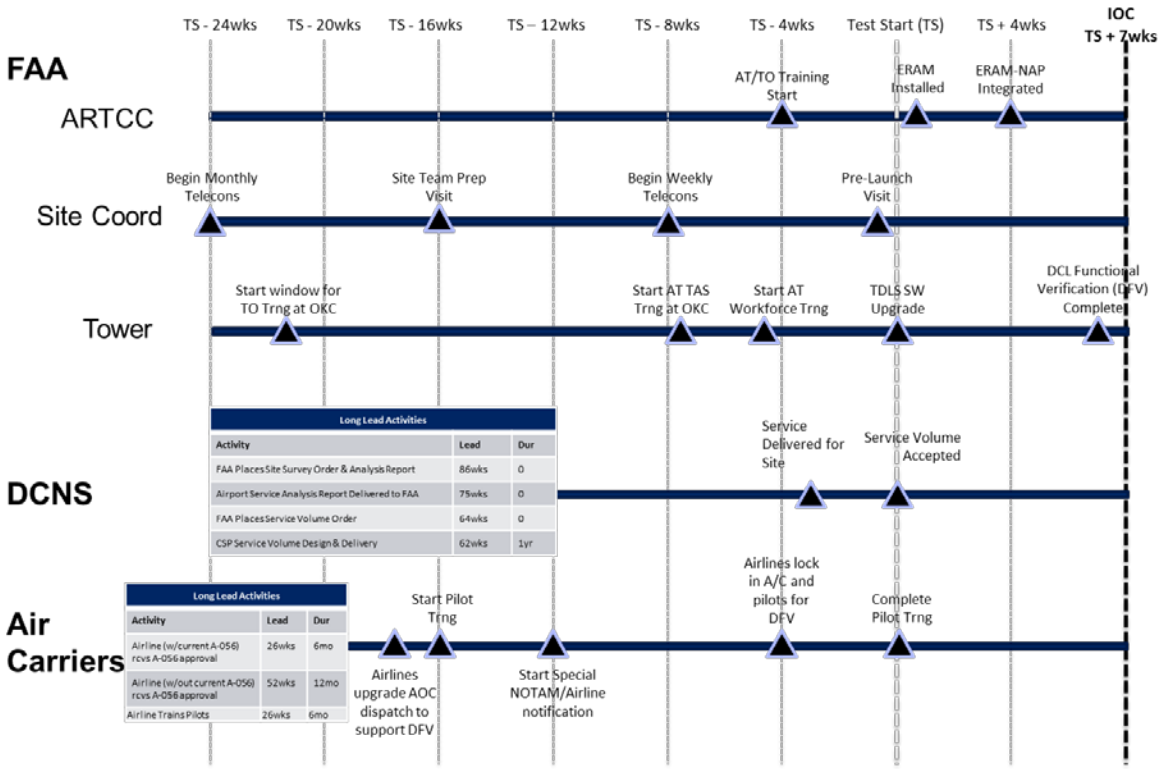
FAA Activities

Revised Departure Clearances (DCL) - S1S1
To deliver the DCL capability the FAA is leveraging existing investments already in operational use including the Tower Data Link Services (TDLS), En route Automation Modernization (ERAM), FAA Telecommunications Infrastructure (FTI), and Future Air Navigation System (FANS 1/A) avionics widely available in transport category aircraft today. The program will provide modifications to many of these systems as well as deliver the air to ground DataCommunications Network Service (DCNS) infrastructure.

The DCNS will leverage the existing Airline Operations Center (AOC) VHF Data Link (VDL) network to minimize impact to industry.
The S1P1 DataComm Program has already transitioned to the system test and implementation stage. Though the program has baseline implementation dates of 2016-2019, the program is working to an accelerated schedule to deploy services in 2015-2016. The NIWG DataComm Team endorses this acceleration effort. The FAA will conduct integrations, tests, and operational test and evaluation (OT&E) activities required to reach keysite Initial Operating Capability (IOC), and start the subsequent implementation waterfall shown in Figure 3. The FAA will also conduct the required training for controllers and technicians during the implementation waterfall timeframes.

Figure 4 below shows both the FAA and air carriers required actions at each tower, as well as their required schedule in relation to site test activities. Close coordination between the FAA and air carriers is required to successfully deliver capability to the site.

Figure 4 Site Implementation Activities



Long Lead Activities

Activity	Lead	Dur
FAA Places Site Survey Order & Analysis Report	86wks	0
Airport Service Analysis Report Delivered to FAA	75wks	0
FAA Places Service Volume Order	64wks	0
CSP Service Volume Design & Delivery	62wks	1yr

Long Lead Activities

Activity	Lead	Dur
Airline (w/current A-056) rcvs A-056 approval	26wks	6mo
Airline (w/out current A-056) rcvs A-056 approval	52wks	12mo
Airline Trains Pilots	26wks	6mo

En route Services – S1P2

The FAA will leverage the S1P1 infrastructure to deliver the S1P2 services to the En route domain. The program will make the necessary enhancements to the TDLS and ERAM software to deliver the expanded capabilities. Additional DCNS and FTI services will be provided to encompass the En route airspace. S1P2 will continue to leverage FANS/VDL avionics. The FAA will also conduct the additional required training for controllers and technicians on the additional services.

S1P2 will be comprised primarily of software capability enhancements to TDLS and ERAM. The majority of the infrastructure required for S1P2 services in the En route domain will have been delivered in the

S1P1 phase of the program. However, the FAA will need to conduct additional required training for controllers and technicians on the additional services, in addition to amending appropriate procedures.

The program is planned to be baselined for cost, schedule and technical requirements at a Final Investment Decision (FID) in Q4 CY 2014.

National Industry Activities

Revised Departure Clearances – S1P1 - In order for controllers to maintain familiarity with DCL operations and realize the full DataComm benefits the FAA estimates an additional 1900 aircraft will need to be equipped with FANS/VDL avionics. Several air carriers have already signed Memorandums of Agreement (MOAs) to participate in the DataComm Avionics Incentive Initiative, which if fully executed would provide 1900+ certified and equipped aircraft into the fleet. The operators will need to obtain operational approval, conduct the necessary training for pilots, AOC personnel, and develop appropriate software.

Close coordination will be required between the FAA and operators for delivering the service to the site; therefore required operators activities have been integrated into Figure 4 above.

En route Services – S1P2 - No additional avionics will be required to receive S1P2 En route services to fully participate in S1P2. However, operators may need to conduct additional training for their aircrew depending on the fleet and update their procedures accordingly.

Recommendations and Other Considerations

The NIWG reviewed the FAA's program strategy focusing on functional capabilities, implementation locations and timelines, and operational considerations. The following sections include recommendations and areas of consideration the NIWG has identified as significant for the successful implementation of the DataComm capabilities:

Operator Equipage Commitment (VDLM2/FANS 1/A+)

The FAA established a DataComm equipage incentive program to encourage early adopters and to help achieve a goal for the program of 1900+ aircraft equipped with VHF Data Link Mode 2 (VDL Mode2) and FANS 1/A+ avionics and software by 2019. These funds are part of the DataComm program baseline. The 1900+ aircraft goal was based upon creating enough daily operations to produce a "tipping point" of DataComm benefits to the operation and safety of the National Airspace System and to the operators.

Under the DataComm equipage program, eight agreements have been executed between Harris Corporation and the individual operators. These agreements are captured in Memorandum of Agreement. Under the MOAs, the operators agree to equip aircraft with VDL Mode 2 and FANS 1/A+ avionics and software in accordance with the schedule attached to the individual MOAs.

The specifics of the individual MOAs are proprietary information between Harris, the operator and the FAA. However, each of the MOAs contains essentially the same terms and conditions in accordance with the FAA's contract rules for the incentive program.

The MOAs provide the operators with an incentive payment in the form of a rebate after the operator has demonstrated that it has equipped its aircraft with the incentivized avionics and software.

The projected cumulative number of equipped aircraft by Government Fiscal Year (assuming some percentage dropout from MOA schedules) is as follows:

FY15	FY16	FY17	FY18

825 1275 1650 1900+

These equipped aircraft numbers, and projected operations that will result, are in alignment with the challenge waterfall of ground automation upgrades at the 56 airports in the US which will deliver DCL services starting in 2015, and ultimately DataComm services in the En route airspace (projected first En route services IOC in 2019). Additionally, the DataComm program has made the decision to accommodate FANS1/A + over media other than VDL Mode2 for surface operations (DCL-S1P1). It is projected that approximately 500 aircraft will utilize FANS over VDL Mode 0. These aircraft are not incentivized via the DataComm Incentive Program but will add to the projected number of DCL operations per airport per day.

In order for the DataComm program to be successful, industry Stakeholders will work to honor the commitments documented in the MOAs. In addition, industry and the FAA will work together to promote the use of DataComm services across as many aircraft as feasible beyond the incentivized equipage program with the joint goal of ensuring the benefits of DataComm services are realized across the operation for all Stakeholders and users of the NAS.

Operator support for key site testing

For transition to DCL operations in the NAS at the targeted 56 airports to be a success, industry and the operators commit to provide support to FAA sites and operational acceptability test activities. In order for testing to occur, operators need to provide equipped aircraft, trained crews, and dispatch support for key site testing and the DCL waterfall starting in 2015. DCL Crews may be limited to line check/ instructor pilots during this period.

There is a potential avionics schedule risk which may impact the number of operations at early key sites. The minimum Flight Management Computer (FMC) version for DCL (S1P1) operations on the Boeing 737 has been stated as U11. Versions prior to U11 do not support the route clearance generation rules agreed to within DCIT, and the U10.8 version also has software issues that have resulted in aircraft operators deactivating FANS-1/A and FMC-AOC functionality. Industry has committed to delivering the U11 version for the B737 which is scheduled for a May 2015 Service bulletin. This version will provide support for route clearance elements (UM79, UM80, UM83), Arrival, Departure, Approach, and Transition procedures. These features are necessary for the activation, approval and participation in DCL and En route DataComm. Achieving readiness is based on the expectation that at least some operators expect to activate on a few aircraft prior to full-fleet activation.

An additional issue, not addressed with U11, is the B737's FMC ability to handle airway-to-airway route constructs when uplinked without a published waypoint at the airway intersection point. When such an uplink is received, the aircraft does not use the uplinked airways in its route modification. Two limitations exist:

- The FMC on the B737 design does not allow this construct, irrespective of the presence of DataComm. This is a known feature, which is core to the FMC's route processing and not specific to DataComm operations; B737 operators manage this through a combination of flight planning and flight deck procedures. Modifying the FMC would be a new and complex feature which will take time to introduce.
- The FMC does not insert a DISCON indication on route review pages where the uplinked airways should appear, making it possible for the crew to overlook the fact that airways are dropped, resulting in an incorrect route. The NIWG DataComm Team recommends this be fixed in B737

avionics by December 30, 2015 and deployed as soon as possible thereafter to help to mitigate the safety issue.

The first limitation will take time to correct, and is not viewed as critical to Departure Clearance operations provided the second limitation is addressed. B737 operators have standard procedures to address the first limitation, since it is used regularly in today's voice environment. However, it may be a more significant issue in the dynamic En route DataComm environment.

B737 Operators require the second limitation to be addressed before airway-to-airway route constructs without a published waypoint at the intersection point are sent to B737 aircraft. Until this limitation is addressed, the NIWG recommends that the FAA not uplink this route construct to B737 aircraft unless it can be converted to a loadable construct. Once the second limitation is fixed, this route construct can be used, at least within the DCL environment.

The FAA's Joint Resources Council (JRC) is scheduled to make a Final Investment Decision (FID) on En route services in October 2014. Immediately thereafter, the NIWG recommends that industry and the FAA conduct a thorough examination of the operational impact of the inability to load air-way to air-way intersection without a published waypoint at the intersection available in the En route phase of DataComm, and work with industry on the best way to address that operational impact (modification of B737 avionics or other operational adjustments) with results by December 2015.

Data Link Recording Rule Recommendation

The NIWG agrees that crash survivable data link recording capability is clearly an important component of safety systems. Newer aircraft can provide this recording without significant expense, and many installations can be accomplished without recording under the guidance for the current rule. However, some operators that desire to retrofit data link capability on aircraft or modify existing aircraft data link installations are opting not to proceed with the installation or modification owing to the additional significant costs to include data link recording capability. In this regard, the data link recording rule is an impediment to equipping a portion of the fleet with NextGen technologies and may be hindering advances in operational safety.

The NIWG recognizes that the Performance-based Operations Aviation Rulemaking Committee (PARC) initiated a project in January 2014 to investigate the impact of the data link recording rule. Specifically, the PARC Communication Working Group (PARC CWG) is investigating the impacts of the current rule and guidance and is developing a recommendation on rule or policy changes, considering the impacts on operational safety, global harmonization, accident investigations and operator costs. The PARC CWG has completed its recommendation and has delivered it to PARC leadership.

The NIWG agrees that its concerns are consistent with the scope of the PARC's data link recording rule project. In addition, the PARC CWG comprises the appropriate expertise to address the issues and is considering the impact of the data link recording rule more broadly to include retrofit data link installations on aircraft operating outside U.S. domestic airspace. Therefore, the NIWG recommends that:

- Industry members participated through the PARC CWG to develop recommendations and supporting rationale.
- The FAA gives priority to the recommendations from the PARC and initiates changes to regulations or guidance as appropriate to resolve these issues.

Supplemental Information

ATC clearances issued through voice communication have been recorded on the cockpit voice recorder for fifty years. Recognizing that these clearances would transition from voice to data, the NTSB recommended in 1999 that the CVR be used to capture data clearances to support accident and incident investigations. The FAA acted on this recommendation and adopted a final rule in 2008 defining data link recording requirements for new aircraft, and for any prior aircraft that installs a data link capability.

Since 2008, a number of issues have arisen concerning this rule. These include:

- The cost-benefit used in the regulatory evaluation did not consider any costs, since DataCommunications capability was not required to be installed. However, the FAA's NextGen plans feature a prominent role for DataCommunications, and the NIWG believes that the costs impacts to equipage should be considered in light of the NextGen objectives.
- The structure of the rule for operators who install data link capability has caused considerable confusion. While the rule specifies that all aircraft that install data link after 2010 are required to comply, the FAA guidance allows many aircraft to install data link after this date without data link recording, if the engineering design work was completed before the deadline. This has made it difficult to commit to any DataCommunication initiatives, since the applicability of the recording rule is not resolved until after a certification or installation project is initiated with the FAA.
- The NIWG is concerned that the FAA did not fully consider alternative methods to support accident investigation. Unlike analog voice communication which can sound different at the aircraft than at the ground transmitter, data link communications are protected by digital processing techniques that assure every message is delivered without error, or discarded. It is difficult to imagine scenarios in which recording of CPDLC messages in the cockpit would provide significant value over the recording of the messages by the ground system. Since CPDLC was implemented prior to the original rule, the FAA has been required to record messages by the ground system.
- ICAO and EASA requirements, and plans for requirements, have changed since 2008. Global harmonization is a key objective for the operators and the FAA should consider the relationship between US regulations and those of other States.

FAA program schedules have been defined, and the only clearance which is moving from a voice format to a data format before 2018 is a revised departure clearance. As the En route program is implemented, additional clearances will transition from voice to data. The current regulation requires recording of messages that will not be used for several years, making it even more difficult to justify the investment for some operators to install a DataCommunications capability.

Due to these concerns, the FAA should re-evaluate the data link recording rule and guidance. That evaluation should also consider the impact of any recommended changes to accident investigation, flight operations quality assurance programs, and the investments that some operators have already made in retrofitting a data link recording capability into their aircraft.

Use of FANS 1/A Over Media Other Than VDL Mode 2 in En route Airspace

Since the early investment analysis phase, the FAA's DataComm Program has focused on implementation of air-ground data link in the continental US, utilizing VHF Digital Link Mode 2 (VDL Mode 2). VDL Mode 2 is a digital air-ground communications protocol defined in a suite of complementary aviation standards including ICAO SARPS, RTCA MOPS (DO-281B), and ARINC Specification 631. Each of these standards outlines the airborne and ground system implementation requirements for VDL Mode 2 and was drafted specifically for Air Traffic Services DataCommunications.

Today most air transport aircraft are equipped with data link technology to support company communications for safety and regularity of flight. Plain Old ACARS (POA), or VDL Mode 0, is the legacy character oriented analog communications link developed in the 1970s to facilitate automated communication for airlines. Today airline company communications have greatly evolved and are supported on both POA and VDL Mode 2, however many airlines have not fully adopted VDL Mode 2 in their older aircraft.

FANS 1/A+ is the baseline air traffic services application in the FAA DataComm program. FANS 1/A+ supports both the VDL Mode 2 and POA air-ground media as well as a number of long range communications media including satellite communications. Today FANS 1/A is primarily used in oceanic and remote airspace using long range communications systems. FANS 1/A provides safe communications where traditional air-ground voice is impractical. Many operators have chosen to equip their aircraft that fly over oceanic and remote airspace with FANS 1/A. Since these aircraft do not spend a great amount of time over land, many of them are only equipped with POA and long range communication systems.

During the investment analysis phase of the program, the FAA received industry feedback through the DataComm Implementation Team (DCIT) and the RTCA 2011 DataComm Task Group requesting accommodation of POA since many of the long haul aircraft which are equipped with FANS 1/A are not equipped with VDL Mode 2. The FAA responded to the RTCA recommendation by providing an accommodation for FANS 1/A over POA for the Departure Clearance Service on the Airport Surface in the NAC response letter dated June 4, 2012.The FAA estimated in 2014 there are a significant number of air transport aircraft equipped with FANS 1/A that do not have VDL Mode 2. This number is expected to decrease over time as older aircraft are retired and aircraft operators upgrade to VDL Mode 2. The number of non-US registered FANS 1/A aircraft has not been assessed.

In oceanic and remote airspace operations, the FAA specifies that the aircraft operator is responsible for maintaining a specific Required Communications Performance (RCP) for the operation of FANS 1/A over their chosen long range communications media.

In domestic US airspace, the FAA Air Traffic Organization takes responsibility for the communications performance from the controller to the aircraft's antenna over VDL Mode 2. The FAA has specified VDL Mode 2 system performance requirements and has contracted with Harris Corporation to operate and monitor the service as part of the DataComm Integrated Services contract. The Communications Service Providers have stated to Harris that performance of POA is thebest effort and that performance guarantees for POA are not available for ATC operations.

The FAA has received continued feedback from aircraft operators to expand their accommodation of POA to the planned implementation in the domestic US En route airspace. The FAA has stated that if the POA were permitted as a primary air-ground media for FANS 1/A communications in domestic US En route airspace, the operator would be responsible for communications performance, similar to oceanic airspace. The FAA has indicated that the updated guidance materials for operators to seek operational approval for domestic En route DataCommunications only includes provisions for VDL Mode 2. Another update to the guidance material and a new aircraft operator application will be required if provisions are expanded to allow for FANS 1/A operations over POA.

The NIWG recommends that the FAA allow operators to use FANS 1/A+ over media other than VDL Mode 2, including POA, in domestic US En route airspace. Other media which meet the performance requirements may be used. If any media other than VDL Mode 2 is used, the operator would be

responsible for contracting with an air-ground communications provider and complying with any corresponding communications performance requirements.

Support/input regarding FANS1/A+ legacy installations
FANS 1/A+ is a mitigation means for messages which are delayed in the air/ground DataCommunications network, and then delivered to the flight deck leading to the potential for a superseded clearance being acted on by the aircrew. FANS-1/A+ refers to a function which either discards the message with a rejection notice to the ground, or annunciates the late time of delivery to the aircrew so that they do not act on the message without contacting air traffic control.

The FAA does not require FANS-1/A+ for Tower Services but does require FANS-1/A+ for En route services, in order to mitigate the latent message hazard. However, some aircraft have limited or no upgrade path and are unable to install FANS-1/A+. For these aircraft, the NIWG recommends that FAA consider alternate mitigation means for the latent message hazard.

En route Trials
The DCL (S1P1) Phase of the FAA's DataComm program has benefited from a comprehensive in-service trials program. This trials program, conducted for multiple years at Memphis and Newark airports and supported by FedEx, UPS, and United Airlines, along with the Air Traffic Control facilities serving those airports, has resulted in extensive changes to the original designs for DCL Services. Observations and changes arising from these trials have been significant enough that it is widely accepted among participants that the operational system would have failed upon introduction without the lessons learned in DCL (S1P1) trials.

Industry and the FAA collectively believe that, while such trials would benefit the En route (S1P2) Phase of the FAA's DataComm Program, they are not required for the successful deployment of En route Services. En route trials of a similar fidelity to surface trials are not practical and there are alternative risk mitigations. The NIWG recommends that as long as a collaborative and consultative issue resolution methodology with industry is carried forward into En route services, comprehensive S1P2 trials are not necessary.

Upon establishment of S1P2 baseline, NIWG recommends that DCIT be the forum for the collaboration and consultation with the DataComm Program for S1P2 En route testing and En route risk assessment and mitigation.

DataComm Appendix A

Departure Clearances - S1P1

Pacing Items	Description
Change in Roles	Yes. There will be a change in roles for FOC/Airline Dispatch Operations; DCL Clearances will be sent directly to the pilot and copies will be sent to FOC.
Technology/equipage Required	Yes. There will be some changes to technology/equipage required. Changes for pilots/aircraft and FOC/Airline Dispatch Operations will require the FAA to make changes to AC 20-170B and the A056-Ops Spec template for DataComm. There will be no major ATC policies required, but minor changes to facility directives and national clearance orders will be necessary.

ATM/TFM Automation	DataComm System: Applications in automation/TDLS, ERAM, ground-to-ground network (DCNS) assume shared ATS/AOC network.
Decision Support tools needed by controllers, and TFM specialists	No.
Training	Yes. Training will be needed. Pilots will need training for new users and minimal training for existing FANS 1/A users. Controller training will be required as they transition from PDC to DCL. There will be minor training requirements for FOC/Airline Dispatch Operations. Training will also be required for TFM.
Airspace changes	Yes. Airspace changes will be needed for Controllers, FOC/Airline Dispatch Operations and TFM. Standard automation route processing information needs to be modified to support routes that can be pushed to load into aircraft FMS. DataComm initiated route changes benefit FOC by more efficient flight planning and route segments to reduce workload.
Procedures	Yes. Changes to procedures will be needed for ATC and FOC/Airline Dispatch Operations. PODC procedures need to be revised for DCL. Current drafting is to split into two sections, one for legacy PDC and one for DCL (CPDLC-DCL) sites – 7110.113. DCL Operations will have clearances sent directly to the pilot and a copy is sent to FOC.
Policies	Yes. Changes to policies will be required. FAA AC 20-170B and A056-Ops Spec Template for DataComm will require changes. Minor changes to facility directives and national clearance orders will be needed for ATC.
Technical Standards	Yes. Technical Standards required have been published: RTCA DO-258A, RTCA DO-350 and ICAO GOLD.
Certification	Yes. Certification will be needed for ATC, FAA ground systems designed to meet safety and performance standards as required by RTCA DO-350.
Ops Approvals	Yes. Ops Approvals will be required for pilot/aircraft, AC20-170B and A056.
Political risks	Yes. Political risks exist and the program needs to be funded at adequate levels and a critical mass of operations must show support and value. If airlines are slow to equip and/or low number of aircraft operations there is a risk of ATC acceptance.
Environmental and noise-related risks	No.

Other	See Appendix C.

DataComm Appendix B

En route Services – S1P2

Pacing Items	Description
Change in Roles	Yes. There will be some change in roles for ATC and FOC/Airline Dispatch Operations. Controller responsibilities may change among controller teams at sector positions. FOC/Airline Dispatch Operations may require role changes in route changes sent.
Technology/equipage Required	Yes. Technology/equipage is required for Pilot/Aircraft and ATC. The baseline is FANS 1/A(+) and VDL Mode 2 (FANS 1/A(no +) and/or VDL Mode 0 long term use under evaluation using DO-350 SPR). Multi-Frequency VDL Mode 2 is required for newly equipped aircraft. ATC will leverage ground system infrastructure of the deployment of DCL and augment with En route services (ERAM, TDLS, FTI, DCNS).
ATM/TFM Automation	Leverage Ground system infrastucture deployment with DCL and augmented with En route data services (ERAM, TDLS, FTI, DCNS).
Decision Support tools needed by controllers, and TFM specialists	Maybe. There may be possible changes for TFM with the integration of DataComm with TFM to enhance the benefits.
Training	Minimal for existing FANS 1/A users; yes for new users such as domestic medium haul fleet. Controller training will be required.
Airspace changes	Yes. Airspace changes will be needed for ATC and TFM. Standard automation route adaption and some publication revisions will be required to accommodate uplink of routes to aircraft or aircraft FMS.
Procedures	Yes. ATC will need En route procedures to be revised as initial and full services come online.
Policies	Yes. Changes to policies will be required. FAA AC 20-170B and A056-Ops Spec Template for DataComm will require changes. Minor changes to facility directives and national clearance orders will be needed for ATC Technical Standards.
Technical Standards	RTCA DO-350 published initial release. Final release by 2016 in process with RTCA SC-214. DO-258A.
Certification	No.
Ops Approvals	Ops Approvals will be required for pilot/aircraft, AC20-170B and

	A056.
Political risks	Political risks exist, program needs to be funded at adequate levels and a critical mass of operations must show support and value. If airlines are slow to equip and/or there is a low number of aircraft operations, there is a risk of ATC acceptance.
Environmental and noise-related risks	No.
Other	See Appendix D.

DataComm Appendix C

39-Surface DataComm DCL

	Change in Roles	Technology/Equipage Required	Technology/Equipage Available?	Decision Support Tools Required	Need Policy	Need Procedures	Implementation Bandwidth	Need Airspace Changes	Standards Required?	Ops Approval Required	Cert Required	Political Risk	Links to Planning Documents	Training	Other Challenges
Pilot/Aircraft	No	Yes, DCL baseline is FANS 1/A and VDL Mode 2 (FANS 1/A and VDL Mode 0 (POA), plain old ACARS, is permissable for DCL)	Yes, FANS 1/A(+) available, VDL Mode 2 and VDL Mode 0 are availible,	No	Changes required to FAA AC 20-170B and A056-Ops Spec Template for Data Comm	No, existing oceanic FANS 1/A procedures leveraged for DCL	Varies by operator. Equipage Initiative program projected upward of 1,900 aircraft by 2018. FANS 1/A over VDL Mode 2 Equipped: 350 FANS 1/A over VDL Mode 2 Retrofit: 1600 FANS 1/A over VDL Mode 2 Forward Fit: 500 FANS 1/A over VDL Mode 0: 500	No	RTCA DO-258A & ICAO GOLD published.	Yes, ops approval will be required, AC20-170B and A056	No FANS 1/A or VDL Mode 2 certification required for most air transport aircraft. Regional aircraft and some buisness aircraft need FANS 1/A certification. Clarification on recorder rule for retrofit aircraft.	Program funded at adequate levels. Critical mass of operators show support and value - "If you build it, they will come"	FAA NGIP; FAA Enterprise Architecture; RTCA, AEEC, and ICAO Standards; DCIT	Minimal for existing FANS 1/A users, yes for new users such as domestic medium haul fleet	Meeting commitments for Equipage MOU and FAA Ops approvals. Recorder rule interpretations continue to challenge buisness case. Single pilot operations- Define human factors input, when can be used & what equipage
ATC	No	Data Comm System: Applications in automation/TDLS, ERAM, ground-to-ground network (FTI), and air-to-ground network (DCNS), assume shared ATS/AOC network.	Ground system infrastucture already exists and is being modified and upgraded to support DCL: (ERAM, TDLS, DCNS)	No	No major ATC policies required. Minor changes to facility directives and national clearance orders	Yes. PDC procedures need to be revised for DCL. Current drafting is to split into two sections one for legacy PDC and one for DCL (CPDLC-DCL) sites - 7110.113	Target 56 airports (57 towers)identified. Baselined IOC & post IOC waterfall created. Minor additions to VDL Mode 2 network, TDLS version 12 software, ERAM release EAD deployment, end-to-end service verification testing. (Note: Code will be in all TDLS the towers, but it will not be turned on in all TDLS towers, but it can be enabled later)	Yes, Standard automation route processing information needs to be modified to support routes that can be pushed to load into aircraft FMS.	RTCA DO-350 published ICAO GOLD published.	No	FAA ground systems designed to meet safety & performance standards as required by RTCA DO-350	Airlines slow to equip and/or low number of aircraft operations risk ATC acceptance	FAA NGIP; FAA Enterprise Architecture; RTCA, AEEC, and ICAO Standards; DCIT	Controller training will be required, uplift from PDC to DCL.	Funding for DCL trials in MEM/EWR beyond Sept 2014. Funding for additional 16 TDLS tower sites.
FOC/Airline Dispatch Operations	Yes. DCL clearance sent directly to pilot and copy is sent to FOC.	No air/ground message cost to operators withFANS VDLM2 FANS VDLM0/SAT based will have service cost	Yes, additional minor updates to flight planning (ICAO Flt Plan & J Identifier Codes) & ground communications interface options May require AOC automation changes - they will no longer deliver the message to the aircraft.	No	Changes required to FAA AC 20-170B and A056-Ops Spec Template for Data Comm	Yes for DCL Operations, clearance sent directly to pilot and copy is sent to FOC	Minor ground system changes required. May vary by operator, typically configuration of flight plan systems	Data Comm initiated route changes benefit FOC by more efficient flight planning, route segments to reduce workload	No	No	No	No	DCIT	Yes (minor)	Capture of lessons learned from trials, collection of metrics critical to providing DCL benefits.
TFM	No	No	Yes	No	No	No	Yes	Yes, Standard automation route adaptation & some publication revisions required to accomidate uplink of routes to aircraft or aircraft FMS	No	No	No	None	FAA NGIP; FAA Enterprise Architecture; RTCA, AEEC, and ICAO Standards; DCIT	Yes	None Staying informed with work with CDM-Go button to ensure works with program
FSS	No	No	Yes	No	No	No	N/A	No	No	No	No	None	N/A	No	None

DataComm Appendix D

17a-En route DataComm

	Change in Roles	Technology/ Equipage Required	Technology/ Equipage Available	Decision Support Tools Required	Need Policy Changes	Need Procedures	Implementation Bandwidth	Need Airspace Changes	Standards Required	Ops Approval Required	Cert Required	Political Risk	Links to Planning Documents	Training	Other Challenges
Pilot/Aircraft	No. Roles well establihsed from oceanic Data Comm (ICAO GOLD)	Yes, baseline is FANS 1/A+ and VDL Mode 2 (FANS 1/A, no +, and/or VDL Mode 0 long term use under evaluation using DO-350 SPR). Multi-Frequency VDL Mode 2 required for newly equipped aircraft.	Yes, FANS 1/A(+) available, VDL Mode 2 and VDL Mode 0 are availible, Baseline 2 Standards Published (RTCA DO-350), products not availible.	No	Changes required to FAA AC 20-170B and A056-Ops Spec Template for Data Comm	No, existing oceanic FANS 1/A procedures leveraged for En Route Data Comm Maybe Standard Operator Procedure Changes.	Varies by operator. Equipage Initiative program projected upward of 1,900 aircraft by 2018. FANS 1/A over VDL Mode 2 Equipped: 350 FANS 1/A over VDL Mode 2 Retrofit: 1600 FANS 1/A over VDL Mode 2 Forward Fit: 500 FANS 1/A over VDL Mode 0: 500	No	RTCA DO-350 published initial release. Final release by 2016 in process with RTCA SC-214. DO-258A.	Yes, ops approval will be required, AC20-170B and A056	No FANS 1/A or VDL Mode 2 certification required for most air transport aircraft. Regional aircraft and some buisness aircraft need FANS 1/A certification. Clarification on recorder rule for retrofit aircraft.	Program funded at adequate levels. Early operational benefits from enroute trials may be needed for operator buy-in.	DCIT	Minimal for existing FANS 1/A users, yes for new users such as domestic medium haul fleet	Meeting commitments for Equipage MOU and FAA Ops approvals. Recorder rule interpretations continue to challenge buisness case. Global harmonization plan with Baseline 2 (DO-350) a neccessity for long term buisness case. Multi-frequence not planned until enroute services deployment. At some stage there will be a need for J Codes for alternate implementation scenarios.
ATC	Possible change of controller responsibilities among controller team at sector position (Will work on language)	Leverage Ground system infrastucture deploymened with DCL and augmented with enroute data services (ERAM, TDLS, FTI, DCNS)	Ground system deveopment required (ERAM, TDLS)). DCNS based on VDL Mode 2 infrastructure enables enroute service volumes.	No. Other NextGen capabilities will be able to leverage data comm services.	No major ATC policies required (minor changes to existing facility directives)	Yes. En Rroute procedures to be revised as initial and full services come online.	ERAM deployment strategy. ERAM release capacity to support the following DataCom capabilities including: transfer of communications, initial check in, altimeter settings, altitudes, airboune reroutes/go button, controller initiated routes, direct-to-fix,crossing-restrictions, tailored arrivals, holding instrctions, advisory messages, speed and headings, beacon codes and stuck microphone.	Yes, Standard automation route adaptation & some publication revisions required to accomidate uplink of routes to aircraft or aircraft FMS	RTCA DO-350 published initial release. Final release by 2016 in process with RTCA SC-214. DO-258A.	No	FAA ground systems designed to meet safety & performance standards as required by RTCA DO-350	Airlines slow to equip and/or low number of aircraft operations risk ATC acceptance.	DCIT	Controller training will be required	Funding and definition for enroute trials, defined ERAM release schedule, S1P2 enroute baseline. VDL Mode 0 long term use under evaluation.
FOC/Airline Dispatch Operations	Route changes sent. (Conversation in DCIT)	No	Yes, dispatch can receive copies of ATC datalink clearances (Conversation in DCIT)	No (Conversation in DCIT)	No	No (Conversation in DCIT)	N/A	No	No	No	No	No	DCIT	No (Conversation in DCIT)	By-in by operators to provide input into benefits & operational efficiencies.
TFM	No	No	No	Possible changes to integrate Data Comm with TFM to enhance the benefits. (Conversation in DCIT)	No	No	No	Yes, Standard automation route adaptation & some publication revisions required to accomidate uplink of routes to aircraft or aircraft FMS	No	No	No	None	DCIT	No Because of data comm encementments: possible updated training or briefing for TFM personnel	None
FSS	No	No	Yes	No	No	No	N/A	No	No	No	No	None	N/A	No	None

Performance Based Navigation (PBN)

Introduction

PBN presents significant potential for improvement in the efficiency of the aviation system. However, this focus area presented significant challenges for the Team because of the numerous potential sites and the variety of PBN "types". The selection process also required a balancing of perspectives and views of the Industry members because of the variation in purposes and goals of PBN implementations.

The Team chose to respond to these challenges by identifying several existing PBN implementation efforts already underway by the FAA that provide improvements for access and efficiency. In addition, the Team identified opportunities that can lead to valuable "tools" being made available for future PBN implementations. Finally, the Team also recognized that the FAA-Industry partnership provided the ability to focus on a key site that represents an important step forward among the various locations being considered by the FAA for PBN implementation. The selection criteria used by Industry members of the Team to determine applicable sites were:

- Are the issues to be addressed representative of challenges across the NAS?
- Will the solution be scalable to other locations?
- Is there a benefit to operators?
- Are procedures already in place?
- Is the site prepared for PBN procedures?
- What is the geographic location of the site?
- Are the tools and ATC procedures required available for controllers?

Industry members of the Team identified the following efforts for developing the PBN Implementation plans:

Metroplex

Northern California
- Multiple airports in close proximity
- Advanced aircraft capabilities
- Integrated traffic flows

Atlanta
- Large hub where delay impacts can propagate across NAS
- Complex airspace environments
- Mixed traffic types
- Related to Charlotte Metroplex

Charlotte
- Large hub where delay impacts can propagate across NAS
- Complex airspace environments
- Mixed traffic types
- Related to Atlanta Metroplex

Established on RNP (EoR)

RNP Authorization Required (RNP AR) – Recommended target: Denver International Airport (KDEN)
- RNP AR procedures flown in combination with visual approaches to adjacent runways
- Safety case memo received in June 2014
- Widely-spaced runway configuration

- New separation would increase opportunity to use RNP AR and increase efficiency and decrease controller workload

RNP Track-to-Fix (TF) Safety Analysis
During discussion by the Team members, the use of Track to Fix was identified as an important alternative in locations that currently have AR/RF procedures.[5]

- High volume airport
- Low percentage of RNP AR/RF capable aircraft resulting in a mixed equipage environment
- FAA commitment for safety analysis and separation standards has been established
- Investigate if TF designs based on standard criteria would provide benefit that would expand operators who can use RNP procedures
- Cross-aviation community acceptance and alignment

EoR National Standard
To nationalize the ability to apply widely-spaced RNP AR operations, a document change proposal is required. Upon completion of the safety analysis work the FAA will continue to develop and process a national standard to enable deployment throughout the NAS. Upon completion, EoR RNP AR widely-spaced operations will be available through the Metroplex and non-Metroplex processes for any location in the NAS.

Equivalent Lateral Spacing Operations (ELSO)

National standard[6]

- Important NextGen capability for Metroplex implementation
- Fully leverages available benefits of new runway at FLL
- Optimize traffic flows through adjacent airport deconfliction
- Mixed traffic types with a high percentage of General Aviation (GA) operations at FLL

Single Site

Industry members of the Team identified two key locations: Las Vegas was determined as the final location with FAA commitments and Louisville became an alternate location. Louisville activities are being pursued using the processes in FAA Order 7100.41.

Las Vegas Basin[7]

- Complex airspace environment

[5] Recommended target: Future implementation at Hartsfield-Jackson Atlanta International Airport (KATL).
[6] ELSO consideration includes Miami International Airport (KMIA) and Fort Lauderdale-Hollywood International Airport (KFLL) as the first possible PBN implementation to inform. Others sites meriting ELSO consideration after MIA/FLL include: Chicago O'Hare International Airport (KORD), Charlotte/Douglas International Airport (KCLT), and George Bush Intercontinental Airport (KIAH).
[7] The Team strongly endorses the use of PBN in the Las Vegas Basin. During discussion, the Team did not reach a consensus that the Metroplex program (OAPM) should be used; operator members in particular were averse to Metroplex as a desired initial step in moving forward for the Las Vegas Basin as there may be quicker options available. The Team is committed to work with the FAA to develop a comprehensive plan that includes the commitment by aircraft operators and air traffic controllers to design, deploy and subsequently use improved and optimized PBN procedures. This work would include an evaluation and analysis of the previous design work to determine what can be used in the deployment of future procedures. The mechanism for moving forward, be it through Metroplex or as a "Single site", will be determined once the FAA completes the initial assessment.

- Industry has the view that designs were completed and can be leveraged to move forward, although no designs were implemented. An assessment is currently being undertaken under the guidance of the FAA.
- Mixed traffic types with a high percentage of GA operations and tour operators at LAS.
- Adjacent airports that have potential for significant benefits that could be achieved by GA traffic.

Louisville

- Traffic mix
- Highly-equipped fleet
- NextGen technologies "laboratory" – Surveillance/Navigation/Communication
- PBN offers substantial benefits for this airport in terms of optimized profile descents (OPDs) and benefits to Terminal Radar Approach Control (TRACON) efficiency.

Milestone Activities

Metroplex

FAA is already undergoing procedure development efforts at Metroplex sites throughout the NAS, which are in varying phases of the process. For this activity, the Team has selected three priority focus sites to evaluate and assess implementation progress utilizing the identified Office of Management and Budget (OMB) milestones: Northern California Metroplex, Atlanta Metroplex, and Charlotte Metroplex.

The **Northern California Metroplex** site has completed the Study, Design, and Evaluation phases of the Metroplex process. There are 32 procedures planned on the National Strategic Production Plan (NSPP), to include procedures for San Francisco International Airport (KSFO), Sacramento International Airport (KSMF), Oakland International Airport (KOAK), and San Jose International Airport (KSJC). This Metroplex site also has 8 RNAV Air Traffic Service (ATS) routes (Q-routes) planned on the NSPP. Having achieved a signed Finding of No Significant Impact (FONSI)/Record of Decision (ROD) on August 7, 2014, this site is now in the Implementation phase of the Metroplex process.

The **Atlanta Metroplex** has completed the Study, Design, and Evaluation phases of the Metroplex process. There are 57 procedures planned for KATL on the NSPP. There are 10 procedures proposed for adjacent airports, to include Greensboro Airport (KGSO), Greer-Greenville Spartanburg Airport (KGSP), Raleigh Durham International Airport (KRDU), and Charleston Air Force Base Airport (KCHS). Given the proximity and interconnectivity, this Metroplex site is currently being coordinated closely with the Charlotte Metroplex site. The Atlanta Metroplex site is awaiting the start of the Implementation phase.

The **Charlotte Metroplex** site has completed both the Study and Design phases of the Metroplex process. There are 46 procedures proposed for KCLT on the NSPP, as well as the previously identified 10 procedures planned for the adjacent airports shared with the Atlanta Metroplex site. The Charlotte Metroplex site has started the Evaluation phase.

Capabilities

Operational Capability 108209: Increase Capacity and Efficiency using Area Navigation (RNAV) and Required Navigation Performance (RNP).

Scope

FAA will develop procedures at Metroplexes to improve airspace efficiency. FAA will perform integrated airspace design and associated activities, including traffic flow analysis, arrival and departure route

design, and procedures optimization. This will lay the foundation for future development of PBN initiatives. Airspace and procedure integration in Metroplexes:

- Examines the use of additional transition entry and exit points that are not tied to ground-based navigation aids
- Develops and implements arrival and departure procedures concurrently
- Integrates the approach for optimizing procedures
- Decouples conflicting operations to and from primary and secondary/satellite airport serviced by the same complex terminal airspace
- Develops high altitude routes through congested airspace to create more efficient routes between major metropolitan areas

- Implementation of RNAV and RNP routes and procedures will help accelerate NextGen concepts, maximize benefits, and continue to address the RTCA Task Force 5 (TF5) recommendations to optimize and increase the use of RNAV operations and institute tiger teams that focus on quality at each location (TF5 Operational Capabilities: 20, 32a).
- Integrate procedure design to deconflict airports, implement RNP with RF capability and expand the use of terminal separation rules (TF5 Operational Capabilities 4, 21a, 32b).

Expected Benefits

The Metroplex optimization benefits are part of NextGen benefits which indicates that by 2020 NextGen will reduce aircraft CO2 emissions by 14 million metric tons and fuel consumption by 1.4 billion gallons. These benefits, combined with a projected 38 percent reduction in aircraft delays in the air and on the ground, are expected to generate $24 billion in savings for aircraft operators, the traveling public, and FAA. Specific attribution of Metroplex quantitative benefits is pending implementation of the first pilot-sites: Washington, North Texas, and Houston Metroplex in FY14.

Airspace redesign and procedure development will be accomplished with a Metroplex focus, targeting specific Metroplex areas that have been designated as high priority using quantitative and qualitative metrics. Study Teams will use these results to implement those improvements providing the highest benefits and design work that will include analyses and simulations, assessments of alternatives, and modeling of projected airspace and procedure benefits. Qualitative and quantitative expected benefits achievable at a Metroplex site can include:

- **Access and Equity:** PBN application in the Metroplex allows for additional exit points and the potential for earlier route divergence.
- **Capacity:** Reductions in lateral track distances.
- **Efficiency:** Reductions in flight distances and increases in flight efficiency due to better altitude profiles; Improved connectivity to En route structure through additional PBN structure in terminal airspace.
- **Flexibility:** Optimization of arrival and departure vertical profiles.
- **Safety:** Reduced need for Traffic Management Initiatives (TMIs) due to provision of additional exit points/earlier route divergence; Provision of PBN structure that will form the foundation for NextGen capabilities (e.g. use of Required Time of Arrival).
- **Environment:** Reduced fuel emissions.

Implementation Plan with Milestones – Overview

FAA will complete the implementation of Northern California Metroplex, Q3 CY 2015.
FAA will complete the implementation of Atlanta Metroplex, Q2 CY 2017.

FAA will complete the implementation of Charlotte Metroplex, Q2 CY 2017.

Established-on-RNP (EoR)

EoR allows ATC to clear aircraft on an RNP approach with a turn to final without providing the current minimum of 1,000 feet vertical or 3 miles radar separation from aircraft established on approaches to parallel runways (as noted in FAA Order 7110.65 para 5-9-6 and 5-9-11). EoR provides safety, reliability and efficiency benefits in the NAS while improving customer service and minimizing delays En route and on the ground.

This activity is under Advanced Concepts Research and involves safety analysis, flight standards safety risk assessment and creation of a national standard to enable national implementation of the capabilities. Safety analysis of simultaneous RNP AR procedures for widely-spaced runways has begun with KDEN as the key site. RNP TF procedures will be a key activity for FAA work activities.

Capabilities

Operational Capability 108209: Advanced and Efficient RNP

Scope

Two important aspects impacting the ability to implement PBN are:

- Mixed equipage—will remain an issue for many capabilities and it is a reality that must be addressed as a part of any implementation strategy.
- Near term delivery of capabilities—will maximize the use of existing aircraft equipage, with no broad-based fleet upgrades required.

Therefore, exploring advanced RNP procedures to maximize utility of RNP-equipped aircraft is also important. This is a NAS-wide effort utilizing developmental sites (Seattle, Denver and Atlanta) for research, analysis and concept validation.

Dependent Ops/Seattle EoR focus:

- Dependent Simultaneous Parallel Dual Arrivals (runway separation: 2,500'-4,300')

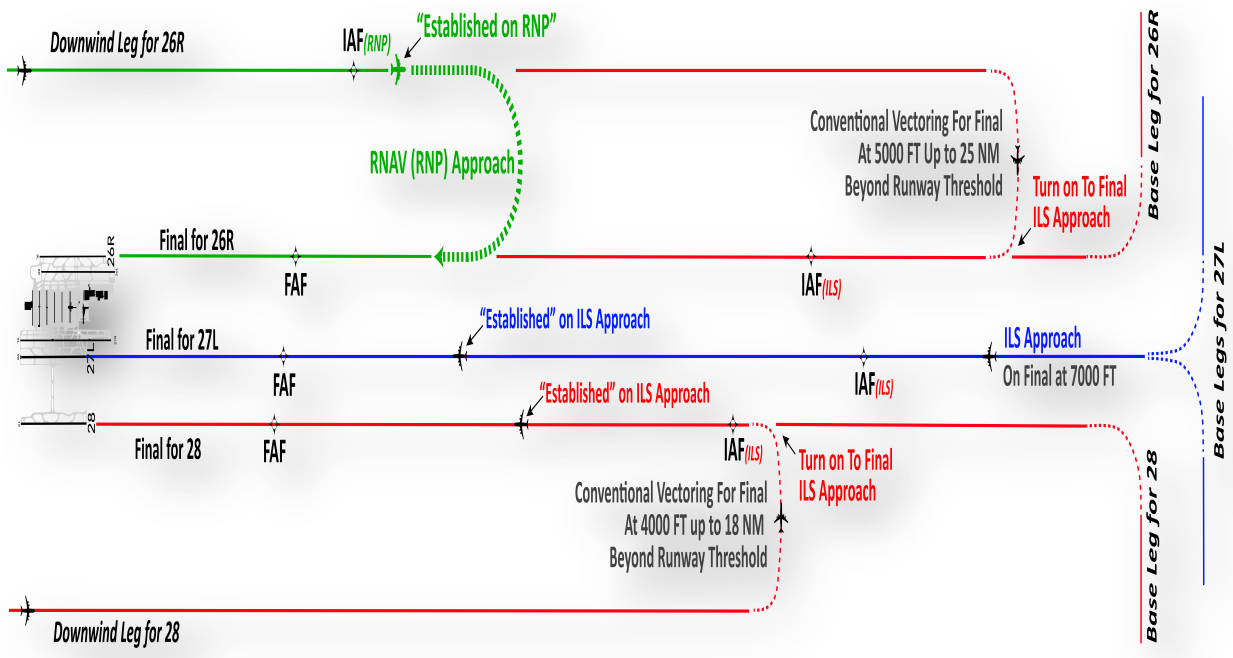
Independent Ops/Denver and Atlanta EoR focus:

- Independent Simultaneous Parallel Widely-Spaced Arrivals w/o Monitors (runway separation: 9,000'+)
- Independent Simultaneous Parallel Dual Arrivals (runway separation: 3,600'-9,000')
- Independent Simultaneous Parallel Triple Arrivals (runway separation: 5,000'+)

Not all aircraft and crew are equal with regards to their level of RNP equipage and certification. In order to design a solution that is implementable in the NAS, especially at high volume airports, the solution must incorporate the capabilities of a mixed equipage fleet or the operations will not be repeatable and manageable by ATC.

Therefore, the FAA program will be analyzing and evaluating approach procedures that incorporate mixed equipage performance capabilities in conjunction with various runway configurations with a goal of designing NextGen procedures that accommodate the greater percentage of aircraft in the NAS. These scenarios will include but are not limited to aircraft that can perform either RNP Authorization Required (RNP AR), RNP with Radius to Fix (RNP RF) Turns, RNP with Track to Fix (RNP TF) Turns, TF to ILS capture procedures and RF to ILS capture procedures.

EoR Conceptual Diagram



Safety analysis for EoR TF approaches

As a result of recommendations from industry to enable capability that reaches the broadest categories of operators in a mixed equipage environment, the next area of research will be RNP approaches (procedures titled "RNAV (GPS)"), also requiring Global Positioning System (GPS) equipage, using TF legs/ fly-by turn construction and conducted as simultaneous, independent operations. Unlike RF turns with a specified ground track, TF legs/ fly-by turns allow for more variability in flown path, which decreases path repeatability to some degree but is accounted for in operational design. The analysis will not include a requirement for vertical guidance, although this would likely be an optional feature available on most procedures when implemented. These choices reflect capabilities resident in a high percentage of air transport and general aviation aircraft. Similarly, with respect to potential participation, an overwhelming majority of commercial operators hold the required FAA operational authorization for RNP approach operations (not required for most GA operators). The results of the study will inform which runway configurations are best suited to RNP approaches utilizing TF. All separation reductions are dependent on successful completion of safety analyses which show that the proposed procedure meets the FAA standard for safe operations. Any objectives included in this plan are subject to change based upon the results of the safety analyses. Satisfactory conclusion of the FAA safety process is essential prior to implementation of procedures.

The FAA provided a quick-look analysis of airports with configurations and traffic counts that could benefit from the introduction of RNP approaches utilizing TF legs/ fly-by turns. Industry provided a consensus view that the following priorities should be considered for implementation once the safety case is completed. It is understood that some locations will not be able to implement RNP approaches with TF and others may not experience the full benefit of the capability until tools are made available to controllers which support merging and sequencing of traffic utilizing these approaches with other traffic

patterns. To this end, the FAA is encouraged to prepare plans and take the necessary steps to enable prompt deployment and use of RNP approaches with TF procedures when such tools are in place.

- KATL
- KCVG
- KCLT
- KORD
- KDFW
- KDEN
- KIAD
- KIAH

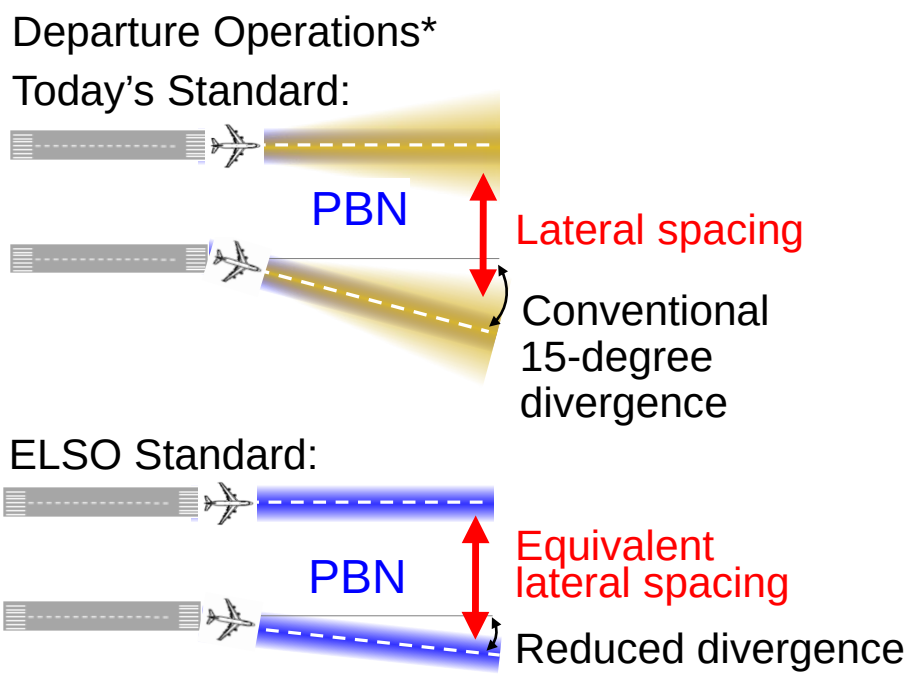
Implementation Plan – Overview
FAA will begin EoR Widely Spaced Operations at Denver, Q3 CY 2015.
FAA will develop an EoR Widely Spaced Operation National Standard by Q2 CY 2017.
FAA will complete the EoR Track-to-Fix of fly-by approach safety analysis by Q4 CY 2015.

Expected Benefits
The EoR operations will allow for opportunities for increased arrival efficiency through shorter, repeatable and predictable/stabilized operations. EoR is focused on reducing arrival track miles by leveraging the capabilities provided by modern aircraft avionics coupled with existing or modified ATC procedures, practices and policies. The reduced track length will equate to less fuel burn, improved environmental footprint(s), decreased noise exposure and reduced communications between pilots and controllers. Overall it is expected that EoR will provide safety, reliability and efficiency benefits in the NAS.

Equivalent Lateral Spacing Operation Standard (ELSO)

Capabilities
Operational Capability 108209: Equivalent Lateral Spacing Operation Standard (ELSO)

Scope
The ELSO concept provides lateral spacing between reduced-divergence paths of PBN departure operations that is equivalent to the spacing observed in conventional departure operations at minimum requirements of the currently applicable divergence standard (15 degrees). Capitalizing primarily on the improved navigational precision of PBN, these reduced-divergence departure paths provide benefit by improving the ability of parallel and same runway operations to do the following: address terrain, obstacle, or noise sensitivity constraints; increase departure capacity or throughput during peak demand periods; reduce departure delay associated with taxi-out time; and reduce fuel burn and emissions.



* Simultaneous departure operations (independent)

Using procedure design criteria waiver, KATL was able utilize ELSO to add a fourth departure route in each airport operational configuration based on a PBN-enabled reduction in departure course divergence, making better use of the existing 16 SIDs. ELSO has permitted diverging departure operations from two additional runways. Net benefits to users were estimated to be over $19 million based on 2011-level departure demand (roughly $44 per ATL departure).

FAA is in the process of developing standards that will allow for application of ELSO at eligible locations across the NAS. A quick-look benefits analysis was conducted and presented to the NIWG. Among the potential candidate sites, industry prioritized four locations with the potential for operationally advantageous implementation. The locations are KMIA/KFLL, KORD, KCLT, and KIAH. The FAA commits to completing the national standard and making this capability available for all NAS locations benefiting from this operation. The FAA will use the Metroplex and Single site processes to deploy the capability. Language/restrictions in the national standard could impact the benefits case for sites identified by industry.

Implementation Plan – Overview
FAA will establish the ELSO National Standard by Q2 CY 2015.

Single Site

Operational Capability 107103 – RNP AR Approaches, RNAV SIDs and STARS at Single Sites
Recognizing that Metroplex is already addressing many sites in the NAS that share these characteristics, the consensus of the Team was that the successful completion of the procedure and airspace design changes in the Las Vegas Basin would be the most beneficial Single Site project for the NAS. The Team also identified Louisville as an alternate.

The Team recognized that significant design work was accomplished in the past for the Las Vegas Basin and that challenges to implementation do exist. FAA is committed to working with Industry and NATCA to assess the current state of work at Las Vegas Basin and to determine what can be used in the deployment of future procedures. The mechanism for moving forward will be determined once the FAA completes the assessment. Industry is committed to work with the FAA to develop a comprehensive plan that includes the commitment by aircraft operators and air traffic controllers to design, deploy and subsequently use improved and optimized PBN procedures.

Implementation Plan – Overview

FAA will complete the Las Vegas basin assessment. Activity is ongoing at time of writing, with completion due Q4 CY 2014.

Additional Single Site Activities

FAA Modernization and Reform Act of 2012, HR658, Section 213

The FAA Modernization and Reform Act of 2012, HR658, Section 213 a/b provides requirements for PBN Development. This language mandates development of RNP/RNAV procedures at Core 30 (formerly 35 airports known as Operational Evolution Partnership, or OEP) to be completed by June 30, 2015, and 35 Non-OEP airports by June 30, 2016. The language defines success for the Core 30 as an airport with an RNP/RNAV procedure; and Non-OEP airports would be compliant if an airport has an RNP AR procedure. The goal is to establish a base framework of satellite-based RNAV/RNP capable airports that should relieve dependency on terrestrial NAVAIDs resulting in long term cost savings.

Through the NIWG, FAA SMEs provided industry with current plans and progress toward the Section 213, but after discussion, the industry group felt that this work was not representative of a NAS-wide effort that was representative of the challenges of PBN; although they understood and appreciated the progress of the work.

The FAA remains committed to completing the effort within the timeline provided. As of June 26, 2014, 83% of the planned procedures are complete for the Core 30 (Section A), and 73% are complete for the non-Core airports (Section B).

* Note that this data excludes RNAV (GPS) WAAS procedures which if included would show this effort completed.

WAAS

The U.S. Wide Area Augmentation System (WAAS) is able to provide a vertically-guided LPV approach based on augmented satellite navigation at all instrument runways where terrain and navigation permit. No ground navigation infrastructure is required. The LPVs provide approach minima equivalent to the Instrument Landing System (ILS) and allow for a stabilized approach in instrument conditions, improving safety. Where vertically-guided approaches cannot be provided, WAAS provides a non-precision LP approach. Additionally, WAAS allow operators to plan to use non-precision LNAV approaches at required alternate airports. There are currently 3,423 LPVs and 521 LPs in the National Airspace System, with about 400 more runways to complete.

PBN Appendix A - Pacing Items

The following pacing items were developed as the elements critical to the successful transition to NAS-wide PBN Operational Capability:

Metroplex

Pacing Items	Description
Change in Roles	N/A
Technology/Equipage Required	Metroplex does not require modification of aircraft avionics. Current RNP/RNAV avionics/equipage are part of the program, however, the cost/benefit does not exist for the vast majority of GA aircraft to equip for RNP AR.
ATM/TFM Automation	The extensive use of OPDs along with the creation of new dual-feed arrival routes at many Metroplex sites has resulted in a focus on decision support tools and automation, specifically Time Based Flow Management (TBFM). In order to achieve the benefits of OPDs and a PBN structure, aircraft need to fly the procedures with limited controller intervention. In high-density environments, metering – potentially through the application of TBFM – could help enable these operations. FAA merging and spacing tools are severely lacking. At the time of the TF5 recommendations, Relative Position Indicator (RPI) was identified as a key technology to accomplish terminal merging and spacing, although that tool has since become obsolete. TSS is the latest tool selected by FAA for application in the TBFM development strategy. As a result, TSS and integration of TMA with TSS are key gaps that FAA must be prioritized at the highest level. Metroplex has taken an integrated approach to procedure design and metering, and metering and decision support considerations and testing have been fully integrated into the Metroplex processes. Metroplex incorporates human-in-the-loop testing of TBFM and ensures support is provided from second-level engineering and the TBFM National Operations Team. This ensures that automation and decision support are considered prior to implementation to enable a smooth transition to the new operation.
Decision Support tools needed by controllers, and TFM specialists	Same as above.
Training	Air traffic controllers and pilots are trained by their organizations/companies in accordance with the ATC training plan developed for each Metroplex site, and conducted in the

	Implementation phase. Each organization/company covers the associated costs of their particular training activities. FAA is responsible for providing ATC training. Any changes required to phraseology, separation standards, and directives must be included in 7110.65 as necessary.
Airspace changes	FAA will integrate airspace design and associated activities, including traffic flow analysis and facilitated design and procedures optimization. This will lay the framework for accelerating PBN initiatives, taking a systems approach for airspace design and procedure implementation. Implementation of RNAV and RNP routes and procedures will continue to address the RTCA Task Force 5 recommendations, maximizing benefits, and accelerating NextGen concepts.
Procedures	Airspace redesign and procedure development will be accomplished with a Metroplex focus, targeting specific Metroplex areas that have been designated as high priority using quantitative and qualitative metrics. Results from Study Teams will be used to implement those improvements yielding the highest benefits and lead to design work that will include analyses and simulations, assessments of alternatives, and modeling of projected airspace and procedures benefits. The program integrates the safety requirements, through all phases of implementation, to ensure successful implementation.
Policies	Metroplex solutions are focused on optimizing procedures and traffic flows, and may include airspace structure changes to support those optimal routings. Specific operational changes include converting conventional procedures to PBN, mitigating level-offs on arrivals (through the design and implementation of OPDs), segregating arrival routes to de-conflict flows, adding departure points, expediting departures, adding new high-altitude PBN routes, and realigning airspace to support those changes, including T/Q routes within the context of the Scope of Work for each Metroplex site and in reference to the National Route Structure Plan Concept of Operations (in draft).
Technical Standards	(Add the order numbers that AJV is using for their design work)
Certification	Existing airworthiness certification standards for aircraft with RNAV 1 capability are sufficient.
Ops Approvals	Existing RNAV 1 operational approvals are expected to be sufficient.
Political risks	Executive and legislative support are documented through appropriation increases, and permitted acceleration is documented for this program. Local governments and airport authorities have been extremely cooperative and engaged at all active sites.

Environmental and noise-related risks	Metroplex is limited to designs that qualify for a CATEX and/or Environmental Assessment. To date, all sites are preparing Environmental Assessments to evaluate the impacts of the designs.
Other	N/A

Established on RNP

Pacing Items	Description
Change in Roles	Controllers are not required to vector aircraft. The aircraft are brought together on the parallel approach tracks via a pre-defined lateral path that is stored in the on-board navigation database and flown by the path and guidance functions of the AFCS.
Technology/equipage Required	Established on RNP operations do not require modification of aircraft avionics; current RNP approach equipage is believed to be sufficient (safety analysis has yet to confirm).
ATM/TFM Automation	In- trail spacing of aircraft must be managed to ensure the maximum arrival rate is maintained to the runway. This task is made more challenging for the traditional tactical air traffic control function by the increased complexity of the defined PBN path to join the parallel arrival track to the runway. Automation is necessary to provide accurate time management for the merging and spacing of aircraft along the defined arrival path.
Decision Support tools needed by controllers, and TFM specialists	A TBFM tool is required to maintain maximum runway arrival capacity during parallel arrivals with EoR procedures. TSS is the most common tool in the current development strategy but TSS and integration of TMA with TSS is a key FAA gap that must be prioritized at the highest level.
Training	Existing Flight Crew training for RNP procedures is expected to be sufficient for EoR. Controllers will require additional training in the use of TSS and the specific application for EoR Operations.
Airspace changes	None are expected as the procedures are expected to keep the aircraft within the range of existing tracks and vertical profiles of aircraft on visual or vectored turns to align with the extended runway centerline.
Procedures	RNP approach procedures will need to be designed for RF or TF leg types, as appropriate, and published for the intended aircraft population.
Policies	Current parallel approach procedures require 1,000 feet vertical or 3 miles radar separation of aircraft until established on the parallel localizers. A Safety Case is in process to establish

	equivalent performance to localizer tracking for aircraft established on RNP procedures that will not be aligned with the runway centerline. A successful Safety Case will support local waivers to validate operational concepts and a Document Change Proposal to amend Order 7110.65 to support EoR operations to parallel runways.
Technical Standards	Order 7110.65.
Certification	Existing airworthiness certification standards for RNP and RNP AR approach aircraft are sufficient.
Ops Approvals	Existing RNP approach operational approvals are expected to be sufficient.
Political risks	EoR Operations are broadly expected to provide significant improvements in parallel runway operational efficiencies, and reduced environmental impact where opportunities exist. These benefits will not be achievable at high traffic airports without TBFM decision support tools. There is a significant gap in the existing FAA merging and spacing capability that must be closed for EoR to be considered a success. It could become politically challenging if the EoR DCP was complete, procedures published and aircraft equipped and qualified, and no TSS support due to a delay in that program.
Environmental and noise-related risks	EoR operations will permit a more close-in turn to align with the runway track than is possible with the existing separation standards. This is expected to reduce the length of the parallel tracks of aircraft on the extended runway centerlines, which in turn will reduce the noise exposure to populations underlying the existing routes. These benefits may be offset by additional environmental considerations for new RNP paths.
Other	

Single Site

Pacing Items	**Description**
Change in Roles	N/A
Technology/equipage Required	Single Site PBN deployments do not require modification of aircraft avionics. PBN benefits incentivize airlines to equip for RNP procedures. However, the cost/benefit does not exist for the vast majority of general aviation aircraft.
ATM/TFM Automation	In general, single sites may not have the traffic volumes or airspace complexity of Metroplex sites. The use of OPDs along with the creation of new arrival routes may result in a need for

	improvements in ATM/TFM automation. In order to achieve the benefits of OPDs and a PBN structure, aircraft need to fly the procedures with limited controller intervention. As traffic volumes increase, metering – potentially through the application of TBFM – could help enable these operations. FAA merging and spacing tools are lacking. At the time of the TF5 recommendations, Relative Position Indicator (RPI) was identified as a key technology to accomplish terminal merging and spacing, although that tool has since become obsolete. TSS is the latest tool selected by FAA for application in the TBFM development strategy. As a result, TSS and integration of TMA with TSS are key gaps that FAA must be prioritized at the highest level.
Decision Support tools needed by controllers, and TFM specialists	As traffic volume increases, single sites may require TSS for PBN operations such as OPD, EoR, etc.
Training	Air traffic controllers and pilots are trained by their organizations/companies in accordance with the specifics of the PBN operations. Each organization/company covers the associated costs of their particular training activities. FAA is responsible for providing ATC training. Any changes required to phraseology, separation standards, and directives must be included in 7110.65 as necessary.
Airspace changes	This determination is site-specific and cannot be answered categorically. Airspace changes may be necessary, depending on the lateral path and the vertical profile that is developed. Specific consideration is required for the current airspace organization and it is likely that LOAs will need attention if OPD benefits are sought.
Procedures	PBN procedures that provide benefits to Stakeholders will need to be developed and published.
Policies	No new policies.
Technical Standards	None.
Certification	None.
Ops Approvals	None.
Political risks	The national emphasis on Metroplex (OAPM) programs is intended to provide early benefits to large populations of Stakeholders. Single site implementation of PBN procedures are processed through FAAO 7100.41 process which has been recently established. Lack of experience in this process may result in short-term conflict until understanding and comfort is achieved.

Environmental and noise-related risks	Environmental assessments should be properly planned and resourced as part of the implementation activity in order to insure success with procedures that deliver expected benefits**.**
Other	N/A

Safety Analysis for Established on RNP TF Approaches

Pacing Items	Description
Change in Roles	Aircrews will be responsible for managing compliance with the lateral track through the turns to the runway aligned track in order to comply with separation requirements of the safety case.
Technology/equipage Required	It is expected that RNP approach aircraft equipment and qualification will be adequate for EoR TF operations.
ATM/TFM Automation	In- trail spacing of aircraft must be managed to ensure the maximum arrival rate is maintained to the runway. This task is made more challenging for the traditional tactical air traffic control function by the increased complexity of the defined PBN path to join the parallel arrival track to the runway. Automation is necessary to provide accurate time management of aircraft along the defined arrival path.
Decision Support tools needed by controllers, and TFM specialists	Time Based Flow Management is required to maintain maximum runway arrival capacity during parallel arrivals with EoR procedures. TSS is the most common tool in the current development strategy but TSS and integration of TMA with TSS is a key FAA gap that must be prioritized at the highest level
Training	Existing Flight Crew training for RNP procedures is expected to be sufficient for EoR. Controllers will require additional training in the use of TSS and the specific application for EoR Operations
Airspace changes	None are expected as the procedures are expected to keep the aircraft within the range of existing tracks and vertical profiles of aircraft on visual or vectored turns to align with the extended runway centerline.
Procedures	RNP procedures will need to be designed for TF leg types and published. It is expected that RF-capable aircraft will be assigned the TF procedure designed for procedure commonality purposes.
Policies	Current parallel approach procedures require vertical separation of aircraft by 1000’ until established on the parallel localizers. A Safety analysis is in process to establish equivalent performance to localizer tracking for aircraft established on RNP procedures that may not be aligned with the runway centerline. Analysis results will inform the subsequent Safety Case leading to revised

	National Standards.
Technical Standards	Order 7110.65.
Certification	Existing airworthiness certification standards for aircraft with RNAV RNP 0.3 capability are sufficient.
Ops Approvals	Existing RNP approach operational approvals are expected to be sufficient.
Political risks	If the safety case does not support the use of TF legs, a large population of aircraft will not be able to participate in EoR operations which will greatly reduce the benefit opportunity at busy hub airports with high frequency regional aircraft operations.
Environmental and noise-related risks	In general, EoR operations will permit a more close-in turn to align with the runway track than is possible with the existing separation standards. This is expected to reduce the length of the parallel tracks of aircraft on the extended runway centerlines, which in turn will reduce the noise exposure to populations underlying the existing routes. TF leg-type procedure construction will likely require more offset from the runway for the downwind track than RF leg-type EoR procedure designs. This is necessary to accommodate the larger variance in lateral path steering performance among the population of aircraft and speeds and may result in a larger impact to underlying communities.
Other	N/A

Surface and Data Sharing

Background/Introduction

In 2009, RTCA Task Force 5 (NextGen Task Force) provided the FAA with several surface traffic management recommendations which were founded upon information sharing and situational awareness of airport flight movement activity. At that time, ASDE-X data usage for situational awareness was a fairly new concept, there was no organized distribution of this data, and as a result, Task Force 5 recommended a means to share this data. In addition, and also due to several different surface traffic management demonstrations and activities sponsored by several different organizations and system users, Task Force 5 recommended a central point of contact for surface traffic management issues. It should be noted that the FAA honored and fulfilled both of these recommendations:

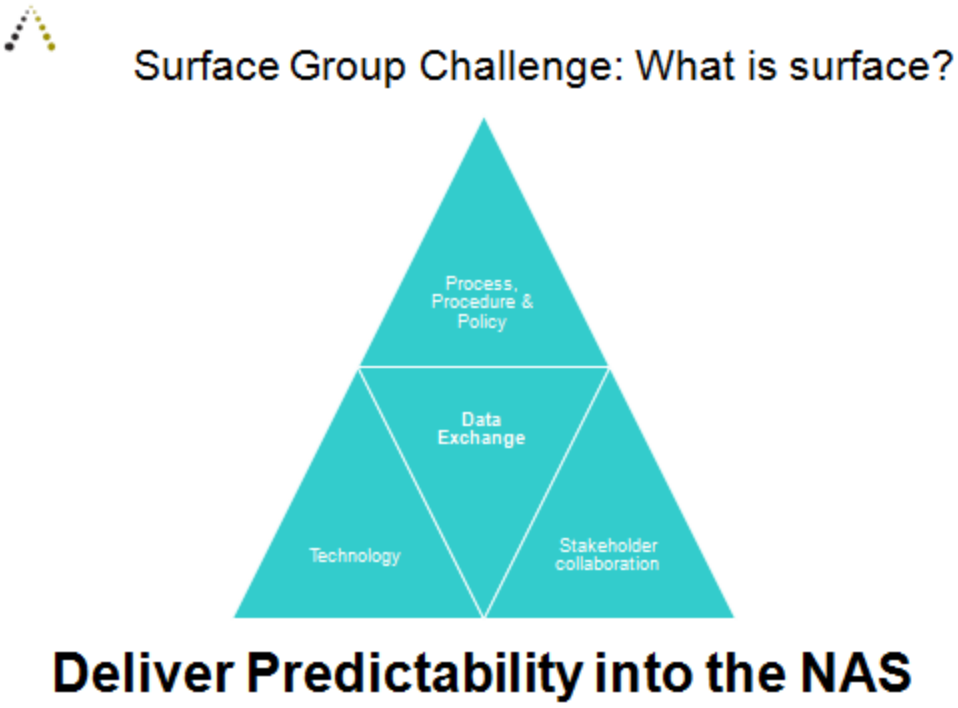
- The National Enterprise System Gateway (NESG) was established which provides a data feed for all ASDE-X and ASSC sites.
- The Surface Operations Office was established within the FAA.

Key Observations, Findings and Outcomes

The recommendations that follow from the Surface Team of the RTCA NextGen Implementation Working Group (NIWG) build on the foundational infrastructure of Task Force 5, and lay out paths for abundant information sharing among FAA, Flight Operators and Airport Operators, to provide for efficient, predictable, and thus well planned NAS operations. The enhanced data sharing proposed in the recommendations, as also reflected in the FAA's U.S. Airport Surface Collaborative Decision Making (CDM) Concept of Operations (ConOps) in the near- term, will lead to more accurate predictions of capacity/demand imbalances, and improve over-all traffic management efficiency while also reducing taxi-out times and associated emissions. It should be noted that all recommendations are thought to be doable within the 2015-2017 timeframe, and leverage existing or on-going work, e.g., TBFM data via SWIM, as well as use of prototype capabilities where FAA has already made an investment, e.g., AEFS to enable electronic flight data in ATCTs. All recommendations support the eventual migration and transition to TFDM, while providing near-term benefits to all Stakeholders prior to TFDM deployment.

For each recommendation provided there will be specific qualitative and quantitative benefits[8] tied to the performance of the actual process. As overarching criteria, the recommendations provided by the NIWG Surface Team will provide greater predictability to airport surface operations and the NAS.

[8] Benefits are the desirable results that are provided by a system/capability. Metrics are statistics that are used to assess the performance of a system/capability. While there could be overlap – many quantifiable benefits can be closely linked to specific metrics; for example, environmental benefits are closely tied to the KPI Calculated Fuel Burn–benefits are typically higher level, can be quantifiable or qualitative, and are typically dependent on multiple metrics to assess.



While each recommendation stands on its own merit, the synergies and holistic application and tracking of all recommendations will provide the maximum benefit and advance surface in the near- (2015-2017) term.

Recommendation 1
Airport Collaborative Decision Making (CDM) Membership & Improved Data Availability

Improved data sharing through (i.) CDM Membership for Airports; (ii.) availability of TBFM, TFMS, and NTML data to CDM Members via SWIM; (iii.) simplified process and instructions for accessing SWIM data

BACKGROUND: Airport and Flight Operators require real-time operational Air Traffic Control and flight movement information to more effectively manage airside operations. Those Airports that provide some type of ramp control in the non-movement area could especially benefit from this data by improving support to the ATCT. Additional uses of real-time information include better gate management and utilization, forecasting of CBP clearance demands, preparedness for irregular operations including severe/winter weather diversions, etc. Accurate, timely data sharing and participation in CDM-related processes and procedures is the foundation of the FAA/Industry CDM program. Currently, Airport Operators participate in CDM related processes and procedures; however, they do not participate in data exchange. To optimize airport surface efficiency, it is important for Airport Operators to be part of the operational data exchange with all Stakeholders by both sharing and receiving data. Additionally, all-inclusive collaboration is further enhanced through real-time updates of TBFM, TFMS, and NTML data to both Flight Operators as well as Airports.

RECOMMENDATIONS:

- The FAA/Industry CDM Stakeholder Group (CSG) shall consider applications of Airport Operators desiring to become CDM MOU signatories. As CDM MOU signatories, Airports will have access to real-time operations data as specified in an updated CDM MOU.

- FAA should make available real-time updates to flow and restriction information within TBFM, TFMS, and NTML via NESG SWIM, to enable access to real-time air traffic data by CDM Members.
- The CDM Member and Stakeholder application process to obtain access for data via NESG SWIM should be clearly defined and simplified. Ideally, a web page with simplified instructions on the process to obtain access would be available, and applicants could expect a response within two-weeks from the date of submission of the application.

CONCEPT: Airport participation in CDM practices continues to grow, especially at those airports that provide or contract for management of aircraft pushbacks in the non-movement area (i.e., Metropolitan Washington Airports Authority at IAD). Airport Operators could also share valuable movement and departure readiness information, e.g., departure readiness and Target Movement Area entry Time (TMAT) conformance. Additionally, through the sharing of TBFM, TFMS, and NTML data with Airport and Flight Operators via SWIM, phone calls and manual look-ups of restriction information will be significantly reduced, leading to more efficient operations for all Stakeholders, as well as the opportunity to plan for predicted demand/capacity imbalances.

Initial Industry Recommended Milestones:

- 1Q 2015: CDM CSG identifies Airport CDM membership criteria in the FAA/Industry CDM program
- 2Q 2015: Utilize ACI-NA and AAAE resources to poll for airports with interest in becoming CDM members, and/or those who desire access to CDM data
- 2Q 2015: FAA provides TBFM, TFMS, and NTML data to CDM Members via SWIM
- 3Q 2015: CSG criteria for Airport CDM membership for Airport Operators to be incorporated into updated CDM MOU, allowing those Airports desiring access to TBFM, TFMS, and NTML data to apply for CDM membership (some airports may require a later timeline to allow for preparation)

In the event that a high number of airports specify a desire to participate in CDM data exchange, and resources are unable to meet this demand, airports that operate or contract operation of ramp towers shall be given priority in 2015.

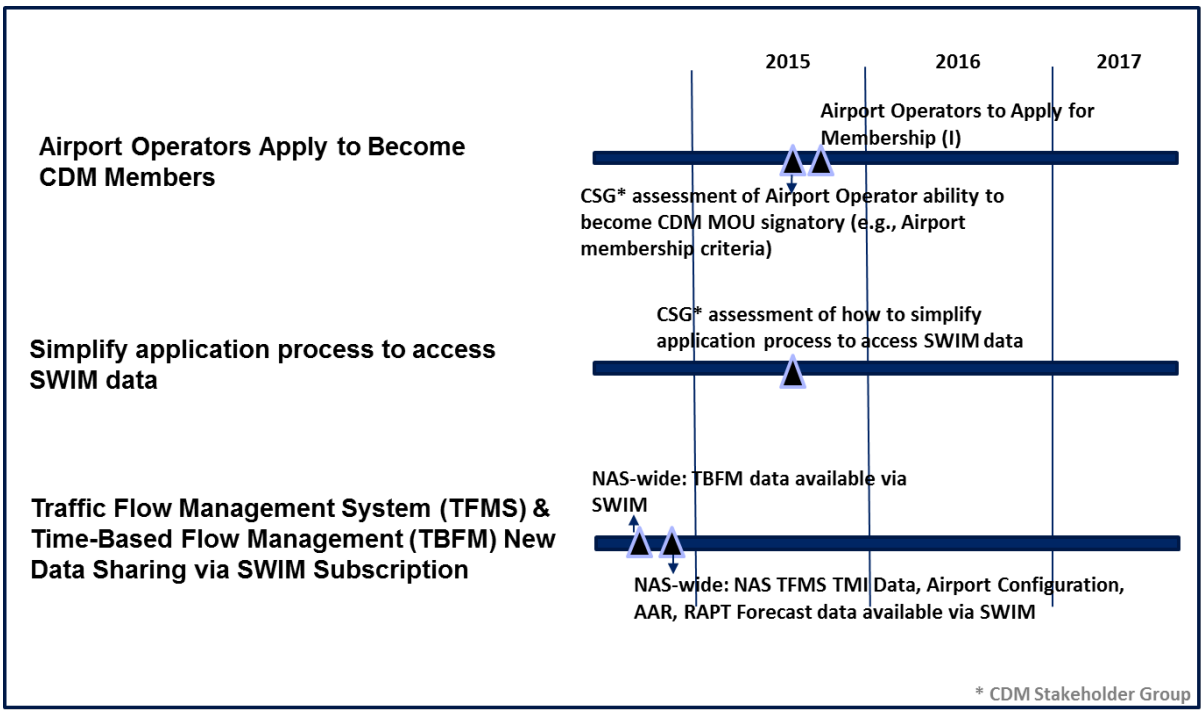
FAA Commitments:

The FAA has agreed to fully endorse the ability of Airport Operators to become CDM members as part of a CDM CSG assessment. FAA is one constituent of the CSG; consensus among all members of the CSG will be required to define the criteria for CDM membership by Airport Operators, and to update the CDM MOU and associated documentation as necessary. It is anticipated that consensus among all Stakeholders and updates to required documentation be completed by 3Q 2015.

FAA also agreed to fully endorse simplifying the process for CDM members to access SWIM data, as part of a CSG assessment for how to update the process. FAA is one constituent of the CSG; consensus among all members of the CSG will be required to modify the current process, and to update associated documentation as necessary. It is anticipated that consensus among all Stakeholders and updates to required documentation be completed by 3Q 2015.

Additionally, the FAA is fully meeting the recommendation that TBFM data, as well as TFMS data, be available to CDM Members via SWIM. The timeframe for this FAA commitment is 4Q 2014. The TFMS data set that is to be made available via SWIM includes Traffic Flow Management Information currently captured in NTML data. In order for CDM Members to take advantage of this data sharing, CDM Members will have to create a mechanism to read and parse the data that is being sent via SWIM.

Milestones and Timelines associated with Recommendation 1



Industry Partners: Airports who have expressed interest in CDM Membership include:

- ATL – Atlanta Hartsfield/Jackson International Airport
- BOS – Boston Logan International Airport (including the Massachusetts Port Authority)
- DEN – Denver International Airport
- DFW – Dallas Fort Worth International Airport
- LAS – Las Vegas McCarran International Airport (including Clark County Department of Aviation)
- ORD – O'Hare International Airport
- Port Authority of NY/NJ (PANYNJ)
- PHX – Phoenix Sky Harbor International Airport
- SFO – San Francisco International Airport

Note: The PANYNJ has submitted a request to become a CDM Member; they have participated in CDM work groups and volunteered to be a test site for this information sharing/exchange.

Metrics and benefits:

- Increased collaboration to operate a more efficient and predictable NAS
- Reduced IROPS recovery time
- Management of operational constraints

Recommendation 2
Airport Surface Departure Metering

Establish an initial airport surface departure metering capability that reflects the FAA's Surface CDM Concept of Operations (ConOps)[9]

BACKGROUND: The implementation of airport surface efficiency capabilities (and associated processes and procedures) supports improvements to the overall predictability of the NAS. Airport surface efficiency capabilities include surface departure metering, which is founded on accurate, timely predictions of future demand and available capacity of shared NAS resources.

Based on projected flight demand and the indicated capacity of the NAS departure resources affecting an airport, it is possible to accurately predict the movement area entry time, departure queue arrival time, and runway departure time for a flight. Predicted departure queue lengths can be compared to the optimum departure queue lengths (as determined by local airport Stakeholders) to determine whether the predicted queue length is expected to exceed an established optimum departure queue length. If this is the case, Stakeholders can be notified of the predicted demand and capacity imbalance(s) and surface departure metering can be implemented to equitably allocate constrained NAS resources among Stakeholders. Specifically, the notification of a predicted demand/capacity imbalance can be provided when it is predicted that the length of the departure queue for a specific resource, such as a runway, will exceed an established threshold within a specified period of time.

When surface departure metering is recommended, an equitable, efficient, and feasible sequence in which flights could enter the movement area can be established and communicated to Stakeholders. Specifically, flights can be "assigned" movement area entry times which reflect "metering hold" times so as to provide a flow of flights to the runway queues at a rate that will maintain the length of each queue within established values. The movement area entry times are managed by the Flight Operator to meet individual business models, while also contributing to the effective management of the airport surface operation. Flight Operators may elect to absorb the assigned metering hold on the gate or in a designated holding area on the airport (in coordination with the appropriate local Stakeholders such as ATC). For flights that enter the movement area via a "spot", the metering point would be the spot. For flights that are parked at gates that require flights to push back directly into the movement area, the metering point would be the end of the pushback process itself, or the point at which the flight is ready to start its taxi. In all nominal cases, the metering point is reached when the flight is ready to taxi to the runway for departure.

The surface departure metering capability in no way constrains or impacts ATC's handling of flights in the movement area that have requested clearance to taxi to the runway for departure. As is the case in the absence of surface departure metering, once flights enter the AMA, ATC determines the sequence in which flights depart the airport.

RECOMMENDATION: Utilizing Flight Operator-provided data expected in the 2015-2017 timeframe and FAA traffic management information, establish a surface departure metering capability that reflects the FAA's Surface CDM ConOps at the identified airports. Use of surface departure metering will improve

[9] *The Surface CDM ConOps, delivered to the FAA in July 2013, was developed in full collaboration with Flight and Airport Operators, NATCA, and ATC, i.e., the CDM Surface Concepts Team* (http://cdm.fly.faa.gov/?page_id=221), *and has been approved by the CDM CSG.*

predictability and airport surface efficiency and enable environmental benefits. The recommendation for multiple sites allows the FAA to understand the potential differences in operational benefits at a set of airports whereby the pushback is managed by a variety of Stakeholders. Specifically, in the context of the surface domain, the FAA Surface Operations Office and Stakeholders (Flight and Airport Operators, NATCA, ATC) have identified three categories of airports as follows:

- At Category I Airports, ATC controls all pushbacks
- At Category II Airports, ATC and a non-ATC Stakeholders approve pushbacks
- At Category III Airports, ATC and more than one non-ATC Stakeholder approves pushbacks

CONCEPT:
The information needed to facilitate the creation of demand predictions, as well as surface departure metering, includes the following:

- Desired departure queue length
- Runway Departure Rate (RDR)
- Actual Off-Block Time (AOBT)
- Actual Takeoff Time (ATOT)
- Actual Landing Time (ALDT)
- Actual In-Block Time (AIBT)
- Aircraft Tail/Registration Number
- Earliest Off-Block Time (EOBT)*
- Flight Cancelation*
- Gate Assignment*
- Initial Off-Block Time (IOBT)
- Flight Intent (focus on intent to absorb metering hold in the movement area rather than at the gate)*
- Target Movement Area entry Time (TMAT)**
- Projected Wheels Up Time**
- Target Off-Block Time (TOBT)**
- Target Takeoff Time (TTOT)**

*New CDM data elements for implementation by end of FY2015
**From the information provided, these items will be calculated locally in real time

Criteria for airport site selection includes:

- Taxi out delay length and/or historically lengthy departure queues
- Aerodrome physical constraints, including operational feasibility of holding at the aircraft parking gate or in a holding area
- Number and type of entities that manage pushback, e.g., ATC, Flight Operator, Airport Operator

Initial Industry Recommended Milestones:

This recommendation gives the FAA discretion as to which of the 8 airports to choose from for initial site-implementation of the surface departure metering capability. These 8 airports, listed below, are the same 8 airports identified as meeting criteria for the Initial 2015 Capability outlined in the Surface Efficiency Operational Capability Integration Plan (OCIP), signed March 25, 2013.

The 8 candidate airports are listed below along with their Airport Category, followed by specific recommendations for 2015, 2016, and 2017.

Candidate Airports[10]:

- ATL - Atlanta Hartsfield/Jackson International Airport – Category III
- BOS - Boston Logan International Airport (including Massachusetts Port Authority) – Category II
- JFK – John F. Kennedy International Airport (including the Port Authority of New York and New Jersey (PANYNJ)) – Category III
- LAS - Las Vegas McCarran International Airport (including Clark County Department of Aviation) – Category II
- LGA - La Guardia Airport (including the Port Authority of New York and New Jersey (PANYNJ)) – Category III
- PHL - Philadelphia International Airport – Category III
- PHX - Phoenix Sky Harbor Airport – Category II
- SFO - San Francisco International Airport – Category III

2015: FAA performs analysis and examines other considerations deemed necessary to select 1 airport from the 8 airports listed above, for implementation of a surface departure metering capability by 2016. Lessons learned at this airport to be applied to other airports.

2016: At airports the FAA identifies, two-way data exchange occurs between Flight Operators and surface departure metering capability. Initial departure metering begins at an additional airport identified by the FAA. Lessons learned at this airport to be applied to other airports.

2017: Implementation of surface departure metering at the additional airport(s) selected by the FAA, with a waterfall schedule for implementation of surface departure metering for the remaining airports.

FAA Commitments

Early Implementation Strategy:

Going into the NIWG effort, the FAA had existing plans to improve surface efficiency through an early implementation strategy (EIS) of select capabilities of the Terminal Flight Data Management Program. The EIS strategy includes the use of Advanced Electronic Flight Strips coupled with introduction of SWIM Surface Viewer Technology for Situational Awareness, making Surface Surveillance data available via SWIM across the NAS, and two-way data sharing of surface data (i.e., new surface data to FAA) for increased efficiency across the NAS.

Building on existing capabilities will enable the FAA to build on surface improvements and bridge the gap between 2015 and core TFDM deployments. The FAA early implementation strategy addresses interim tactical operational needs, TFDM risk reduction, and building a better understanding of potential updates to CDM agreements.

This early implementation strategy includes:

- Providing primary surface situational awareness to include but not limited to Surface Viewer capability for ATCSCC, and selected TRACONs (SoCal TRACON was initial site in April 2014)

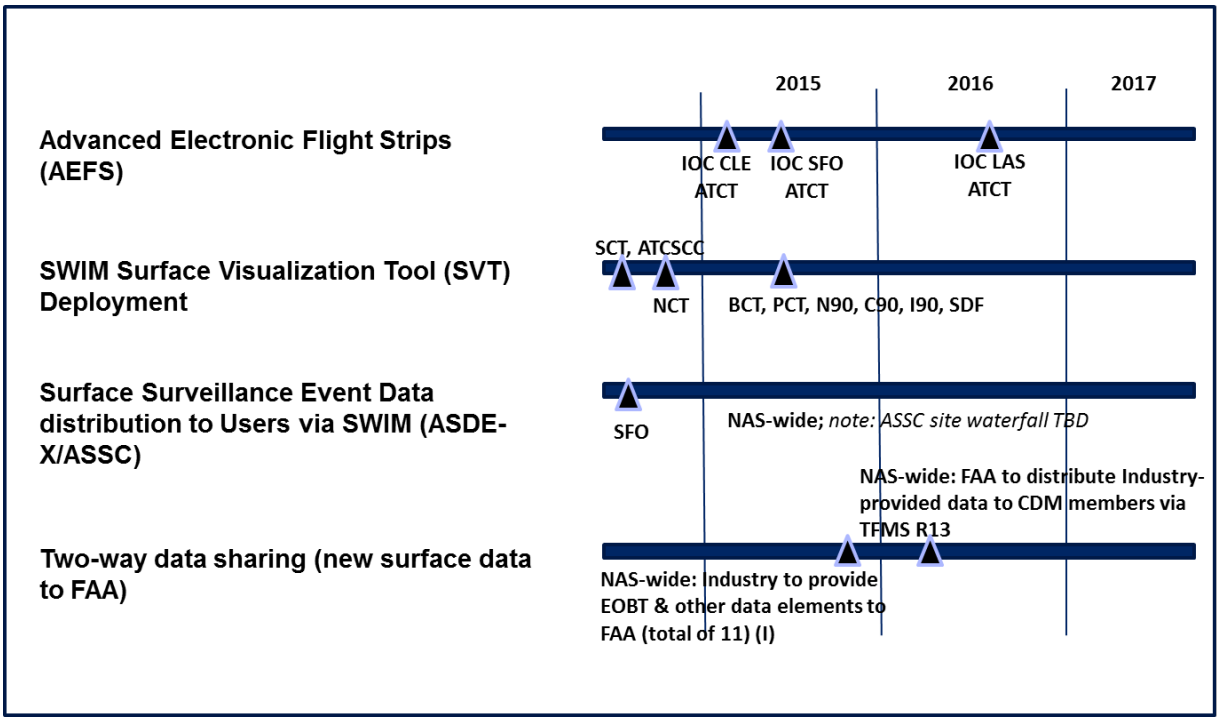
[10] Final airport selection based on FAA surface office selection and a collaborative Stakeholder commitment to the departure metering city list selection section.

- Deploying preliminary Surface CDM capabilities at selected FAA facilities using existing/modified TFMS-CDM data exchange
- Deploying initial Electronic Flight Data via AEFS to selected sites
- Continued interfacing with Surface CDM Team throughout the process to ensure stakeholder buy-in, awareness and support

The EIS takes advantage of capabilities available today; specific milestones for the FAA TFDM early implementation effort are as follows:

- Implement AEFS at CLE and SFO ATCTs in 2015 and at ATCT in 2016
- Deploy the SWIM Surface Visualization Tool at SCT, ATCSCC, and NCT in 2014, and at BCT, PCT, N90, C90, I90 and SDF in 2015
- Distribute Surface Surveillance Event Data to users via SWIM, first at SFO in 2014, and then NAS-wide (ASDE-X/ASSC)
- Enhance two-way data share through Industry provision of 11 data elements to FAA in 2015 and FAA distribution of those data elements to CDM members in 2016
- Introduce new TBFM data sharing via SWIM subscription NAS-wide in 2014 and make TFMS TMI data available via SWIM in 2014 (*see Response to Recommendation #1*)

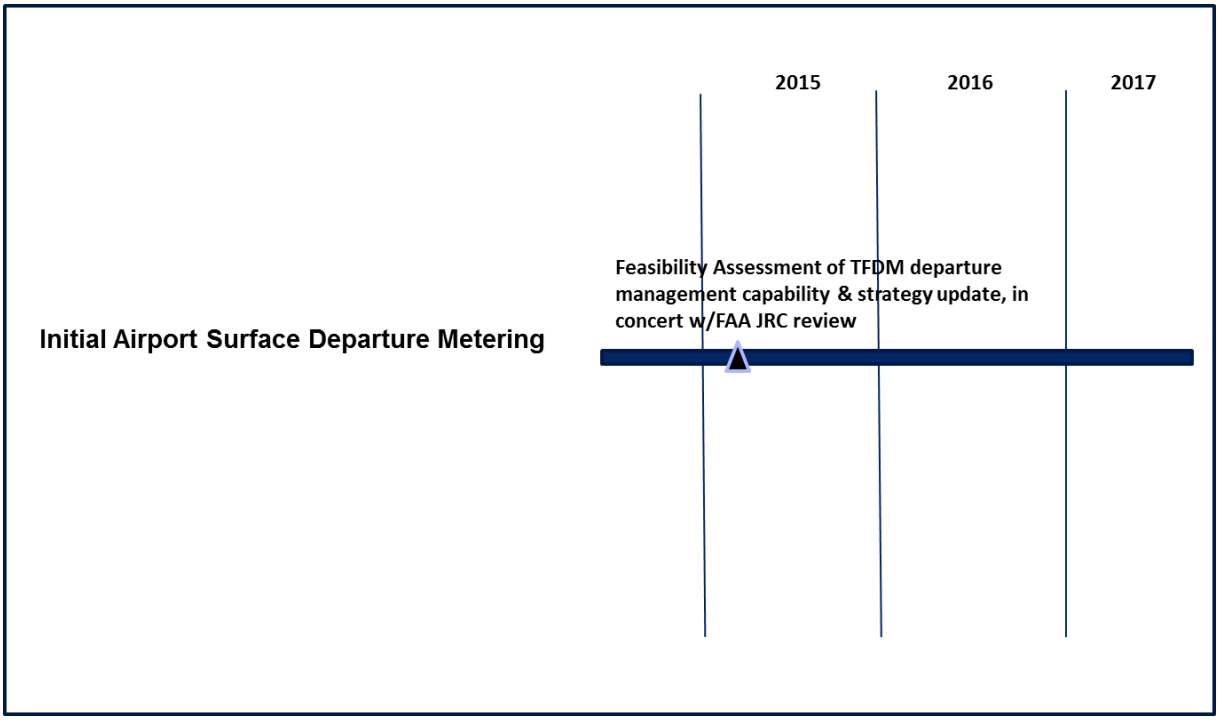
Milestones and Timelines associated with the Terminal Flight Data Manager (TFDM) Early Implementation Strategy (EIS)



Feasibility Assessment for Airport Surface Departure Metering:
In response to the NIWG initial departure metering recommendation, the FAA has agreed to conduct a feasibility assessment of the TFDM departure management capability, as well a TFDM departure management capability strategy update, to coincide with the planned FAA JRC review of the TFDM program in 1Q 2015. This feasibility assessment and strategy update will:

- Consider the foundational work at DTW, MEM, MCO, JFK related to surface departure metering
- Examine the latest deployment timelines and site selections for the TFDM program, as well as the possibility of leveraging investments FAA has already made in surface departure management capabilities, in order to aid in the refinement of procedures to be used in the TFDM program. Some possible refinements include to existing proposals for procedures to address conflicts between DOT on-time performance measures and collaborative surface management; surface-based level of service and incentives; rules for FAA use and management of non-FAA source event data; and surface operational roles and responsibilities.

Milestones and Timelines associated with Recommendation 2



Industry Partners that have demonstrated interest in a surface departure metering capability and relevant data sharing include:

Airport Operators

- ATL - Atlanta Hartsfield /Jackson International Airport
- BOS - Boston Logan International Airport (including Massachusetts Port Authority)
- JFK – John F. Kennedy International Airport (including PANYNJ)
- LAS - Las Vegas McCarran International Airport (including Clark County Department of Aviation)
- LGA - La Guardia Airport (including the PANYNJ)
- PHL - Philadelphia International Airport
- PHX - Phoenix Sky Harbor Airport
- SFO - San Francisco International Airport
- CLT - Charlotte Douglas Airport
- DEN - Denver International Airport
- ORD - Chicago O'Hare International Airport

Flight Operators

- American Airlines/US Airways
- Delta Air Lines
- FedEx Express
- jetBlue Airways
- NBAA
- Southwest Airlines
- United Airlines
- UPS

Metrics and Benefits Expected

- Improved predictability in the NAS
- Reduced departure aircraft taxi time, resulting in
    - Reduced fuel burn from aircraft engines and
    - Associated reduced environmental emissions from taxing aircraft

Recommendation 3
Provide Real-time Traffic Management Updates to NY ATCTs, Flight Operators and Airport Operators

Provide NY ATCT controllers with real-time changes to route and other traffic management initiative (TMI) information (e.g., EDCTs resulting from TMIs) via electronic medium (e.g., electronic flight strips) rather than on printed paper strips, thereby enabling NY ATCTs to better manage airport surface traffic, reduce taxi delays and increase predictability.

BACKGROUND: To manage taxi queue length during runway 13R/31L construction at JFK airport in 2010, the Port Authority of New York and New Jersey (PANYNJ) established a centralized ground metering function. This function allocates Target Movement Area entry Times (TMATs) to departure flights from the various non-movement areas for queuing into the movement area. After the construction was completed, JFK Flight Operators requested that this centralized ground metering capability be continued. The FAA ATCT and N90 do not interface with this centralized ground metering capability and do not receive Flight Operator-provided data (changes) in real-time. The communication of changes to TMIs, reroutes, and 'wheels up' metering times rely on new paper flight strips printing out in the tower cab. Controllers are required to manage a selection of one or more paper strips at a time while simultaneously applying multiple functions (Traffic Management Initiatives, strip marking, etc.) to the strip(s) for progress and coordination within the tower cab environment. Multiple runway construction projects will further constrain surface operations at NY airports in the 2015-2017 timeframe.

With paper strips, the controller is required to physically walk away from and turn their back to their control position in order to pass a flight progress strip (FPS). With AEFS, an electronic flight progress strip (EFPS) is passed with the drag of a finger, or the touch of a button. AEFS eliminates the need for controllers to turn their back on the operation to manage flight progress strips and allows the controller to spend the time engaged in scanning their control environment improving airport surface efficiency and the overall safety of the NAS. Additionally, the ability to allow any controller, TMU or FLM in the tower cab to access or manipulate EFPS has proven to improve the service provided to the customer during Severe Weather Avoidance Plan (SWAP) weather events where flights on certain routes were

affected and had to be changed to a different route. AEFS provides situational awareness for all involved, especially the TMU's as they are able to remain at their position with AEFS and work the amendments versus having to continuously walk around the tower CAB to visually search for whatever route was affected with paper strips. Further AEFS has proven to increase the safety and awareness to the NAS by the notification and management of TMU Initiatives as well as flight plan timeout notification. AEFS highlights and brings attention to all EFPSs affected by a flow program, SWAP program, Ground Stop program, flight plan timeout, etc.

RECOMMENDATION: Provide electronic flight data capabilities to New York ATCTs to improve collaboration and surface efficiency at JFK and operationally coupled NY area airports (e.g., JFK, LGA, EWR, TEB). This electronic medium will enable NY ATCTs to have real-time access to routes and other changes made in NY ARTCC (ZNY), thereby improving efficiency and predictability. Advanced Electronic Flight Strips (AEFS) is currently deployed at Phoenix ATCT and available to be deployed at other locations in the 2015-2017 time-frame. This AEFS capability supports this recommendation.

> *NOTE: Surface NIWG Recommendation #2, which provides for Airports to become CDM Members, and also provides for TFMS, NTML, and TBFM data via NESG SWIM subscription to CDM members, is a critical enabler to this recommendation.*

Concept: Availability of and collaboration using real-time information by the FAA, Flight and Airport Operators, would yield more collaborative and unified planning, expectations, and predictability.

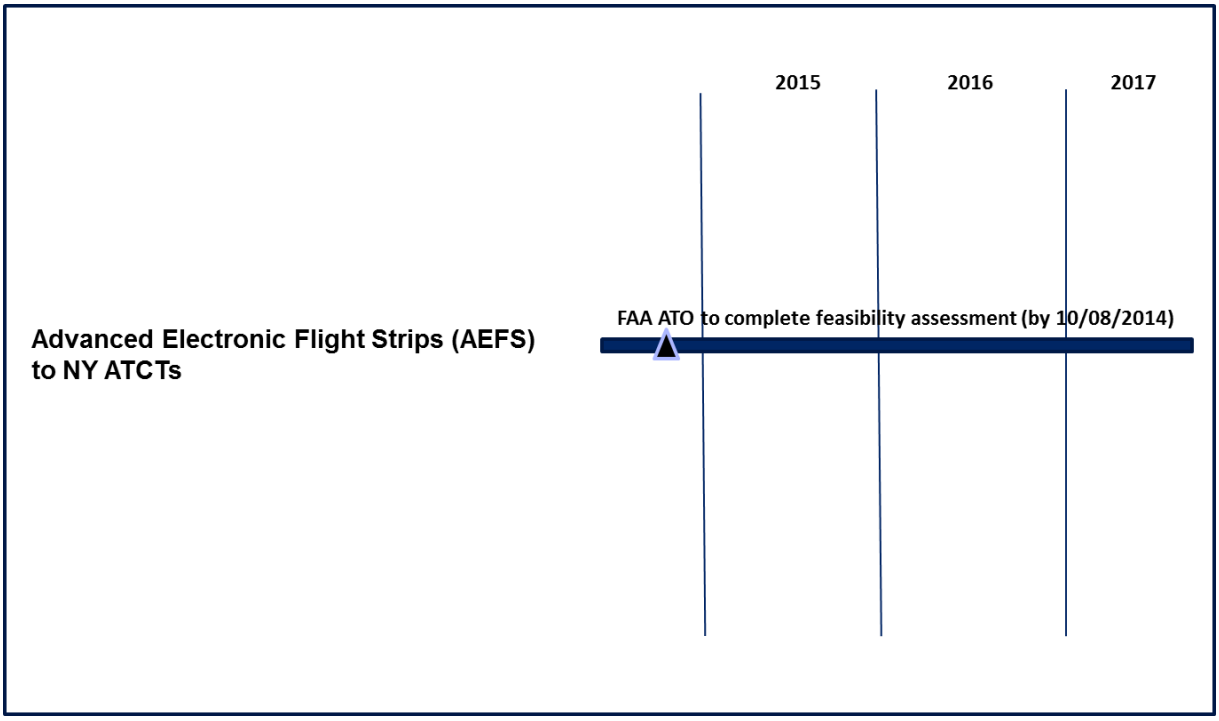
Initial Industry Recommended Milestones

- 2Q 2015 - TFMS, NTML, and TBFM data via NESG SWIM subscription to Flight Operators
- 3Q 2015 – Assuming updates to CDM MOU reflect criteria for airports to become CDM Members (as described in Recommendation #2), PANYNJ to apply for CDM Membership
- 2Q 2016 – AEFS into JFK, EWR, LGA, and TEB ATCTs

FAA Commitments

The FAA has agreed to complete a feasibility assessment for introducing the AEFS capability to New York ATCTs, by 4Q 2014. This feasibility assessment will examine technical considerations associated with introducing AEFS software and hardware into the New York ATCT operation, including connectivity to New York's DSP (Departure Sequencing Program).

Milestones and Timelines associated with Recommendation 3



Industry Partners

- American Airlines
- Delta Air Lines
- jetBlue Airways
- NBAA
- PANYNJ
- Southwest Airlines
- United Airlines

Metrics and benefits: Increased collaboration will produce efficiencies and predictability. An optimized runway queue provides reduced taxi times, lower fuel consumption and CO2 emissions and delivers overall predictability to airport surface operations.

Recommendation 4
Utilize Earliest Off Block Time (EOBT) or Equivalent Data Element (e.g., ERTD) to Reduce TBFM Delays for Short Range Flight

Departure Readiness (e.g., Earliest Off Block Time (EOBT) or equivalent data element such as Earliest Runway Time of Departure (ERTD)) to become basis for TBFM wheels-off time assignment for short-range flights inbound to metering locations (i.e., wheels-off assignment process is initiated while flight is still at the gate, as opposed to waiting until initial radio contact with ATC, which often occurs after taxiing to "the spot")*

**NOTE: For flight operators not providing departure readiness times, today's procedures to be followed for TBFM wheels-off assignment*.

BACKGROUND: Currently, standard procedure is to assign a TBFM wheels-off time to a flight once the flight has pushed back from the gate (or requested to leave the gate in some locations) and taxied to "the spot" on the airport surface, i.e., the location where ATC provides clearance to taxi within the airport's movement area. As a result, internal and 1st tier departures into a TBFM-controlled airport experience an inequitable amount of delay, as they are last to request a metering wheels-off time and thus availability of these times is restricted. The result of this inequitable delay is missed connections, unplanned and poorly managed delays which impact the traveling public, impacts to FAR117 compliance, gate utilization at hub airports, etc. Some operators at certain limited locations are providing departure readiness for these short-range flights but are not receiving the TBFM wheels-off time prior to the initial 'call for service' to ATC.

RECOMMENDATION: For those operators providing departure readiness via CDM data elements (e.g., EOBT or equivalent data element such as ERTD), leverage the infrastructure to provide EOBTs to FAA Traffic Management Units in support of surface metering (see Recommendation # 1) to provide an additional benefit to flight operators for internal and 1st tier flights inbound to an airport utilizing TBFM for arrival metering (i.e., FAA to utilize the EOBT or equivalent data element to pre-schedule a wheels-off time in TBFM prior to push back), as opposed to when the flight has already left the gate and taxied to "the spot".

- FAA/Industry CDM Steering Group (CSG) governance and process to be followed to seek procedural change allowing use of Flight Operator data of this purpose.
- FAA to make available the assigned wheels-off time to the Flight Operator via the subscribable SWIM TBFM feed via the NESG.
- The flight operator or Ramp Control entity would be responsible for push back from the gate in time to conform to the wheels-off time.

CONCEPT: Scheduling short-range flights in advance, using the EOBT, would allow for a smoothing of TBFM delays, specifically, by scheduling short-range flights earlier, more long-range flights would be outside the TBFM freeze horizon and thus more TBFM times would be available for short-range flights.

If the flight operator does not supply an EOBT for an internal or 1st tier departure inbound to a TBFM-metered airport for this purpose, there is no penalty. The current procedures utilized to obtain TBFM times on taxi out would apply.

Initial Industry Recommended Milestones:
For operators to provide EOBTs and FAA to use EOBTs to pre-schedule wheels-off time for internal and 1st tier departures inbound to TBFM-metered arrival airports:

- FY 2015: ATL, CLT, BOS
- FY 2016: NY Airports
- FY 2017: all who supply EOBT

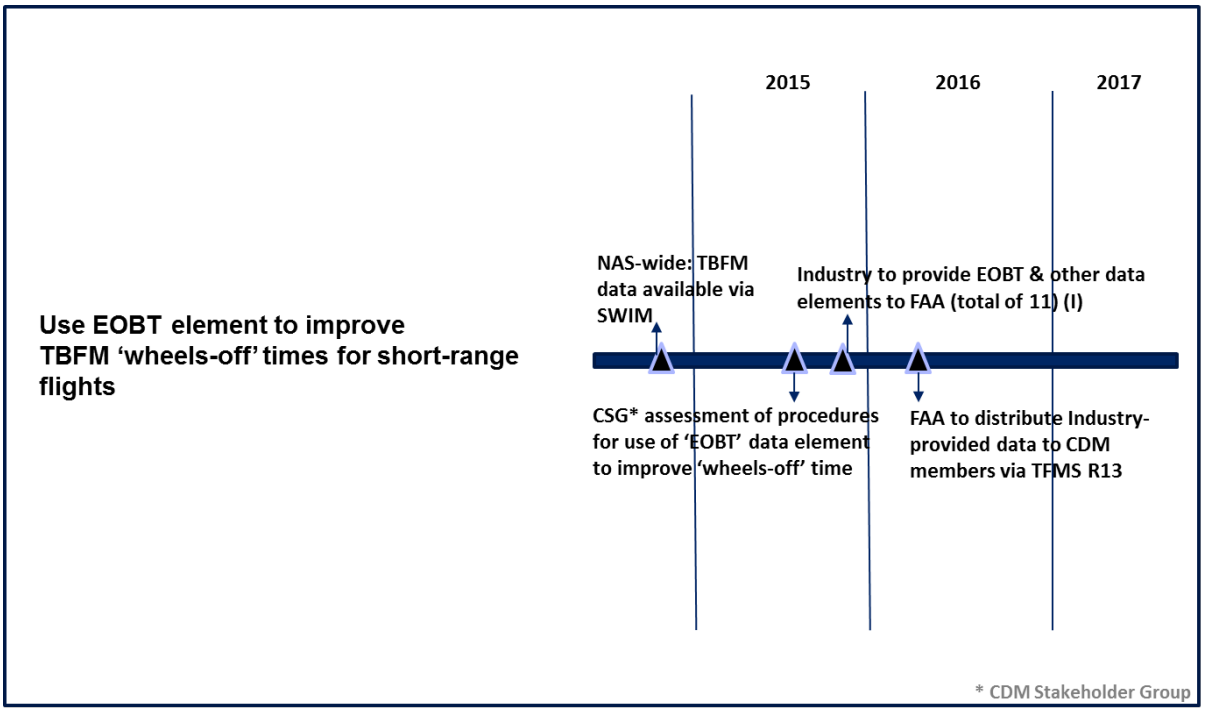
FAA Commitments:
The FAA has agreed to fully endorse the creation of procedures for the use of Industry's EOBT data element to improve 'wheels off' time for internal and first-tier departures into a TBFM-metered arrival airport, as part of a CDM CSG assessment. FAA is one constituent of the CSG; consensus among all members of the CSG will be required to create these procedures, and to update associated documentation as necessary. It is anticipated that consensus among all Stakeholders and updates to required documentation could be completed by 3Q 2015. A requirement to enable the use of these CSG-

developed procedures is that industry sends their EOBT data for individual flights to the FAA. Industry will need to provide the FAA this data by 4Q 2015.

Also required to enable the use of these procedures is that FAA:

- Make TBFM data available via SWIM, which FAA has committed to do by 4Q 2014.
- Distribute Industry-provided data to CDM members, which it has committed to do by 2Q 2016.

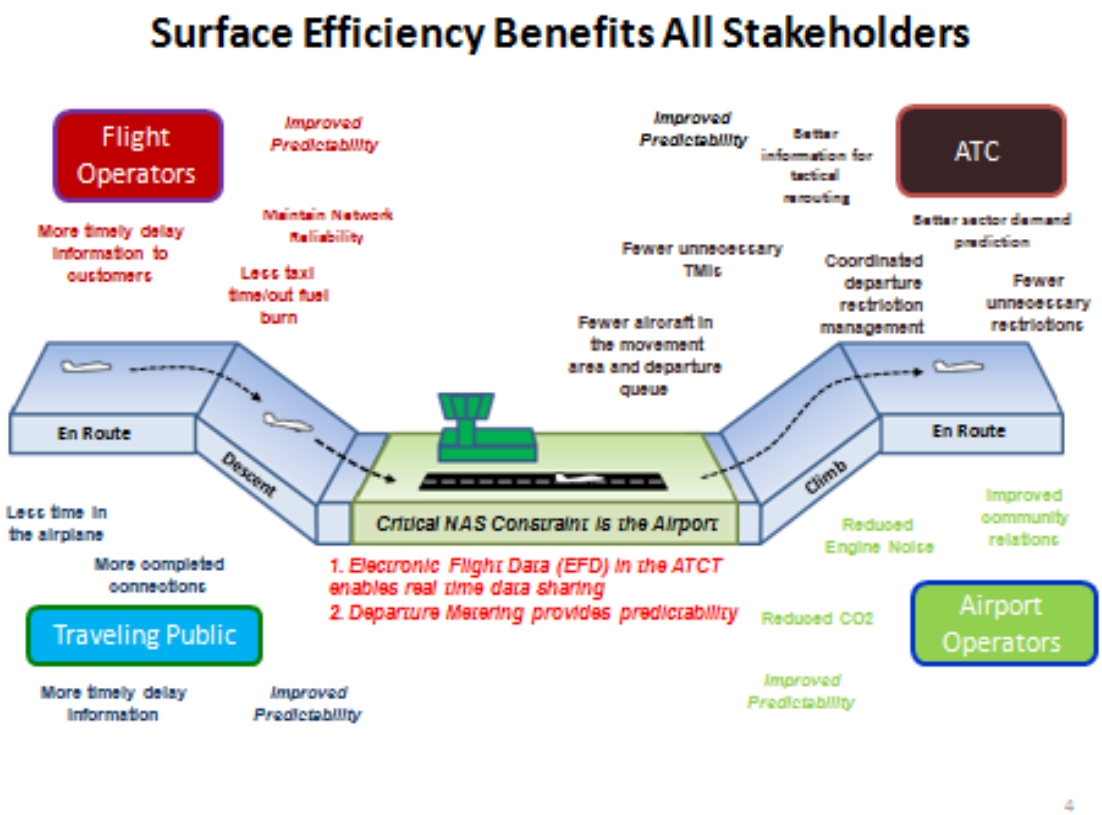
Milestones and Timelines associated with Recommendation 4



Industry Partners

- Delta Air Lines
- jetBlue Airways
- American Airlines
- Southwest Airlines
- NBAA
- PANYNJ
- Massachusetts Port Authority
- others who supply EOBT

Metrics for Success: Reduced TBFM delay for departures from short-range airport



Surface Appendix A – Pacing Items

The following pacing items were developed as the elements critical to the successful implementation for each Surface Capability:

Airport Collaborative Decision Making (CDM) Membership & Improved Data Availability

Pacing Items	Description
Change in Roles	N/A
350207165205	Cockpit: None Ground: FAA: o Creation of a SWIM data feed(s) containing TBFM, TFMS, and NTML, as well as instructions for CDM Members re: how to "subscribe" to the data feeds Flight Operator: o Working in collaboration with FAA, update CDM Membership Memorandum of Understanding o Create capability to subscribe to and process TBFM, TFMS, and NTML data made available by FAA via SWIM feeds

	Airport Operator: o Create capability to ingest, submit, and distribute CDM Member data.
ATM/TFM Automation	N/A
Decision Support tools needed by controllers, and TFM specialists	N/A
Training	CDM-type data training for Airport personnel
Airspace changes	None
Procedures	None
Policies	Through the CDM Stakeholder Group in collaboration with Operators, update to CDM Membership Memorandum of Understanding (MOU) to include Airport CDM membership criteria.
Technical Standards	None
Certification	None
Ops Approvals	None
Risks	FAA: ▪ Timeline for CSG approval of criteria for CDM Membership for Airports. ▪ Timeline for the revised CDM MOU that also includes additional CDM data elements to be shared by Flight Operators, needed to deliver surface departure management capability. ▪ Two-way data sharing proposal lacks ROI incentive for industry to provide new data to FAA in 2016: o Predictability o Actionable and measurable surface efficiency improvements • TFMS Release timelines could slip for reasons unknown today. Flight Operator: • New CDM MOU approval • Some Flight Operators may elect not to participate in providing new data elements. Airport Operator: ▪ Some Airports may not want to become CDM Members. ▪ Airports will need to establish the capability to participate, requiring resources (financial, staffing, equipment, etc.). As a result, some airports may be constrained in establishing

	this capability, which may impact timeline of implementation.
Environmental and noise-related risks	None.
Other	N/A

Corresponding OI # 104209-17

Airport Surface Departure Metering

Pacing Items	Description
Change in Roles	N/A
Technology/equipage Required	Technology for all Flight Operators to submit required data elements (EOBT and others) by the end of 2015.
ATM/TFM Automation	N/A
Decision Support tools needed by controllers, and TFM specialists	N/A
Training	The departure metering capability should be implemented in accordance with a formal training plan that reflects the recommendations from the four Work Areas comprising the Processes, Procedures, and Policy (P3) initiative led by the FAA Surface Operations Office. The P3 initiative is being conducted in collaboration with external Stakeholders, FAA Lines of Business (LOB), NATCA and ATC, also reflects feedback received from local airport Stakeholders where the capability is planned to be implemented.
Airspace changes	None.
Procedures	The departure metering capability should be implemented in accordance with the recommendations from the four Work Areas comprising the Processes, Procedures, and Policy (P3) initiative led by the FAA Surface Operations Office in collaboration with external Stakeholders, FAA Lines of Business (LOB), NATCA and ATC.
Policies	No policy changes are expected.
Technical Standards	None.
Certification	None.
Ops Approvals	None.
Risks	FAA: o TFMS Release timelines could slip for reasons unknown today (e.g., FAA not ready to receive new data elements

	in TFMS Release 13 as planned in 1Q 2016) o Two-way data sharing proposal lacks ROI incentive for Industry to provide new data to FAA in 2016: • Predictability • Actionable and measurable surface efficiency improvements <u>Flight Operators</u>: o Industry Partners not ready to deliver required data elements by 4Q 2015 o Some Flight Operators may elect not to participate in providing new data elements. o In some cases, Flight Operators, particularly those operating from FBO facilities, may not have the means or technology to enable submission of specific data elements, such as the EOBT, that are required to successfully implement the airport surface departure metering capability. To mitigate the risk of non-participation and/or non-compliance due to a technical deficiency, it will be important to identify alternatives for submission of essential data (i.e., EOBT). Airport Operators: o Some Airport Operators may not want to become CDM Members.
Environmental and noise-related risks	N/A
Other	N/A

Corresponding OI # 102406-11

Provide Real-time Traffic Management Updates to NY ATCTs, Flight Operators and Airport Operators

Pacing Items	Description
Change in Roles	None
Technology/equipage Required	Capitalize on existing FAA-owned infrastructure (e.g., AEFS) to facilitate two-way data exchange among Stakeholders. • Cockpit: None • Ground: o FAA – ATCT, ATCSCC o Flight Operator – Capability to receive data from SWIM NESG o Airport Operator – Capability to receive data from SWIM NESG

ATM/TFM Automation	None.
Decision Support tools needed by controllers, and TFM specialists	None.
Training	Non-FAA personnel training on how to interpret traffic management data correctly.
Airspace changes	None.
Procedures	As needed in accordance with the findings of the FAA Surface Operations Office (SOO) Processes, Procedures, and Policy (P3) initiative, which includes participation from external Stakeholders, FAA Lines of Business (LOBs), and NATCA.
Policies	As needed in accordance with the findings of the FAA Surface Operations Office (SOO) Processes, Procedures, and Policy (P3) initiative, which includes participation from external Stakeholders, FAA Lines of Business (LOBs), and NATCA.
Technical Standards	None.
Certification	None.
Ops Approvals	None.
Risks	Risks described here are focused on the critical enabler for this recommendation: two-way data exchange. FAA: • TFMS Release timelines could slip for reasons unknown today (e.g., FAA not ready to receive new data elements in TFMS Release 13 as planned in 1Q 2016) • Two-way data sharing proposal lacks ROI incentive for Industry to provide new data to FAA in 2016: o Predictability o Actionable and measurable surface efficiency improvements <u>Flight Operators</u>: • Industry Partners not ready to deliver required data elements by 4Q 2015. • Some Flight Operators may elect not to participate in providing new data elements. • In some cases, Flight Operators, particularly those operating from FBO facilities, may not have the means or technology to enable submission of specific data elements, such as the EOBT, that are required to successfully implement the airport surface departure metering capability. To mitigate the risk of non-

	participation and/or non-compliance due to a technical deficiency, it will be important to identify alternatives for submission of essential data (i.e., EOBT). <u>Airport Operators</u>: • Some Airport Operators may not want to become CDM Members. • Potential misapplication of NAS traffic flow management data. To mitigate the risk, appropriate data sharing agreements will be executed among the Stakeholders.
Environmental and noise-related risks	None.
Other	None.

Corresponding OI # 104209-17

Utilize Earliest Off Block Time (EOBT) or Equivalent Data Element (e.g., ERTD) to Reduce TBFM Delays for Short Range Flight

Pacing Items	Description
Change in Roles	None.
Technology/equipage Required	Cockpit: None Ground: FAA: • TBFM feed to SWIM Flight Operators: • Operator automation to provide EOBT to FAA • Flight/Airport Operator access and subscription to SWIM TBFM feed. Airport Operators: • Those that operate or contract ramp towers access to TBFM wheels up time via SWIM NESG.
ATM/TFM Automation	None.
Decision Support tools needed by controllers, and TFM specialists	None.
Training	FAA: • For internal and 1st tier airports, procedure at TMU responsible for TBFM arrival metering to utilize EOBT to pre-schedule wheels-off time based on the provided EOBT rather than waiting for the flight to 'call for service' at ATCT after pushback from the gate/parking

	stand. Airport Operators: • Those airports that operate or contract ramp towers. Flight Operator: • Personnel at internal and 1st tier airports: o May require training on the EOBT concept. o May require training on how/when to advise FAA if circumstances arise that put an assigned wheels-off time at risk.
Airspace changes	None.
Procedures	Yes. New procedures and process needed to utilize departure readiness indications from flight operator. Process change of EOBT utilized to request TBFM time in advance, operator gate departure to enable capturing of assigned time, and information request and time assignment via NESG SWIM.
Policies	None.
Technical Standards	None.
Certification	None.
Ops Approvals	None.
Risks	FAA: • In order to pre-schedule flights for TBFM, data in addition to EOBT may be required to estimate an aircraft's surface transit time from gate to runway; this includes the departing flight's terminal, gate, and assigned departure runway. • If Operator does not meet the assigned wheels-up time, capacity at the arrival airport is lost and cannot be recovered. • Internal and/or 1st tier airports may not have TFMS in the ATCT to receive EOBT times (i.e., ATCT may not have situational awareness re: which flights have been pre-scheduled); however, in near-term ATCT can rely on "trust and verify" to learn of assigned wheels-off time (that is, when a flight checks on with the ATCT to request clearance to taxi). • ARTCC TMU managing TBFM will require a mechanism for seeing which flight(s) have provided a readiness time, in order pre-schedule based on that time in TBFM. • TFMS Release timelines could slip for reasons unknown today. Flight Operator: • Accuracy of EOBT is essential. • Assigned wheels-up time conformance is essential.

	Airport Operator: • At ramp tower locations, awareness of the importance to conform to the wheels up time.
Environmental and noise-related risks	None.
Other	None.

Corresponding OI # 104209-17

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