



**Approved by the NextGen Advisory
Committee June 2016**

**NextGen Integration Working Group
Rolling Plan - Final Report**

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

June 2016

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Background/Introduction

In 2014 the NextGen Advisory Committee (NAC) approved the NextGen Integration Working Group (NIWG) final report and the NextGen Priorities Joint Implementation Plan was presented to Congress. Collectively we have achieved many successes in meeting implementation milestones for fielding NextGen capabilities, advancing work in the four priority areas of DataComm, Multiple Runway Operations (MRO), Performance Based Navigation (PBN), and Surface Operations.

- DataComm – In response to NAC recommendations, the FAA resolved implementation issues, including addressing the data recording requirement that presented a potential barrier for aircraft operators to use pre-departure clearances in the terminal area. The FAA has met or exceeded the planned dates for implementation of Departure Clearance Tower Services at more than 25 of 56 planned airports.
- The FAA has made substantial progress on implementing Wake Recategorization (Wake ReCat) at more locations as recommended by the NAC. This progress is expected to continue over the life of this rolling plan. The FAA also successfully reduced separation standards for multiple dependent and independent parallel approaches at numerous locations, including the standards required to support the opening of the new south runway at Chicago O’Hare International Airport. Work continues on the safety analyses for a variety of other separation standards reductions.
- In the critical area of PBN, the FAA implemented Established on RNP (EOR) capabilities at Denver, completed a Metroplex implementation at Northern California, and began the Metroplex work for Atlanta and Charlotte. The FAA also conducted a single site assessment for Las Vegas and implemented a national standard for Equivalent Lateral Spacing Operations (ELSO).
- In an effort to improve efficiency on the surface, the FAA installed the System Wide Information Management (SWIM) Surface Visualization Tool at multiple TRACONs, and deployed electronic flight strips at Newark and Cleveland Airports. The FAA, in partnership with NASA, launched an effort to implement departure metering capability at Charlotte. Industry and the FAA reached agreement to have airports participate in Collaborative Decision Making and are working toward ingesting 11 key data elements into traffic flow management tools.

In 2015 the FAA and RTCA conducted a comprehensive set of interviews with over 30 individuals involved in the NIWG effort to identify lessons learned. Consistent themes emerged from the insights of stakeholders, the FAA and the National Air Traffic Controllers Association. The study found collaborative efforts have increased trust and confidence, and there is a new appreciation for working together to advance the work of NextGen. The 3-year focus connected planning closer to the operation; the timeline and FAA responsiveness made this an extremely productive effort; and, success in implementing the priorities, coupled with the increased transparency are having a synergistic effect.

As part of the process improvement findings, the team agreed the plan needs to be updated to capture the dynamic environment and to reflect current realities. The findings also revealed the need to be nimble and agile, flexible where needed, and to make legitimate adjustments to commitments where warranted and justified. These are adopted in the methodology going forward

The findings revealed 100 percent agreement on the need to continue to collaborate on a set of NextGen Priorities. Based on these findings, the FAA and the NAC agreed to update the joint plan on an annual basis and to roll the plan forward two years, bi-annually. They agreed to continue to focus on a few priority areas, and to work towards the goal of focusing not just on implementation, but improvements in operational performance.

Interdependencies of the capabilities, among not only the four priority areas, but also among how capabilities are integrated in a way that makes the four priority areas more beneficial to the operation of the national airspace system, is important. Implementing capabilities individually, while helpful, doesn't always lead to the bigger benefits being sought.

The Joint Plan has focused on Tier 1A capabilities to date. For this rolling plan, Tier 1A priorities, including the decision support tools to optimize PBN, are still valid priorities for the NAC's criteria of High Readiness-High Benefit capabilities for the 2017-2019 timeframe.

The Joint Plan continues to focus on the following priority areas:

- Multiple Runway Operations (MRO)
- Data Communications (Data Comm)
- Performance Based Navigation (PBN) including Time Based Flow Management (TBFM)
- Surface and Data Sharing (Surface)

The purpose of this initiative is to continue to deliver tangible benefits and increase the community's confidence in NextGen by continuing to deploy these four capabilities in the next 1-3 years. It is important to note that these focus areas represent a subset of work that industry has prioritized and not NextGen in its entirety. Tier 1B and Tier 2 have not yet been addressed with joint planning milestones.

The work of the NIWG represents a new model of collaboration between industry and the FAA and is helping accelerate the implementation of near-term NextGen capabilities.

The pacing items that were identified in the 2014 recommendations as critical to the successful implementation of each of the priority areas still apply. These include various areas such as change in roles for pilots/controllers, technology/equipment, ATM automation, decision support tools, training, airspace changes, procedures, policies, technical standards, certification, operations approvals, political risks, environmental and noise related risks and an "other" category.

Executive Summary

The NextGen Integration Working Group has successfully delivered against the commitments made in the 2014 Joint Implementation Plan as well as the NextGen Priorities October 2015 Update. The NIWG agreed to roll the plan forward through 2019 with additional commitments that meet the "high benefit, high readiness" criteria.

The recommendations for each priority area are highlighted below.

DataComm

- The continuation of the accelerated timeline for deployment of Data Comm Tower Services

- Development of currently baselined En Route Initial Services, to be deployed at all 20 CONUS Air Route Traffic Control Centers (ARTCC).
- Development of a baseline for En Route Full Services.
- Development of a baseline for remaining En Route Full Services.
- Consider FANS 1/A over VDL Mode 0 as a viable medium for Data Comm En Route operations within a performance based framework in the NAS En Route airspace.

Multiple Runway Operations (MRO)

- Continue Wake RECAT 1.5 and 2.0 implementations at additional sites.
- Continue safety analyses and publication of new separation standards and pursue supporting RNAV procedure development.
- Complete analysis of Vertical Navigation Requirement (VNAV) for Simultaneous Independent Parallel Instrument Approaches to Closely Spaced Parallel Runways.
- Complete assessment of potential benefits and facility requirements for upgrade of existing Wake RECAT Phase 1.5 sites to Phase 2.0.
- Complete assessment of Time Based Separation (TBS) on final approach for use in the NAS as a transition to dynamic pair-wise wake turbulence separation standards.

Performance Based Navigation (PBN)

Plan includes the following capabilities for safety assessment where needed, and implementation as determined.

- Established on Required Navigation Performance (EoR) – EoR w/ Radius-to-fix (RF), EoR w/ Track-to-fix (TF), assessment of TF/RF Concurrent Operations
- Metroplex – tracking milestones at three locations
- Established on Departure Operations (EDO) – FAA assessing concept viability
- RF to xLS (RF/TF) – Assessment/identification of pre-implementation milestones
- Optimized Profile Descents (OPD) - Area Navigation (RNAV) Standard Terminal Arrivals (STARs)
- Enhanced Flight Vision Systems (EFVS) – implementation of new capability
- Advanced RNP (A-RNP)
- New Vertical Guidance
- Departures – RNP and RNAV
- Seattle Greener Skies - Actions TBD after assessment

Surface and Data Sharing

- Implementation of the capabilities outlined in the S-CDM CONOPS and the TFDM Program
- Data Sharing among FAA, Flight and Airport Operators involved in the NIWG process
- Establishment of a forum for on-going Industry engagement with FAA regarding TFDM/Surface decision support tools, processes, procedures, and policies throughout the lifecycle of development and deployment

Assumptions

The following assumptions were derived from a lessons learned assessment of the NIWG effort and are being used as the teams roll the plan forward:

- Build on existing focus areas to make them more effective/useful
- Include follow on commitments from assessments
- Include more Industry commitments
- Be clear about budget constraints
- Model the performance contributions (metrics) to inform ranking of priorities
- Be agile and nimble to make legitimate adjustments to priorities where warranted and justified
- Add flexibility into planning
- Integrate activities across the four focus areas
- Include decision support tools in the PBN focus area

Methodology

The success of this effort continues to be dependent upon effective collaboration between the FAA and the industry. FAA leadership has worked closely with industry leadership 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 through 2019. The members of the NAC Subcommittee have also played an important role in the process by applying their expertise in the details associated with the specific capabilities.

As part of the process improvement findings, the team agreed to memorialize this highly successful process as an iterative process; repeat FAA and Industry team makeup; keep the teams engaged; and to increase the flexibility around planning milestones.

The joint plan will be updated on an annual basis every October. The NIWG teams will remain engaged via the quarterly reporting process at the NAC SC meetings and as needed at the working group level. The NIWG teams will reconvene bi-annually to confer on high priority high readiness focus areas and provide new recommendations every two years.

The same teams (with some membership changes) led by industry representatives from the aircraft operator and automation/technology providers that developed the October 2014 plan developed this rolling plan. 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. FAA and industry team members worked very closely together in order to plan specific milestones and locations for each capability.

To increase the flexibility around milestones, recommendations include a number of sites by year end in some instances, rather than specific sites by quarter. The teams agree to provide transparency into the waterfall throughout the monitoring and oversight of the plan.

Joint Analysis Team

The NIWG working groups are taking the findings of the Joint Analysis Team (JAT) chartered by the NAC and the FAA to analyze the performance impacts of NIWG implementations into consideration as they

developed the recommendations. Under the JAT, industry and the FAA have worked together to analyze changes in performance as a result of implementation of Wake RECAT in Charlotte and Chicago (Midway and O'Hare) and performance based navigation procedural changes in the North Texas Metroplex. The NAC identified the following six key performance metrics for measuring performance impacts:

1. Actual block time
2. Fuel burn
3. Actual distance flown
4. Taxi out time
5. Gate departure delay
6. Facility reported capacity rates

The JAT is examining these metrics as well as other more detailed metrics relevant to each unique project to measure the operational performance impacts, validate the modeled performance, and inform future benefits projections. These metrics are envisioned to help identify areas of focus, process change, and organizational change.

Specific Recommendations by NextGen Focus Areas

Data Comm - Controller Pilot Data Link Communications (CPDLC)

Summary

Evolving the National Airspace System (NAS) to meet the goals of NextGen requires the implementation of advanced Data Communications (Data Comm) 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. As the NAS moves to a time-based flow management system it will become increasingly critical to have the capability to provide En Route data communications between the flight deck and the controllers. In the future, controllers and pilots communicating verbally using analog radios may detract from technologies that enable the implementation of increasingly complex NextGen capabilities. 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 program also provides an interface to the aircraft operator dispatch function, increasing operational efficiency. The investment in data communications is critical to enhancing the NAS and modernizing air traffic operations.

In an effort to ensure that Data Comm capabilities are delivered and the benefits are realized, the RTCA Data Comm NextGen Integration Working Group (NIWG) thoroughly reviewed the FAA Data Comm Program and developed timelines, locations and services to which both industry and the FAA would commit. To that end, the Data Comm NIWG specifically reviewed seven areas for this rolling plan update. These are as follows:

- Acceptance of the capabilities contained in the segment of the program called En Route Full Services which is scheduled to be baselined by FAA in Q3 2016.

- Consideration for using VHF Data Link (VDL) Mode 0/ alternate media to conduct Data Comm operations in all phases of flight to include En Route services. The current baseline is to only allow VHF Data Link Mode 2 (VDLM2) for En Route services.
- Address requests for additional and/or alternate airports for Departure Clearance (DCL) Tower services.
- Review of progress and commitments relative to operator equipage for Data Comm.
- Assess, review, and incorporate experience and lessons learned from the Data Comm interface to operator's operations' control center dispatch function.
- Review of Data Comm program benefits and metrics.
- Address operator requests for system enhancements.

The first two areas: acceptance on En Route Full Services and the allowance of VDL Mode 0/alternate media for En Route services invoked the most review and discussion by the Data Comm NIWG. The Data Comm NIWG learned that in the upcoming FAA baseline decision there was insufficient projected funding to accommodate the entire suite of En Route Full Services and it was suggested that En Route Full Services would be broken into two parts; one part baselined in Q3 2016 and a second part to be baselined at a yet to be determined future date. As a consequence, the Data Comm NIWG was asked to rank in priority the Full Services capabilities. The proposed Q3 2016 baseline set of services include full controller initiated routes, full direct-to-fix messages, full crossing restrictions, full advisory messages, and full holding instructions. The future set of services includes tailored arrivals, full speeds, stuck microphones and beacon codes.

For the most part the Data Comm NIWG concurred with the proposed segmentation with the exception of the tailored arrivals capability. The Data Comm NIWG believes the capability for a controller to provide altitude and airspeed constraints on a reroute would be a valuable first step in the development of a truly dynamic tailored arrival and Optimized Profile Descent (OPD). This would also provide an important element to enable complex path- stretches off OPDs for time based flow management into the terminal area. However, even though the Data Comm NIWG ranked tailored arrivals as one of the top priorities for En Route Full Service and therefore a strong candidate for inclusion in the Q3 2016 En Route Full Services baseline, the Data Comm NIWG, in consultation with the Performance Based Navigation (PBN) NIWG Time, Speed, Spacing (TSS) Task Group, could not determine how tailored arrivals would best fit into the overall PBN strategy. Therefore, the timeline and need for the tailored arrivals capability was referred to the PBN TSS Task Group. The Data Comm NIWG recommends the PBN NIWG TSS Task Group address tailored arrivals in its report to the NAC in October 2016.

The Data Comm NIWG notes that En Route Full Services in their entirety was rated a Tier 1 capability in the initial NAC report and as such the limitation of funding and the subsequent need to break En Route Full Services will delay the realization of delivery of operational benefits and efficiencies. The Data Comm NIWG recommends that En Route Full Services, a 2014 Tier 1 priority by the NAC, be implemented as soon as possible commensurate with the original schedule for IOC in 2022. The Data Comm NIWG recommends the remaining En Route Full Services be baselined by end of FY2017. The aircraft equipage and airline incentive was based on a joint understanding that En Route Full Services would be delivered in the 2022 timeframe.

There are currently more than 400 aircraft operating in the NAS with VDL Mode 0, which are able to use Data Comm Tower Services. Industry believes these aircraft have the potential to increase the use of

Data Comm En Route Services. The Data Comm NIWG requested the Performance-based Operations Aviation Rulemaking Committee (PARC) Communications Working Group (CWG) initiate a project to assess the feasibility of non-VDL Mode 2 media for CPDLC services in the NAS En Route airspace. Based on their analysis, the PARC CWG recommended that the FAA consider Future Air Navigation System (FANS) 1/A over VDL Mode 0 as a viable medium for Data Comm En Route operations within a performance based framework in the NAS En Route airspace. The Data Comm NIWG endorses this recommendation.

The Data Comm NIWG also endorses the changes that the FAA made to the airports receiving DCL services under the accelerated waterfall. This includes adding DCL service to Portland (PDX), Milwaukee (MKE) and San Juan (SJU) and PDC only service at Cincinnati (CVG), Jacksonville (JAX) and Providence (PVD). The Data Comm NIWG will continue to work collaboratively to identify additional changes.

In summary the Data Comm NIWG endorses the following:

- The continuation of the accelerated timeline for deployment of Data Comm Tower Services in accordance with the sites and schedules shown in Figure 3 of this report.
- Development of currently baselined En Route Initial Services, to be deployed at all 20 CONUS Air Route Traffic Control Centers (ARTCC), beginning in 2019, that include transfer of communication, initial check in, altimeter setting, airborne reroutes, altitudes, limited speeds, limited controller initiated reroutes, limited direct-to-fix, and limited crossing restrictions.
- Development of a baseline by end of FY2016 for En Route Full Services, to be deployed to all 20 CONUS ARTCCs, beginning in 2022, that include full controller initiated routes, full direct-to-fix messages, full crossing restrictions, full advisory messages, and full holding instructions.
- Development of a baseline by end of FY2017 for remaining En Route Full Services, to be deployed to all 20 CONUS ARTCCs, at a future yet to be determined date, that include tailored arrivals, full speeds, stuck microphone, and beacon codes.
- The FAA consider FANS 1/A over VDL Mode 0 as a viable medium for Data Comm En Route operations within a performance based framework in the NAS En Route airspace.

Background

The Data Comm Program will provide data communications 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. Data Comm will provide a data interface between ground automation and the flight deck for controller and pilot communications, allowing pilots and controllers with a push of a button to send, accept, and insert (if allowed) into flight deck avionics safety-of-flight ATC clearances, instructions, traffic flow management notices, flight crew requests and reports. Data Comm is critical to the success of NextGen, enabling efficiencies not possible with the current voice system.

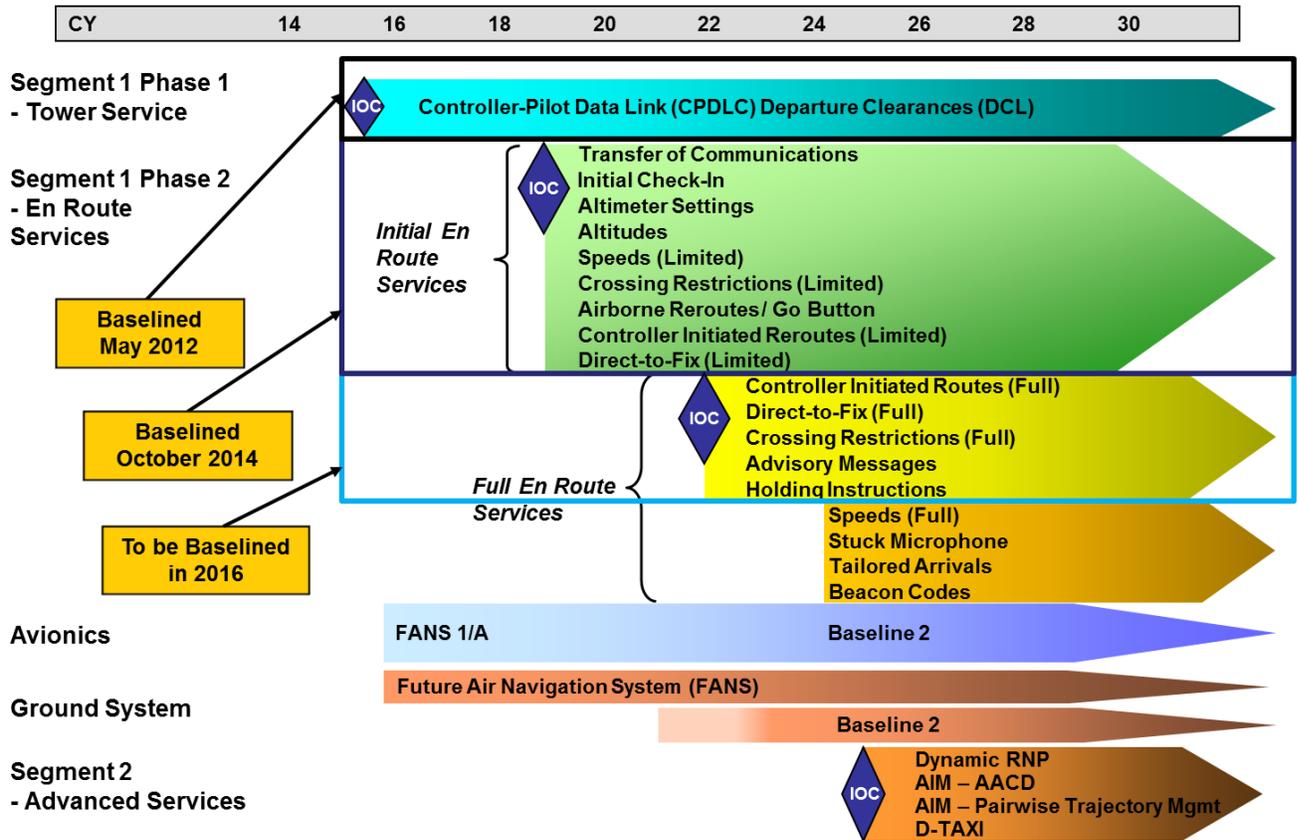
The operational benefits of the Data Comm Program are:

- Enhanced safety by reduced communication errors,
- Reduced communication time between controllers and pilots,
- 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 reroutes, trajectory operations,
- Enables the communication of complex clearances that can be efficiently executed,
- Ability to do post operational data mining of route changes to improve flight planning,
- Improved situational awareness and reduced time for route clearance acceptance through improved integration of dispatch.

These improvements to the NAS will be realized through the execution of the Data Comm Program in two primary segments. Segment 1 will deliver the initial set of Data Comm 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). Segment 2 will further build upon the Tower and En Route services by supporting more advanced NextGen capabilities not possible using voice, such as Dynamic Required Navigation Performance (DRNP), Advanced Interval Management – Arrival, Approach, Cruise, and Departure (IM-AACD), Advanced Interval Management – Pairwise Trajectory Management (PTM), and D-TAXI. These advanced services will require the deployment of Baseline 2 avionics. The focus of the activities of this working group is on Segment 1 Phases 1 and 2.

The Data Comm services phasing strategy for the program is shown graphically below in Figure 1. Segment 1 Phase 1 is Tower Services providing Controller Pilot Data Link Communications (CPDLC) Departure Clearances (DCL) and was baselined in May 2012. Segment 1 Phase 2 is CPDLC En Route Service which will be deployed in three increments. En Route Initial Services were baselined in October 2014. A portion of En Route Full Services consisting of Controller initiated routes (Full), Direct-to-Fix (full), Crossing Restrictions (Full), advisory messages and holding instructions are expected to be baselined Q3 2016. The remaining En Route Full Services consisting of speeds (Full), stuck microphone, tailored arrivals and beacon codes do not have a projected baseline date as of yet.

Figure 1 Data Comm Services Strategy



Departure Clearances (DCL) – Segment 1 Phase 1 (S1P1) (Baselined in May 2012)

In S1P1, the Data Comm program will deliver DCL to airports including revisions with full route clearances transmitted directly to the aircraft on the airport surface. Route revisions can be loaded directly into aircraft avionics by the pilots. The Data Comm program is currently in the process of implementing DCL Services in accordance with the accelerated timeline requested in the 2014 NIWG report. 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 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.
- Data Communications 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 FANS 1/A avionics and VHF Data Link (VDL) Mode 2 radios.

En Route Initial Services – Segment 1 Phase 2 (S1P2) (Baselined in October 2014)

S1P2 En Route Initial Services will leverage the S1P1 infrastructure to deliver services to the En Route domain using CPDLC. En Route Initial Services will include airborne reroutes, altitude and speed assignments, altimeter settings, crossing restrictions, and will automate routine communications such as transfer of communications and initial check-in. Controller initiated reroutes include limited functionality for pilot requested reroutes. The Data Comm En Route Initial 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 Data Comm becomes fully operational, the majority of pilot-controller exchanges will be handled by Data Comm for appropriately equipped operators.

The major elements of the En Route Initial Services Segment 1 Phase 2 implementation are:

- ERAM software enhancements for En Route CPDLC applications.
- DCNS expanded coverage and capacity.

En Route Full Services – Segment 1 Phase 2 (S1P2) (To be Baselined in September 2016)

S1P2 En Route Full Services will further leverage the S1P1 infrastructure to deliver additional services to the En Route domain, to include additional CPDLC messages and expanded reroute capabilities. The En Route Full Services will be delivered in two stages. The first stage of S1P2 En Route Full Services will include expanded controller and pilot initiated downlinks, direct-to-fix messages, issuing of crossing restrictions, holding restrictions and will automate some routine communications such as advisory messages. The Data Comm En Route Full 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 Data Comm becomes fully operational, the majority of pilot-controller exchanges will be handled by Data Comm for appropriately equipped operators.

The major element of the En Route Full Services Segment 1 Phase 2 implementation is:

- ERAM software enhancements for En Route CPDLC applications.

Remaining En Route Full Services (Not Baselined)

A subsequent stage of En Route Full Services will include the next level of evolution of the Optimized Profile Descent (OPD)-Tailored Arrivals, beacon codes, speeds, and stuck microphone. Tailored Arrivals functionality was removed from the first stage of the En Route Full Services and placed into this unscheduled second stage as a result of FAA budget constraints. The airline industry believes the capability for a controller to provide altitude and airspeed constrains on a reroute would be a valuable first step in the development of a truly dynamic tailored arrival and OPD which is a desire of both the FAA and industry. This would also be an important element to enable complex path-stretches off OPDs for time based flow management into the terminal area. Even though the Data Comm NIWG supports tailored arrivals as initially proposed for En Route Full Services, the group could not determine how the development of those tailored arrivals would best fit into the overall PBN strategy. Therefore, the timeline and need for Tailored Arrivals was referred to the PBN Time, Speed, Spacing (TSS) Task Group. The Data Comm NIWG recommends the PBN NIWG TSS Task Group report to the NAC by October 2016. The Data Comm NIWG further recommends the FAA baseline the additional En Route Full Services by end of FY2017.

Data Comm Benefits and Metrics

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

Expected Benefits

Data Comm will revolutionize ATC communication between the ground and the cockpit, increasing the capacity, flexibility, and productivity of the NAS. Data Comm provides services which will enhance safety, airspace throughput, flight times, reduce carbon emissions, reduce fuel usage, 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. Data Comm 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. Data Comm is a key transformational program under NextGen that will enable advanced capabilities, such as Trajectory Based Operations, Advanced Flight Interval Management, Enhanced Surface Movement, and Dynamic RNP. Data Comm 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 cost savings for both the FAA and operators from reduced delay enabled by a reduction in communication time for revised departure clearances and enhanced aircrew coordination with company dispatch.
- Enable post operational data analytics of clearances that are revised from the filed flight plan.

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 cost savings for both the FAA and operators from increased throughput/efficiency realized through reduced delays and improved communications.
- Direct cost savings for both the FAA and operators from reduced distance flown enabled by more precise airborne reroutes.
- Enable post operational data analytics of crossing restrictions, climb/descent requests, holding instructions, and re-routes after take-off to improve flight planning.

Metrics

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

Metrics for DCL Services at the Tower (S1P1)

- Data Comm 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 Data Comm functions. The metric is broadly covered by comparing known voice communication times with the communication times observed during Data Comm 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 sector throughput for both routine operations and weather or other disruption events.
- Efficiency - This category of metric tracks the impact on more efficient routes.
- Fuel Burn - This category of metric tracks the impact on the amount of fuel burned during En Route phase of flight.
- Implementation - Industry will jointly track with the FAA the operational milestones published by the program.

Metrics for CPDLC Services in En Route (S1P2)

- Data Comm 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 Data Comm functions. The metric is measured by comparing known voice communication times with the communication times observed during Data Comm exchanges.
- Improved controller and flight crew efficiency providing reductions in fuel burn, carbon emissions, and flight time through an increase in the most-optimum reroutes during a disruption event.
- Airspace Throughput - This category of metric tracks the impact on sector throughput for both routine operations and weather or other disruption events.
- Efficiency - This category of metric tracks the impact on more efficient routes.
- More efficient re-routes (weather and general) – Increased time saved through decreased approval/acceptance time for re-routes, more efficient re-routes through increased use of

auxiliary waypoints (HAR, PBD, lat/long), and increased acceptance/approval of weather re-routes before the re-route benefits opportunity window closes.

- Fuel Burn (for the purposes of evaluating Data Comm) - This category of metric tracks the impact on the amount of fuel burned during En Route phase of flight.
- Ability to do post operational data analytics of crossing restrictions, climb/descent requests, holding instructions, and re-routes after take-off to improve flight planning.
- Implementation - Industry will jointly track with the FAA the operational milestones published by the program.

Implementation Plan

The Data Comm Program S1P1 DCL Service is baselined for cost, schedule, and technical requirements to deliver the DCL service. S1P1 DCL service is being implemented at selected airport towers. Data Comm is meeting the industry requested challenge dates and projects completion of implementation by the end of 2016.

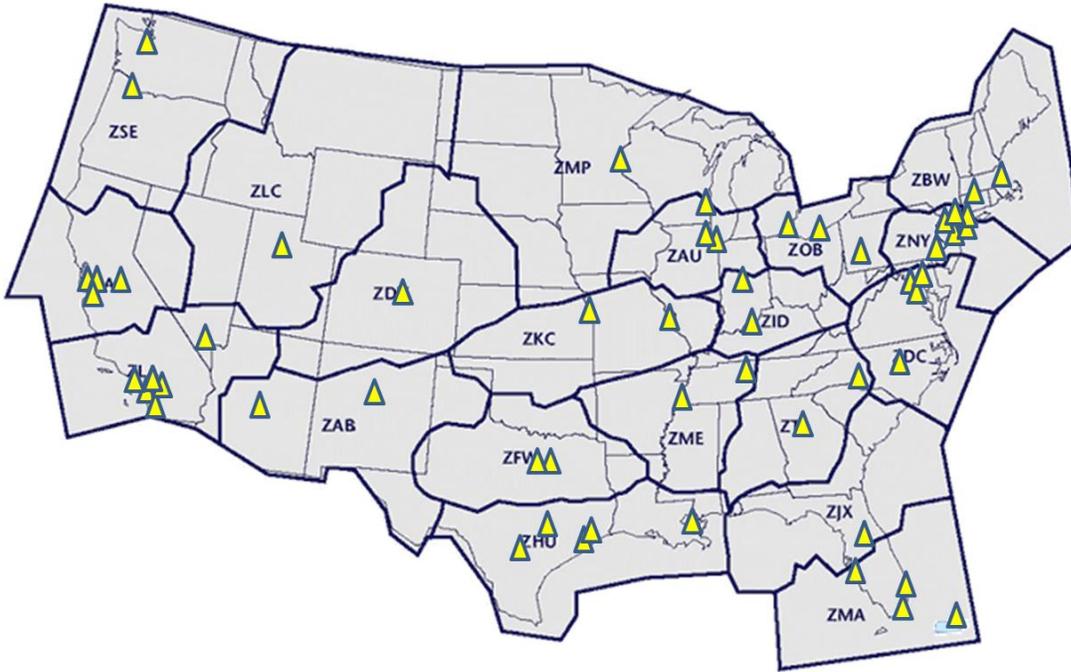
The Data Comm Program is also baselined for cost, schedule, and technical requirements to deliver the S1P2 En Route Initial Services. This plan includes schedule milestones and metrics to ensure the program is delivering its capabilities on time. The program is developing the plan for implementation of En Route Initial Services to all 20 ARTCCs.

The program has also developed a plan, schedule, and budget to deliver Stage 1 of S1P2 En Route Full Services to include controller and pilot initiated downlinks, direct-to-fix messages, crossing restrictions, holding restrictions and advisory messages. The FAA plans to baseline this stage of the program in September 2016. The program is also developing a plan, schedule, and budget to deliver the remaining S1P2 En Route Full Services to include tailored arrivals, beacon codes, speeds, and stuck microphone. The baselining date for this stage of the program is yet to be determined. The Data Comm NIWG recommends baselining this stage by end of FY2017.

Implementation Locations

The DCL service will be implemented at the Tower Data Link Services (TDLS) airports, shown below in Figure 2. En Route services will be implemented at all 20 Continental United States (CONUS) ARTCCs, also shown below in Figure 2.

Figure 2 Data Comm Tower Implementation Sites



DCL Services – S1P1

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 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 Data Comm 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 Data Comm Implementation Team (DCIT).

Figure 3 Data Comm Tower Implementation Waterfall

Key Sites				Group A				Group B				Group C			
Site Name	Site ID	ARTCC ID	IOC	Site Name	Site ID	ARTCC ID	IOC	Site Name	Site ID	ARTCC ID	IOC	Site Name	Site ID	ARTCC ID	IOC
KS 1: Salt Lake City	SLC	ZLC	Q3 2015	New Orleans	MSY	ZHU	Q1 2016	Louisville	SDF	ZID	Q1 2016	Newark	EWR	ZNY	Q1 2016
KS 2: Houston Intd	IAH	ZHU	Q3 2015	Austin	AUS	ZHU	Q1 2016	Indianapolis	IND	ZID	Q1 2016	J F Kennedy	JFK	ZNY	Q1 2016
KS 3: Houston Hobby	HOU	ZHU	Q3 2015	San Antonio	SAT	ZHU	Q1 2016	Memphis	MEM	ZME	Q2 2016	La Guardia	LGA	ZNY	Q1 2016
				Los Angeles	LAX	ZLA	Q1 2016	Nashville	BNA	ZME	Q2 2016	Teterboro	TEB	ZNY	Q1 2016
				Las Vegas	LAS	ZLA	Q1 2016	Denver	DEN	ZDV	Q2 2016	Westchester	HPN	ZNY	Q2 2016
				San Diego	SAN	ZLA	Q2 2016	Atlanta	ATL	ZTL	Q2 2016	Philadelphia	PHL	ZNY	Q2 2016
				John Wayne	SNA	ZLA	Q2 2016	Charlotte	CLT	ZTL	Q2 2016	Boston	BOS	ZBW	Q2 2016
				Burbank	BUR	ZLA	Q2 2016	Orlando	MCO	ZJX	Q2 2016	Bradley	BDL	ZBW	Q2 2016
				Ontario	ONT	ZLA	Q2 2016	Miami	MIA	ZMA	Q3 2016	Detroit	DTW	ZOB	Q3 2016
				San Francisco	SFO	ZOA	Q2 2016	Ft Lauderdale	FLL	ZMA	Q3 2016	Cleveland	CLE	ZOB	Q3 2016
				Oakland	OAK	ZOA	Q2 2016	Tampa	TPA	ZMA	Q3 2016	Pittsburgh	PIT	ZOB	Q3 2016
				San Jose	SJC	ZOA	Q3 2016	San Juan	SJU	ZMA	Q3 2016	Balt/Wash	BWI	ZDC	Q3 2016
				Sacramento	SMF	ZOA	Q3 2016	St Louis	STL	ZKC	Q4 2016	Dulles	IAD	ZDC	Q3 2016
				Phoenix	PHX	ZAB	Q3 2016	Kansas City	MCI	ZKC	Q4 2016	Reagan	DCA	ZDC	Q3 2016
				Albuquerque	ABQ	ZAB	Q3 2016	Minn-St Paul	MSP	ZMP	Q4 2016	Raleigh/Durham	RDU	ZDC	Q4 2016
				Seattle	SEA	ZSE	Q3 2016					Chicago Midway	MDW	ZAU	Q4 2016
				Portland	PDX	ZSE	Q3 2016					Chicago O'Hare	ORD	ZAU	Q4 2016
				Dallas Love	DAL	ZFW	Q4 2016					Milwaukee	MKE	ZAU	Q4 2016
				Dallas FTW	DFW	ZFW	Q4 2016								

En Route Services – S1P2

The CPDLC services and airborne reroutes will be implemented in the En Route airspace in all 20 CONUS ARTCCs. The services will be delivered in two stages: En Route Initial Services and En Route Full Services.

En Route Initial Services has been baselined to deliver services beginning in 2019, and will consist of the following CPDLC services:

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

The first stage of En Route Full Services is planned to be baselined in Q3 CY2016 and to be delivered beginning in 2022, and will consist of the following CPDLC services:

- Holding Instructions
- Advisory Messages
- Controller Initiated Routes (Full)
- Direct-to-Fix (Full)
- Crossing Restrictions (Full)

Due to budget constraints the remaining En Route Full Services have been deferred to a future second stage. This stage has not yet been baselined. The following services were deferred:

- Tailored Arrivals
- Speeds (Full)
- Beacon Codes
- Stuck Microphone

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

Implementation Activities

In order to implement the Data Comm 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 Data Comm capabilities to the NAS.

FAA Activities

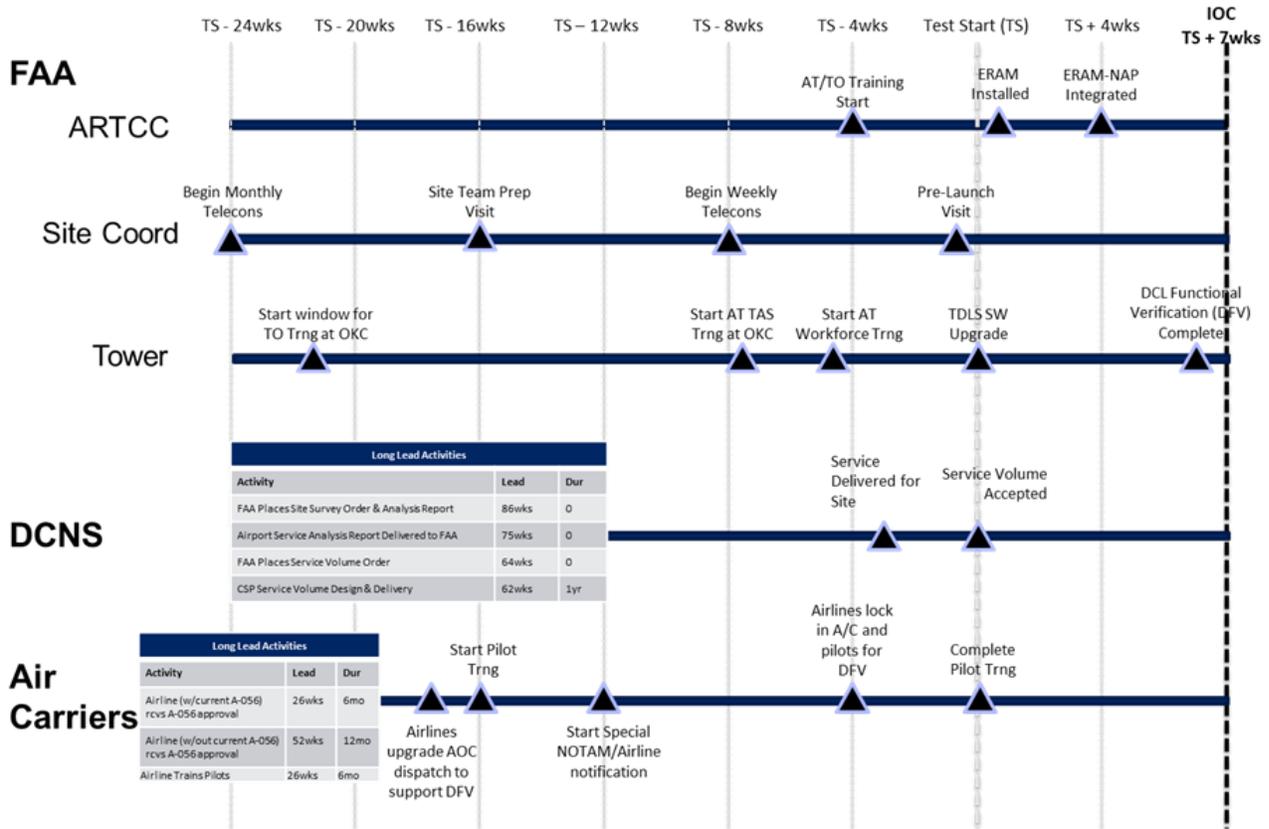
Departure Clearances (DCL) - S1P1

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 Data Communications 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 Data Comm Program has transitioned to the implementation stage. Though the program has baseline implementation dates of 2016-2019, the program is executing against the accelerated schedule to deploy services in 2015-2016. The Data Comm NIWG endorses this acceleration effort. The FAA successfully completed integration, test, and operational test and evaluation (OT&E) activities required to reach key site Initial Operating Capability (IOC), and has started the implementation waterfall shown in Figure 3. The FAA is also conducting the required training for controllers and technicians during the implementation waterfall timeframes. The operators are also completing training, host software upgrades, avionics upgrades, and regulatory requirements during this timeframe.

Figure 4 below shows both the FAA and operators required actions at each tower, as well as their required schedule in relation to site test activities. The FAA and operators work closely together during site test and rollout activities. Close coordination between the FAA and operators is required to successfully deliver capability to the site.

Figure 4 Tower Services Site Implementation Activities



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 FAA and operators will work closely together during site test and rollout activities. For transition to En Route operations in the NAS 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 starting in 2018.

S1P2 En Route Initial Services were baselined for cost, schedule and technical requirements at a Final Investment Decision (FID) in Q4 CY 2014. A subset of S1P2 En Route Full Services consisting of full controller initiated route, full direct-to-fix, full crossing restrictions, advisory messages, and holding instructions are planned to be baselined for cost, schedule, and technical at an FID in Q3 CY 2016. The

deferred S1P2 En Route Full Services, including full speeds, tailored arrivals, stuck microphone, and beacon codes does not yet have an FID date set.

National Operator Activities (for both DCL and En Route Services)

In order for controllers to maintain familiarity with DCL operations and realize the full Data Comm benefits the FAA estimates an additional 1900 aircraft will need to be equipped with FANS/VDL avionics. Eight air carriers have signed Memorandums of Agreement (MOAs) to participate in the Data Comm Avionics Incentive Initiative, which when fully executed will provide 1900+ certified and equipped aircraft into the fleet.

Close coordination will be required between the FAA and operators for delivering the service to the site; therefore, required operator’s activities have been integrated into Figure 4 above. These activities specifically include operator filing of Ops Spec A056, pilot training, support for test and integration, and operations center interoperability testing and software support.

No additional avionics will be required to receive S1P2 En Route services to fully participate in S1P2.

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 areas of consideration the NIWG has identified as significant for the successful implementation of the Data Comm capabilities:

Operator Equipage Commitment (VDL Mode 2/FANS 1/A)

The FAA established a Data Comm 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 Data Comm program baseline. The 1900+ aircraft goal was based upon creating enough daily operations to produce a “tipping point” of Data Comm benefits to the operation and safety of the National Airspace System and to the operators.

Under the Data Comm equipage program, eight agreements have been executed between Harris Corporation and the individual operators. The projected cumulative number of equipped aircraft by Government Fiscal Year (assuming some percentage dropout from MOA schedules) is as follows:

<u>FY15</u>	<u>FY16</u>	<u>FY17</u>	<u>FY18</u>
584 (actual)	1197	1712	1900+

The operators are currently executing against these MOA commitments and fully expect to have enough daily operations to produce the expected Data Comm benefits within the NAS.

These equipped aircraft numbers, and projected operations that will result, are in alignment with the challenge waterfall of ground automation upgrades at the airports in the US which will deliver DCL services, which started in 2015, and ultimately Data Comm services in the En Route airspace (projected first En Route services IOC in 2019). Additionally, the Data Comm program has made the decision to allow FANS1/A over media other than VDL Mode2 for Tower Services. It is projected that over 400 aircraft will utilize FANS over VDL Mode 0. These aircraft are not incentivized via the Data Comm

Incentive Program but will add to the projected number of DCL operations per airport per day. The Data Comm NIWG recommends the FAA consider extending allowance of VDL Mode 0 aircraft, and possibly other communications media, in En Route airspace.

In order for the Data Comm 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 Data Comm services across as many aircraft as feasible beyond the incentivized equipage program with the joint goal of ensuring the benefits of Data Comm services are realized across the operation for all stakeholders and users of the NAS.

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 Data Comm 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.

In domestic US airspace, the FAA Air Traffic Organization (ATO) 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 Data Comm Integrated Services (DCIS) contract.

During the investment analysis phase of the program, the FAA received industry feedback through the Data Comm Implementation Team (DCIT) and the RTCA 2011 Data Comm 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 DCL 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.

At the request of the Data Comm NIWG and DCIT, the PARC CWG initiated a project to assess the feasibility of non-VDL Mode 2 media for CPDLC services in the NAS En Route airspace.

The report provides recommendations to the FAA based on the results of a PARC CWG assessment. It describes the issues and costs with upgrading an aircraft from VDL Mode 0/A to VDL Mode 2 and concludes on the need for a global performance-based framework to evaluate the performance of VDL Mode 0/A and other media technologies. It includes an overview of the expected CPDLC En Route services and the associated requirements; these were based on the FAA's data communication definition and RTCA/EUROCAE Baseline 2 data communication standards. Finally, it provides the results of performance-based evaluations that show FANS 1/A over VDL Mode 0/A is viable for using CPDLC services in the US NAS En Route airspace. The PARC CWG applied the performance Based Communications and Surveillance (PBCS) provision and methods employed by Harris Corporation to

determine whether FANS 1/A over VDL Mode 0/A could be a viable option for using CPDLC in the US NAS En Route airspace.

Therefore, the Data Comm NIWG concurs with the PARC recommendation that the FAA consider FANS 1/A over VDL Mode 0/A, and potentially other communications media, as viable mediums for CPDLC En Route operations within a performance-based framework in the US NAS.

Operations Center Dispatch Message Copy

The FAA Data Comm Program provides participating operators with a dispatch center, flight following system, or other base of operations the ability and option to receive CPDLC message copies through the Dispatch Copy service. The Dispatch Copy was conceived by the DCIT in order to improve situational awareness and enhance communications between the flight dispatcher, flight deck and FAA air traffic control.

Feedback from the Dispatch Copy service shows that it provides operators with additional situational awareness for route revisions issued after a flight’s initial clearance. Some examples include automated alerts presented to the flight dispatchers for route revisions, integration with flight planning systems, and increased situational awareness to manage disruptions more proactively. Operators have also found value in the dispatch copy data for their post operational analysis functions including detection of navigation database discrepancies and optimized initial flight plan filing which results in fuel and time savings. Based on this initial feedback from the Dispatch Copy service for DCL, the FAA plans to implement a similar service for En Route CPDLC.

Data Comm NIWG Milestones

Milestone	FAA or Industry	Implementation (I) or Pre-implementation (P)	Milestone Date Q/CY
Final Investment Decision (FID) for Full En Route Services	FAA	P	3Q2016
Implementation Framework for non-VHF Digital Link (VDL) Mode 2 media	Industry FAA	P	1Q2017
Airlines to Equip 1,900 Aircraft	Industry	I	4Q2019
Initial Operating Capability (IOC) for Initial En Route Services at first Air Route Traffic Control Center (ARTCC)	FAA	I	3Q2019

Multiple Runway Operations (MRO)

Background

With increasing demand for air travel, the need for increased peak throughput performance at the busiest airports and in the busiest arrival and 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.

Delays ripple throughout the NAS when closely spaced parallel runways are not utilized to their greatest extent. This happens in less-than-visual flight conditions. With new technology in the cockpit and a concerted effort to examine the safety standards for closely spaced parallel runway operations, the FAA has made significant progress in providing new procedures and tools to better utilize runway capacity in all weather conditions. With these new procedures and data-driven changes to wake turbulence separation standards (Wake RECAT), 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 initiative because it is capable of delivering tangible benefits today at minimal cost and is expected to be available at specific locations within the three-year rolling time horizon of the plan. The new procedures and standards 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, environmental review, or 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. The new separation standards in general, and wake recategorization (Wake RECAT) in particular, have been providing immediate increases in capacity and reductions in delay.

Implementation Plan

Scope

NextGen Multiple Runway Operations capabilities improve access to parallel runways, including closely spaced parallel runways, while Wake RECAT can increase basic runway capacity and throughput. 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 research and data analysis conducted over the past several years. The associated NextGen Operational Improvement Increments for 2017-2019 are as follows:

Increment	Increment Title	Increment Description
102141-11	Amend Dependent Runway Separation Standards for 7110.308	Allow reduction of dependent stagger separation for 7110.308 airports from 1.5NM to 1.0NM, based on new collision risk standards.
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).
102141-28	Amend Dependent Runway Separation Standards for Runways Spaced Greater Than 4300 Feet	Reduce the dependent stagger separation from 2.0NM to 1.5NM for runways greater than 4300' and less than 8300'
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.
102152-31	Wake Recategorization Phase 3 -- Dynamic, Pair-wise Wake Separation Standards	Improve throughput at capacity-constrained, high-density airports by developing the capabilities required to achieve safe, efficient dynamic pair-wise wake mitigation separations of aircraft in a given airspace. This dynamic spacing will allow for reduction of the RECAT Phase 2 static pair-wise wake separation standards based on the variable, real-time conditions of the airspace, such as the current winds.

Expected Benefits and Metrics

The capabilities recommended in this report will provide benefits via increased arrival and/or departure capacity and throughput. This will lead to reduced delays, more flight opportunities, and better reliability and predictability for the traveling public, particularly during less-than-visual approach weather conditions. The increased capacity available with Wake RECAT, 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.

This potential capacity is unrealized today due to legacy separation standards that do not consider 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 wake encounter risk. These capabilities can provide operational benefits to the NAS without requiring additional aircraft equipage and with minimal cost to FAA when compared to other large NextGen programs.

Ultimately, the benefits of new separation standards, including Wake RECAT, are a function of the fleet mix and demand, as well as runway configuration. Initial analysis by the JAT has confirmed that expected reductions in separation from Wake RECAT have been realized between the relevant pairs of aircraft at Charlotte and Chicago. Empirical data have also shown that expected increases in separation due to a less favorable fleet mix at Chicago Midway have had minimal effect.

Recommendations

Recommendation 1: Continue Wake RECAT 1.5 and 2.0 implementations at additional sites as determined collaboratively with industry based on expected benefits and facility capabilities.

Recommendation 2: Continue safety analyses and publication of new separation standards as outlined in the table below. Pursue supporting RNAV procedure development, where required and as determined collaboratively with industry.

Recommendation 3: Complete analysis of Removal of Vertical Navigation Requirement (VNAV) for Simultaneous Independent Parallel Instrument Approaches to Closely Spaced Parallel Runways to increase availability of simultaneous procedures when ILS is out of service. Although this capability has universal utility, there is an immediate need at ORD due to the inability to site an offset localizer for runway 28L.

Recommendation 4: Complete assessment of potential benefits and facility requirements for upgrade of existing Wake RECAT Phase 1.5 sites to Phase 2.0. (At most locations, previous studies have shown incremental benefits from RECAT 2, however the assessments need to be refreshed due to fleet mix and demand changes.

Recommendation 5: Complete assessment of Time Based Separation (TBS) on final approach for use in the NAS as a transition to dynamic pair-wise wake turbulence separation standards.

MRO NIWG Milestones

Milestone	FAA or Industry Milestone	Implementation or Pre-Implementation?	Milestone Date Q/CY
Wake Recategorization – MIA	FAA	I	1Q2017
Amend Dependent Runway Separation Standards for Runways Spaced Greater Than 4300 Feet – CVG, MEM, PHX, SDF	FAA	I	1Q2017

Technical Report – Removal of Vertical Navigation Requirement for Simultaneous Independent Parallel Instrument Approaches to Closely Spaced Parallel Runways	FAA	P	1Q2017
Wake Recategorization – HNL	FAA	I	2Q2017
Amend Dependent Runway Separation Standards for 7110.308 – SFO	FAA	I	2Q2017
Assessment of potential benefits from upgrade of current Wake RECAT Phase 1.5 sites to Phase 2.0	FAA	P	2Q2017
Wake Recategorization – IAD	FAA	I	3Q2017
Amend Standards for Simultaneous Independent Approaches, Triples – ATL, IAD	FAA	I	3Q2017
Wake Recategorization – 5 sites* (PHL, MSP, SAT, PHX, LAS)	FAA	I	CY2018
Assessment of Time Based Separation concept for use in the NAS for dynamic wake turbulence separation standards	FAA	P	4Q2018
Wake Recategorization – 4 sites* (DTW, SEA, BOS, DFW)	FAA	I	CY2019

*Industry and FAA have agreed that flexibility on site implementation schedules is in the best interest of achieving MRO goals. For that reason, commitments have been documented by year. Planned sites are based on current best estimates for benefit, but may be subject to change if further analysis shows that any site(s) are not deemed cost beneficial by the MRO team.

The proposed implementation waterfall was developed based on the best current knowledge, expected benefits, facility training schedules, and schedules for construction and system/procedure implementation.

Risks and Other Considerations

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. 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 is ongoing. 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.
- Planned sites are based on current best estimates for benefit, but may be subject to change if further analysis shows that any site(s) are not deemed cost beneficial by the MRO team
- Implementation of MRO capabilities are dependent upon available R, E&D, F&E, and Ops funding in future and yet approved appropriations. There is an expectation that FAA will budget in these accounts to support full implementation of the MROWG recommendations. Significant budget cuts in any of these accounts may impact the capability waterfall described in this report.
- There may be some environmental risks if the impacts of new procedures exceed FAA threshold criteria for significance, which could delay implementation.

Operational Use

The MRO NIWG team is committed to implementing reduced separation capabilities through operational use. There are some community issues surrounding the implementation of new procedures and require additional time to address environmental concerns. The team remains committed to monitoring the progress of the following capabilities:

- BOS Runway 4L RNAV Approach/7110.308 Procedures
- SFO 7110.308 Runways 19L/R
- Dual Independent Parallel Operations with Offset (JFK, MSP, PDX)

As we implement new procedures through 2019, there may be additional procedures that will require monitoring through to operational use.

Performance Based Navigation (PBN)

Background

The industry and the FAA have made significant progress implementing PBN at locations throughout the NAS since the original PBN NIWG output was approved in 2014. The pre-deployment and implementation activities identified by that group have moved PBN forward and led to operational approvals that facilitate the use of PBN capabilities. This has included Established on Required Navigation Performance for Widely Spaced Operations at Denver (work on national standard), Northern California, Atlanta and Charlotte Metroplex, Las Vegas assessment and Equivalent Lateral Spacing Operations National Standard.

Starting with the elements identified in the recently endorsed PBN NAS Navigation Strategy, the Team built upon the collective Industry-FAA experiences by incorporating several of the FAA PBN implementation efforts and concepts already underway and identified additional sites important to the

industry. As before, the Team also identified opportunities for assessments that can lead to valuable capabilities being made available for future PBN implementations. The recommendations identify commitments and milestones for both the FAA and industry. For the purposes of this report the lead operator¹ is considered the principal sponsor and industry facilitator at a specific site. Where processes already exist to formally identify the lead operator for a project, those processes will be followed.

The 2014 Joint Plan focused on Tier 1A capabilities and included Time Based Flow Management (TBFM) in the PBN focus area. TBFM milestones were not included however because they were not projected in the 3-year window. Now, as we roll the plan forward through 2019, TBFM decision support tools to optimize PBN are becoming increasingly critical and are being deployed. They are included herein.

As experience has been gained with numerous PBN implementations across the NAS, it has become apparent that integration of PBN procedures into busy traffic operations requires new methods. In consideration of this, the FAA is planning and investing in a number of programs that address the challenges of gate-to-gate aircraft operations that are managed into a time-based flow and executed with a number of tools. In addition to the near term TBFM milestones through 2019, the Team is aware that the FAA tasked the NAC in December 2015 to review decision support plans and provide recommendations over a period of the 15 years via the PBN Time, Speed, and Spacing Strategy Task Group.

The implementation of near term Time Based Flow Management into the NAS, brought a new area of emphasis for the Team in considering the Decision Support Tools (DSTs) that are critical to the successful implementation of PBN in daily operations. The ability to safely integrate operations with time, speed, spacing tools will expand the practical implementation and effectiveness of PBN. The Team believes that there are existing tools that can assist controllers during a transition time-frame. The opportunities to maximize the contributions of these tools should be completely evaluated and pursued given the extended period of time before the more complete solutions that are currently in development are

¹ The organization Airlines for America (A4A) with input from other operators has provided the following recommendation for Lead Operator. While not yet accepted by the FAA, the PBN Team is referencing this definition (or what is subsequently agreed to) as the principle for the role at each implementation site with the understanding that this may be modified, however the underlying principle is to engage at the specific areas.

Participants involved in the implementation of new and revised flight procedures and airspace modifications, in the context of a Metroplex initiative, single-site effort or any other project in which industry has a stake, include representatives from FAA management, labor and industry. The Lead Operator will solicit input from and work to address concerns of all industry partners during the study, design, implementation, and post-implementation, review, and modification phases. Tasks Include:

- Perform detailed Integrated Airspace and Procedures design work in collaboration with the FAA workforce to provide best possible designs.
- Coordinate the assessment of procedure simulation and fly ability on different airframes
- Discuss and reach consensus with FAA on simulation guidelines/criteria
- Coordinate industry participation in the Safety Management review and revision of procedures and airspace
- Facilitate industry activity in outreach activities
- Provide Industry representation on Implementation Go-Teams
- Brief and provide information to Dispatchers (This is a component of the information dissemination process jointly accomplished by FAA and operators—not strictly a lead operator function)

available. It must be emphasized that the use of existing tools is only seen as a means to provide partial capability during the transition period. The Team supports the implementation of Time Based Flow Management (TBFM) decision support tool capabilities of Ground Based Interval Management (GIM-S) and Integrated Departure Arrival Capability (IDAC) as well as the initial deployment of Terminal Sequencing and Spacing (TSAS).

During the Team's deliberations the following criteria were used as part of the evaluation process to determine applicable sites for PBN procedures and supporting capabilities:

Alignment with the PBN NAS Navigation Strategy

- Does the procedure or capability move the NAS toward the vision laid out in the PBN Strategy?
- Does the procedure or capability align with a specific commitment in the PBN Strategy?
- Does the procedure or capability align with the commitment timeframes set out in the PBN Strategy?

Scalability/representative of challenges across the NAS

- Are the issues to be addressed representative of challenges across the NAS?
- Will the solution be scalable to other locations?

Benefits

- Is there a benefit to operators?
- Is there a benefit to controllers?

Procedures in place/Site readiness

- Are procedures already in place?
- Is the site prepared for PBN procedures?

Geographic location

- What is the geographic location of the site?
- How does this fit into the overall demands of the NAS?

Tools and procedure available for controllers

- Are the tools and ATC procedures required available for controllers – interim, longer term?

Industry's PBN Implementation Recommendations

Industry members of the Team identified the following focus areas for PBN Implementation plans:

Established on RNP (EoR)

EoR enables controllers to clear aircraft on an RNP approach while on the downwind to the airport without the need to use the standard 1,000 feet of vertical or 3 nm lateral separation when the aircraft turns to align with the runway centerline. This change allows aircraft to turn to align to the runway closer to the field, reducing track miles, fuel burn, and noise. EoR provides safety, reliability, and efficiency benefits in the NAS.

The Team identified EoR as a key capability for the FAA to complete the required safety assessments and implement at identified locations. The Team identified that the ultimate objective is to deploy Radius to Fix (RF) legs at locations that will leverage the EoR standards. In the interim, as operator capabilities evolve, the Team recommends that FAA leverage the existing equipage of prevailing traffic at each location when determining how to implement EoR. Pending safety and applicability studies, this will

likely include the interim use of Track to Fix (TF) legs as appropriate. The Team also recognizes that full use of EoR may require DSTs, especially at large, busy airports.

Recommended Implementation Locations

EoR with RF

SEA (Alaska), DEN (Southwest), PDX (Alaska), BNA (Southwest), IAH (United)

Selection Criteria:

- New operation would increase opportunity to use RNP AR and increase efficiency and decrease controller workload
- The PBN Strategy includes a commitment to establishing routine operational use of EoR at a key site in the near-term (2016-2020).

Status: SEA and DEN arrival operations are currently operating under a waiver to use EoR with RF legs.

EoR with TF

CLT (American), PHL (American), ATL (Delta), SDF (UPS)

Selection Criteria:

- Deployment would increase the opportunity to use RNP and TF at high volume airports to increase efficiency and decrease controller workload
- Low percentage of RNP AR/RF capable aircraft (equipage/authorization) resulting in a mixed equipage environment
- Provide opportunity for increased participation to gain experience in RNP operations for all NAS operators
- The PBN Strategy includes a goal of increasing the number of aircraft eligible to participate in EoR operations. The strategy also indicates that TF legs will exist as needed to support the eventual migration to RF legs by 2030, especially at busier airports.

Status: Complete the supporting safety assessment that could begin development of the initial sites of ATL and CLT.

Recommended Pre-Implementation Activities

To expand the use of EoR, the Team recommends that the FAA conduct the following pre-implementation RNP safety analysis activities:

- Dual TF – Evaluate designs, criteria and safety case for using TF-TF construction based EOR procedures. This application has the potential to provide benefit to a larger set of aircraft that cannot currently fly RF legs.

- Dual RF – Evaluate designs, criteria and safety case and complete the Document Change Proposal (DCP) required to nationalize the ability to apply EoR to runways that are widely-spaced using RNP AR operations.
- Complete an assessment of TF/RF Concurrent Operations
- Evaluate and complete a safety assessment of operations using a common downwind and having multiple transitions off of the downwind to different runways. This would be for both TF and RF constructions.

Metroplex

A key NextGen goal is to safely improve the overall efficiency of the National Airspace System by increasing efficiencies at metropolitan areas, or in a Metroplex, with multiple airports and complex air traffic flows. Through the Metroplex program, the FAA collaborates with aviation stakeholders to improve regional traffic movement by optimizing airspace and procedures built on precise satellite-based navigation. A near-term focus area in the PBN Strategy's is completion of optimized procedures at the first round of Metroplex sites.

Recommended Implementation Locations

The Team identified Atlanta, Charlotte, and Las Vegas as project sites to track with the understanding that the complete set of planned Metroplex activity includes additional sites such as Cleveland and Detroit:

Atlanta (Delta)

Selection Criteria:

- Large hub where delay impacts can propagate across NAS
- Complex airspace environments
- Mixed traffic types
- Related to Charlotte Metroplex
- Implementing various tools and capabilities

Status: The FAA's plans indicate final procedure publication in September 2016 with implementation completed in November 2016.

Charlotte (American)

Selection Criteria:

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

Status: The FAA's plans indicate procedure publication over four cycles from May 2016 to January 2017.

Las Vegas (NBAA)

Selection Criteria:

- Complex airspace environment
- Traffic mix
- 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

Status: The FAA completed the Study Phase of the Las Vegas project in March 2016.

Established on Departure Operations (EDO)

The PBN Strategy emphasizes the importance of continuous improvements that accelerate the delivery of benefits to the NAS from developments in navigation technologies and standards. The Established-on-Departure Operation (EDO) is a concept that applies the underlying ELSO concept to current diverging procedures in the terminal area where aircraft transition from terminal to En Route control. The concept aims to advance today's Transitional Separation standard by proposing that aircraft that are separated in terminal airspace (by prescribed divergence minima) and established on diverging PBN procedures no longer need to be delivered to En Route controllers with a minimum of 3 miles increasing to 5 miles spacing. EDO builds on to the ELSO work in the previous PBN NIWG planning period that resulted in a national standard. The Team recommends the FAA pursue development of a national standard for EDO.

Recommended Implementation Locations

Initial deployment at Atlanta and Dallas/Ft. Worth.

Atlanta (Delta)

Selection Criteria:

- Large hub where delay impacts can propagate across NAS
- Complex airspace environments
- Experience with implementing EDO
- Procedures already in place that can leverage EDO

DFW (American)

Selection Criteria:

- Large hub where delay impacts can propagate across NAS
- Complex airspace environments
- Multi-airport site

Status: The FAA is assessing concept viability.

RNP to xLS (with RF/TF)

The Team recommends the deployment of hybrid procedure designs that integrate an RNP initial and an intermediate segment that includes a Radius-To-Fix or Track-to-Fix leg-type with an ILS approach. The RF/TF leg would connect to the ILS at or outside of the final approach fix. An RNP (RF/TF) to ILS procedure design can allow for a shorter final approach while providing the lowest available minimums. The PARC WG work has completed its recommendations and provided them to the FAA. The Team recommends the FAA conduct an assessment of implementation at the industry identified locations and the identification of pre-implementation milestones.

Recommended Implementation Locations

Potential Sites: RNO (Southwest), SEA (Alaska)

Selection Criteria: The PBN Strategy indicates increasing availability of RNP (RF) to ILS procedures through 2030, with this type of procedure recommended at the busiest airports. According to the PBN Strategy, SEA and RNO are airports that fall within the navigation service group that may be provided with this type of procedure if the airports meet criteria that establish specific operational needs associated with safety, efficiency, capacity, or access.

Status: Safety Risk Assessment Complete

Optimized Profile Descents (OPD) using Area Navigation (RNAV) Standard Terminal Arrivals (STARs)

The Team recognizes that the FAA and Industry have been successful in implementing OPD procedures at many locations in the NAS. Using these procedures, aircraft burn less fuel because they allow aircraft to descend from high altitude airspace using minimal engine power with minimal use of level off segments. The PBN Strategy indicates RNAV STARs will be increasing in availability across the NAS through 2025 and will be provided at other locations based on specific operational needs associated with safety, efficiency, capacity, or access. Benefits achieved may be affected by revisions to existing and development of new procedures according to criteria. The Team has identified several additional high priority locations for OPD implementations.

Recommended Implementation Locations

Gary/Chicago LUCIT1 (Boeing Executive Flight Operations)

Status: Publication anticipated 3Q2016

Boston JFUND1 (JetBlue)

Status: Publication anticipated 3Q2016

Austin PINCH 1 (Southwest)

Status: Publication anticipated 2Q2017

Enhanced Flight Vision Systems (EFVS)

Currently, EFVS can be used only for continued operation between the Decision Altitude/Minimum Descent Altitude (DA/MDA) and 100 feet height above touchdown (HAT) zone elevation. The PBN Strategy indicates that the FAA will issue updated regulations and guidance material to enable EFVS operations through the entire visual segment, from 100 feet HAT to touchdown. The new regulations would be applicable to any approach with vertical guidance. The Team is recommending that upon publication of the final regulations, the capability would then be applied at the selected location.

Recommended Implementation Locations

Indianapolis (FedEx)

Selection Criteria: Lead Operator (FedEx) has equipped most of their fleet with the required sensors to support this operation.

Status: Fed Ex developing industry milestone

Advanced RNP (A-RNP)

The Advisory Circular (AC) 90-105A update was published in March 2016, which contains a description of A-RNP. A-RNP is a navigation and operational specification that provides a streamlined approval for PBN procedures. It also facilitates the use of some Authorization Required (AR) capabilities in non-AR applications (i.e., RF legs, scalable RNP value). It is expected that this new guidance will greatly expand the eligibility of aircraft and operators to fly procedures with RF legs. The Team is recommending that the FAA identify one or more demonstration locations and the industry will identify operators who will engage in the new approval process.

Recommended Implementation Locations

Identifying demonstration sites and industry commitments.

Status: FAA has published the applicable approval criteria.

New Vertical Guidance

Many runways in the NAS have not been eligible for instrument approaches with vertical guidance due to the proximity of obstacles and legacy design criteria. The FAA, working with industry, published new criteria in March 2016 that expands the eligibility of runways and will allow for additional sites to have procedures developed with vertical guidance. The Team is recommending that the FAA begin implementation of the new procedures at industry identified locations.

Recommended Implementation Locations

Identifying and prioritizing sites

Potential site: SMO

Decision Support Tools

Fundamental to the successful implementation and operation of PBN across the NAS is the need to advance the development, deployment, and use of Time Based Flow Management Decision Support Tools (DSTs) essential to ensuring more efficient traffic flows that fully leverage available system capacity. These merging and spacing tools must be specifically developed to support the PBN operational environment and to enhance traditional controller techniques of vectors, level-offs, and speed assignments for optimizing capacity. The Team is recommending that the FAA prioritize the development and deployment of these capabilities and endorses the current FAA plan.

Recommended Time Based Flow Management DST Priorities

Ground-Based Interval Management-Spacing (GIM-S)

Integrated Departure Arrival Capability (IDAC)

Terminal Sequencing and Spacing (TSAS)

Departures

Description

Recommended Implementation Locations

RNP

SNA as possible location for use of RNP-1 with RF departure procedures (Southwest)

RNAV

Henderson Executive Airport (HND) - Independent utility (NBAA)

Status: New RNAV SID off of RWY 35L for HND; workgroup has been initiated through 7100.41 PBN Implementation process. Core Workgroup will kick off in June 2016. A publication date will be chosen following that meeting.

PBN NIWG Milestones

Milestone <i>(Include a separate milestone for each unique location)</i>	FAA or Industry Milestone	Implementation (I) or Pre-implementation (P)	Milestone Date Q/CY
Established on Required Navigation Performance (EoR)			
<u>Collision risk assessment (if favorable leading to 7110.65 para 5.9.7 DCP)</u>	FAA	P	1Q 2017

IAH (RF): w/ Existing Proc (if favorable assessment)	FAA	I	Est. 4Q 2017
Lead Operator –United	Industry		
DEN (RF): w/existing procedures (If favorable assessment)	FAA	I	Est. 4Q 2017
<i>Lead Operator – Southwest</i>	Industry		
Track to Fix (TF): CLT, PHL, ATL, SDF Assessment of TF locations and path forward	FAA	P	Est. 4Q 2017
<i>If assessment leads to implementation Lead Operator – CLT & PHL (American), ATL (Delta), SDF (UPS)</i>	Industry		
Radius to Fix (RF): SEA, PDX, BNA, DAL Assessment of RF locations and path forward	FAA	P	Est. 4Q 2017
<i>If assessment leads to implementation Lead Operator – SEA & PDX (Alaska), BNA & DAL (Southwest)</i>	Industry		
Assessment of TF/RF Concurrent Operations	FAA	P	Est. 4Q 2018
<i>If assessment leads to implementation Lead Operator – TBD</i>	Industry		
Las Vegas Metroplex			
Design Team Kickoff (will establish future schedule and milestones)	FAA	P	4Q 2016
Lead Operator - NBAA	Industry		
CLT Metroplex			
Procedure publication	FAA	I	2Q 2016
Procedure publication	FAA	I	3Q 2016
FINAL Procedure publication	FAA	I	1Q 2017
Lead Operator – American	Industry		
ATL Metroplex			
FINAL Procedure publication	FAA	I	4Q2016
Lead Operator – Delta	Industry		

Single-Site implementations			
OPD/RNAV STAR GYY – LUCIT1	FAA	I	3Q 2016
Lead Operator – Boeing Executive Flight Operations	Industry		
OPD/RNAV STAR BOS – JFUND1	FAA	I	3Q 2016
Lead Operator – JetBlue	Industry		
OPD/RNAV STAR AUS – PINCH1	FAA	I	2Q 2017
Lead Operator – Southwest	Industry		
RNAV SID - HND	FAA	I	Est. 4Q 2017
Lead Operator – NBAA	Industry		
Established on Departure Operations (EDO)			
ATL – National Order Decision	FAA	P	Est. 1Q 2017
<i>If assessment leads to implementation</i> Lead Operator – Delta	Industry		
DFW – National Order Decision (Follows if ATL successful)	FAA	P	Est. 2Q 2017
<i>If assessment leads to implementation</i> Lead Operator – American	Industry		
RF/TF to xLS			
Assess key sites – Industry recommendation: RNO, SEA	FAA	P	Est. 2Q 2017
<i>If assessment leads to implementation</i> Lead Operator – RNO (Southwest), SEA (Alaska)	Industry		
Enhanced Flight Vision Systems (EFVS)			
Final Rule Publication	FAA	P	4Q 2016
Potential site IND			
Lead Operator – FedEx	Industry	I	TBD
Advanced RNP (A-RNP)			
AC 90-105 Update published	FAA	P	2Q 2016
Identifying key site (Industry recommendation: SNA, EGE)	FAA	P	1Q 2017

Industry to identify Operator to qualify under new AC	Industry	P	TBD
New Vertical Guidance			
Criteria published	FAA	P	1Q 2016
Identifying locations – (industry recommendation SMO)	FAA	P	1Q 2017
Lead Operator – NBAA	Industry		
Decision Support Tools			
Terminal Sequencing and Spacing (TSAS)	FAA	I	2019: Intent SEA or DEN
Ground-Based Interval Management-Spacing (GIM-S)	FAA	I	2016: 3 additional sites 2017: 3 add'l sites 2018: 3 add'l sites 2019: 4 add'l sites
Integrated Departure Arrival Capability (IDAC)	FAA	I	2016: 3 add'l sites 2018: 1 add'l site 2019: 4 add'l sites
RNP Departures			
Identifying key site (Industry recommendation SNA)	FAA	P	Est. 1Q 2017
Lead Operator – Southwest	Industry		

Surface and Data Sharing

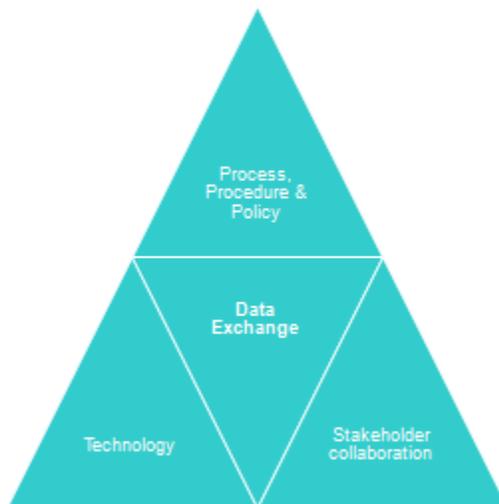
Background

In 2014, collaboration between Industry and the FAA as part of the Surface NextGen Integration Working Group (NIWG) led to surface traffic management and data sharing recommendations as well as commitments to meet those recommendations by both Industry and FAA. The areas of focus for the recommendations built upon RTCA’s Task Force 5, whose own recommendations were founded upon information sharing and situational awareness of airport flight movement activity. The 2014 Industry recommendations provide for tracking and reporting of specific commitment milestones by Industry and FAA as well as implementation locations within a 1-3-year timeframe, i.e., by 2017. The four recommendations were: Airport Collaborative Decision Making (CDM) membership and improved data availability; airport surface departure metering; to provide real-time traffic

management updates to New York (NY) Air Traffic Control Towers (ATCTs), Flight Operators and Airport Operators; and to utilize Earliest Off Block Time (EOBT) or equivalent data element (e.g., Estimated Runway Time of Departure (ERTD)) to reduce Time Based Flow Management (TBFM) delays for short range flights. While some of the commitments to address these recommendations are completed, others are in progress (please see <https://www.faa.gov/nextgen/snapshots/priorities/?area=sops/>) for the most up-to-date status of the Industry and FAA commitments, and refer to document “NextGen Integration Working Group Final Report” from October 2014 for a more detailed description of each commitment).



Surface Group Challenge: What is surface?



Deliver Predictability into the NAS

The 2014 NIWG surface recommendations focused on foundational capabilities. The FAA then asked the NIWG, through the RTCA NextGen Advisory Committee (NAC), for an updated “rolling plan” for the 2017-2019 timeframe. The NIWG wanted to continue to build upon the successful planning and implementation resulting from the 2014 foundational recommendations described above, and thus concentrated on the three areas described in the next section when developing the 2017-2019 plan.

Implementation Plan

Scope

At the time of the writing of this report, the FAA program that is expected to provide the needed comprehensive solution for the highest priority surface management concerns, the Terminal Flight Data Manager (TFDM) program, is facing the possibility of a significant budget cut. While TFDM itself is an FAA program, the capabilities identified in this program are those

of highest interest to Industry. The anticipated budget cut would slip the entire TFDM implementation timeline by 3 or more years. Additionally, the delay would also prolong the maintenance of the Departure Sequencing Program (DSP) in the New York Area, as well as other tools planned for subsuming by TFDM. High-priority surface-related issues that TFDM will address include: Wide-spread use of paper flight strips, along with outdated technology and disparate flight management systems, which reduces productivity and delays safety enhancements; inefficient runway utilization (balancing) and non-efficient runway queues, which result in wasted fuel and aircraft/crew utilization, as well as increased CO2 emissions and noise; and the need for surface collaborative decision making and surface metering predictability based on a common situational awareness between the various stakeholders and systems. Other surface management concerns addressed by TFDM and future “3T” (TFDM/TBFM/TFMS) decision support system integration include: The disconnect between En Route restrictions and the “first call - first serve model”, which negatively impacts surface efficiency; the lack of full data sharing among all stakeholders; as well as full stakeholder inclusion throughout the lifecycle deployment of TFDM/Surface decision support tools, processes, procedures, and policies.

The recommendations and implementation plan for Surface 2017-2019 span multiple areas: (1) implementation of the capabilities outlined in the S-CDM CONOPS and the TFDM program; (2) data sharing; and (3) development of a forum for on-going Industry engagement with FAA regarding TFDM/Surface decision support tools, and related processes, procedures, and policies throughout the lifecycle of deployment.

Recommendation 1: Implementation of the Capabilities outlined in the S-CDM CONOPS and the TFDM Program

As demand for our nation's airspace grows, smarter NextGen technologies are making air travel more efficient, predictable, safer, and environmentally friendly. The TFDM program capabilities, the FAA's surface management solution for NextGen, will help save time and fuel, reduce emissions, and improve the experience for the flying public. TFDM will work by integrating digital flight plans with surface surveillance data to create accurate, real-time predictive tools for the terminal environment. TFDM will share data among controllers, aircraft operators, and airports so they can better stage arrivals and departures, and manage traffic flow within terminal airspace for greater efficiency.

In response to the 2014 Industry recommendations, the FAA and NASA have jointly committed to demonstrating a departure metering capability, planned for in the TFDM Program, at Charlotte Douglas International Airport (CLT) through the Airspace Technology Demonstration 2 (ATD-2) project. The Surface NIWG Team recommends that the FAA leverage this opportunity to collaboratively exercise and refine the processes, procedures, and policies necessary for

surface departure metering, as defined by the S-CDM CONOPS, in an operational environment. This effort will build upon the previous process, procedure, and policy development work initiated by the Surface Operations Office and will reduce risk to the TFDM Program for the operational integration of, and transition to, the FAA's implementation of surface departure metering within the NAS.

TFDM's surface management capabilities include:

- **Electronic Flight Data:** TFDM will provide Electronic Flight Data (EFD) and Electronic Flight Strips (EFS) in the tower to replace printed flight strips. This functionality will be integrated with Flight Plans for automatic updating and creates electronic data that can be used for collaboration with flight operators and airports.
- **Surface Collaborative Decision Making:** TFDM will provide a departure scheduler with live data provided by Air Traffic systems/controllers and Flight Service Providers that will offer departure metering and other surface management tools, improving surface traffic flow management.
- **Enhanced Traffic Flow Management:** TFDM will enhance traffic flow management through TFDM, TBFM (Time Based Flow Management) and TFMS (Traffic Flow Management System) data integration to enable airlines, controllers and airports to share and exchange real-time data. This will result in improved surface traffic management and better airport operations.
- **Systems Consolidation:** TFDM will replace multiple unsupportable systems in the National Airspace System through integration of their functionality into TFDM. This achieves technology modernization, improved data sharing and lower maintenance costs.

With TFDM capabilities, Stakeholders will have a shared awareness of flights on the ground and in the air; the ability to exchange data electronically; a constantly updated picture of traffic volume, weather, and other changing circumstances; and more accurate predictive modeling. Additionally, TFDM capabilities will consolidate/subsume functionality spread across multiple, disparate systems, improving productivity. TFDM's subsuming of DSP in New York will allow the integration and use of important capabilities in the New York area operation, including Integrated Departure Arrival Capability (IDAC), which automates the process of monitoring departure demand and identifying departure slots; Pre-Departure ReRouting (PDRR), which enables Traffic Management Coordinators (TMCs) to use a single system to coordinate and send reroute information to towers handling departure flights; and Airborne ReRouting (ABRR), which will support both broad strategic reroutes affecting multiple En Route Air Route Traffic

Control Centers (ARTCCs), and local strategies within an ARTCC (such as arrival fix balancing operations).

In summary, TFDM capabilities integrates decision support tools in a gate-to-gate concept envisioned by both Industry and FAA, i.e., specifically, the integration of tools supporting electronic flight data/strips; queue management; and Traffic Flow Management (TFM) System integration and consolidation. TFDM capabilities will provide a better and more predictable product for the flying public; improved airport safety, efficiency, and predictability; as well as reduced taxi times, fuel emissions, and burden from DOT3/FAR117 requirements.

The Surface NIWG recommends the restoration of the originally planned FY18, FY19, and FY20 funding for the TFDM program, in order to restore the program back to its original timeline, i.e., 3 years earlier than currently planned in light of the anticipated budget cuts. The NIWG also recommends that the program receive a contract award in June 2016 or sooner. Furthermore, the NIWG recommends that the TFDM build that subsumes DSP is moved up in the overall waterfall.

Recommendation 2: Data Sharing among FAA, Flight and Airport Operators involved in the NIWG process

Data sharing among stakeholders in the surface environment is foundational to the success of surface traffic management. FAA, Flight Operators, as well as Airport Operators have valuable information that, if accurate and shared/exchanged in a timely way, can eliminate many of the issues in today's operational environment. For example, at many airports ATC is not aware of when a specific departure will operate, and Flight Operators are often unaware of in-trail restrictions until the pilot's initial contact with Ground Control (GC). While there are exceptions where ATC and the Flight Operator at an individual airport have an increased level of information sharing, typically the lack of adequate information sharing affects planning and overall demand predictability. A transparent, collaborative information sharing process will create better predictability and improve situational awareness, which in turn will lead to a safer, more efficient, and more economically managed surface operation, e.g., through avoiding excessive taxi-out times, reducing emissions, and optimizing airport capacity.

Examples of data to be shared are provided below for FAA, and for those Flight and Airport Operators who are involved in the NIWG process and commit to sharing/exchanging accurate data in a timely manner.

FAA commits to share, among other data, the following data via SWIM:

- ASDE-X CAT 10 MLAT Non-Movement Area (NMA) data (for all ASDE-X sites by end of CY2017)
 - o *Note: Movement Area (MA) CAT 10 MLAT data will also be included in this SWIM feed*
 - o *Note: More of the technical details behind FAA's ADS-B data processing infrastructure upgrade, currently underway, have been shared since Industry's original request for NMA ADS-B data. While the infrastructure upgrade allows for significantly more ADS-B data capture and processing in the MA, ADS-B NMA data will only be commercially available to FAA and Industry. (As of the writing of this report, the Surface NIWG Team is seeking full understanding with respect to why this data may be limited to commercial availability only.)*

Flight Operators commit to data sharing as well as outreach to foster additional data sharing:

- Participating CDM members commit to share, among other data:
 - o Earliest Off Block Time (EOBT)
 - o Flight Intent
 - o Aircraft Parking Gate/Area
 - o Actual OUT/OFF/ON/IN block time (more timely)
- Outreach to additional Flight Operators can continue to foster more comprehensive participation (i.e., General Aviation and international carriers)

Airports may share data, such as:

- Improved OUT/OFF/ON/IN times for non-participating flight operators (see above; i.e., international and GA aircraft)
- Parking capacity
- EOBT (for non-CDM participating Flight Operators (see above; i.e., international and GA aircraft)
- Number of diversions that can be accepted
- Gate Availability from the vantage point of the Airport Operator
- De-icing throughput rates
- Aerodrome surface conditions & construction (runways, taxiway closure)
- Remote/overnight parking
- Scheduled closures (one week in advance or when data available)
- *Note: List is notional and to be determined by further workgroup activities as described below*

Also, FAA commits to take steps necessary to allow on-boarding of Airport Operators and data exchange of new Airport-provided data elements.

With respect to data sharing by airports, selection of “pilot” airports is underway to help determine what data elements airports will share, and to propose and execute a process for how to share the data. The Port Authority of New York and New Jersey (PANYNJ) has committed to be one of these “pilot” airports, as well as three other airports. Additional airports will be asked to participate in years to come. Interest has been expressed by many airports to join this “pilot” group, including ATL, CLT, DFW, FLL, LAS, LAX, MIA, ORD, PHX, SFO, SEA and DEN. Multiple airports have also indicated they have already been working on data sharing programs with their lead operators. However, these initiatives are independent from one another. As a standardized process and format is developed for airport data sharing, it is expected that all participating airports will modify their process and data formats as necessary to be consistent with the standards developed by this “pilot” group.

Recommendation 3: Establishment of a forum for on-going Industry engagement with FAA regarding TFDM/Surface decision support tools, processes, procedures, and policies throughout the lifecycle of development and deployment

The Surface NIWG Team recommends the creation of a forum for continued industry engagement with the FAA regarding TFDM/Surface decision support tools throughout their lifecycle of development and deployment. This shared commitment would enable Industry the opportunity to engage with the FAA to develop a collaborative, informed industry message of support for Surface/TFDM and related initiatives. Such a forum would facilitate the creation of clear, unified messaging that reflects Industry’s interest and support of the TFDM program’s suite of tools, and to communicate this message Industry-wide and to relevant decision-making stakeholders. Team members will be able to participate in forums related to integration of data sharing initiatives and Terminal Flight Data Manager electronic flight data as well as procedures which will enable users to have a stake in the success of the TFDM program and to carry on the activities essential to success in integrating the TFDM capabilities. Transparency afforded by this engagement will assure that the Surface S-CDM CONOPS, when deployed via TFDM, remains intact. Participation in such a forum is envisioned to include CDM members; non-CDM participants; Part 121/135 Operators; Business Aviation; Airport Operators and airport user groups; as well as support organizations such as FAA ATO, FAA NextGen Office, and Decision Support Services and Research organizations.

Surface NIWG Milestones

Milestone <i>(Include a separate milestone for each unique location)</i>	FAA or Industry Milestone	Implementation (I) or Pre-implementation (P)	Milestone Date Q/CY
Implementation of the Capabilities outlined in the S-CDM CONOPS and the TFDM Program			
Plan to deliver capabilities to provide electronic flight strip capability, departure queue management capability and TFM system integration and consolidation to key sites as early as possible	FAA	P	3Q2016
Restoration of Original FY18/19/20 Funding for the TFDM Program and Contract Award	FAA	P	3Q2016
Plan to move up the TFDM build that subsumes DSP within the overall TFDM waterfall	FAA	P	3Q2016
Increased data sharing among FAA, Flight Operators, and Airports			
FAA			
<p>Surface Surveillance MLAT CAT 10 data (MA and Incidental NMA) to Industry via SWIM</p> <p>NOTE: ADS-B Surface Data in NMA is available commercially <i>(As of the writing of this report, the Surface NIWG Team is seeking full understanding with respect to why this data may be limited to commercial availability only.)</i></p>	FAA	I	4Q2017

Milestone <i>(Include a separate milestone for each unique location)</i>	FAA or Industry Milestone	Implementation (I) or Pre-implementation (P)	Milestone Date Q/CY
Flight Operators			
Surface Data Elements Initial Off Block Time (IOBT) Earliest Off Block Time (EOBT) (multiple input sources needed to include all – CDM, non-CDM, GA) Flight Intent (intent to hold in Movement Area prior to Target Movement Area entry Time) Aircraft Parking Gate/Area Actual In Block Time (AIBT), Actual Off Block Time (AOBT), Actual Take Off Time (ATOT), Actual Landing Time (ALDT) (more timely and uniform than OOOI) Flight Cancellation Aircraft Tail/Registration Number	Industry – Flight Operators	I	Initial CDM – 2016 Expansion Discussion - TBD
Provision of specific examples of desired TFM data not currently available via SWIM (such as full TBFM data for all sites; Full Route Clearance (FRC) required; complete set of MIT restrictions in effect; whether Call for Release (CFR) in effect; etc.)	Industry – Flight Operators	P	TBD

Milestone <i>(Include a separate milestone for each unique location)</i>	FAA or Industry Milestone	Implementation (I) or Pre-implementation (P)	Milestone Date Q/CY
Conduct Outreach to facilitate participation from additional Flight Operators	Joint FAA & Industry	P/I	TBD
Airports			
Selection of set of 4 initial “pilot” airports. <i>(NOTE: PANYNJ has already committed.)</i>	Joint FAA & Industry	I	3Q2016
Supplement Actual In Block Time (AIBT), Actual Off Block Time (AOBT), Actual Take Off Time (ATOT), Actual Landing Time (ALDT) <i>(NOTE: other data elements are under discussion)</i>	Joint FAA & Industry	P/I	TBD
Additional Pilot Airports	Joint FAA & Industry	P	TBD
Establishment of a forum for on-going Industry engagement with FAA regarding TFDM/Surface decision support tools, processes, procedures, and policies throughout the lifecycle of development and deployment			
Establishment of forum	FAA	P	4Q2016

Appendix A: Members of the NextGen Integration Working Group

Closely Spaced Parallel Runways - Multiple Runway Operations Team

John Bergener	San Francisco International Airport	Flavio Leo	Massachusetts Port Authority
Bradley Billheimer	Federal Aviation Administration	Glenn Morse	United Airlines, Inc. (Co-Chair)
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