NextGen Advisory Committee (NAC)
November 17, 2020 Meeting Summary

The NextGen Advisory Committee (NAC) convened virtually November 17, 2020. The meeting discussions are summarized below. Reference the attachments for additional contextual information.

List of attachments:

- Attachment 1: NAC Presentation Deck
- Attachment 2: Attendance List
- Attachment 3: Public Statements
- Attachment 4: Approved *Minimum Capabilities list (MCL) Ad Hoc Team NAC Task 19-1 / 20-4 Report*
- Attachment 5: Approved *Performance Based Navigation (PBN) Clarification Ad Hoc Team NAC Task 19-4 / 20-5 Report*

Opening of Meeting

NAC Chairman Mr. Chip Childs (SkyWest, Inc.) opened the meeting and welcomed virtual attendees.

Public Statements

After administrative housekeeping notes, Mr. Greg Schwab (FAA) invited the following public speakers to make their pre-approved public statements. Please reference Attachment 3 for the full text of each statement.

- Karen Porter, Palo Alto, CA - Palo Alto Citizens Coalition
- Cindy Christiansen, Milton, MA - Aviation-Impacted Communities Alliance and BOS Fair Skies
- Rebecca Ward, Palo Alto, CA

Chairman's Report

Mr. Childs then provided the Chairman's Report. To begin, he called for a motion to approve the August 6, 2020 NAC Meeting Summary Package, which the NAC approved.

Outcome: The NAC passed a motion to approve the August 6, 2020 NAC Meeting Summary Package

Mr. Childs recalled that at the August 6 NAC he began with an acknowledgment of the unbelievably difficult time our aviation community, our nation, and the world was experiencing due to the COVID-19 pandemic. He said that while the aviation sector has continued to adapt since that meeting, it has also had to make very difficult decisions in an economic environment where forecasts are still not clear and the pandemic drags on. He then acknowledged that his fellow NAC members have encouraged keeping focused on continuing the NAC's work during these trying times. He said they have been emphatic that the work of implementing NextGen is still essential to the aviation community's future and achieving the goals of a modernized National Airspace System.

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Mr. Childs then offered thanks to the FAA on behalf of the NAC. Although the FAA was facing the same pandemic impacts to its operations and programs, it continues providing remarkable air traffic services as it has stood shoulder to shoulder with Industry to press ahead with the NAC priorities. He said it's important to remember that while the NAC is very important, we can't ignore the crisis affecting the country and Industry. He emphasized that the NAC is committed to completing its tasks, but the first priority has to be a safe NAS, which the FAA Air Traffic Control organization has continued to provide throughout this pandemic. He said that the NAC supports all efforts to keep the people of every organization safe and healthy and that everyone is better for this unique FAA / NAC partnership.

He then reviewed the agenda, which he said was not time-limited based on the NAC members' request for a full meeting. He said that the agenda was designed to engage all NAC members as they attempt to offer insights on trends that will allow technical experts to help the NAC provide more informed advice. He said the technical experts are grappling with the issues the NAC must ultimately provide advice on, including PBN, VNAV, MCL, Section 547, ADS-B In, Data Comm, etc. He said these issues require a common understanding of potential future fleet trends that is being shaped daily as the industry continues to adapt to the pandemic.

Before moving on to the FAA Report, he offered a farewell to FAA Deputy Administrator and NAC Designated Federal Officer (DFO) Mr. Dan Elwell. He summarized some of Mr. Elwell's accomplishments with the NAC, including serving as the FAA's DFO for the NAC for more than two years and, in various other capacities, for nearly a decade. Mr. Childs continued that Mr. Elwell has watched over this important committee, ensuring the NAC effectively addressed and resolved barriers to achieving the maximum benefits from NextGen investments, managing the development of the three-year NextGen Joint Implementation Plan, and guiding the NAC through the anomalies of COVID-19 impacts to joint endeavors. He wished Mr. Elwell well on behalf of the NAC and handed off to FAA Administrator Mr. Steve Dickson.

Mr. Dickson thanked Mr. Elwell for his leadership as his second tour of duty with the FAA comes to a close later in the year. He said that Mr. Elwell has had an impressive career as a federal executive, an Air Force officer, and as a line pilot. He came back to the FAA as Deputy Administrator officially in June 2017 and served as Acting Administrator from January 7, 2018 to August 19, 2019. During his first tour, from 2006-2008, Mr. Elwell was the FAA Assistant Administrator for Policy, Planning, and Environment. In each of these executive leadership roles, he distinguished himself by providing thoughtful, yet energetic, counsel and guidance every step of the way. He said that Mr. Elwell has a great mind for policy and the FAA will miss his ability to anticipate issues. He said that Mr. Elwell, as a U.S. Air Force veteran and Air Force Academy graduate, retired from military service as a Command Pilot with more than 6,000 hours of military flight time, including combat service during Operation Desert Storm. In addition to his experience in military aircraft, he flew 16 years for American Airlines and also led their Office of International and Governmental Affairs. He said that Mr. Elwell's policy expertise, aviation acumen, and relationships with a host of stakeholders is second to none. His staunch dedication to safety will be his lasting legacy at the FAA and across the aerospace industry, domestically and internationally. Mr. Dickson wished Mr. Elwell and his family all the best in future endeavors.

Mr. Childs then opened the floor for other NAC member comments. Mr. Joe DePete (ALPA) offered brief congratulatory remarks. Mr. Childs then turned the floor over to Mr. Elwell for the FAA Report.

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FAA Report

Mr. Elwell thanked Mr. Childs, Mr. Dickson, and all NAC members for their kind words. He said that he has been blessed to be a part of the NAC, in various capacities over the years. He said this has allowed him to experience firsthand the significant contributions that a strong advisory committee relationship between the FAA and the aviation community can achieve. He continued that the NAC has helped the FAA prioritize NextGen implementation milestones in ways that have resulted in benefits for all operators in the National Airspace System and dividends for the American traveling public. He said that in recent years, the FAA has begun to leverage the NAC to tackle some of the most vexing barriers to full NextGen implementation, including: developing a Minimum Capabilities List, continuing to resolve long standing avionics issues around Data Comm, providing a NAC consensus on priorities for new Performance Based Navigation procedures, and having a conversation earlier this year to see if there were any "opportunities" which the FAA and Industry could jointly explore to take advantage of a NAS that was operating at 40 percent below capacity during the early days of the COVID-19 pandemic. He continued that Industry and FAA have established a solid model for the NAC going forward where the NAC continues to provide aviation community consensus advice on priorities for the FAA's remaining NextGen implementation milestones while, at the same time, forming time and scope-limited NAC ad hoc teams to provide options for reducing aviation barriers to achieving a fully modernized NAS. Next, he handed off to Mr. Dickson.

Mr. Dickson thanked Mr. Elwell and said the NAC is one of the most valuable forums that the FAA has. He said he appreciated the NAC's continued efforts despite the challenging issues facing the industry. He added that he appreciated Mr. DePete's words and indicated that Industry has really shown the ability to close ranks and face the challenge of COVID. Despite this reality, he said this is a really exciting time with lot of cool stuff going on. He continued that instead of pulling the throttles to idle as the pandemic began to deeply impact every aspect of aviation, the community rallied and leaned in so that the NAC could advance the throttles on all efforts.

He said that the FAA is proud to have fully committed to leaning in together on the NAC priorities while never losing sight of the top priority, ensuring the safety of NAS operations. He indicated that the NAC would hear more later in the meeting on how the FAA Air Traffic Organization was able to learn and adapt to the pandemic environment, providing near continuous air traffic services, while still never losing focus on the safety of NAS professionals. He said this continues to be a challenge and the FAA is not immune to what is happening around the country. He described this as a tribute to the essential nature of the aviation community and that he is sure it will be a story everyone will be proud to share with others in the community, families, and friends for years to come.

Mr. Dickson then provided a quick overview of some other effort areas across the FAA. He said the FAA is heads down today and continuously on 737 MAX. He acknowledged that the pandemic pushed the MAX below the fold, but that it has never been out of mind for the FAA. He offered his thoughts and prayers to the victims, which he said motivates the FAA each and every day to continue to raise the bar on aviation safety. He indicated that since the last NAC meeting, he had the opportunity to personally fly the 737 MAX prior to its return to flight to fulfill a commitment that he made to personally evaluate the flight control system and functionality. He said this commitment was to the traveling public that he would not sign off on a return to flight unless he was sure it was safe enough even for his own family. He said it was important to him as a pilot to experience the training and the handling of the aircraft

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personally, to ensure his own comprehensive understanding of the aircraft and systems. While there have been many advances, the FAA will not take any shortcuts to get it done by a certain date and remains focused on the remaining milestones. He said the FAA will continue to keep everyone apprised on developments.

He also mentioned some news on the commercial space front. He said that on October 15, U.S. Secretary of Transportation Ms. Elaine L. Chao announced the publication of the FAA's Streamlined Launch and Reentry Licensing Requirements Final Rule for commercial space transportation launches and reentries. He said this rule paves the way for an industry that is moving at lightning speed. The FAA is simplifying the licensing process and enabling industry to move forward in a safe manner. This rule streamlines the application process while ensuring fulfillment of the FAA's mission to ensure the protection of the public, property, national security and foreign policy interests of the U.S. during commercial launch or reentry activities.

Next, he mentioned progress in the world of unmanned aerial systems. He said on August 21 the FAA announced plans to evaluate technologies and systems that could detect and mitigate potential safety risks posed by unmanned aircraft as part of the agency's Airport Unmanned Aircraft Systems Detection and Mitigation Research Program. He added that the FAA plans to test and evaluate at least 10 technologies or systems. The evaluations are expected to begin later this year and will initially occur at the FAA's William J. Hughes Technical Center, located adjacent to the Atlantic City International Airport in New Jersey. After the initial testing and evaluation in New Jersey, the agency expects to expand the effort to four additional U.S. airports. This is part of the work required by the FAA Reauthorization Act of 2018 to ensure that technologies used to detect or mitigate potential risks posed by unmanned aircraft do not interfere with safe airport operations.

He closed with indicating that it is his intent to continue to share progress the agency is making in areas lesser known here in the NAC. As the composition of those operating in the NAS change over time, it is important that the NAC is aware and understands the complexities of these additional NAS operators. He said it is important to take these other capabilities in to account to make decisions. He then handed back off to Mr. Elwell.

Mr. Elwell said that the importance of the NAC work is also a focus for Congress. The FAA recently provided the Senate Commerce and House Majority Transportation and Infrastructure Staffs the annual update on the NAC priorities with a focus on the recent NextGen implementation impacts caused by COVID-19. He said that all the data for this conversation with the Hill was derived from the NextGen NAC Priorities Joint Implementation Plan (NJIP) 2020 Update, which the FAA shared with the NAC at the August 6 NAC Meeting. He then introduced Acting Assistant Administrator for NextGen Ms. Pam Whitley and ATO Chief Operating Officer Teri Bristol who shared their insights on this engagement.

Ms. Whitley expressed appreciation to the NAC for its commitment to pushing and challenging the FAA to move NextGen into the implementation state. She said the engagement with the Hill staffs this year was different in many ways. It was the first time the FAA engaged with them virtually and it was the first time that the FAA reported delays and unknown timelines for NAC priorities milestones. She said that both meetings ended with the Hill having a better appreciation of impacts of COVID-19 on the NAC NextGen Priorities Joint Implementation Plan (NJIP) 2020 Update milestones.

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Next, Ms. Whitley reviewed some of the data reported during the briefings. She said that the 2019-2021 NJIP includes 185 (FAA and Industry) commitments across five focus areas: Data Comm, PBN, MRO, Surface & Data Sharing, and NEC. In the first year of the NJIP, the FAA completed 45 of 45 commitments and industry completed 25 of 26 commitments in CY2019. She continued that by Q1 CY2020, FAA completed a total of 55 out of 55 commitments and Industry completed 32 of 33—87 of 88 total for a 99% completion rate before the beginning of the national public health emergency. She said that consequently, the FAA and the NAC began a detailed assessment of NJIP priorities to identify and attempt to mitigate potential effects of COVID-19, which is published in the NJIP and publically available on the NAC website. She indicated that the conversation was welcome from the Hill staffs.

Ms. Whitley said that moving forward there are a growing number of FAA and industry programs showing delays, some into 2022 and beyond. The 2020 NJIP Update includes a list of successes, a list of milestone changes, and in some cases TBDs until we can determine an effective date. We decided to publish the update with the best information available. Publishing allowed all stakeholders to see a snap shot of what we knew in early August. Ms. Whitley then handed off to ATO COO Ms. Teri Bristol.

Ms. Bristol added that the Senate Commerce and House Transportation & Infrastructure Majority Staffs were appreciative of the information presented from the NJIP 2020 Update. She said the Senate Commerce staff seemed very interested in the information and the scope of the impacts of COVID-19 to not only the NAC priority NextGen implementation milestones, but also interested in COVID-19 impacts to ATO operations and controller hiring and staffing. The House T&I Majority Staff was very versed in the technical issues and was interested in a detailed conversation on Data Comm and airline equipage changes as a result of the current fleet composition during the COVID-19 impacts. She said that the FAA promised to provide the staffs updates on the NAC priorities delays, which are due to COVID-19 barriers, impacted by federal/local/state restrictions in travel, quarantine, and limits to the size of group meetings, become clearer. She then handed off to Mr. Elwell.

Mr. Elwell said that the FAA's Air Traffic Organization continues to amaze as they endlessly adapt to the non-stop challenges of this national health emergency while at the same time providing air traffic services to all operators in the National Airspace System. He said that he asked Ms. Bristol to provide some insights into how they have achieved these remarkable results and also provide us with her best prediction on the way ahead.

Ms. Bristol began by saying that all the members of the Air Traffic Organization team, including teammates from NATCA, appreciate the supportive words from Mr. Elwell, the Administrator, and the NAC Chairman. She said nearly nine months in to this public health emergency, the FAA and ATO continue to lean in, working collaboratively with Customers, Stakeholders and Labor to manage through the increasing number of positive COVID cases in Operational facilities. She said the top priority of the Air Navigation Service Provider mission rests on the delivery of safe and efficient air traffic services to all operators in the National Airspace System around the clock. She said those that have visited an operational floor know that facilities were not designed for the social distancing needed today. This presents a unique challenge as very often our control positions are separated by less than the CDC-recommended guidance. This environment of limited separation between controllers means that a positive COVID case can remove not only the employee who tests positive, but may also require quarantine of additional employees. Another key partner in our successful response to COVID has been our FAA Flight Surgeons, who have helped interpret, adapt and implement CDC guidance.

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She then provided a brief look into a few of the numerous strategies employed to maintain operational tempo while safeguarding the health and safety of our employees, including:

- Mandating facial coverings in our facilities where social distancing is not possible.
- Increasing routine cleanings, and established contracts for what we call Level 3 cleanings to address positive cases of COVID.
- Realigning facility schedules to create reserve crews where possible, and adjusted operating hours to match the decreased traffic at many airports.
- Standing up our Joint Crisis Action Team (JCAT) at the Command Center to consistently coordinate response plans with our operational facilities and our regional flight surgeon for each positive COVID case. Cleanings are targeted for a time of reduced traffic demand, thereby attempting to limit the impact to the operation.

She said that, to date, the JCAT has worked more than 300 confirmed COVID cases in our workforce from across the continental U.S., Alaska, Hawaii and the Caribbean. In fact, more than 200 of our facilities have been impacted by COVID cases, some facilities with more than one incidence. As COVID cases recently spiked again US-wide, we have renewed our commitment to work even harder to keep the operation running safely and efficiently, and to minimize disruptions to our Customers. This has not stopped the FAA from achieving success. The FAA continues to execute on high priority critical safety and sustainment activities across the NAS, emphasizing engineering and repair work outside of facilities, on airfields and remotely populated sites. Pilots are out flight checking procedures and equipment each day, including work for the new Runway 9C/27C at Chicago's O'Hare airport. Inside facilities, the FAA is conducting safety reviews to ensure standards remain high in this unique posture.

She said that although delays are down across the system, though there are pockets of increased activity, such as at DFW. While current trends suggest that traffic volumes will still be significantly lower in 2021 than 2019, the FAA is working to refine processes and establish new tactical capabilities to maintain and improve efficiency as traffic returns. The System Operations VP continues to lead work with the airline vice presidents of operations to set clear performance goals for the coming year. For example, the FAA is introducing new analytic capabilities to review and mitigate the impact of routine miles-in-trail restrictions. With operators such as United and American, the FAA is looking to new capabilities that would allow an operator to balance its traffic at an arrival fix in real time. ATO is using data to update rates for airspace flow programs and provide improved guidance to facilities on how to use them. Both ATO and industry have committed to improving compliance with traffic management programs by 5%. These near-term operational initiatives dovetail well with the operational improvements that is a focus in the NAC.

Over these last months, the workforce has looked for creative ways to move NAS modernization forward. ATO has employed virtual remote capabilities for everything from system testing to conducting safety panels and site surveys. ATO has made great progress staging work to conduct onsite activities at air traffic operational facilities. ATO has software and hardware, developed and partially tested, awaiting the next step—the ability to perform operational tests in facilities and then move forward with deployment waterfalls and workforce training. Ms. Bristol said her hope is that in the coming months ATO will be able to resume onsite access for our programs. While local conditions will dictate travel restrictions, Subject Matter Expert availability, and facility access, ATO is continuously looking for opportunities to allow non-operational personnel to deploy into the field to support modernization

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initiatives where risk is low. Coordinating multi-month, multi-facility schedules with large cadres of people against the backdrop of a situation in which there is little predictability, gets extremely complicated. Training, certification and user acceptance are the lynchpins for implementation. ATO has about 30 days before training on a new system goes stale and needs to be redone. A large program such as Data Comm requires an entire en route center, hundreds of controllers, to be trained and continuously 'hands on' the system. As you can see from these examples, NextGen implementation work, which has always required a complex choreography of engineering and program management to accomplish, has become exponentially more complex with COVID.

The weeks ahead will be a delicate balance. ATO is laser focused on working smartly and taking advantage of whatever low-risk opportunities it can find to conduct activities in support of NAS modernization. In the next few weeks ATO will be training controllers for the Las Vegas metroplex and working in Miami and Jacksonville Centers to design training scenarios supporting that metroplex initiative. They will be sending subject matter experts into the Tech Center to work on training for TFDM as well as the TBFM departure scheduling tool that supports our New York TBO activity. She said ATO also has TFMS operational evaluation testing underway in support of the Northeast Corridor commitments. She said COVID will remain a challenging and complex endeavor to overcome and an ever evolving challenge. She said it is ATO's commitment to the NAC that it will continue to lean in as far as possible while staying mindful of the safety of the ATO workforce.

Mr. Elwell then concluded the FAA Report and handed off to Mr. Childs.

Chairman's Roundtable

Next, Mr. Childs said that he is trying something a little different. Many of the emerging NAC issues (VNAV, MCL, 547, PBN Clarification, Opportunities, ADS-B In, etc.) would benefit from high-level insight in to current and future aircraft and fleet forecasts. He said that information is here today in the expertise of the NAC members. He said this section of the meeting is called the Chairman's Roundtable. He asked NAC Member Mr. Mike Sinnett (Boeing) to present a quick recent market outlook, followed by an avionics outlook from NAC Member Mr. Mike Ingram (Honeywell). Mr. Childs said that these outlooks are meant to be a primer to start a conversation with all NAC members today. He said he also foresees this conversation continuing in future NAC meetings to get insights from across the vast NAC membership expertise. He said these insights will result in better informed NAC meetings and advice. He said he knows that the airlines have been intensely focused on adapting fleets in response to the industry crisis. In fact, many have reported on near-term fleet plans in the media and even provided updates to those plans as travel forecasts change. Mr. Childs said that in a few minutes, he is going to ask the NAC members to help interpret those publicly available forecasts and the implications those they might have on fleet equipage relative to MCL, PBN, VNAV, etc. He clarified that this is not an endorsement of any one forecast. It is a discussion so NAC members can get insight into industry-wide trends. Mr. Childs then handed off to Mr. Sinnett.

Mr. Sinnett said that each year Boeing publishes a current market outlook to forecast demand for planes over the course of 20 years that looks at all macro and micro market trends. He said that the current market outlook forecasts fewer airplanes than the outlook for the first time. He introduced Mr. Darren Hulst (Boeing) to share further insights on the information. Mr. Hulst began by reviewing graphs depicting the historic impact of COVID on commercial passenger aviation. He indicated that fleets are

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returning but levels have plateaued. He continued by saying that 75% of single-aisle planes are active, 60% of wide body planes are active, and 100% plus of freighter planes are active where some planes have been unparked to accommodate the demand. Mr. Hulst said Boeing is confident about 2023/2024 for a recovery but said the question and issue is the pace of the recovery. He indicated that with the complexities surrounding vaccines, government policies, and passenger confidence it will not be a simple curve, but when it happens it will happen quickly. He reviewed a slide showing a three-speed market recovery where domestic recovers, then regional, then long-haul. He said that COVID will accelerate fleet retirements and replacement, specifically mentioning to expect similar levels to post-9/11. He said there was above trend annual rates growth last year and that it will take until 2023-2024 for those trends to return. While speaking to aviation's proven resilience, he said that past crises impacting aviation have taken two to three years to return to trends. He said it takes time but aviation does recover and there is a pent-up demand returning. He reviewed data that showed the long-term forecast for aircraft deliveries. He said there are 10-15% fewer deliveries than without the pandemic, but that long-term needs continue to grow. In closing, he indicated that industry adaptability and versatility is key to recovery. Mr. Childs then handed off to Mr. Mike Ingram (Honeywell).

Mr. Ingram said that the largest impact on aviation industry due to COVID-19 has been in the commercial air transport segment. He reviewed that:

- Overall Air Passenger traffic reduced approximately 60% in 2020 vs 2019 (by ICAO)
- Airlines decline of approximately 55% from 2019 to 2020 level (by IATA)
- Airports loss of approximately 60% of passenger traffic (by ACI)

With specific regard to Business and General Aviation (BGA), he said that avionics sales dropped 37% during Q2 and 24% for 1st Half of 2020 vs 2019 (by NBAA). He added that forecasters expect Business Jet sales to decline by 25-30% in 2020 (by Honeywell BuyerX survey) but expect Business Jet usage to be at 2019 levels by 2nd half of 2021. He said that Airlines, Manufactures and Operators are less concerned about capacity and more focused on costs, mentioning that aircraft have been parked, routes have been significantly modified, and workforces have been reduced (furloughs, layoffs). He said that recovery depends on how fast the world returns to 'normalcy' with a vaccine being available, business 'open' for external visitors, and air travel increases.

He continued that flying depends on consumer confidence and reviewed three items aerospace suppliers must focus on through the pandemic, including:

- Maintain deliveries and support to the existing OEMs and operators
- Reduce fixed costs for the resizing of the business based on revenue and profit, in order to keep our investors and shareholders happy
- Sustain a strong workforce ready to grow as the industry recovers

He said that the resurgence of COVID-19 is again having an impact on airline and business jet travel (WingX Advance data). He reviewed that passenger travel for airlines continues at 50% capacity; business jet travel is down 20% from 2019 and down 13% MoM; mid-size jet travel shows optimism (Phenom 300, Citation X, Lear 60); and cargo is the only bright spot seeing a 20% increase in November. He said that domestic and business jet recovery is faster but involves less passengers and fewer routes, which is accelerating widebody retirements and increasing dependence on smaller and regional aircraft.

Mr. Ingram reviewed items that contribute to aerospace resilience, including:

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- Aircraft must continue to fly – need to continue to approve relief efforts, e.g. CARES Act, while consumer confidence grows
- Supply Base to stay strong – preserve cash and liquidity, Industry could be in this for an extended recovery. Look for adjacent, safety and productivity innovations to increase consumer confidence.
- Exit out of Pandemic with Strength – Industry must preserve our national resource assets of Aerospace by maintaining the workforce and domestic supply base

In closing, Mr. Ingram concluded by posing the question of what the NAC can do to assist with recovery and provide value to a struggling aviation industry.

Mr. Childs said that interesting part is when you talk about recovery, everything Industry is doing is predicting what is going to happen in next one to two years. He said Industry has seen windows of retiring 50-seat fleets, but also seeing some recovery in smaller locations through different partners, specifically mentioning retrofit investments. He said that having been said, immediately smaller older fleets in regional space have been removed. Mr. Childs opened the floor for NAC Member comments.

Mr. Don Dillman (FedEx) offered his congratulations to Mr. Elwell. He said that he first wanted to build on Ms. Bristol's comments. He said he reached out to her team last week and by Friday they had a call with her team about impacts to cargo carriers. He said that through a lot of good collaboration, they have a roadmap for plans to improve contingency plans and that he appreciates the collaboration. On the subject of equipage, he said the challenge is FedEx is trying to get as much lift as it can—brought planes out of retirement that are not equipped for NextGen, which he framed as a temporary challenge. He said as FedEx gets back to normal footing it will return to its retirement plan and sees equipage heading back in positive way.

Mr. Craig Drew (Southwest Airlines) said his airline has a replacement plan in place for the next 10 to 15 years and that they have started bringing planes out of storage that they are looking to replace with MAX 8 and MAX 7s, which are both fully equipped.

Mr. Warren Christie (JetBlue) said Airbus is fully equipped by MCL standards and Embraer is equipped by Data Comm. He said that the A220 family will be fully compliant and that JetBlue continues to be fully invested in equipage.

Mr. Kimball Stone (American Airlines) said that he feels good about American Airlines' levels of equipage and that the profile going forward looks favorable.

Mr. Brian Quigley (United Airlines) said that United has not planned on huge aircraft departures from fleet. They will be challenged in certain areas of MCL but new aircraft expected to be compliant.

Mr. Patrick Burns (Delta Air Lines) said that Delta is in pretty good shape. He said en route Data Comm is the biggest challenge but that they have a plan to equip to meet requirements.

Mr. Childs acknowledged the tremendous pressure the industry is under, but said these investments can play a big part. He said he is hopeful there are things the NAC can do to assist in ROI with this, such as leveraging the new political environment. He then thanked NAC Members for their inputs. He said it appears that Industry might be in a totally different fleet equipage environment than back in March. With these insights, he believes the advice the NAC will receive going forward will be better after this conversation.

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Next, Mr. Childs announced that Mr. Christie has taken over leadership of the Section 547 Ad Hoc Team. He thanked Mr. Christie for for taking on the very important leadership role. Mr. Childs added that this team needs to assess whether Section 547 as written by Congress may or may not be possible to execute now without further adversely impacting industry economics. The FAA has extended the 547 tasking until Spring 2021 to allow the NAC more time to work this issue. He then handed off to Mr. Christie.

Mr. Christie began by reviewing the key points in the Section 547 language. He said that the new tasking extends the original request through Spring 2021. He reviewed the following excerpt from the new tasking:

- The NAC advice should include the following:
    - A short list of recommended candidate airports and applications (airport, aircraft capability, and concept) for the pilot program
    - For airports, while the legislation points to providing preferential basis at airports with Ground Delay Programs, the FAA seeks a recommendation from industry if this is appropriate or if other airports are preferred and why
    - Describe potential and targeted benefits of most value to industry.

Mr. Christie reviewed the high-level schedule, indicating that although the team just began to reengage, the plan is to have final recommendations ready by the Spring 2021 NAC Meeting. He promised to solicit additional NAC member input in January and February. Mr. Childs thanked Mr. Christie, indicating that he loves the strategy and emphasis on broad participation outside the team.

NAC Subcommittee (SC) Chair's Report - NAC Taskings Status

Next, Mr. Childs introduced NAC SC Chairman Mr. Craig Drew (Southwest Airlines). Mr. Drew began by saying it has been a real breath of fresh air to see how everybody in Industry and FAA have come together during this period of time and pull their weight. He then reviewed the slate of briefings for the NAC SC Chair's Report. He said that since the NAC, the NAC SC and working groups have worked to engage on many issues and have made it a priority to keep NAC principal members informed and prepped ahead of today's meeting.

Multiple Runway Operations (MRO)

Mr. Drew said he had asked representatives from each NextGen Integration Working Group (NIWG) to give a briefing focused on updates since the August 6 NAC, any impacts from COVID-19, and providing a forecast of any anticipated schedule changes. He then introduced the MRO team, including Mr. Natee Wongsangpaiboon and Mr. Raul Zamora from the FAA and industry co-chairs Mr. Phil Santos (FedEx) and Mr. Scott Dehart (Southwest Airlines).

Mr. Santos reviewed the following milestone update:

- Consolidated Wake Turbulence (CWT) Separation Standards Benefit Analysis
    - A sample analysis format from one operator was validated
    - Will complete the analysis for several airports by various operators
    - We are on target to meet the Q4 2020 milestone
        - He indicated that this was reduced from 4 to 2 locations—Boston and Seattle removed—on target to submit for IAD and DFW

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Mr. Wansangpaiboon then reviewed the following FAA milestone status update:

- Continue to assess opportunity to resume CWT implementation
    - Training date set for Cincinnati (CVG/LUK) on 11/2 – 11/17 with an estimated IOC 11/18
    - This will be the first virtual/remote implementation, if all goes well, attempting A11/ANG in December
- Pre-Implementation Milestone
    - Separation Standards for CSPO HUR - Q2 CY2021
        - SRM Panel took place on October 14 & 15, 2020
        - Additional analysis to be performed with the new ADS-B distribution data. Anticipate preliminary result by November

Surface and Data Sharing

Next, Mr. Drew introduced the Surface and Data Sharing team including Mr. Doug Swol and Mr. Ayaz Kagzi from the FAA and industry co-chairs Rob Goldman (Delta) and Steve Vail (Mosaic).

Mr. Swol reviewed the following TFDM Program Status Information:

- Build 1 Accomplishments (Key Site: PHX)
    - Completed remote developmental testing of Build 1.1a software (September 2020)
    - TFDM Vendor delivered Software v1.2 to FAA's WJHTC Tech Center (October 2020)
- Looking Ahead
    - Conduct software testing on v1.2 and delivery of v1.3 (IOC version)
- Build 2 Accomplishments (Key Site: CLT)
    - B2.0 software on track for delivery January 2021
- Looking Ahead
    - Leidos developing TTP/TFCS testbed for industry
        - Plan to offer remote testing in January
    - SWIFT 12 (November 19, 2020)
        - Plan to brief on future use of TFDM TTP data to identify flights affected by a Traffic Management Initiative

Mr. Swol reviewed the following impacts of COVID-19:

- Very limited access to FAA facilities restricts program's ability to:
    - Conduct operational testing
    - Conduct air traffic and tech ops training
    - Install hardware/software updates in the field
        - Both for TFDM and other programs where TFDM has a dependency
- Access to WJHTC has improved and remote testing keeps software developmental testing moving ahead

Mr. Swol then reviewed the following milestone impacts:

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SURFACE AND DATA SHARING		
PRE-IMPLEMENTATION COMMITMENTS	**Old Date**	**New Date**
TFDM program will complete the operational testing for Build 1	Q2 CY2020	**Late CY2021***
NASA ATD-2 interim technology transfer from Phase 2: Fused IADS at CLT	Q4 CY2019	Complete
NASA ATD-2 final technology transfer from Phase 3: Terminal departure IADS at DFW/DAL	Q3 CY2020	Q4 CY2021
IMPLEMENTATION COMMITMENTS	**Old Date**	**New Date**
TFDM program will achieve key site IOC for Build 1 at PHX	Q2 CY2020	**Late CY2021***
TFDM program will achieve the in-service decision (ISD) for Build 1 to allow additional TFDM system deployments into the NAS	Q4 CY2020	TBD
TFDM program will achieve IOC at 3 additional sites	Q1 CY2021	TBD
TFDM program will achieve the key site IOC for Build 2 at CLT	Q4 CY2021	TBD
TFDM program will achieve ISD for Build 2 to allow additional deployments of the full TFDM capabilities into the NAS	Q1 CY2022	TBD
TFDM program will achieve IOC at 5 additional sites	Q1 CY2022	TBD

* New Dates dependent on ability of program to travel, access FAA facilities, conduct training, conduct testing and other FAA program dependencies. If dependencies are not met, the program will not meet these dates.

Mr. Goldman provided the following industry update:

- Continued NIWG meetings and other industry forum discussions around integrated flow management with TFDM as the integral part of the gate-to-gate concept
    - Data exchange foundation
    - Trajectory based operations
    - Future Flow management
    - Full stakeholder involvement
- Participation in SWIFT
    - Leverage SWIM and other sources of data to better manage the NAS
    - Use the same data to develop meaningful and common insight through metrics
- NASA ATD-2 phase 3 extension
    - Advance the Digital Microservices Concept
- Uncertainty in the TFDM program waterfall and changes in overall industry conditions have stalled progress
    - Need to collaborate to find innovative ways to get back on trajectory
        - Cloud based solutions
        - Agile Sprints
        - Taking advantage of virtual options and reduced traffic demand

Performance Based Navigation (PBN)

Next, Mr. Drew introduced the PBN team including Mr. Juan Narvid, Mr. Aaron Wilkins, and Ms. Wendy O'Connor from the FAA and industry co-chairs Mr. Brian Townsend (American) and Mr. Bill Whyte (RAA).

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Mr. Whyte indicated that the team had not met since the August 6 NAC Meeting and there were no changes to milestones.

Data Communications (Data Comm)

Next, Mr. Drew introduced the Data Comm team with Mr. Jesse Wijntjes from the FAA and industry co-chairs Mr. Chris Collings (L3Harris) and Mr. Ed Evans (Southwest Airlines).

Mr. Wijntjes reviewed the following Data Comm accomplishments:

- Activated Data Comm services at first 3 En Route Centers
    - En Route services exceeding operational performance targets (>99% success) – best performing data link capability in the world
- Air-ground interop issues fault isolated & addressed
    - Avionics software updates delivered and/or in development for all identified issues
    - Implemented fixes and upgrades to air-ground networks
    - ERAM system performance & enhancements have been and continue to be critical to program success
- Operators purchased & installed upgrades to enhance air to ground system performance
- Business/General aviation & DOD communities addressing avionics issues and resuming En Route participation

He also provided a Data Comm operational status, indicating that Data Comm is operational at 62 Towers, Data Comm is operational at 3 En Route Centers, and that the remaining 17 En Route Centers are on hold due to COVID-19.

Mr. Collings then provided an overview of industry avionics accomplishments detailed in the following slide:

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Industry Avionics Accomplishment

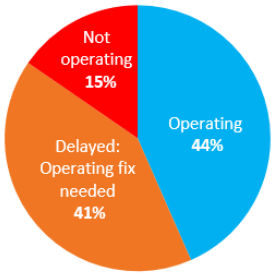
Completed Actions

Operator & Fleet Actions Complete	Status
American Airlines: B777, B787	Operating en route, no action required
FedEx: B777, MD11	Operating en route, no action required
Southwest Airlines: B737	Operating en route, no action required
UPS: B744, B757, B767, MD11	Operating en route, no action required

Pending Avionics Actions

Avionics Action	Operator/Fleet	Status
Collins CMU 900 Core 16	Alaska, American, Delta, United	Install Delayed (COVID), Aircraft operating
Airbus A320/30 ATSU CSB 7.5	Alaska, American, Delta, JetBlue	Fix Release Delayed –Dec 2020 (COVID) Aircraft operating
Boeing 757/767 Pegasus 1 Procedure Mitigation	FedEx	Delayed – Pending approval; Aircraft removed
Boeing 757/767 Pegasus 1 Fix	FedEx, UPS, United	Delayed – March 2021 (some aircraft operating under procedure mitigation)
Collins VDR Update	Alaska, United, FedEx	Install Delayed (COVID), Aircraft removed
Boeing 777 AIMS 2 BP17B	United	Install Delayed (COVID), Aircraft operating
Boeing 787 CMF BP6	United	Install Delayed (COVID), Aircraft operating
Airbus A350/A380	Delta	New, aircraft removed from en route
Boeing 747-8 ATN-203	UPS	Planned – Q2 2021, aircraft operating

Data Comm Fleet Status



Data Comm critical path action	Operating, no action required	Delayed: Operating fix needed	Delayed/Not Operating

52

Mr. Collings then reviewed the Data Comm forward plan. He said the FAA team continues to focus on reducing implementation risks once deployments restart. On the industry side he said that despite the impacts from COVID-19, multiple operators made progress on avionics updates. The continued success of the program relies on operators upgrading to A320 ATSU CSB 7.5 and Collins CMU 900 Core 16. He added that they need the Boeing Pegasus 1 fix delivered in Q1 2021 as planned.

Northeast Corridor (NEC)

Next, Mr. Drew introduced the Northeast Corridor team with Mr. Aaron Wilkins, Mr. Juan Narvid, and Ms. Wendy O'Connor from the FAA and industry co-chairs Mr. Mark Hopkins (Delta) and Mr. Ralph Tamburro (Port Authority of New York and New Jersey).

Mr. Tamburro reviewed the status of the following key issues for NEC:

- 2020/2021 Commitments
  - Facility access, travel, training and fiscal limitations are delaying some commitments (e.g. ACR and GBAS)
  - Virtual resources allow continued progress (e.g. Industry TOS discussions)
- Facilitating implementation of NAC-recommended opportunities
  - LGA Runway 31 approach procedure
  - High-performance escape routes for TEB/HPN
- Looking ahead

- Continue to monitor exiting milestone status
- Advancing additional pre-implementation milestones and adjusting/adding new milestones

With specific regard to the ACR milestone, Mr. Tamburro said despite COVID-related schedule delays the team is still making good progress (completed 68% of project elements by the end of 2020).

Mr. Hopkins also announced that he is moving on from his role as NEC Co-Chair and thanked his NEC colleagues for their dedication.

Minimum Capabilities List

Next, Mr. Drew said that based on the NAC's endorsement to extend the MCL task at the August meeting, the FAA extended the MCL tasking one NAC cycle to allow the team to finish its analysis on steps to drive MCL adoptions and commitments. He said today NAC Members will hear about the team's report that concludes this task. He introduced the MCL Team Co-Leads, including Ron Renk (United) and Greg Young (Delta).

Mr. Renk began by reviewing the tasking requirements and previous accomplishments. He said the tasking extension afforded more time to collect needed cost/benefit data and document the effort into a comprehensive report. Mr. Young reviewed the report highlights, including the goal to drive industry consensus on what equipage is critical to advancing the NAS into a NextGen state.

Mr. Renk said the working group felt it was important for operators to have reliable information on the costs and benefits associated with each component of the MCL before making equipage investments. While the group is unable to build a complete business case for each operator, they provided the source information for benefits and average costs for each group of capabilities. Mr. Renk reviewed the cost information included in the report:

Mr. Young then provided examples of benefit assessments provided from existing Joint Analysis Team (JAT) and MITRE data included in the report. They said that this initial assessment of MCL costs and benefits identified preliminary elements to answer the questions of how much equipping will cost and its expected return on that investment. Mr. Young said there are many variables in the cost and benefit equation, such as which aircraft are being purchased and where those aircraft will fly, which make it impossible for the working group to give one set of numbers.

He added that benefit assessments based on actual capability implementation (vs. modeled benefit projections) is a sound approach for establishing expected ROI. NAC data and JAT analysis may require augmentation with other operational assessments to obtain a more complete benefits outlook, specifically for PBN applications. Operators can use this data to better understand how to build a complete business case.

In conclusion, Mr. Renk said neither Industry nor the FAA favors a mandate. If no action is taken, they will continue to see investments made by both FAA and Industry whose impact is greatly diminished. He specified that the MCL is forward-fit. He added that both Industry and FAA will benefit if the MCL is a living document. Mr. Renk said NAC action is required on the following:

- Agreement that a forward fit business case is indeed plausible, and support for its adoption

  And/or

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- Recommendation that aircraft manufacturers adopt MCL Baseline capabilities as standard on all U.S. delivered aircraft

Mr. Drew thanked the MCL team and recommended that the NAC approve the MCL team's report as NAC advice to the FAA for their consideration in response to NAC Tasks 19-1 and 20-4. Mr. Childs called for a motion to approve the MCL Report as advice to the FAA.

Outcome: The NAC passed a motion to approve the *Minimum Capabilities list (MCL) Ad Hoc Team NAC Task 19-1 / 20-4 Report* as advice to the FAA

Note: Reference Attachment 4 for the full report.

NAC Task 19-4 / 20-5: PBN Clarification

Next, Mr. Drew said the PBN Clarification tasking has been a tremendous example of aviation community and FAA collaboration leading to a consensus set of priorities. He said he is pleased with this effort and the final product. He continued by saying that following discussion at the last NAC meeting, he made it a priority to engage the entire NAC SC by allowing substantial time at every monthly meeting for the team to review the report and allow for comments and feedback. The PBN Clarification team has been working diligently to discuss and incorporate feedback received on the PBN Clarification Ad Hoc Team Report since the August NAC Meeting. He said that these efforts are complete, with full NAC SC endorsement. He said today NAC Members will hear about the team's report that concludes this task. He introduced the PBN Ad Hoc Team, including Steve Brown (NBAA), Brian Townsend (American), and Bill Whyte (RAA) as the aviation community reps and FAA representatives Clark Desing, Wendy O'Connor, and Aaron Wilkins.

Mr. Townsend reviewed the tasking language. He then reviewed that the vote to accept the PBN Clarification Report at the August 6, 2020 NAC meeting was tabled. He mentioned that there were questions and concerns were raised by some NAC members that led the NAC Chairman to task the NAC SC to conduct a deep-dive into the report and resolve outstanding issues. He reported that comment resolution is complete, including comments from the public, NAC SC, and ALPA. Mr. Townsend said that the team appreciates the patience. He said the original report is largely still in tact. The edits boiled down to added clarifications and minor changes in wording. He said he is pleased with the way everyone came to table.

Mr. Drew thanked the PBN Clarification Ad Hoc Team and recommended that the NAC approve the PBN Clarification Ad Hoc Team's report as NAC advice to the FAA for their consideration in response to NAC Tasks 19-4 and 20-5. Mr. Childs called for a motion to approve the MCL Report as advice to the FAA.

Outcome: The NAC passed a motion to approve the *Performance Based Navigation (PBN) Clarification Ad Hoc Team NAC Task 19-4 / 20-5 Report* as advice to the FAA

Note: Reference Attachment 5 for the full report.

NAC Task 20-1: ADS-B In Commercial Application Technologies

Next, Mr. Drew said that since the August NAC, he had worked with the FAA on the administrative processes necessary to stand up an Ad Hoc Team for both the ADS-B In and VNAV NAC taskings. He said that as part of that process, he nominated co-leads for each group, then worked with those co-

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leads to identify a list of nominations for each group and submitted those lists to the FAA for processing. He said that both teams received word on November 6 that they are cleared to begin work. With that approval, he asked the co-leads of both teams to prepare a short briefing to share initial plans and expectations with the NAC.

For Task 20-1: ADS-B In Commercial Application Technologies, he said the FAA issued this tasking in response to several NAC requests to begin a conversation on future potential applications with ADS-B. The first task requests information on NAC member organizations' insight into ADS-B In operator side applications. Mr. Drew then introduced Co-Leads Don Kauffman (Honeywell) and Dave Surridge (American).

Mr. Surridge reviewed the tasking, then said the team plans on meeting a few times a month with each meeting focusing on one aspect that will help educate the work group, including:

- What problem can ADS-B In solve?
- How does it solve the problem?
    - Potential Benefits
- Safety benefits from ADS-B In technologies.
- Answer the NAC question of - what value will ADS-B In applications bring to the NAS?

Mr. Kauffman said that the team will use MITRE, FAA, and OEM SMEs to assist in developing an accurate picture of ADS-B In uses along with benefits. He said that the team will meet with OEMs to understand what their plans are for forward and retro fit solutions, including timelines and discussion on deidentified estimated catalog pricing. He said the team will also meet with the FAA to discuss future investment plans, specifically mentioning ERAM / STARS and TBO as examples. He closed by indicating that the final report is due in Spring 2021, which he hopes will result in a comprehensive picture for NAC members to review when determining how much interest is there in ADS-B In applications along with the NextGen enhancements for the NAS.

NAC Task 20-2: Vertical Navigation (VNAV)

For Task 20-2: Vertical Navigation (VNAV), Mr. Drew said in this tasking the FAA is encouraging the NAC to continue its important discussion on VNAV to reduced barriers to full PBN. He noted that during tentative discussion of task approaches, he and the co-leads realized that the Fall 2020 deadline included on the tasking is premature for completion of associated work activities. He said that the FAA NAC team is working on the recommended extension of this deadline out to Summer 2021 to accommodate potential changes to relevant equipage data needed for the tasking. He then introduced Co-Leads Mr. Greg Young (Delta) and Mr. Michael McDowell (Collins Aerospace).

> Note: Mr. Childs announced during this briefing that Mr. Elwell needed to leave the meeting and allowed him to provide his closing remarks during this briefing that are covered in the next section.

Mr. Young reviewed background information and indicated that the overarching goal is to increase equipage capabilities so nearly all can participate with LNAV/VNAV and RNP a/c in CSPO. He continued that understanding how will the 1000+ LNAV Only aircraft (not addressed by MCL) affect NextGen implementation in the 5-7 year timeframe will better inform the timeline and implementation sequence of NextGen improvements.

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Mr. McDowell then reviewed the tasking language and the following proposed actions:

1) Determine state of LNAV Only fleet currently operating in the NAS
    - How many, which models, who operates?
2) Determine:
    - Models not capable: no existing upgrade path
    - Models not capable, but upgrade path exists
        - Obtain Upgrade Information from OEM/Avionics Manufacturers
    - Models capable, but not being operated in equipped configuration
3) Obtain information from Operators on Plan associated with "Gapped" Aircraft
4) Develop 5-10 Year Outlook Based on Specific Fleet Plans of "Gapped" Aircraft

Mr. McDowell also reviewed the tasking deliverables, including a Current Equipage Landscape, Review of LNAV Only Aircraft (Models, Quantities, Retirement Plans, Upgrade Options Available), Impediments to Equipage, and 5-10 year Equipage Outlook.

Mr. Drew thanked the VNAV co-leads and all the working groups for the updates and handed off to Mr. Childs, who indicated that he is highly interested in the VNAV task.

DFO Announcements

Mr. Childs handed off to Mr. Elwell for announcements. Mr. Elwell provided a few responses to previous NAC requests and a few announcements for the NAC on the way forward. First was a response to a NAC request to change the Pegasus 1 milestone in the NextGen Joint Implementation Plan. He said the FAA is impressed with the progress the NAC is making to resolve this issue involving Data Comm avionics but feels that more time to explore additional potential solutions is warranted. He said the FAA encourages the NAC to continue the important discussions occurring in the Data Comm Avionics Ad Hoc Team established by the NAC SC Chairman.

Next, he said the FAA is extending the VNAV tasking deadline to the summer of 2021. The NAC SC requested the extension after initial analysis found that essential equipage data needed to answer the tasking may significantly change in the next several months. The FAA agreed and has modified the deadline. He said the FAA will follow up with the official tasking letter modification as soon as possible.

He said the NAC previously recommended that the FAA consider adding three additional airports to the Data Comm Tower Services program. This recommendation was for three towers that met the NAC's assessment of a benefits use case. Those towers were PBI, CVG, and JAX. He said that since none of these towers were part of the baseline funding for this program, the FAA is reviewing potential options to see if these additions might be accommodated. This will be very difficult as the budget demands of so many milestone delays may not leave any option to proceed.

Next, he said the FAA has also decided to extend the current *CY2019-2021 NAC NextGen Joint Implementation Plan (NJIP)* into 2022. As discussed at the last NAC meeting, the FAA is currently tracking 43 NAC priority milestones that are designated TBD and 27 more NAC priority milestones designated in delay. He said most of these milestones will likely move into 2022 and some beyond. By

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extending the NJIP, the FAA is staying committed to those milestones that the NAC told the FAA are their priority for NextGen and the FAA will remain focused on their successful implementation. He said this action will result in an additional NJIP update being produced in 2022. The FAA does not anticipate adding any significant amount of additional milestones to ensure we complete NAC agreements and protect the funding for their implementation.

Lastly, he said the FAA, in fulfillment of DOT guidance, has approved a more streamlined membership structure for the NAC Subcommittee. The new Subcommittee membership will be directly aligned with the Secretary of Transportation-approved NAC membership. He said the Secretary's membership balance plan specifies that 30 members of the NAC ensures optimum representation from across the aviation community. The new subcommittee membership will require the Secretary to approve its membership too. Each NAC member will receive an email requesting they nominate a primary and alternate for the NAC Subcommittee membership. The FAA will collect nominations, vet them, and then send them to DOT for an ethics review and final secretary approval. He asked that NAC Members respond to the request for nominations as soon as possible to allow time for coordination with DOT.

In closing, Mr. Elwell said he wanted to say what a professional pleasure it has been to work with this incredibly talented and accomplished committee. He wished NAC Members continued success and said he looks forward to hearing about future successes in the NAC. He then handed off to Mr. Childs.

Closing Comments and Adjourn

Mr. Childs said that he and Mr. Elwell would like to thank NAC Members for their time and participation. He said he appreciates the input from everyone on the way forward for the NAC and that Industry has seen the importance of collaboration through pandemic. He advised NAC Members to pay attention to the right COVID protocols as the NAC needs all players to be engaged. Mr. Childs then adjourned the meeting.

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Attachment 1

NAC Meeting

November 17, 2020

Opening of Meeting

Chip Childs, NAC Chairman

President & CEO, SkyWest, Inc.

November 17 NAC Administrative Announcements

- Reminder: Please keep your phones and/or computer mics on mute.
- We ask that those observing today to please keep your mics muted at all times.
- For **NAC members with comments or questions, presenters, and pre-approved speakers only,** when called upon to speak by the Chairman:
  - Please announce your name and organization
  - If using Zoom computer audio, click the Mute/Unmute button in the bottom left corner
  - If using the phone line audio without a participant ID, dial *6 to unmute, as well as your phone's mute button if enabled
  - If using a phone line and entered a participant ID, click the Zoom Mute/Unmute button, dial *6 to unmute your phone line, as well as your phone's mute button if enabled
- Rather than do a roll call, please feel free to scroll through the Zoom Participants list by clicking the Participants button at the bottom of the Zoom window. All meeting participants will be captured in the meeting summary.

PUBLIC MEETING ANNOUNCEMENT

NextGen Advisory Committee

November 17, 2020

This meeting is being held pursuant to a notice published in the Federal Register on October 19, 2020. The agenda for the meeting was announced in that notice, with details as set out in the agenda provided today. The FAA Deputy Administrator, Dan Elwell, is the Designated Federal Officer responsible for compliance with the Federal Advisory Committee Act, under which this meeting is conducted.

The meeting is open to the public, and members of the public may address the NAC with the permission of the Chair. The public may submit written comments in advance of the meeting. In addition, the Chair may entertain public comment if, in his judgment, doing so will not disrupt the orderly progress of the meeting and will not be unfair to any other person.

Public Statements

Members of the Public

Chairman's Report

Chip Childs, NAC Chairman

President & CEO, SkyWest, Inc.

Motion for NAC Approval

- August 6, 2020, NAC Meeting Summary Package Draft

FAA Report

Dan Elwell, FAA Deputy Administrator

NAC Designated Federal Officer

Chairman's Roundtable

Chip Childs, NAC Chairman

President & CEO, SkyWest, Inc.

Commercial Market Outlook

Darren Hulst, Vice President Commercial Marketing
The Boeing Company

November 2020

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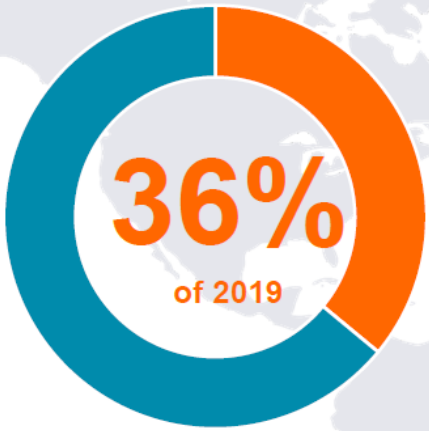
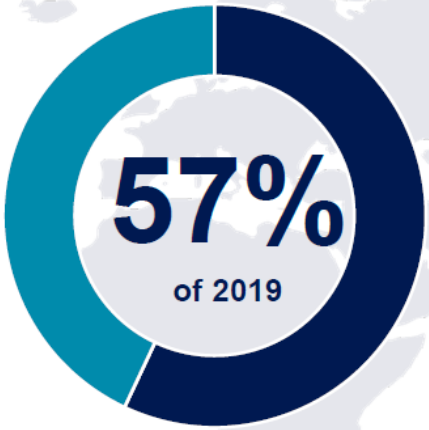
Historic impact to commercial passenger aviation

October US TSA

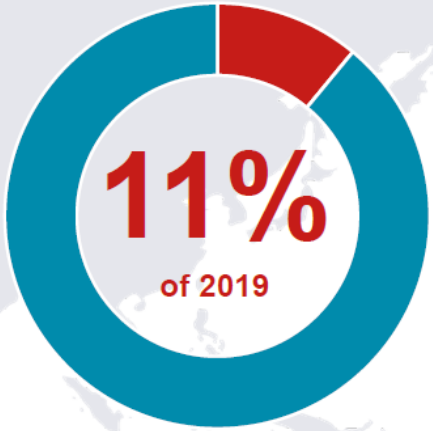


TSA

September Domestic



September International



IATA

SOURCE: IATA, TSA

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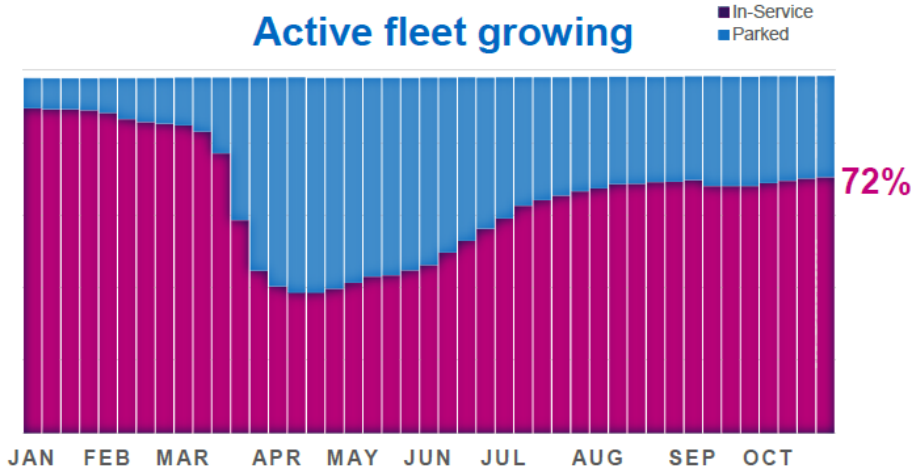
Fleets returning, **but levels have plateaued**

Single-aisle
75%

Widebody
60%

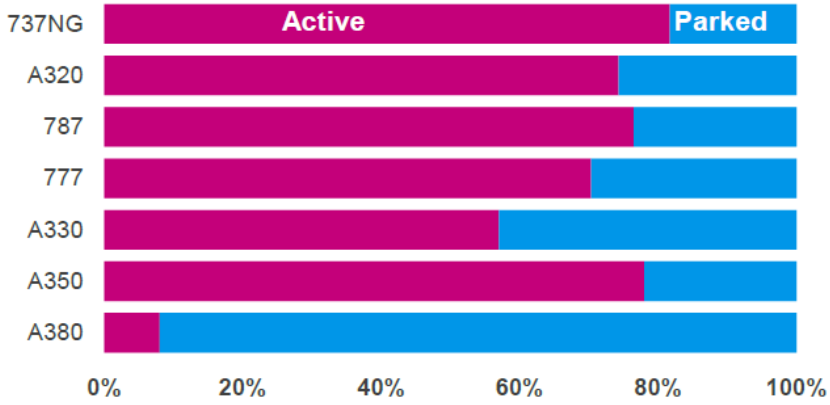
Freighter
100+%

Active fleet growing



SOURCE: Cirium Fleets Analyzer

Dynamics by fleet type



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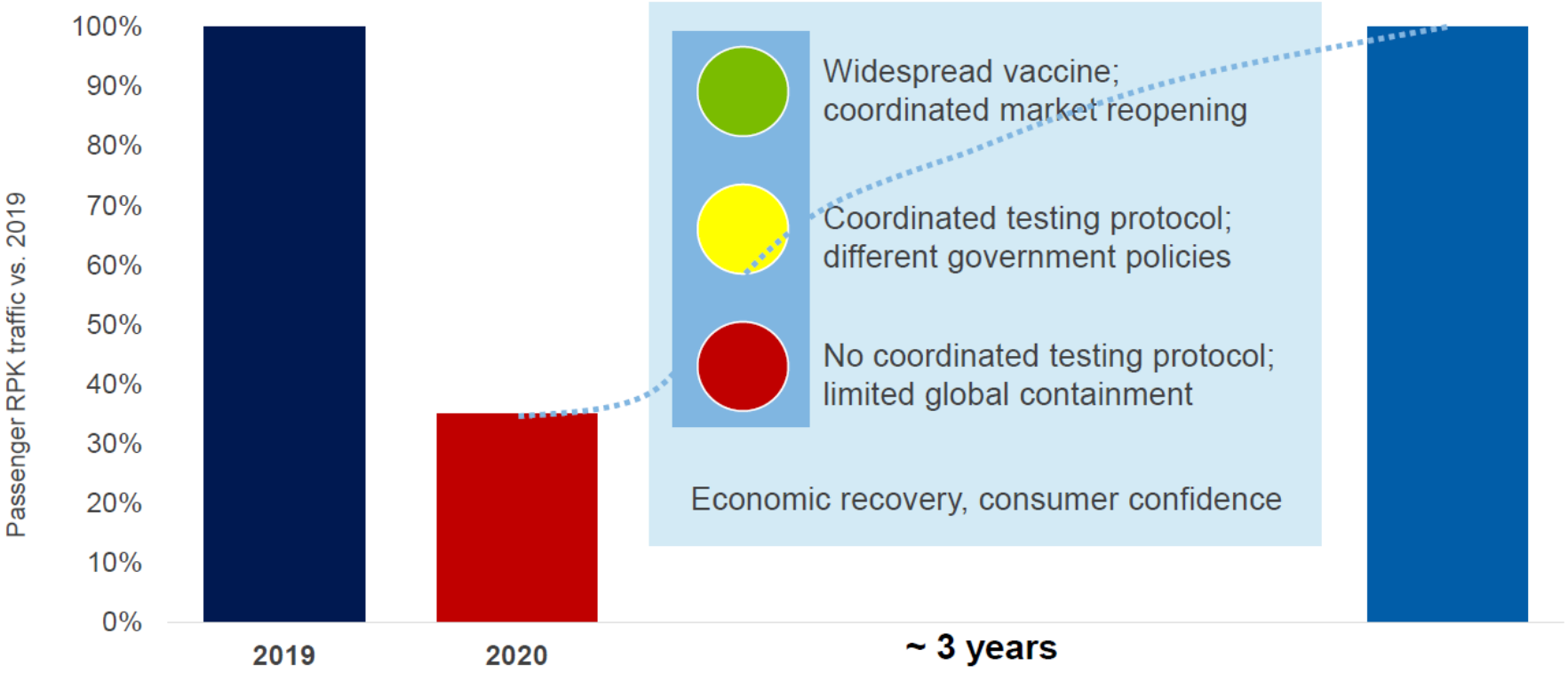
The ends are easier than the means



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2020 2024

1

Domestic

Fewer restrictions
Domestic economies restart

2

Regional

Lower risk international
Regional connections & trade

3

Long-haul

Higher risk & regulation
Premium traffic return

Three-speed market recovery

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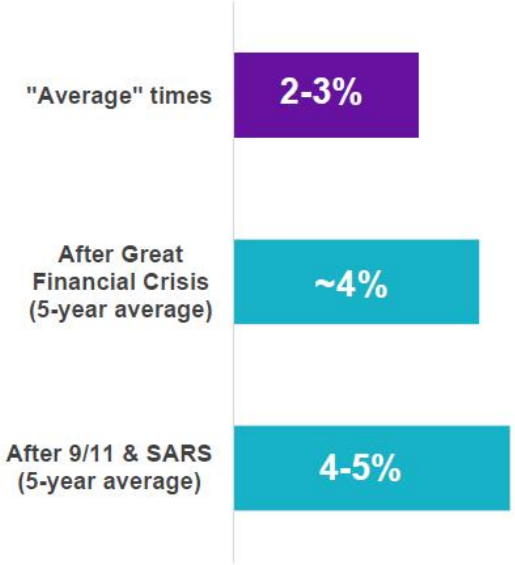
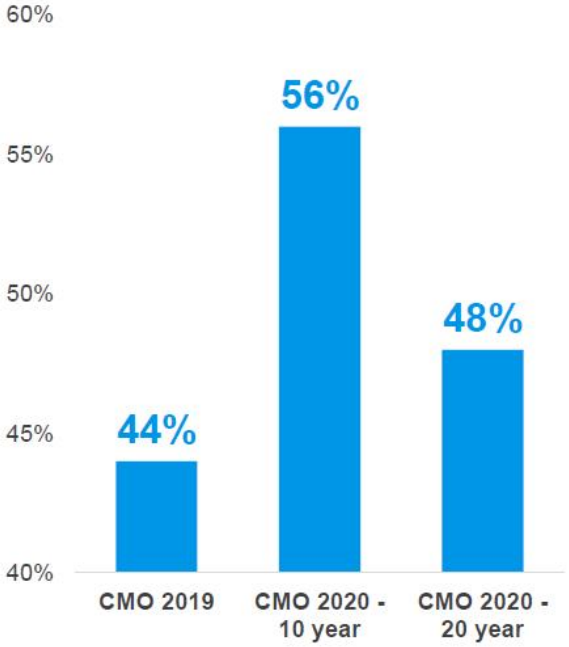
Shocks **accelerate fleet retirements** and replacement

Average annual fleet retirement rates



Replacement as share of deliveries



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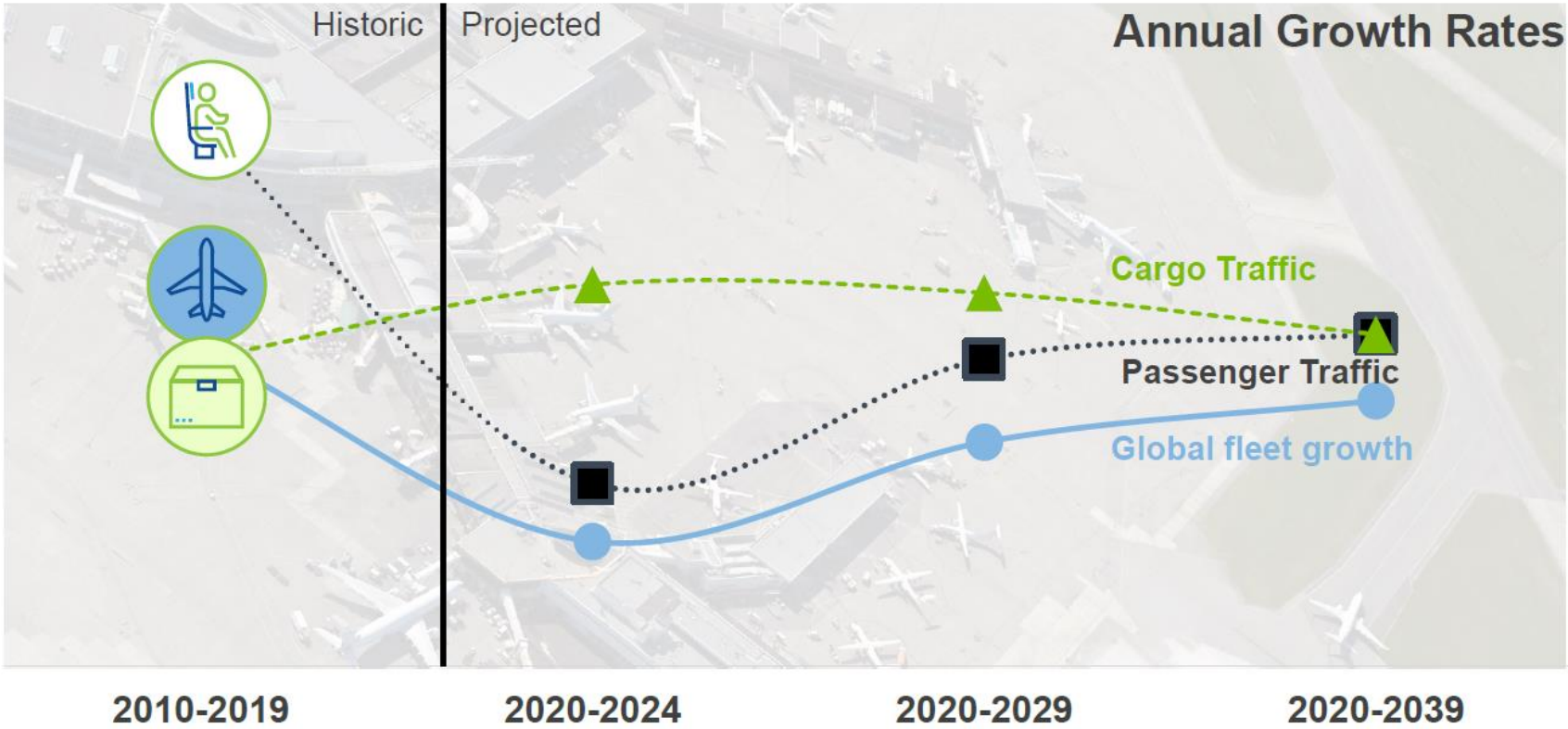
Impact to first decade outlook, stability in long-term



Growth rates

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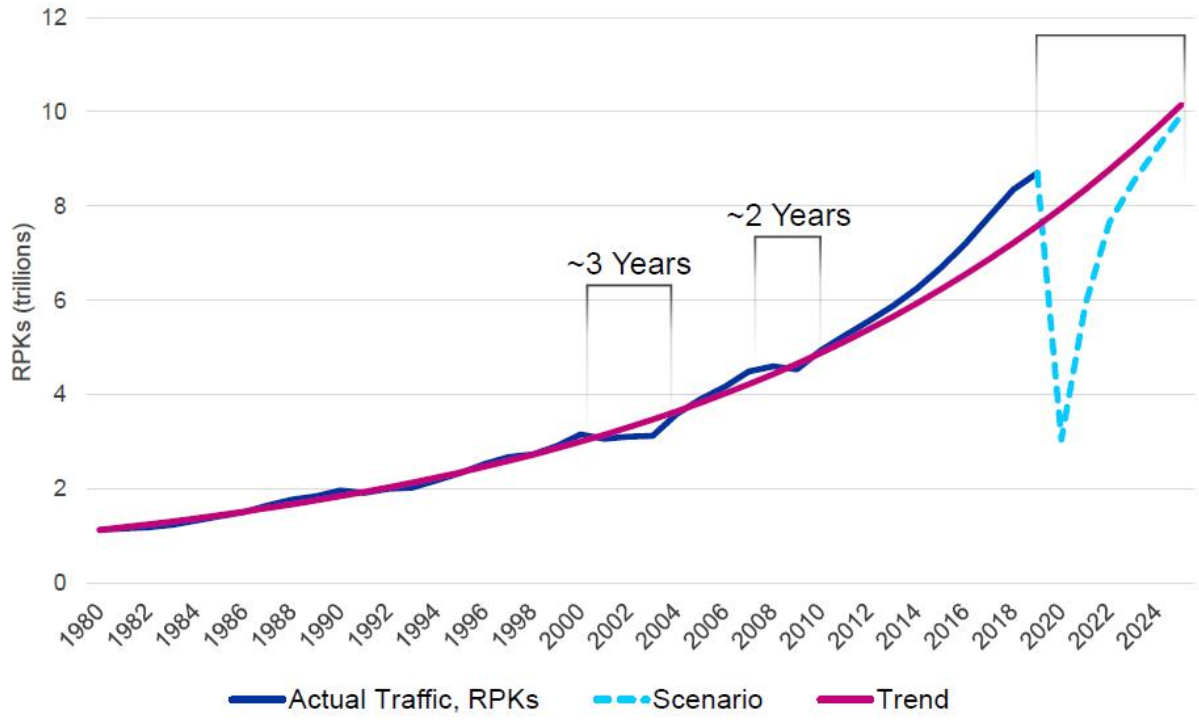
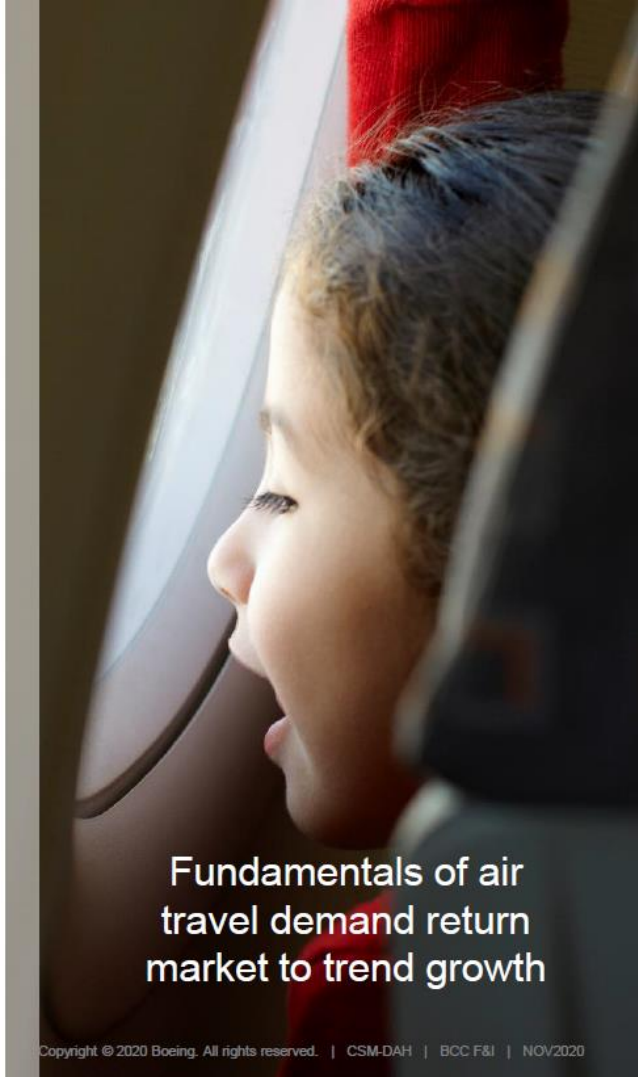
Aviation's **proven resilience**



RPKs = Revenue Passenger Kilometers
SOURCES: ICAO scheduled traffic through 1999 / 2000-2019E IATA stats / 2020F IATA September 2020



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Forecasting in uncertain times: **providing perspective**

Current Market Outlook 2002

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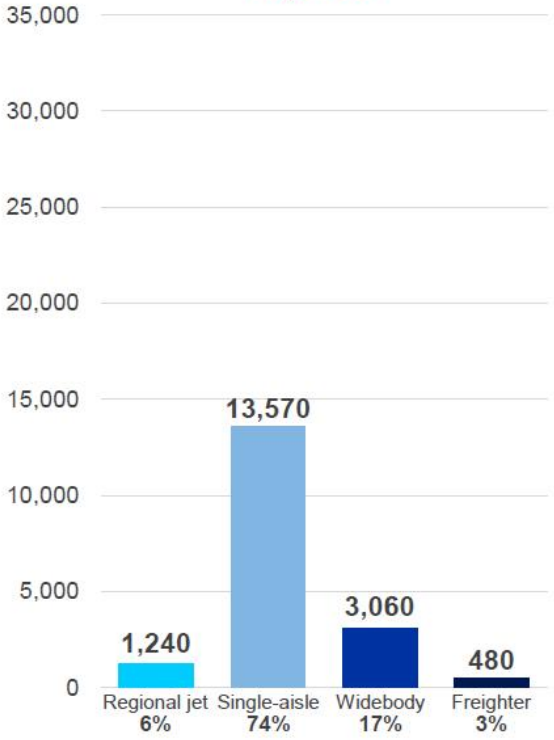
First decade impact, **longer-term market resilience**

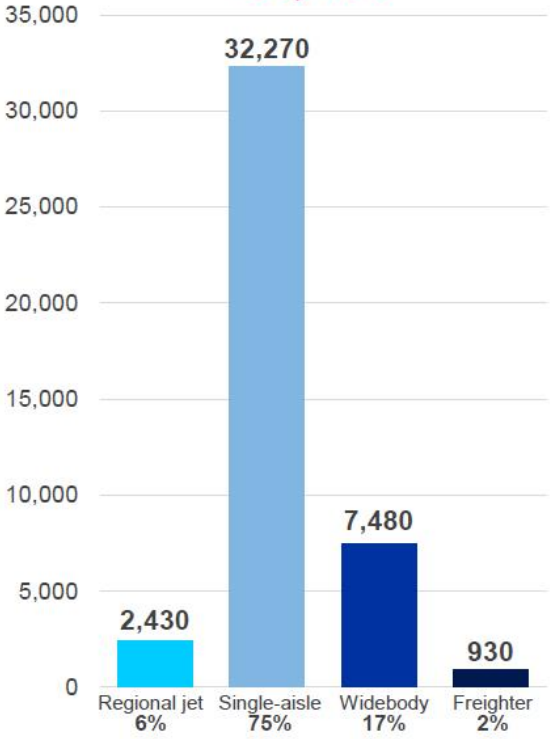
New airplane deliveries **2020-2029**

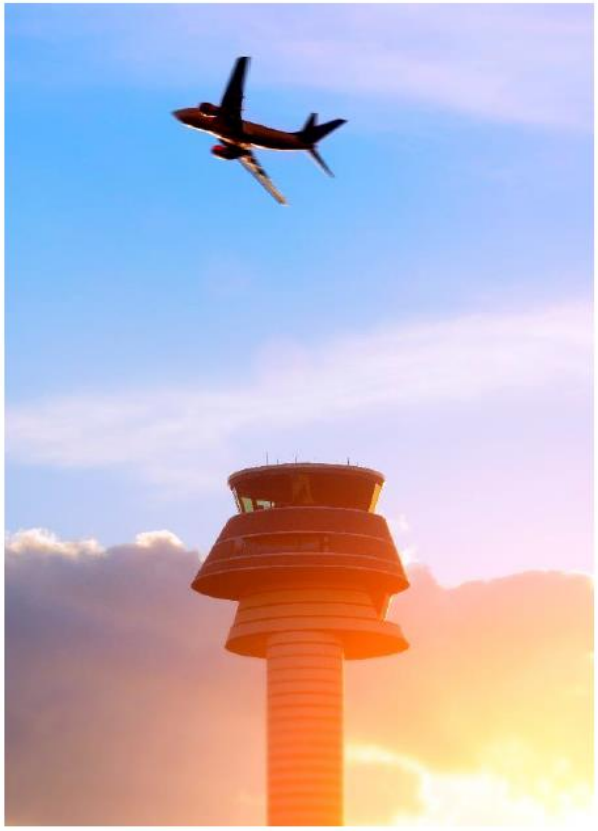
18,350



New airplane deliveries **2020-2039**

43,110





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Innovations through challenges

9/11	GFC	CV-19
Legacy costs	Capacity discipline	Networks
LCC expansion	Mergers / scale	Products
Right-sizing	Productivity	Competition
COSTS	**CAPACITY**	**VERSATILITY**

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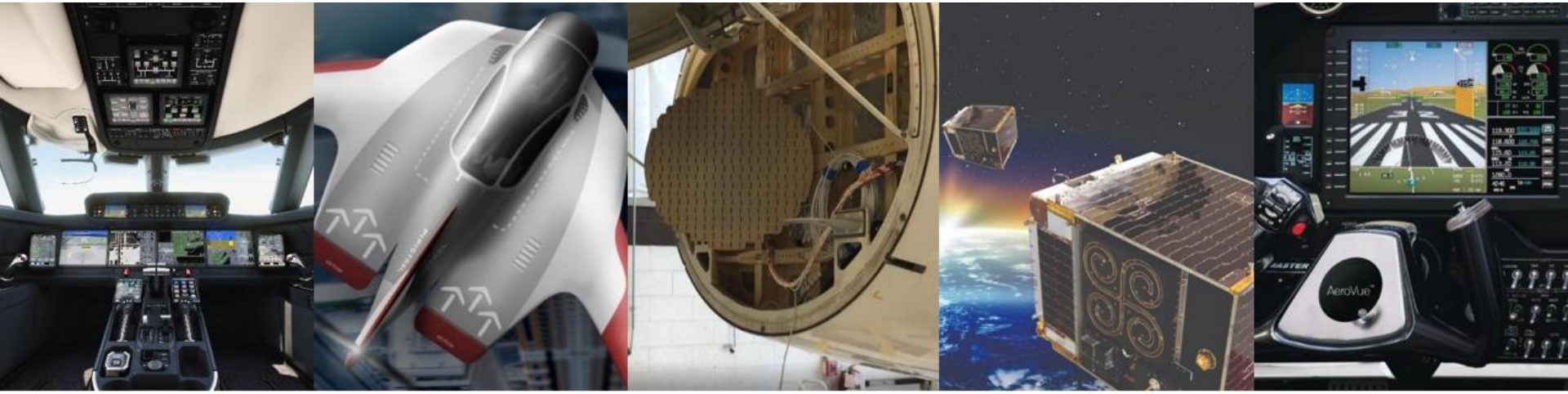


AVIONICS
SUPPLIER BASE PERSPECTIVE

November 16, 2020

MIKE INGRAM
VP/GM AVIONICS

Honeywell

NAC
NEXTGEN ADVISORY COMMITTEE

Executive Summary

- Largest impact on aviation industry due to Covid-19 has been in the commercial air transport segment.
  - Overall Air Passenger traffic reduced approximately 60% in 2020 vs 2019 (by ICAO)
  - Airlines decline of approximately 55% from 2019 to 2020 level (by IATA)
  - Airports loss of approximately 60% of passenger traffic (by ACI)
- Business and General Aviation (BGA)
  - Avionics sales dropped 37% during Q2 and 24% for 1st Half of 2020 vs 2019 (by NBAA)
  - Forecasters expect Business Jet sales to decline by 25-30% in 2020 (by Honeywell BuyerX survey) but expect Business Jet usage to be at 2019 levels by 2nd half of '21.
- Airlines, Manufactures and Operators are less concerned about capacity and more focused on costs. Aircraft have been parked, routes have been significantly modified and workforce has been reduced (furloughs, layoffs).
- Recovery depends on how fast the world returns to 'normalcy' with a vaccine being available, business 'open' for external visitors and air travel increases

Our Recovery is Uncertain

AEROTIME HUB
Airbus expects 2019-levels of business to return in 2025

Business Traveller
News
British Airways takes delivery of first B787-10

ch-aviation
Delta to be first US airline to resume China ops

CINCINNATI BUSINESS COURIER
GE Aviation details 605 layoffs at Evendale headquarters

NEW STRAITS TIMES
Airbus working with customers including MAS, AirAsia on cabin air quality, safety amid Covid-19 pandemic

South China Morning Post
Cathay Pacific: 90 per cent of staff agree to second round of unpaid leave as Hong Kong's flag carrier braces for slow recovery amid pandemic

CGTN
Chinese air carriers seek new ways to spur ticket sales

CheshireLive
Airbus detectors could 'sniff out' coronavirus on planes

CNN BUSINESS
'We simply don't have any money.' Lufthansa shareholders approve $10 billion bailout

CorkBeo
Ryanair releases full list of new health measures as flights from Cork Airport set to resume

ch-aviation
Singapore Airlines Group resumes two-way transfers at Changi

BARRON'S
Boeing and Airbus Stock Is Downgraded. Don't Count on a Quick Vaccine, Analyst Says.

THE HINDU
As COVID-19 grounds fliers Emirates converts 10 passenger aircraft into mini freighters

Los Angeles Times
His plane-disinfecting invention didn't take off — until COVID-19 hit

REUTERS
American Airlines CEO sees 10%-20% extra staff in July 2021, 'hard' to avoid furloughs

BARRON'S
Southwest Airlines May Have Just Started a Fare War

THE VERGE
American Airlines will resume booking flights to capacity, as COVID-19 cases soar

yahoo! finance
Coronavirus: Airbus expects 40% drop in production over next two years

yahoo! finance
Google Is Providing Search Data to Air France, Lufthansa, Other Airlines Looking to Decide Which Routes to Restart

WRAL.com
RDU and Delta airlines reveal safety and cleaning measures to bring back passengers

The Market News Reports
Aerospace MRO Market to Witness Huge Growth by 2025 | Delta TechOps, HAECO, Honeywell International

Forbes
U.S. Airlines Now Require Passengers To Self-Declare COVID-19 Symptoms And Contacts

TRAVEL PULSE
United Flight Attendants to Carry Thermometers

Simple Flying
The Lufthansa Group Will Have 380 Aircraft Flying By October

ABS-CBN NEWS
Airbus says risk of COVID-19 transmission in aircraft 'very low'

MARKET REALIST
Delta Air Lines Warns Pilots about Possible Furloughs

Forbes
Boeing May Sell 777s To China Eastern, But 777-9 And 787 Order A Distant Prospect Amid Coronavirus

The Guardian
BA tells longest-serving cabin crew to take 20% pay cut or lose jobs

ALJAZEERA
Emirates airline to redefine strategy for post-pandemic era: COO

UAE
Air France KLM resume flights to and from UAE from July 1

Simple Flying
The Big Three Chinese Airlines All Take Delivery Of Their First ARJ21s

FAA starts Boeing 737 Max test flights, a milestone in getting the planes back in service after crashes

The New York Times
E.U. Barring U.S. Visitors a 'Huge Deal' for Airlines

FlightGlobal
Airbus cancels plan to develop its own A320neo nacelle

TRAVEL PULSE
Delta Extends Block on Middle Seats, Flight Capacity Limitations

THE POINTS GUY
Delta likely to pull flights as number of US coronavirus cases rises

jamestownsun.com
Collins Aerospace takes part in face shield initiative

INTERNATIONAL FLIGHT NETWORK
Air France bids farewell to Airbus A380 fleet

THE POINTS GUY
Air travel recovery may come slower than expected, with Southwest Airlines a likely leader

Business Standard
Covid-19: Singapore Airlines may grab Emirates, Etihad traffic in India

THE POINTS GUY
Emirates will resume flying the Airbus A380 on July 15

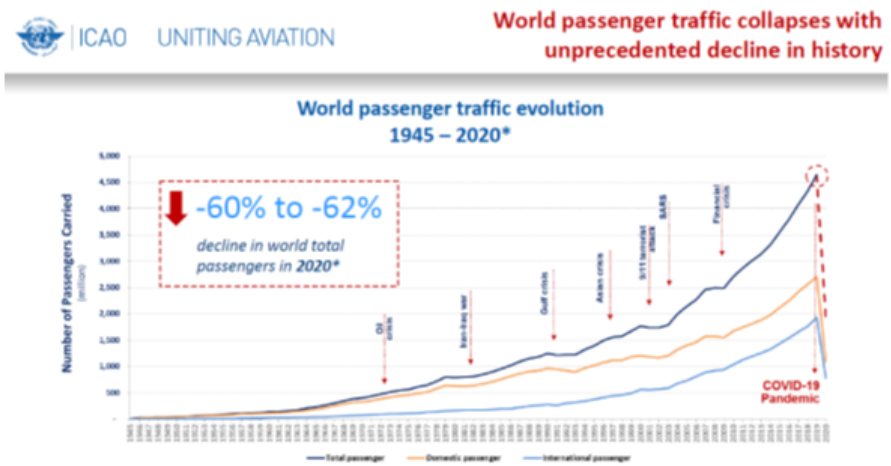
Evening Standard.
Ryanair boss Michael O'Leary calls on EU Commission to block KLM bailout

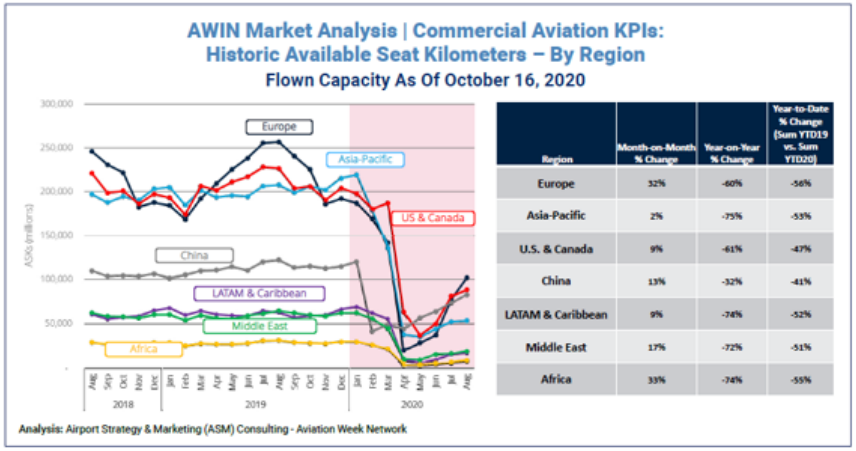
NAC NEXTGEN ADVISORY COMMITTEE

Flying Depends on Consumer Confidence

As Aerospace suppliers we must focus on 3 items through the pandemic:

1. Maintain deliveries and support to the existing OEMs and operators
2. Reduce fixed costs for the resizing of the business based on revenue and profit, in order to keep our investors and shareholders happy
3. Sustain a strong workforce ready to grow as the industry recovers





Region	Month-on-Month % Change	Year-on-Year % Change	Year-to-Date % Change (Sum YTD19 vs. Sum YTD20)
Europe	32%	-60%	-56%
Asia-Pacific	2%	-75%	-53%
U.S. & Canada	9%	-61%	-47%
China	13%	-32%	-41%
LATAM & Caribbean	9%	-74%	-52%
Middle East	17%	-72%	-51%
Africa	33%	-74%	-55%

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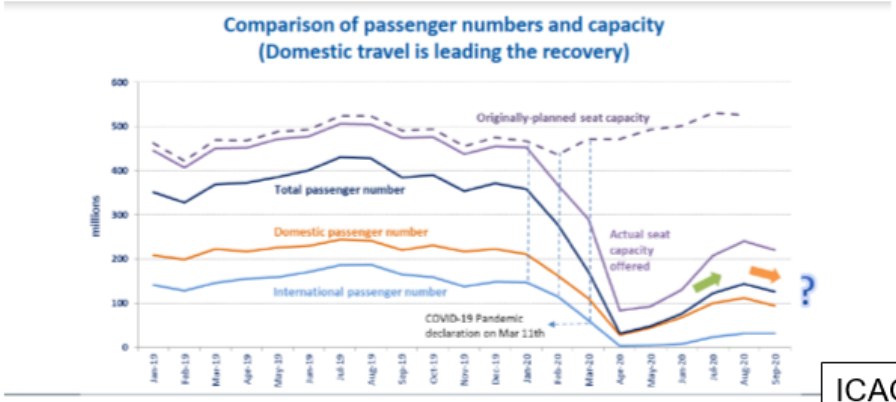
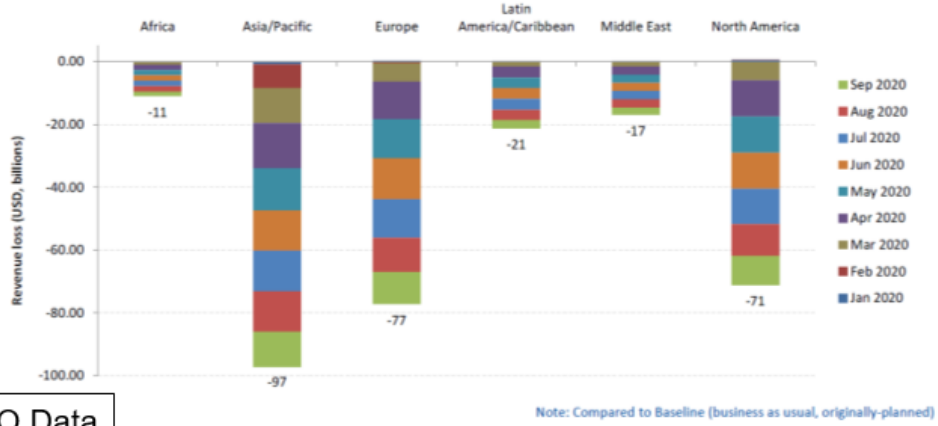
Phase 2, Covid Resurgence

The resurgence of Covid-19 is again having an impact on airline and business jet travel. (WingX Advance data)

- Passenger travel for airlines continues at 50% capacity
- Business jet travel down 20% from 2019 and down 13% MoM
- Mid-Size jet travel shows optimism (Phenom 300, Citation X, Lear 60)
- Cargo is the only bright spot seeing a 20% increase in November

Domestic and business jet recovery faster but less passengers and fewer routes – accelerating widebody retirements and increasing dependence on smaller and regional aircraft





ICAO Data

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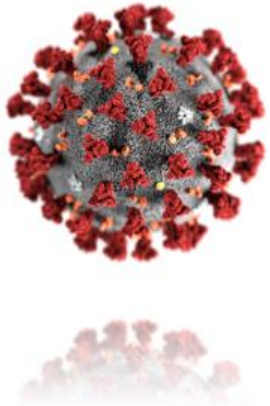
Must Have Aerospace Resilience



Aircraft must continue to fly – need to continue to approve relief efforts, e.g. CARES Act, while consumer confidence grows

Supply Base to stay strong – preserve cash and liquidity, we could be in this for an extended recovery. Look for adjacent, safety and productivity innovations to increase consumer confidence.

Exit out of Pandemic with Strength – we must preserve our national resource assets of Aerospace by maintaining our workforce and our domestic supply base.

Ultra-Violet Light Disinfectant
"Germ Falcon"

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Conclusion and NAC

…2020 is the year that we would all like to forget

Recovery path is uncertain but we all know it will recover

What value can NAC bring to a struggling industry? How can we enable a faster recovery?

As the industry slowly improves, what can the NAC do to assist with the recovery? Is it time to rethink our special projects?

Aerospace Will Recover

NAC Task 19-2/20-3: Section 547

Warren Christie

Senior Vice President (Safety, Security & Fleet Operations), JetBlue Airways

FAA Reauthorization Act of 2018, Section 547

(a) IN GENERAL. – Not later than 180 days after the date of enactment of this Act, the Administrator shall **establish a pilot program to provide air traffic control services on a preferential basis to aircraft equipped with certain NextGen avionics** that –

(1) **lasts at least 2 years**; and

(2) operates in **at least 3 suitable airports**.

(b) DURATION OF DAILY SERVICE. – The air traffic control services provided under the pilot program established under subsection (a) shall occur for **at least 3 consecutive hours** between 0600 and 2200 local time during each day of the pilot program.

(c) AIRPORT SELECTION. – The Administrator shall designate airports for participation in the pilot program after **consultation with aircraft operators, manufacturers, and airport sponsors**.

(d) DEFINITIONS. –

(1) **CERTAIN NEXTGEN AVIONICS**. – The term ''certain NextGen avionics'' means those avionics and related software designated by the Administrator after consultations with aircraft operators and manufacturers.

(2) **PREFERENTIAL BASIS**. – The term ''preferential basis'' means –

(A) prioritizing aircraft equipped with certain NextGen avionics during a Ground Delay Program by assigning them fewer minutes of delay relative to other aircraft based upon principles established after consultation with aircraft operators and manufacturers; or

(B) sequencing aircraft equipped with certain NextGen avionics ahead of other aircraft in the Traffic Flow Management System to the maximum extent consistent with safety.

(e) SUNSET. – The pilot program established under subsection (a) shall terminate on **September 30, 2023**.

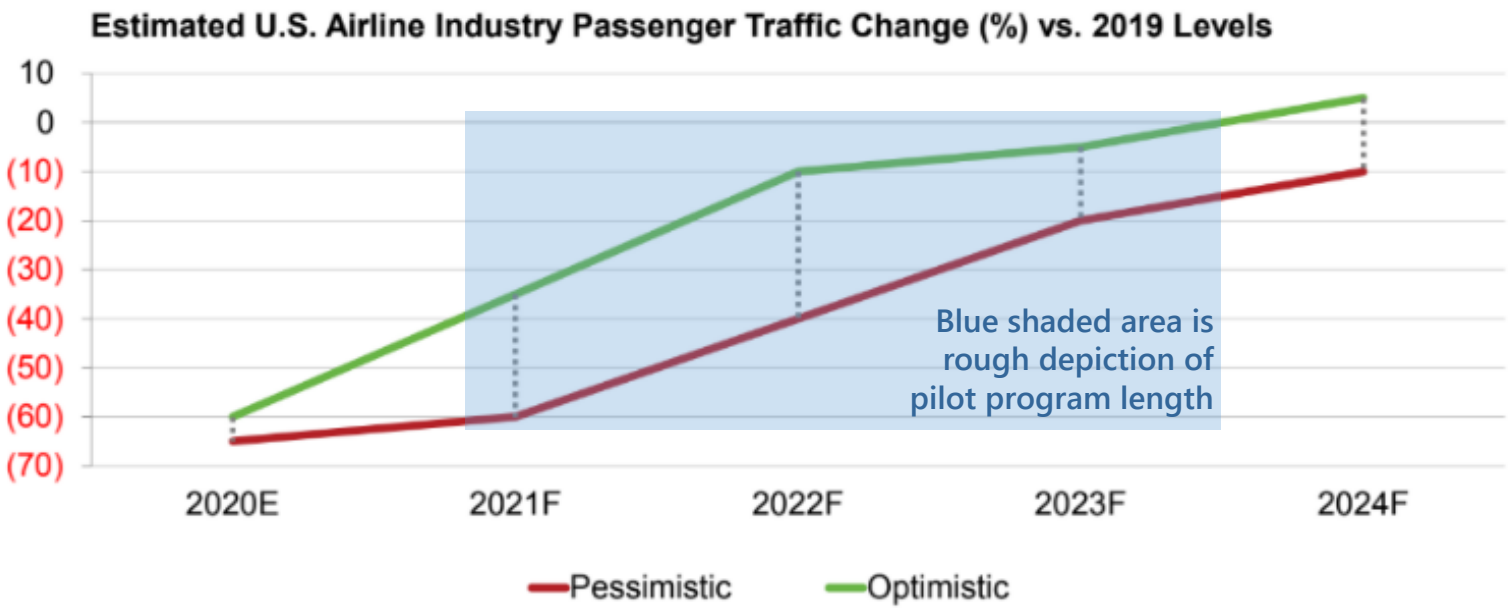
(f) REPORT. – Not later than 90 days after the date on which the pilot program terminates, the Administrator shall submit to the appropriate committees of Congress a report on the results of the pilot program.

Section 547 Pilot Program

From Reauthorization language:

"…lasts at least 2 years"

"…shall terminate on September 30, 2023"



Source: A4A, "Tracking the Impacts of COVID-19," 10/21/2020

Task 20-3: FAA Reauthorization Act of 2018, Section 547

- New tasking extends original request through Spring 2021
- Excerpt from tasking description…

  The NAC advice should include the following:

  - *A short list of recommended candidate airports and applications (airport, aircraft capability, and concept) for the pilot program*
  - *For airports, while the legislation points to providing preferential basis at airports with Ground Delay Programs, the FAA seeks a recommendation from industry if this is appropriate or if other airports are preferred and why*
  - *Describe potential and targeted benefits of most value to industry.*

High-Level Schedule

Oct – Dec 2020 Team deliberations and findings compiled

Jan 2021 Additional NAC member inputs

Feb 2021 NAC socialization and review

Spring 2021 Final recommendations to FAA at Spring 2021 NAC

2020	2021	2022	2023

Prep for Pilot Program

Sec 547 Pilot Program – Sep 2021 thru Sep 2023

NAC Subcommittee (SC) Chairman's Report

Craig Drew, NAC Subcommittee Chair, Southwest Airlines

NAC Tasks 18-4 & 18-5: Focus Area Risks/Mitigations

FAA NIWG Subject Matter Experts (SMEs)

Multiple Runway Operations (MRO)

Surface & Data Sharing

Performance Based Navigation (PBN)

Data Communications (Data Comm)

Northeast Corridor (NEC)

Multiple Runway Operations (MRO)

Natee Wongsangpaiboon (FAA) & Raul Zamora, Jr. (FAA)

Phil Santos (FedEx) & Scott Dehart (Southwest Airlines)

Status of MRO Industry Q4 2020 Milestone

- Consolidated Wake Turbulence (CWT) Separation Standards Benefit Analysis
  - A sample analysis format from one operator was validated
  - Will complete the analysis for several airports by various operators
  - We are on target to meet the Q4 2020 milestone

Status of MRO FAA Milestone

- Continue to assess opportunity to resume CWT implementation
  - Training date set for Cincinnati (CVG/LUK) on 11/2 – 11/17 with an estimated IOC 11/18
  - This will be the first virtual/remote implementation, if all goes well we'll attempt A11/ANG in December

- Pre-Implementation Milestone
  - Separation Standards for CSPO HUR - Q2CY2021
    - SRM Panel took place on October 14 & 15, 2020
    - Additional analysis to be performed with the new ADS-B distribution data. Anticipate preliminary result by November

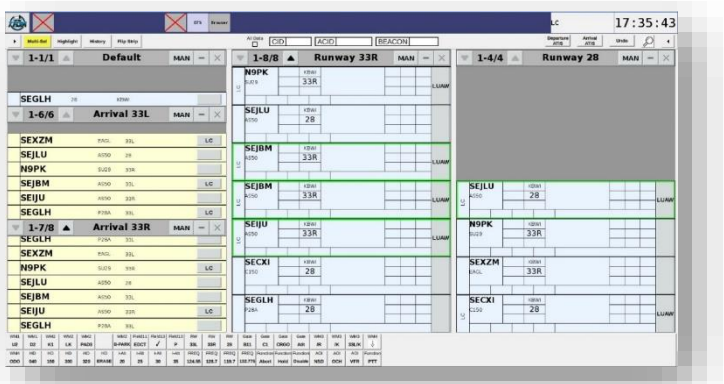
Surface & Data Sharing

Doug Swol (FAA) & Ayaz Kagzi (FAA)

Rob Goldman (Delta Air Lines) & Steve Vail (Mosaic ATM)

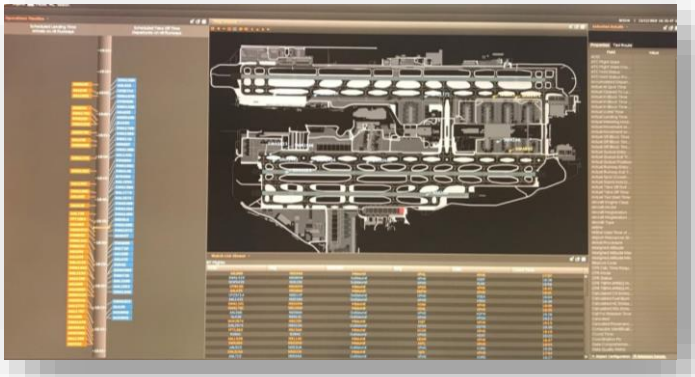
TFDM Program Status

- **Build 1 Accomplishments (Key Site: PHX)**
  - > Completed remote developmental testing of Build 1.1a software (September 2020)
  - > TFDM Vendor delivered Software v1.2 to FAA's WJHTC Tech Center (October 2020)
- **Looking Ahead**
  - > Conduct software testing on v1.2 and delivery of v1.3 (IOC version)



TFDM Build 1 Electronic Flight Strips Display

- **Build 2 Accomplishments (Key Site: CLT)**
  - > B2.0 software on track for delivery January 2021
- **Looking Ahead**
  - > Leidos developing TTP/TFCS testbed for industry
    - – Plan to offer remote testing in January
  - > SWIFT 12 (November 19, 2020)
    - – Plan to brief on future use of TFDM TTP data to identify flights affected by a Traffic Management Initiative



TFDM Build 2 Surface Management Display

Impacts of COVID-19

- Very limited access to FAA facilities restricts program's ability to:
  - Conduct operational testing
  - Conduct air traffic and tech ops training
  - Install hardware/software updates in the field
    - Both for TFDM and other programs where TFDM has a dependency
- Access to WJHTC has improved and remote testing keeps software developmental testing moving ahead

NAC Milestone Impact

SURFACE AND DATA SHARING		
PRE-IMPLEMENTATION COMMITMENTS	**Old Date**	**New Date**
TFDM program will complete the operational testing for Build 1	Q2 CY2020	**Late CY2021***
NASA ATD-2 interim technology transfer from Phase 2: Fused IADS at CLT	Q4 CY2019	Complete
NASA ATD-2 final technology transfer from Phase 3: Terminal departure IADS at DFW/DAL	Q3 CY2020	Q4 CY2021
IMPLEMENTATION COMMITMENTS	**Old Date**	**New Date**
TFDM program will achieve key site IOC for Build 1 at PHX	Q2 CY2020	**Late CY2021***
TFDM program will achieve the in-service decision (ISD) for Build 1 to allow additional TFDM system deployments into the NAS	Q4 CY2020	TBD
TFDM program will achieve IOC at 3 additional sites	Q1 CY2021	TBD
TFDM program will achieve the key site IOC for Build 2 at CLT	Q4 CY2021	TBD
TFDM program will achieve ISD for Build 2 to allow additional deployments of the full TFDM capabilities into the NAS	Q1 CY2022	TBD
TFDM program will achieve IOC at 5 additional sites	Q1 CY2022	TBD

* New Dates dependent on ability of program to travel, access FAA facilities, conduct training, conduct testing and other FAA program dependencies. If dependencies are not met, the program will not meet these dates.

Surface & Data Sharing: Industry Update

- Continued NIWG meetings and other industry forum discussions around integrated flow management with TFDM as the integral part of the gate-to-gate concept
  - Data exchange foundation
  - Trajectory based operations
  - Future Flow management
  - Full stakeholder involvement
- Participation in SWIFT
  - Leverage SWIM and other sources of data to better manage the NAS
  - Use the same data to develop meaningful and common insight through metrics
- NASA ATD-2 phase 3 extension
  - Advance the Digital Microservices Concept
- Uncertainty in the TFDM program waterfall and changes in overall industry conditions have stalled progress
  - Need to collaborate to find innovative ways to get back on trajectory
    - Cloud based solutions
    - Agile Sprints
    - Taking advantage of virtual options and reduced traffic demand

Performance Based Navigation (PBN)

Juan Narvid (FAA), Aaron Wilkins (FAA), & Wendy O'Connor (FAA)

Brian Townsend (APA) & Bill Whyte (RAA)

PBN NIWG Status

- No meetings since Aug 25 NAC SC meeting

Key Issues

- Barriers to Established on RNP (EoR)
  - Next steps remain under consideration; how to address with future milestones in upcoming NJIP updates

- Vertical Navigation (VNAV) Issue
  - The VNAV issue continues to impact EoR implementation with mixed equipage
  - Flight Standards met with ALPA over the summer
  - New tasking (Task 20-2: Vertical Navigation)
    - Awaiting DOT approval of workgroup members
    - "Industry forecast" of VNAV equipage is a primary objective

No meetings since Aug 25 NAC SC meeting

- No changes since Aug 6 NAC meeting

Milestone		Date	Status (New updated JIP dates)
CLE/DTW	Post-impl. phase complete	1QCY20	Completed - 10/10/19
DEN	Implementation phase start Implementation phase complete Post-impl. phase complete	1QCY20 2QCY20 1QCY21	Completed - ACM 1/28/20 Completed - 3/26/20 TBD
LAS	Implementation phase start Implementation phase complete Post-impl. phase complete	2QCY20 3QCY20 2QCY21	Completed – 7/7/20 1QCY21 - Targeting 11/2020 TBD
Florida	Implementation phase start Implementation phase complete	4QCY20 3QCY21	On Track - Expect to commence 10/2020 On Track - Expect to publish procedures 8/2021
Provide input, validate data, review findings and confirm conclusions to post-impl. analyses for implemented PBN procedures.		CLE/DTW Q3CY20 DEN Q3CY21 LAS Q4CY21	On Track – FAA delivered data to Industry focals TBD TBD
Implement select iTBO capabilities in NEC and Denver		NEC Q4CY21	On track - Currently maturing the time-based metering design and coordinating with field facilities to prepare for departure scheduling from multiple ARTCCs.
		DEN Q4CY21	On track - Currently planning the implementation of enroute metering improvements in 2020.

Data Communications (Data Comm)

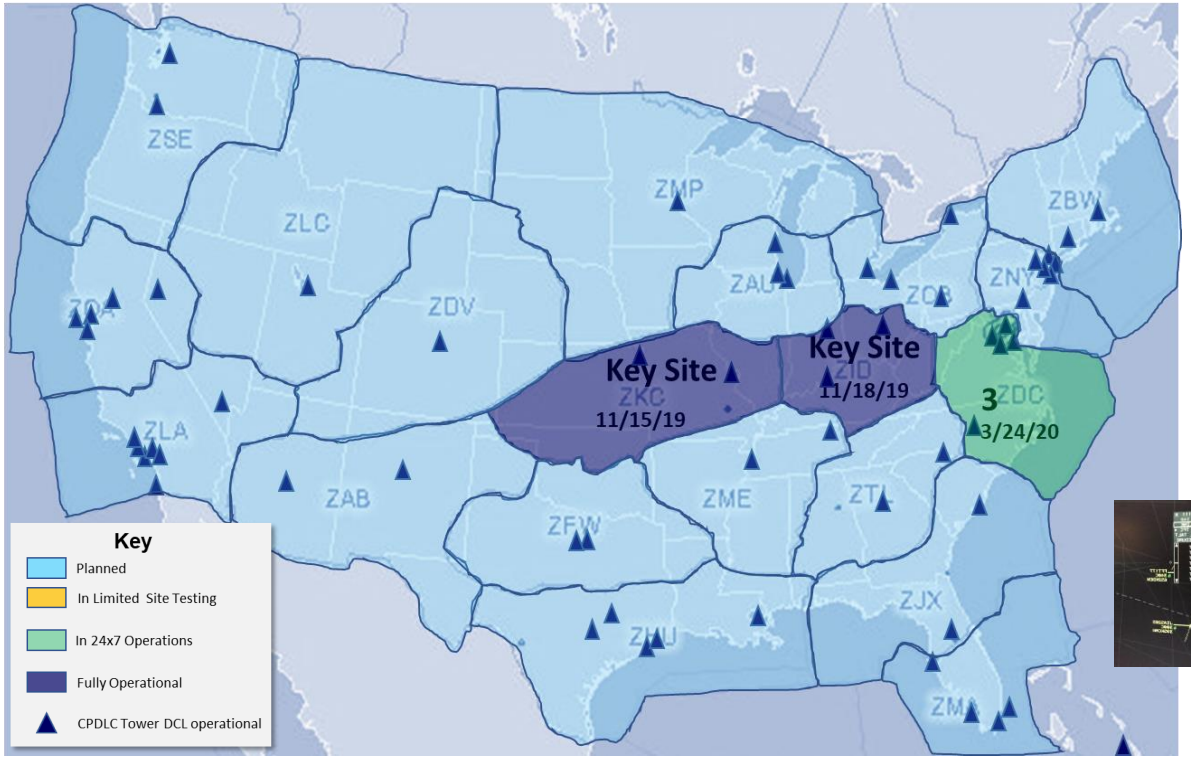
Jesse Wijntjes (FAA)

Chris Collings (L3 Harris) & **Ed Evans** (Southwest Airlines)

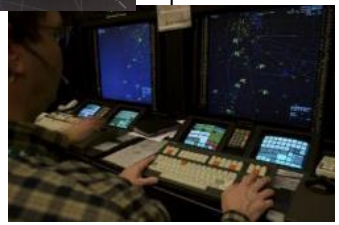
Data Comm Accomplishments

- Activated Data Comm services at first 3 En Route Centers
  - En Route services exceeding operational performance targets (>99% success) – best performing data link capability in the world
- Air-ground interop issues fault isolated & addressed
  - Avionics software updates delivered and/or in development for all identified issues
  - Implemented fixes and upgrades to air-ground networks
  - ERAM system performance & enhancements have been and continue to be critical to program success
- Operators purchased & installed upgrades to enhance air to ground system performance
- Business/General aviation & DOD communities addressing avionics issues and resuming En Route participation

Data Comm Operational Status



Air-to-Ground Network



En Route

Tower

Data Comm operational at 62 Towers

Data Comm operational at 3 En Route Centers

Remaining 17 En Route Centers on hold due to COVID-19

Note: 19 additional airports have asked for Data Comm Services including a NAC / NAC SC request for Data Comm Services at CVG, PBI, and JAX

Industry Avionics Accomplishment

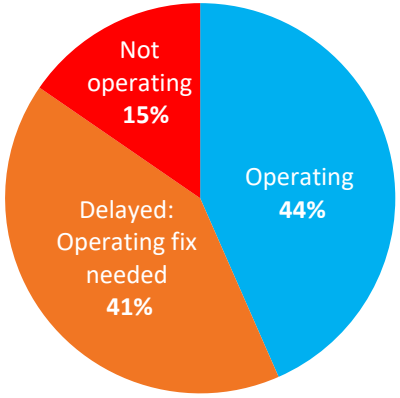
Completed Actions

Operator & Fleet Actions Complete	Status
American Airlines: B777, B787	Operating en route, no action required
FedEx: B777, MD11	Operating en route, no action required
Southwest Airlines: B737	Operating en route, no action required
UPS: B744, B757, B767, MD11	Operating en route, no action required

Pending Avionics Actions

Avionics Action	Operator/Fleet	Status
Collins CMU 900 Core 16	Alaska, American, Delta, United	Install Delayed (COVID), Aircraft operating
Airbus A320/30 ATSU CSB 7.5	Alaska, American, Delta, JetBlue	Fix Release Delayed –Dec 2020 (COVID) Aircraft operating
Boeing 757/767 Pegasus 1 Procedure Mitigation	FedEx	Delayed – Pending approval; Aircraft removed
Boeing 757/767 Pegasus 1 Fix	FedEx, UPS, United	Delayed – March 2021 (some aircraft operating under procedure mitigation)
Collins VDR Update	Alaska, United, FedEx	Install Delayed (COVID), Aircraft removed
Boeing 777 AIMS 2 BP17B	United	Install Delayed (COVID), Aircraft operating
Boeing 787 CMF BP6	United	Install Delayed (COVID), Aircraft operating
Airbus A350/A380	Delta	New, aircraft removed from en route
Boeing 747-8 ATN-203	UPS	Planned – Q2 2021, aircraft operating

Data Comm Fleet Status



Data Comm critical path action	Operating, no action required	Delayed: Operating fix needed	Delayed/Not Operating

Data Comm Forward Plan

FAA

- The team continues to focus on reducing implementation risks once we restart deployment
- Completion of deployment will be executed as safely and efficiently as possible

Industry

- Despite the impacts from COVID-19, multiple operators made progress on avionics updates
- Continued success of the program relies on operators upgrading to A320 ATSU CSB 7.5 and Collins CMU 900 Core 16
- Need Boeing Pegasus 1 fix delivered in Q1 2021 as planned

Industry & FAA Data Comm team is ready to resume the national deployment of En Route services

Northeast Corridor (NEC)

Aaron Wilkins (FAA), Juan Narvid (FAA) & Wendy O'Connor (FAA)
Mark Hopkins (Delta Air Lines) & Ralph Tamburro (PANYNJ)

Northeast Corridor: Key Issues & Status

- 2020/2021 Commitments
  - Facility access, travel, training and fiscal limitations are delaying some commitments (e.g. ACR and GBAS)
  - Virtual resources allow continued progress (e.g. Industry TOS discussions)
- Facilitating implementation of NAC-recommended opportunities
  - LGA Runway 31 approach procedure
  - High-performance escape routes for TEB/HPN
- Looking ahead
  - Continue to monitor exiting milestone status
  - Advancing additional pre-implementation milestones and adjusting/adding new milestones

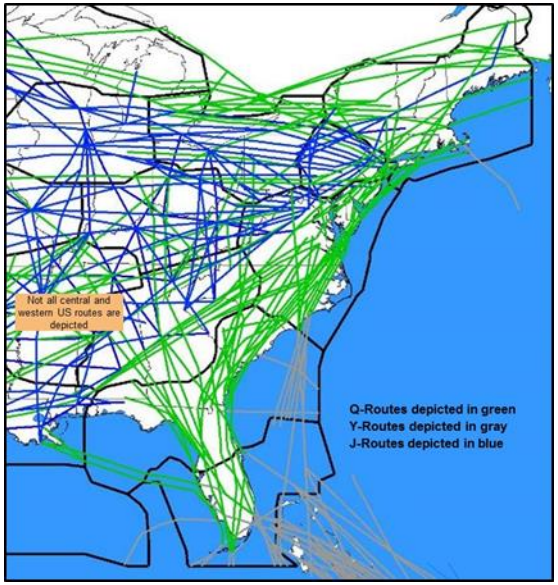
Outlook for CY2020/2021 Commitments

Type	Commitment/Milestone	Jun 2019 NJIP	Aug 2020 NJIP**
Implementation*	Improved departure management for flights destined for LGA	Q3 CY2020	Q4 CY2020
Implementation*	DSP enhancements	Q4 CY2020	Q2 CY2021
Implementation*	Atlantic Coast Routes	Q4 CY2020	Q4 CY2021
Implementation*	PDRR/ABRR Enhancements	Q4 CY2020	Q2 CY2021
Implementation*	Arrival time-based metering (TBFM) for PHL	Q4 CY2021	Q4 CY2021
Pre-implement*	FIM review and analyses	Q3 CY2020	Completed
Industry	GBAS evaluation at BOS	Q2 CY2020	Q4 CY2021
Industry	DCA north end hold pads	Q3 CY2020	Completed
Industry	PHL 27R analyses	Q3 CY2020	Completed
Industry	GBAS at LGA	Q4 CY2020	TBD
Industry	GBAS at JFK	Q3 CY2021	TBD

* Implementation and Pre-implementation milestones are jointly shared by FAA and Industry for the NEC efforts
** Newly updated JIP dates continue to be at risk due to COVID-19 impacts and may change

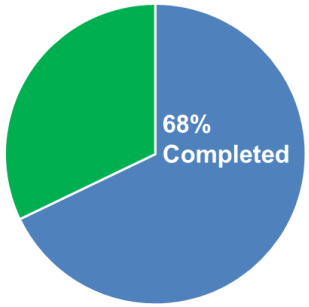
- Complete on time or early
- No delay to date
- Delayed 1-2 quarters
- Delayed 3 or more quarters

ACR: Incremental Implementation



- ✓ 10/10/2019 Publish/Implement 1 New Y-Route and 8 Waypoints
- ✓ 11/7/2019 Implement ZDC Low Altitude Sector Changes
- ✓ 12/5/2019 NOTAM NA 33 J-Routes/Q-Routes (FL Metroplex) for 56 days
- ✓ 1/30/2020 Delete/Amend 33 J-Routes/Q-Route (FL Metroplex), Cancel N/A NOTAM
- ✓ 1/30/2020 Delete 5 CHS STARs
- ✓ 3/26/2020 Delete/Amend 6 SIDs (BWI/IAD/DCA/HEF/ADW)
- ✓ 5/21/2020 Amend 2 Q-Routes: Q75, Q475
- ✓ 5/21/2020 Amend 1 SID (DOV)
- ✓ 7/16/2020 Delete/Amend 18 J-Routes
- ✓ 9/10/2020 Publish/Amend 8 Q-Routes, N/A NOTAM for 56 days
- ✓ 11/5/2020 Implement 8 Q-Routes, Cancel N/A NOTAM
- ✓ 11/5/2020 Publish/Delete/Amend 18 STARs (TEB/LGA/CHS)
- ✓ 11/5/2020 Delete/Amend 11 J-Routes/Q-Routes

2/25/2021 Publish/Delete/Amend 20 RDU SIDs/STARs
4/22/2021 Establish ZDC Ultra-High Sector 30
10/7/2021 Publish/Amend 24 Q-Routes, N/A NOTAM for 56 days
10/7/2021 Amend 1 ATL SID, Amend 4 Y-Routes
12/2/2021 Publish/Amend 5 STARs (PHL/EWR/TEB/LGA), Cancel N/A NOTAM
12/2/2021 Amend/Delete 24 J-Routes
1/27/2022 Delete 2 STARs (LGA/EWR)



- Incremental progress amid COVID-related schedule delays
  - Completed 68% of project elements by the end of 2020 (even though full project completion was delayed by over one year to early 2022)
- Recent progress
  - Eight Q-Route additions/amendments published on Sep 10, 2020 and operational on Nov 5, 2020
  - Operational implementation on Nov 5 went very smoothly

Looking Forward: Progress on NEC Capability Objectives

RTCA

Approved by the NextGen Advisory Committee June 2017

Goals and Priorities for Improving Operations in the Northeast Corridor Phase One

Capability Objectives	Description
Deconflict Airports	• Reduce or remove dependencies between New York airports that constrains airport throughput today
Improve Individual Airport Throughput	• Improve throughput to/from NEC airports and terminal airspace sectors • May impact separation standards, rules, etc.
Improve and Integrate Existing Flow Management Capabilities	• Improve use and adaptation of existing tools • Enhance collaborative planning process and tools • Integrate application of existing capabilities across system
Improve Airspace Throughput	• Improve throughput through NEC airspace and en route airspace sectors • May impact separation standards, rules, etc.
Implement New Flow Management Decision Support Tools	• Implement new tools to assist in future time-based flow management
Improve NAS Information, Common SA	• Enhanced information to aid in planning or decision making
Create New Noise Abatement Procedures	• Implement and operate new noise abatement procedures that maximize aircraft participation and, where feasible, reduce impact to local communities

* Capability Objectives from NEC Phase 1 Report and NAC Presentation, June 2017

19-1/20-4: Minimum Capabilities List (MCL)

Ron Renk, United Airlines

Greg Young, Delta Air Lines

Task Review

NAC Task 19-1:

NAS Aircraft Minimum Capability List (MCL) 4 Oct 2019

Sub-task 1

- Collaborative analysis of current fleet equipage with respect to the MCL capabilities

Sub-task 2

- Socialization of the MCL with additional stakeholder groups, including aircraft and equipment manufacturers and regional airlines not involved in discussions to date

Sub-task 3

- Recommendations on steps to encourage MCL adoption and commitments to equip aircraft with the associated capabilities

Previous Accomplishments

- **Sub-task 1:** Collaborative analysis of current fleet equipage with respect to the MCL capabilities

Air Transport Aircraft	Total Count	Baseline MCL						
		Approach					Terminal	Enroute
			A-RNP		VNAV (GPS)			
		RNP ARa	Capable	Ops Spec	Coupled VNAV	Advisory VNAV only	RNP-1 w RF	RNP-2
WB/NB	5,355	4,827	[illegible]	4,088	5,130	225	4,859	5,303
Regional	2,033	702	887	509	1,106	927	887	2,021
WB/NB	5,355	[illegible]%	91%	76%	96%	4%	91%	99%
Regional	2,033	35%	44%	25%	54%	46%	44%	99%

Accepted Last NAC

Previous Accomplishments (cont.)

- **Sub-task 2:** Socialization of the MCL with additional stakeholder groups, including aircraft and equipment manufacturers and regional airlines not involved in discussions to-date

Accepted Last NAC

Previous Accomplishments (cont.)

- **Sub-task 2:** Completed the MCL Matrix with industry consensus

NextGen Enabling Category	Aircraft Enabling Capability	Key Missing Components	Benefit	Example Use Cases	Areas Receiving Benefit	Ground Investment	Risks to ROI
Performance Based Navigation	• RNP-2 (Enroute) • RNP-1 w/ RF (Terminal SID/STAR) • RNP APCH w/ RF (Approach) • A-RNP or RNP AR 0.3 w/ RF (Approach) • RNP Scalability • Autopilot-coupled VNAV	• RF Leg Type • Autopilot-coupled VNAV • Auto-throttle • RNP AR capability • FMC database size	• Precise deconflicted arr and dep with reduced separation reqs • Shorter track miles • Reduced fuel burn • Maximize poor weather capacity • Predictable flows • Increased access • Reqd for Trajectory Based Operations (TBO)	• Established on RNP (EoR) • RNAV/RNP arrivals/departures • Optimum Profile Descents (OPD) • Q/T/Y routes • LNAV/VNAV apch minima • Apchs where ground based navaid does not exist or is being removed.	• North East Corridor (NEC) • NSG-1/NSG-2 Airports • Terminal Airspace • GA Airports with restricted access due to conflicts with terrain or other airports o SMO, G3ADS, PWK HHR, MRI, OPL • Enroute (more efficient routing) • Maintain access after NAVAID decommissioning	• Airspace and procedures enhancements • Reduced lateral separation between routes • Controller training •Procedure implementation process (IAP, EoR) • FAA Policy	• Reqd environmental work • Non-equipped a/c • Decision Support Tools • Automation enhancements • Requires pre-conditioned flows • Right sizing development • Maintenance and removal of procedures • FMC database size to support new p[illegible]res & wpts
Data Comm	• FANS-1/A with "Push to Load" over VDL Mode 2 with multi-frequency	• CMU/CMF/ATSU • VHF Digital Radios • FANS 1/A capable FMC/FMGC	• Shorter ground delay for clearances • Reduced communication errors • Efficient delivery of complex clearances • Reduce long voice communications • Reduced freq congestion • Accurate re-route • Weather avoidance • Pilot requested re-routes • Enables Trajectory Based Operations (TBO) • CTOP/TOS	• High rate clearances during SWAP • Efficient wx re-route • Improved human factors (errors in re-route entries) • More efficient routing	• NAS ground ops • Enroute ops	• Development / delivery of Data Comm svcs • Enhanced automation and Decision Support tools • Controller [illegible]	• R[illegible]/Controller tra[illegible]g dur[illegible]plementation • [illegible]pped a/c • Actual [illegible]tem [illegible] • Con[illegible]ity of equipment to us[illegible]ANS messages ([illegible] spec being adapted for modern use) • Partially equipped aircraft - Meets some but not all FANS 1/A requirements
Surveillance	• ADS-B Out - Mandate	• Transponder • Highly accurate position source with integrity	• Enables 3NM enroute separation • Reduced separation in select situations • Improved surveillance in non-radar areas (including surface) • More accurate position more frequent update [illegible]e • Enables impr[illegible]sa[illegible] via ATC auto[illegible]on an[illegible] [illegible]M Decision [illegible]pport too[illegible] [illegible]ved P[illegible]ing an[illegible] [illegible]M Se[illegible] [illegible] • [illegible]bles ADS-B IN ap[illegible]ations	• 3NM enroute separatio[illegible] • Western Atlantic Route [illegible]m (WATRS) operatio[illegible] • Reduced te[illegible] vecto[illegible] to conflict • En[illegible]	[illegible]ute [illegible]rmina[illegible] • N[illegible]r environments • Mountainous terrain	• Ground infrastructure • ERAM/STARS enhancements • Controller training • Reduced Spacing	
Performance Based Navigation, Low Vis Ops, Surveillance	• Resilient NextGen Ops (DME/DME/IRU)	• Airworthiness approval for DME/DME, IRU Hardware	• Resilient terminal and enroute ops with GPS loss (Jamming or hardware failure)	• Q/T/Y Routes • RNAV SIDs and STARs	• Navigation and surveillance resilience for all NAS ops; needed most in remote areas.	None	

Accepted Last NAC

Previous Accomplishments (cont.)

- **Sub-task 3:** Recommendations on steps to encourage MCL adoption and commitments to equip aircraft with the associated capabilities

- Items the MCL Working Group felt we needed to address to encourage adoption:
  - Scope – To whom does the MCL apply?
  - Retrofit – "If I took delivery of airplanes just last year, what would I need to buy so as not become an impediment in the NAS?"
  - Cost/Benefit – "What will this cost me and what will I get in return?"

Extended Last NAC

Tasking Extension Revisited

- The extension afforded more time to collect needed cost/benefit data and document the effort into a comprehensive report.

Report Highlights

- Goal of the MCL: to drive industry consensus on what equipage is critical to advancing the NAS into a NextGen state.
- MCL Matrix Organization: a key to reading the rows and columns of the document

Report Highlights (cont.)

- Scope:
  - This was a difficult task: a delicate balance was required
  - Too many operators included: the MCL would likely encounter fatal resistance to acceptance.
  - Too many operators excluded: mixed equipage issue isn't resolved to its fullest potential.

Report Highlights (cont.)

- Retrofit: The MCL continues to be focused on forward-fit only; this section does not change that emphasis.
  - While not recommending a retro-fit, the group examined capabilities which, if absent on an aircraft, could be a future impediment to the NAS.
  - Operators may consider this guidance towards understanding how to get maximum value for their investment should funds be available.

Report Highlights (cont.)

- Costs and Benefits of the MCL:
  - The working group felt it was important for operators to have reliable information on the costs and benefits associated with each component of the MCL before making equipage investments.
  - While the group is unable to build a complete business case for each operator, we can provide source information for benefits and average costs for each group of capabilities.

Costs

- PBN Baseline Item
  - Range = $0 (Basic) - $317,600
  - Average Cost Across all Aircraft Models Submitted = **$50,000**
    - *Some Narrow body/Regional aircraft and widebody aircraft indicated the capability is basic and therefore pricing range is applicable to the full range of forward fit aircraft
- DataComm (FANS 1/A, VDL Mode 2 with push to load)
  - Range = $0 (Basic) - $318,522
  - Average Cost Across all Aircraft Models Submitted = **$94,000**
    - *All Narrow body/Regional aircraft had a priced option, while only some widebody aircraft had priced options (Not all widebody are Basic)
- Surveillance (FAA ADS-B Out compliant)
  - Range = $0 (Basic) - $88,000
  - Average Cost Across all Aircraft Models Submitted = **$13,450**
- Resilient NextGen Operations (DME/DME with IRU)
  - Range = **$0** (Basic)
    - *All respondents indicated that all in-production aircraft models are fitted with this equipment as part of the Basic aircraft

Costs (cont.)

- The range of combined MCL capabilities across all models can vary from **$0 to $448,000** per aircraft. Yet the average cost across all models is only **$158,000**. Important points to remember:
  - These are un-negotiated, catalog prices.
  - Some aircraft models require Buyer Furnished Equipment (BFE) which was not available at the time this report was due.
  - Items with ranges starting at $0 were basic, meaning they are already included in the cost of a particular make/model.
  - The Working Group only considered forward-fit. Therefore, costs are amortized over many years of payments.

Benefits

- Benefits Assessments: Examples provided from existing JAT and MITRE data.
- PBN:
  - Additional flight efficiency, such as reduced track miles and more fuel-efficient flight profiles
  - Additional throughput enabled by precise, deconflicted arrivals and departures
  - Enhanced safety with more predictable flows and stable approaches

Benefits (cont.)

- Data Comm:
  - On the ground: ATC clearances can be delivered more efficiently with reduced communication errors, resulting in shorter taxi-out times.
  - Enroute: re-routes can be accommodated and delivered more accurately, efficiently avoiding weather and congested airspace, resulting in more efficient flow.
  - Overall: data communications reduces voice transactions, read-back errors, and frequency congestion, resulting in enhanced safety.

Benefits (cont.)

- Surveillance:
  - Improves surveillance in non-radar areas (including surface) and enables reduced spacing, and in select situations reduced separation standards (e.g., 3NM enroute separation)
  - Provides more accurate aircraft position data into ATC automation and TFM tools; will enhance safety and increase effectiveness of flow management; more frequent update rate
  - Serves as a foundation for ADS-B In and its associated applications, including interval management.

Benefits (cont.)

- Resiliency:
  - Disruptions manifested in aircraft unable to fly RNAV SIDs, STARs, and extended ILS approaches. While airlines have not publicly disclosed their losses, each operator should consider the impact of that event on their operation.
  - Since this MCL item is now fitted at no cost on all production aircraft, the working group did not spend time examining benefit dollars for this baseline capability.

Cost & Benefit Review

- This initial assessment of MCL costs and benefits has identified preliminary elements to answer the questions of how much equipping will cost and its expected return on that investment. There are many variables in the cost and benefit equation, such as which aircraft are being purchased and where those aircraft will fly, which make it impossible for the working group to give one set of numbers.
- Benefit assessments based on actual capability implementation (vs. modeled benefit projections) is a sound approach for establishing expected ROI. NAC data and JAT analysis may require augmentation with other operational assessments to obtain a more complete benefits outlook, specifically for PBN applications.
- Operators can use this data to better understand how to build a complete business case.

Conclusion

- Neither Industry nor the FAA favors a mandate
- If no action is taken, we will continue to see investments made by both FAA and Industry whose impact is greatly diminished
- ***The MCL is FORWARD-FIT***
- Government and Industry must work together, making investments towards a common goal
- There is no better time than now to make this commitment (a/c retirements now, new orders to follow)
- Both Industry and FAA will benefit if the MCL is a living document

Conclusion (cont.)

- NAC Action Required:
  - Agreement that a forward fit business case is indeed plausible, and support for its adoption

    And/or

  - Recommendation that aircraft manufacturers adopt MCL Baseline capabilities as standard on all U.S. delivered aircraft

Recognition

- We should acknowledge the efforts of the team which worked collaboratively to provide this outstanding product to the NAC. It took robust discussion from a broad section of government and industry to make this happen.

Motion for NAC Approval as Advice to the FAA

- Minimum Capabilities List (MCL) – NAC Task 19-1/20-4 Report

19-4/20-5: PBN Clarification

Ad Hoc Co-Chairs: Steve Brown, Brian Townsend, & Bill Whyte

FAA SMEs: Clark Desing, Wendy O'Connor, & Aaron Wilkins

Task 19-4: Performance Based Navigation (PBN) Clarification

The NAC is asked to provide aviation community consensus advice by:

- Developing consensus agreement on a PBN baseline
  - FAA Procedures
  - Industry Equipage;
- Developing consensus agreement on a joint definition of a PBN NAS; and
- Developing consensus agreement based on gaps in baseline analysis at Core 30 airports (minus HNL, plus TEB), on a list of specific desired outcomes.

August 6th NAC Meeting

- The vote to accept the PBN Clarification Report was tabled
  - Questions and concerns were raised by some of the NAC members
  - NAC Chairman tasked the NACSC to conduct a deep-dive into the report and resolve outstanding issues
  - Various meetings and coordination have produced a successful outcome

Comment Resolution & Final Report Complete

- All comments received have been resolved
  - ✓ Comments from public (pre-Aug 6 NAC) and formatting
  - ✓ Comments during NAC SC deep-dive presentation
    - Wording describing readiness and return scoring in Appendix D
  - ✓ Comments post-deep-dive
    - Ad Hoc Team membership clarified
    - Ambiguous references to "Industry" clarified
  - ✓ Comments from ALPA received in early October
    - Clarified details and revised comments on desired outcomes in Appendix D
- Revised report with a summary of edits distributed to NACSC and accepted during October 29th meeting
  - ✓ Editorial adjustment in Appendix D (communicates same intent)

Final report ready for NAC approval

Motion for NAC Approval as Advice to the FAA

- Performance Based Navigation (PBN) Clarification Ad Hoc Team – NAC Task 19-4/20-5 Report

20-1: ADS-B In Commercial Application Technologies

David Surridge, American Airlines

Don Kauffman, Honeywell Aerospace

FAA Tasking

- ADS-B In applications
  - Current and future
- Airlines interested in the above applications

Our Plan

- We plan on meeting a few times a month with each meeting focusing on one aspect that will help educate the work group
  - What problem can ADS-B In solve?
  - How does it solve the problem?
    - Potential Benefits
  - Safety benefits from ADS-B In technologies.
  - Answer the NAC question of - what value will ADS-B In applications bring to the NAS?

SMEs

- Will use SMEs to assist in developing an accurate picture of ADS-B In uses along with benefits
  - MITRE
  - FAA
  - OEMs

Future Investment Plans

- We will meet with OEMs and understand what their plans are for forward and retro fit solutions
  - Timelines
  - Provide deidentified estimated catalog pricing
    - Forward fit
    - Retro fit
- FAA future investment plans
  - ERAM / STARS
  - TBO

Final Report

- Due Spring 2021
- Hopefully this will result in a comprehensive picture for NAC members to review when determining how much interest is there in ADS-B In application along with the NextGen enhancements for the NAS.

Questions?

20-2: Vertical Navigation (VNAV)

Michael McDowell, Collins Aerospace

Greg Young, Delta Air Lines

Background

- RNAV (GPS) Approaches commonly include LNAV and LNAV/VNAV lines of minima

TERPS AMEND 1A 17 AUG 2017

TERPS STRAIGHT-IN LANDING RWY **28C**

	LPV DA(H) **851′**(200′)			LNAV/VNAV DA(H) **1094′** (443′)		LNAV MDA(H) **1060′**(409′)	
		TDZ/CL out	ALS out		ALS out		ALS out
C / D	RVR 18 or ½	[1] RVR 24 or ½	RVR 40 or ¾	RVR 50 or 1	1½	RVR 40 or ¾	RVR 60 or 1¼

[1] RVR 18 with Flight Director or Autopilot or HUD to DA.

CHANGES: Re-indexed, rwy configuration.

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Background (cont.)

- RNAV procedures are Not Authorized for LNAV Only a/c during Closely Spaced Parallel Operations (CSPO)

KORD/ORD
CHICAGO O'HARE INTL

JEPPESEN
30 OCT 20 22-17 Eff 5 Nov

CHICAGO, ILL
RNAV (GPS) Rwy 28C

D-ATIS	CHICAGO Approach (R)	O'HARE Tower (Main)	O'HARE Tower (North) Rwy 9L/27R	O'HARE Tower (South) Rwy 10R/28L
135.4	119.0	120.75 121.15 126.9 132.7	128.15	133.0

Ground (Main) Rwy 10C/28C	Ground (North)	Ground (South)
134.15 121.9	124.125	118.05

WAAS	Final Apch Crs	SEIKA	LPV DA(H)	Apt Elev 680′
Ch 42634 W-28B	273°	2300′ (1649′)	851′ (200′)	TDZE 651′

MISSED APCH: Climb to 1100′ then climbing LEFT turn to 4000′ direct DPA VOR and hold.

3400
MSA RW28C

Alt Set: INCHES Trans level: FL 180 Trans alt: 18000′

1. For uncompensated Baro-VNAV systems, LNAV/VNAV not authorized below -19°C (-2°F) or above 54°C (130°F). 2. DME/DME RNP-0.30 not authorized. 3. VGSI and RNAV glidepath not coincident (VGSI angle 3.0°/TCH 80′). 4. Simultaneous approach authorized. 5. LNAV procedure not authorized during simultaneous operations. 6. Use of Flight Director or Autopilot providing RNAV track guidance required during simultaneous operations.

Background (cont.)

- The Consequence: LNAV Only aircraft are unable to sequence in with LNAV/VNAV or RNP aircraft in CSPO
- When RNAV in CSPO is in use (GS Outage: planned or unplanned), LNAV Only must be "sorted" by TRACON
  - time, extra comms, inefficient use of airspace
- Our Goal: Increase equipage capabilities so nearly all can participate with LNAV/VNAV and RNP a/c in CSPO

Wait a Minute…

- **Q:** Isn't this issue addressed by the MCL?
- **A:** Yes, *__**but**__* MCL addresses forward-fit only

Table 1 – Combined Air Carrier Baseline PBN Equipage

		Baseline MCL						Supplemental MCL	
		Approach					Terminal	Approach	
			A-RNP		RNAV (GPS)				
Air Carrier	Counts	RNP AR	Capable	Ops Spec	Coupled VNAV	Advisory VNAV only	RNP-1 w RF	GLS	LPV
Majors	4,644	76%	89%	65%	98%	2%	90%	14%	1%
Regionals	1,881	23%	23%	0%	43%	57%	23%	0%	0%

Question of the Day

- How will those 1000+ LNAV Only a/c affect NextGen implementation in the 5-7 yr timeframe?
  - How many might retire (fleet reduction, economics, etc.)?
  - What are the impediments to upgrade?
  - Are there upgrade paths available?
- *Stated another way: "what will the "LNAV Only" fleet look like in 5 yrs?"*
- More clarity here will better inform timeline & implementation sequence of NextGen improvements

NAC Task 20-2

- "Provide the FAA an industry plan to address the existing equipage gap that prevents the full use of Required Navigation Performance (RNP) approaches for parallel operations."
- Advice should include:
  - A comprehensive assessment of mainline and regional airline impediments to equipage for full VNAV operations
  - Achieve consensus on a plan to eliminate impediments to equipage for VNAV operations
  - Where complete consensus cannot be achieved, identify those operators or industry organizations which cannot come to consensus agreement and provide a minority opinion on any objections.

Proposed Actions

1) Determine state of LNAV Only fleet currently operating in the NAS
   - How many, which models, who operates?
2) Determine:
   - Models not capable: no existing upgrade path
   - Models not capable, but upgrade path exists
     - Obtain Upgrade Information from OEM/Avionics Manufacturers
   - Models capable, but not being operated in equipped configuration

Proposed Actions (cont.)

3) Obtain information from Operators on Plan associated with “Gapped” Aircraft

4) Develop 5-10 Year Outlook Based on Specific Fleet Plans of “Gapped” Aircraft

Deliverables

- Current Equipage Landscape
- Review of LNAV Only Aircraft
  - Models
  - Quantities
  - Retirement Plans
  - Upgrade Options Available
- Impediments to Equipage
- 5-10 year Equipage Outlook

DFO Announcements

Dan Elwell, FAA Deputy Administrator

NAC Designated Federal Officer

Review of Action Items & Other Business

Greg Schwab, FAA

NextGen Advisory Committee (NAC) Upcoming Meetings

- Spring 2021
  - March 2021 (target month)
- Summer 2021
  - July 2021 (target month)

Closing Comments & Adjourn

Chip Childs, NAC Chairman

President & CEO, SkyWest Inc.

Back-Up Slides

Data Comm: Read-Ahead Slides

Data Comm: Metrics

Data Comm Tower by the Numbers

17 US Air Carriers
(Part 121)

65 Non-US Air Carriers
(Part 129)

1,900+ Business Aviation Operators
(Parts 91, 91K, 135)

62 Airports

67 Aircraft Types

Over 5,900 Equipped Aircraft

Data Comm Tower Benefits

Departure Clearance Benefits Realized Since 2016

- Saved 2.31M minutes of radio time
- Saved 1,626,870+ minutes of airspace user time
- Served 1.20B+ passengers
- Cleared 8,726,000+ flights
- Prevented 19.4M Kgs of CO_2 Emissions
- Prevented 127,585+ readback errors

Data Comm En Route by the Numbers

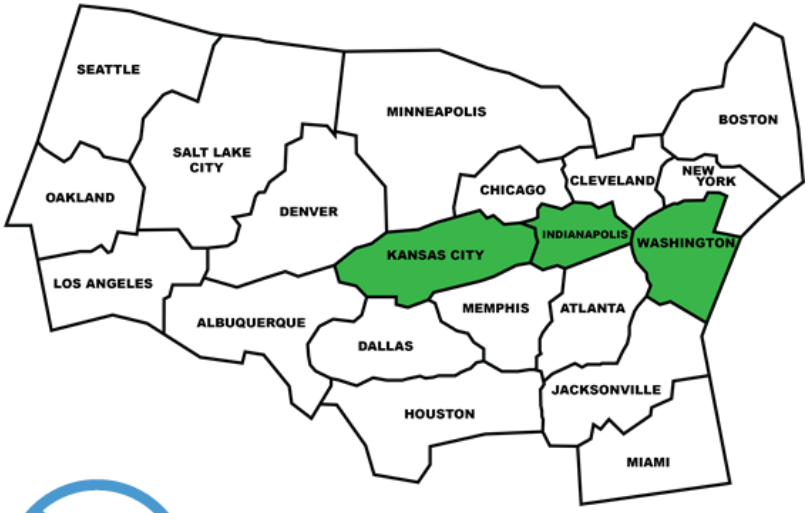
En Route Data Comm Since 2019

3,213,576 transactions

533,942 sessions

22 aircraft types

17 operators



60,613 readback errors mitigated

228,764 minutes of comm time saved

Data Comm: Avionics Status

Data Comm Avionics Availability
Commitments and Risks

	Action	Status	
Priority Items	Collins Core 16	Collins: Delivered Core 16, demonstrating strong performance	
		Operators: UPS & FDX complete; 4 delayed due to COVID-19	
	Pegasus I Mitigation	Interim Procedure Mitigation, 2 operators using, exp. 6 mo after SB release	
		Stale message point fix to Peg 1 – ~~Feb 2021~~ delayed March 2021	
		FAA extended procedure mitigation to 6 months after Peg 1 fix SB release	
	Honeywell Mark II+ v523	Delivered, installed and, demonstrating strong performance	
	Boeing 787 BP6	Service Bulletin released on 20 December 2019, installs progressing	
	Airbus ATSU CSB 7.5	Service Bulletin delayed from June 2020 to December 2020	
	Airbus A350	Removed from en route CPDLC due to poor VDLm2 handoff performance	
	Boeing B748 ATN-203	Service Bulletin planned from Boeing Q4 2021	
	Boeing 777 BP17B	Service Bulletin released on 16 December 2019, installs progressing	
	Business Aviation	Initial fleets re-started en route ops on trial basis	
		FAA planning to publish Notice in Q1 2021	

Complete & Operating	Available for Install	Planned	Delayed

Data Comm Operator Status

Operator	Fleet	Avionics Action	Action Complete by	Action Status	Action Risk	Active En Route
Alaska Airlines	**A320**	ATSU CSB 7.5	Plans to install	Release delayed to Q4 2020	Delayed	Operating
	B737	**Collins CMU 900 Core 16**	TBD	Delayed due to COVID-19	Delayed	Operating
		Collins VDR SB	~~30 March 2020~~ TBD	12% installed Working supplier issue	Delayed	
American Airlines	**A320**	ATSU CSB 7.5	Plans to install	Release delayed to Q4 2020	Delayed	Operating
	B737	**Collins CMU 900 Core 16**	TBD	Delayed due to COVID-19	Delayed	Operating
		Collins VDR SB	Complete	Complete	Complete	
	B777	AIMS 2 BP17B	Remaining AC parked	Complete installs at RTS	All operating AC complete	Operating
	B787	**CMF BP6**	~~30 March 2020~~ Q2 2021	93% installed	Nearing completion	Operating

Data Comm Critical Path Action	Operating, no action required	Operating, pending action	At Risk/Planned	Delayed/ Not operating

Data Comm Operator Status

Operator	Fleet	Avionics Action	Action Complete by	Action Status	Action Risk	Active En Route
DELTA AIR LINES	**A320**	ATSU CSB 7.5	TBD	Release delayed to Q4 2020	Delayed	Operating
	A350	VDL handoff issues	TBD	TBD	New Issue	Removed
	B737	**Collins CMU 900 Core 16**	TBD	Delayed due to COVID-19	Delayed	Operating
		Collins VDR SB	Complete	Complete	Complete	
FedEx Express	**B757/67**	**Collins CMU 900 Core 16**	~~31 August 2020~~ 16 October 2020	Complete	Complete	Pending Procedure Approval
		Collins VDR SB	B757 – ~~31 July 2020~~ 31 December 2020	B757: 89% complete	Installs in progress	
			B767 – Complete	B767: Complete	Complete	
		Peg I Mitigation	~~31 August 2020~~	Pending FAA approval	Delayed	
	B777	AIMS 2 BP17B	Complete	Complete	Complete	Operating
		Collins VDR SB	Complete	Complete		
	MD11	**Collins CMU 900 Core 16**	~~31 August 2020~~ 16 October 2020	Complete	Complete	Operating
		Collins VDR SB	~~March 2020~~ ~~31 August 2020~~ 31 March 2021	94% installed	Nearing completion	

Data Comm Critical Path Action	Operating, no action required	Operating, pending action	At Risk/Planned	Delayed/ Not operating

Data Comm Operator Status

Operator	Fleet	Avionics Action	Action Complete by	Action Status	Action Risk	Active En Route
jetBlue	**A320**	ATSU CSB 7.5	6 months from release	Release delayed to Q4 2020	Delayed	Operating
Southwest	**B737**	**Honeywell Mark II+ CMU v523**	Remaining AC parked	Complete installs at RTS	All operating AC complete	Operating
ups	**B744** **B757** **B767** **MD11**	**Collins CMU 900 Core 16**	Complete	Complete	Complete	Operating
	B748	**Collins CMU 900 ATN-203**	70% 3 months from release, full fleet 6 months from release	Awaiting release from Boeing (Q2 2021)	Pending release	Operating

Data Comm Critical Path Action	Operating, no action required	Operating, pending action	At Risk/Planned	Delayed/ Not operating

Data Comm Operator Status

Operator	Fleet	Avionics Action	Action Complete by	Action Status	Action Risk	Active En Route
UNITED	**B737**	**Collins CMU 900 Core 16**	TBD	Delayed due to COVID-19	Delayed	Operating
		Collins CMU 900 VM update	~~30 Apr 2020~~ Remaining AC parked	92% installed	All operating AC complete	
		Collins VDR SB	~~30 Apr 2020~~ Remaining AC parked	84% installed, complete at RTS	All operating AC complete	
	B757/67	**Peg I Mitigation**	TBD	Evaluate at RTS	Delayed	Awaiting Peg 1 software fix Mar 2021
		Collins CMU 900 Core 16	TBD	Delayed due to COVID-19	Delayed	
		Collins CMU 900 VM update	~~30 Apr 2020~~ TBD	18% installed, complete at RTS	Installs in progress	
		Collins VDR SB	~~30 Apr 2020~~ TBD	88% installed, complete at RTS	Installs in progress	
	B777	AIMS 2 BP17B	~~March 2020~~ ~~August 2020~~ September 2020	50% installed	Delayed	Operating
	B787	**CMF BP6**	~~March 2020~~ TBD 2020	10.3 pre-req 100% 10.4/BP6 20%	Installs in progress	Operating

Data Comm Critical Path Action	Operating, no action required	Operating, pending action	At Risk/Planned	Delayed/ Not operating

Avionics Return to Service

EMBRAER	15
Legacy 450/500/550 (Collins Core 12 Equivalent)	5
Praetor 500/600 (Collins Core 12 Equivalent)	9
Phenom 300 (Collins Core 12 Equivalent)	
ERJ 70/75/90 E2 (HW EPIC CMF BP3.3 VDL 37-52 Equivalent)	
ERJ 170/175/190/195 (HW EPIC CMF BP3.0 VDL 22 -521+ Equivalent)	1

FALCON	31
F900B/C/EX (depends on STC)	10
F900EXEASy/DX/LX (HW-521 equivalent)	
F2000EXEASy/DX/LX/LXS/S (HW-521 Equivalent)	
FA7X (HW-521 Equivalent)	
FA8X (HW -522 Equivalent)	21

GULFSTREAM	321
G280 (Collins Core 12 Equivalent)	216
G500 (HW EPIC CMF BP3.1 -522 Equivalent)	54
G600 (HW EPIC CMF BP3.1 -522 Equivalent)	43
G700 (HW EPIC CMF BP3.4 -523 Equivalent)	7
G650 (522 Equivalent) • HW NG Block 3.1 – Q2 2020	1
G450 (522 Equivalent) • HW NG Block 3.4 – Q1 2021	
G550 (522 Equivalent) • HW NG Block 3.4 – Q2 2021	

BOMBARDIER	156
Challenger 300/500 (Collins Core 12 Equivalent)	97
Challenger 605/650 (Collins Core 12 Equivalent)	10
Challenger CRJ (Collins Core 12 Equivalent)	
Global 5000 GVFD (Collins Core 12 Equivalent) 822-1863-175 and Above	18
Global 6000 (Collins Core 12 Equivalent) 822-1863-175 and Above	27
Global 7500 GVFD (Collins Core 12 Equivalent) Only 822-1863-671 and above	4

OTHER-AVIONICS	38
Various • Garmin 3000/5000 • Honda, LJ75,C700, C68A, C25B, C25M, E55P	30
Various • Universal Avionics • G100, G200, CL60	5
Various • ProLine Fusion v2.0	1
Various • HW -524 Test Aircraft	2

Total Eligible

561

Ready | Test pending | Need data | Test Approved | Update req

Data Comm: NJIP Milestones CY19-21

Data Comm – NJIP CY19-21 Milestones (1 of 2)

Milestone	FAA or Industry	Milestone Date Q/CY	Status
Airlines to Equip 1,900+ Aircraft	Industry	4Q2019	Complete
Deploy Tower Services to an additional seven towers	FAA	3Q2019	Complete
Baseline additional Data Comm capabilities for En Route utilizing the existing FANS message set	FAA Industry	~~3Q2021~~ 3Q2022	Deferred to 2022 to align with deployment of initial and full services en route and funding constraints.
IOC for Initial En Route Services at all CONUS ARTCCs	FAA	~~4Q2019~~ ~~4Q2021~~ 4Q2022	Milestone impacted by COVID-19; Remainder of waterfall to be replanned.
Resolution of avionics/Pegasus 1 interoperability issue	Industry	4Q2021	Extension requested

With the impacts from COVID-19, the last site IOC milestone needs to be adjusted based on when the program can restart the waterfall once facility access restrictions are lifted.

Data Comm – NJIP CY19-21 Milestones (2 of 2)

Milestone	FAA or Industry	Milestone Date Q/CY	Status
Recommendation for target equipage rates for follow-on capabilities	FAA Industry	~~1Q2019~~ 2Q2019	Complete
Recommendation for the equipage strategy for Regional Jet equipage	Industry	~~1Q2019~~ 2Q2019	Complete
Loadability Solution for Runway SID/~~STAR~~	FAA	3Q2019	Complete – Plan developed for future TFDM implementation
Solution for Full Automation for the Confirm Assigned Route Capability	FAA	3Q2019	Removed

NEC: Read-Ahead Slides

Task 18-4. Northeast Corridor: Implementation Risks and Mitigations of the NextGen Priorities Joint Implementation Plan

"The FAA requests that the NAC identify Northeast Corridor risks and mitigations to the successful operational implementation of industry commitments with respect to the NextGen Priorities Joint Implementation Plan through calendar year 2021. This should also include any needed industry mitigations to support successful operational integration of the joint commitments."

Summary of Activities (since Aug 2020 NAC)

- Updates on status and progress of remaining implementation milestones:
  - Atlantic Coast Routes (Sep 2020 route publications and Nov 2020 route implementation)
  - TBFM in PHL
  - TFMS 2020 builds (planned enhancement releases for DSP and ABRR/PDRR)
- Briefing from FAA on estimated benefits for ADS-B In applications; update of materials briefed to the Equip 2020 Workgroup 4
- Continued Operator discussions on TOS in NEC

COVID-19 Impacts on NEC NIWG

- Access to FAA and Industry facilities restricted
  - Operational facilities are most impacted
  - Simulators and laboratories also impacted
- FAA and Industry training impacted
  - Access to training labs and availability of personnel
- Restoration of travel for FAA and Industry still unknown
- Fiscal austerity impacting investment
- Continued reduction in traffic levels across US but very pronounced in the Northeast

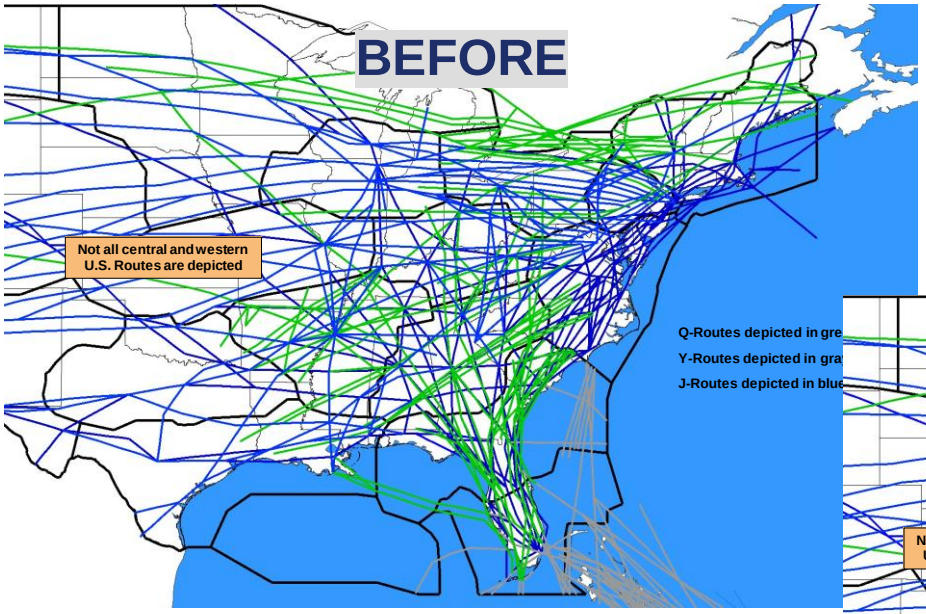
Impact on Remaining 2019-2021 NJIP Commitments

- Five remaining NEC implementation commitments
  - Four in CY2020: Delays expected for all remaining CY2020 commitments:
    - Improved departure management for flights destined to LGA
    - DSP enhancements
    - Eastern seaboard high-altitude routes (Atlantic Coast Routes)
    - PDRR/ABRR
  - One in CY2021: No delay reported yet
    - Arrival time-based metering (TBFM) for PHL

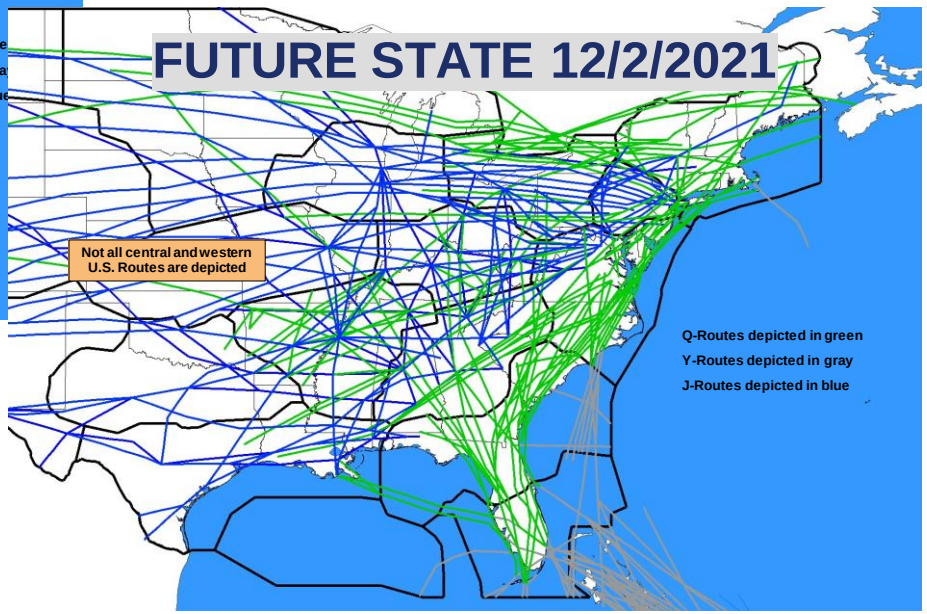
Impact on Remaining 2019-2021 NJIP Commitments

- Seven remaining NEC Industry commitments
  - Three in CY2020:
    - Delays expected for four CY2020 commitments
      - GBAS implementation at LGA
      - GBAS evaluation at BOS
      - Industry support to ACR implementation (tied to FAA delay)
  - Four in CY2021:
    - Delays expected for one commitments
      - GBAS implementation at JFK

Atlantic Coast Routes



- ACR is one of the biggest routes changes in the NAS

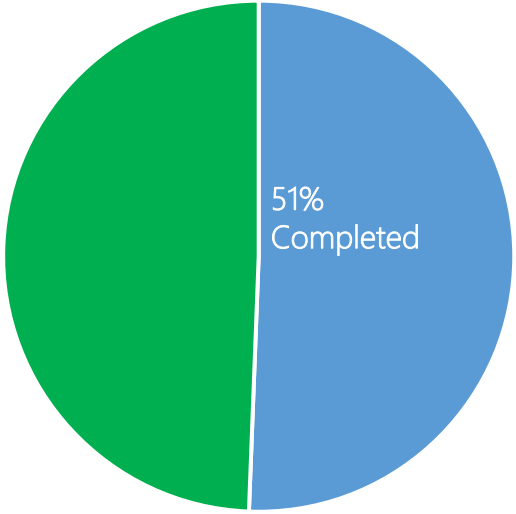


- What: 39 new/amended Q Routes and Y Routes will replace the north-south high-altitude route structure along the east coast of the United States
- Why: Transition to a PBN-Centric NAS thus decreasing reliance on ground-based NAVAIDs
- When: Changes being implemented on 13 separate chart dates 10/10/2019 through 1/27/2022

NEC ACR Implementation Milestones

- ✓ 10/10/2019 Publish/Implement 1 New Y-Route and 8 Waypoints
- ✓ 11/7/2019 Implement ZDC Low Altitude Sector Changes
- ✓ 12/5/2019 NOTAM NA 33 J-Routes/Q-Routes (FL Metroplex) for 56 days
- ✓ 1/30/2020 Delete/Amend 33 J-Routes/Q-Route (FL Metroplex), Cancel N/A NOTAM
- ✓ 1/30/2020 Delete 5 CHS STARs
- ✓ 3/26/2020 Delete/Amend 6 SIDs (BWI/IAD/DCA/HEF/ADW)
- ✓ 5/21/2020 Amend 2 Q-Routes: Q75, Q475
- ✓ 5/21/2020 Amend 1 SID (DOV)
- ✓ 7/16/2020 Delete/Amend 18 J-Routes
- ✓ 9/10/2020 Publish/Amend 8 Q-Routes, N/A NOTAM for 56 days

11/5/2020 Implement 8 Q-Routes, Cancel N/A NOTAM
11/5/2020 Publish/Delete/Amend 18 STARs (TEB/LGA/CHS)
11/5/2020 Delete/Amend 11 J-Routes/Q-Routes
2/25/2021 Publish/Delete/Amend 20 RDU SIDs/STARs
4/22/2021 Establish ZDC Ultra-High Sector 30
10/7/2021 Publish/Amend 24 Q-Routes, N/A NOTAM for 56 days
10/7/2021 Amend 1 ATL SID, Amend 4 Y-Routes
12/2/2021 Publish/Amend 5 STARs (PHL/EWR/TEB/LGA), Cancel N/A NOTAM
12/2/2021 Amend/Delete 24 J-Routes
1/27/2022 Delete 2 STARs (LGA/EWR)



NEC Inputs to "Opportunities" Discussion

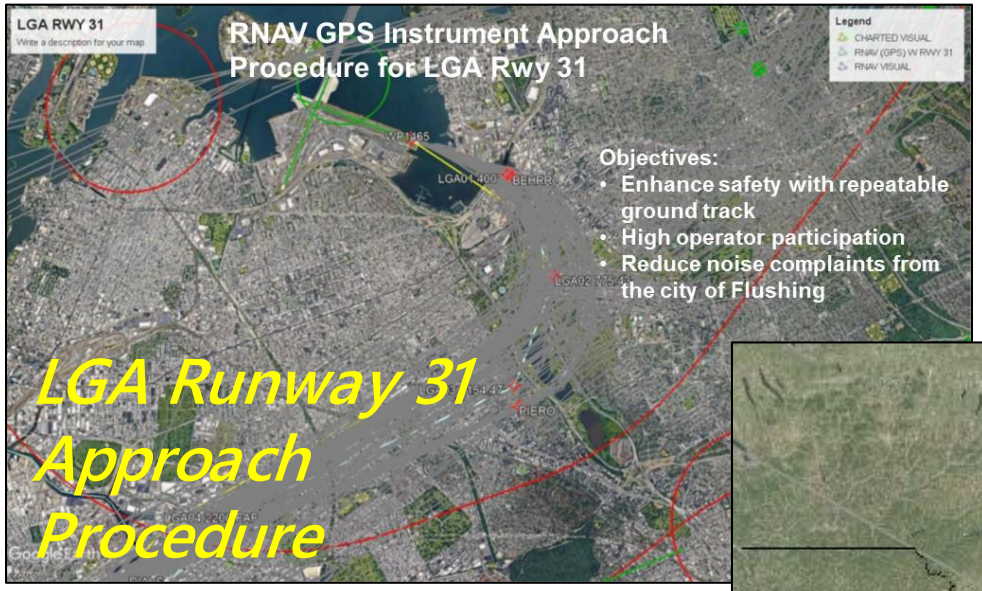
★ LGA RNAV GPS approach to Rwy31: public instrument approach procedure that can provide a stable and guided path to the threshold of Rwy31, enhancing the safety

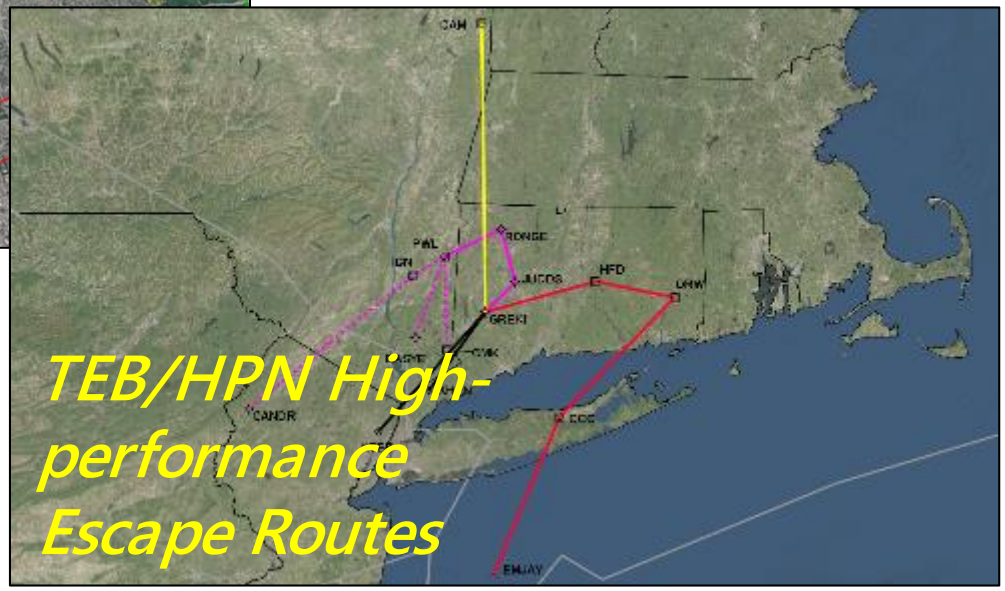
★ TEB/HPN escape route: provides for an alternate route out of the airspace for capable business aviation aircraft

- LGA GLDMN and JFK 31L SKORR departures: use altitude separation to allow simultaneous departures; dispersal headings from LGA 13 provide departure efficiency; also improves efficiency by providing JFK with opportunities to utilize 31L for departures
- EWR 22L/29 operation: address the loss of a second landing runway at EWR during southwest to west winds, enabling a significant reduction in minutes of arrival delay
- LGA ILS 13 approach deconflicting TEB/EWR/LGA: deconflicts the three airports, to improve overall airspace operations and reduce the number of configuration changes

★ Recommended by NAC on Aug 6 and FAA has agreed to pursue

Opportunities Recommended at August 6 NAC Meeting





Status of "Opportunities" Recommendations

- LGA Runway 31 approach procedure
  - Collaborative Operator, Airport and FAA discussions
  - Operator and Airport coordination on bi-weekly basis
  - Technical pilot design and concept meetings underway; including FAA coordination

- High-performance escape routes for TEB/HPN
  - Regrouped with FAA and NBAA
  - Reviewed NBAA tabletop exercises from fall 2019; feedback on viability of proposed climb gradients
  - Additional discussion planned for route design and climb parameters

Attachment 2

NextGen Advisory Committee (NAC)
August 06, 2020 Attendance List

Last Name	First Name	Affiliation
Adcock	Tom	National Air Traffic Controllers Association
Allen	Daniel	FedEx Express
Allen	Jack	Airlines for America
Arbuckle	Doug	Federal Aviation Administration
Artist	Mike	Mosaic ATM, Inc.
Baker	Jodi	Federal Aviation Administration
Baker	Mark	Aircraft Owners & Pilots Association
Batchelor	David	SESAR Joint Undertaking
Bechdolt	Anne	FedEx Express
Becher	Tom	The MITRE Corporation
Berlucchi	Robert	American Airlines
Bertapelle	Joe	JetBlue Airways Corp.
Blum	Danny	Federal Aviation Administration
Bolen	Ed	National Business Aviation Association
Boyle	Virginia	Federal Aviation Administration
Bristol	Teri	Federal Aviation Administration
Brown	Lee	JetBlue Airways Corp.
Brown	Steve	National Business Aviation Association
Burnham	Kristen	Federal Aviation Administration
Burns	Patrick	Delta Air Lines, Inc.
Butler	Steven	Federal Aviation Administration
Buttie	Steve	Department of Defense

Last Name	First Name	Affiliation
Capezzuto	Vincent	Aireon, LLC
Carey	Bill	Aviation Week
Cebula	Andy	Airlines for America
Challan	Peter	L3Harris Technologies
Childs	Russell	SkyWest Airlines
Christiansen	Cindy	Aviation-Impacted Communities Alliance and BOS Fair Skies grassroots organization
Christie	Warren	JetBlue Airways Corp.
Collings	Chris	L3Harris Technologies
Cook	Charles	JetBlue Airways Corp.
Cornett	Megan	Department of Defense
Cunha	Jason	Concept Solutions, LLC
Dalton	Rick	Southwest Airlines
Dehart	Scott	Southwest Airlines
DePete	Joseph	Air Line Pilots Association
Dickson	Steve	Federal Aviation Administration
Dillman	Don	FedEx Express
Dowd	Jody	Federal Aviation Administration
Drew	Craig	Southwest Airlines
Dudley	John	American Airlines
Duffy	Kent	Federal Aviation Administration
Dumont	Peter	Air Traffic Control Association
Egentowich	John	Federal Aviation Administration
Evans	Edward	Southwest Airlines
Fanning	Eric	Aerospace Industries Association
Flynn	Robert	United Airlines, Inc.
Fontaine	Paul	Federal Aviation Administration

Last Name	First Name	Affiliation
Fulton	Steve	Fulton Aviation LLC
Garceau	Rick	Aviation Management Associates, Inc.
Goldman	Robert	Delta Air Lines, Inc.
Graham	Jim	Delta Air Lines, Inc.
Guillermet	Florian	SESAR Joint Undertaking
Gusky	Amy	Federal Aviation Administration
Guy	Rebecca	Federal Aviation Administration
Hahn	Edward	Air Line Pilots Association
Hamel	Christophe	Studio Aerospace
Hill	Fran	Leidos
Hollander	Anne	Montgomery County Quiet Skies Coalition
Hopkins	Mark	Delta Air Lines, Inc.
Hoskins	Craig	Airbus
Hulst	Darren	The Boeing Company
Ingram	Mike	Honeywell International
Ivers	Ben	The Boeing Company
Jackson	Rachel	Raytheon Intelligence & Space
Jennings	Michael	Federal Aviation Administration
Johnson	Antionette	Federal Aviation Administration
Joly	Pascal	Airbus
Jones	Tammy	Federal Aviation Administration
Kamyab	Ahmad	Federal Aviation Administration
Kauffman	Don	Honeywell International
Kearns	Kathy	AlternaSource, Inc.
Keegan	Charles	Aviation Management Associates, Inc.
Kenagy	Randy	Air Line Pilots Association
Knorr	Dave	Federal Aviation Administration

Last Name	First Name	Affiliation
Kozica	Shawn	Federal Aviation Administration
Lamparello	Sandy	Federal Aviation Administration
Landesmann	Jennifer	Public
Lawrence	Huntley	Port Authority of New York and New Jersey
Leone	Gregg	The MITRE Corporation
Loring	Christopher	Federal Aviation Administration
Madera	Chico	Federal Aviation Administration
Matulenas	Caitlin	Federal Aviation Administration
McClay	Jim	Air Line Pilots Association
McCoy	Tiffany	Federal Aviation Administration
McCullough	Angela	Federal Aviation Administration
McDowell	Michael	Collins Aerospace
McGraw	Candace	Cincinnati/Northern Kentucky International Airport (CVG)
McLean	Donna	PlanzerMcClean
Mercer	Roosevelt	Federal Aviation Administration
Merkle	Michele	Federal Aviation Administration
Mitra	Trin	Aviation Consultant
Moloney	John	The Boeing Company
Morse	Glenn	United Airlines, Inc.
Nadarski	Nick	US Government Accountability Office
Narvid	Juan	Federal Aviation Administration
Nguyen	Minh	Federal Aviation Administration
O'Connor	Wendy	Federal Aviation Administration
Olson	Lee	NASA
Pearce	Robert	NASA
Pennington	Darrell	Air Line Pilots Association

Last Name	First Name	Affiliation
Perrone	Mike	Professional Aviation Safety Specialists
Pfingstler	Susan	United Airlines, Inc.
Pierce	Brad	National Association to Insure a Sound Controlled Environment
Porter	Karen	Palo Alto Citizens Coalition
Quigley	Bryan	United Airlines, Inc.
Renk	Ron	United Airlines, Inc.
Riegle	Leslie	Aerospace Industries Association
Rinaldi	Paul	National Air Traffic Controllers Association
Roberts	Bart	Vistair Systems
Santos	Phil	FedEx Express
Schatz	Wayne	Department of Defense
Schwab	Greg	Federal Aviation Administration
Shaffer	Kirk	Federal Aviation Administration
Shull	Mark	Palo Alto, CA
Silverman	Eric	American Airlines
Sinnett	Mike	The Boeing Company
Steinbicker	Mark	Federal Aviation Administration
Stevenson	Dawn	Evans Incorporated
Stone	Kimball	American Airlines
Suarez	Brandon	General Atomics Aeronautical Systems (GA-ASI)
Sultan	Akbar	NASA
Surridge	David	American Airlines
Swayze	Richard	United Airlines, Inc.
Swol	Doug	Federal Aviation Administration
Sypniewski	Jessica	Federal Aviation Administration
Tamburro	Ralph	Port Authority of New York and New Jersey

Last Name	First Name	Affiliation
Thoma	Don	Aireon
Townsend	Brian	Allied Pilots Association
Tranter	Emily	National Association to Insure a Sound Controlled Environment
Vail	Steve	Mosaic ATM, Inc.
Vincent	Jeffrey	Federal Aviation Administration
Ward	Rebecca	Palo Alto Citizens Coalition
Wendling	Kelle	L3Harris Technologies
White	Beth	Federal Aviation Administration
Whitley	Pamela	Federal Aviation Administration
Wickum	Jessica	SkyWest Airlines
Wijntjes	Jesse	Federal Aviation Administration
Wilkins	Aaron	Federal Aviation Administration
Willey	Doug	Air Line Pilots Association
Wongsangpaiboon	Natee	Federal Aviation Administration
Wright	Janelle	Montgomery County Quiet Skies Coalition
Yates	Vaughn	Federal Aviation Administration
Young	Greg	Delta Air Lines, Inc.

Attachment 3

November 17, 2020 NAC Public Speaker Statements

Ms. Cindy Christiansen, Milton, MA - Aviation-Impacted Communities Alliance and BOS Fair Skies grassroots organization

A vast discrepancy exists between increasing community complaints about aviation noise and the FAA's consistent "Findings of No Significant Impact (FONSIs)" for new Metroplex and single site operations designs. Yet the FAA continues to use the DNL metric and the 65 DNL standard to issue FONSIs in every case of NextGen rollouts as stated by the FAA at the Florida workshops in June 2020.

Congress (US Code 49, Section 47502) requires "a single system of measuring noise" that has a "highly reliable relationship between projected noise exposure and surveyed reactions of people to noise...." DNL does not satisfy Congress's criteria for noise measurement for heavily affected areas outside of the 65 DNL contours that are under NextGen Performance Based Navigation paths. The number of aviation events 100, 200, sometimes 500 per day, not the average daily noise level, is what causes the negative community reactions and complaints.

Residents nation-wide support the September 25th letter from 29 members of Congress to Administrator Dickson requesting a revised report on alternative metrics from the FAA so that Congress can truly understand what alternative measurements should be used for assessing noise burden from NextGen PBN procedures in communities outside the 65 DNL contours.

On behalf of the Aviation-Impacted Communities Alliance, I request that the FAA task this NextGen Advisory Committee to provide its independent advice and recommendations to the FAA and Congress on alternative metrics for noise measurement.

Ms. Karen Porter, Palo Alto, CA - Palo Alto Citizens Coalition

The FAA's Community Involvement Manual states the agency's commitment to give the public an opportunity to be informed, become involved, and have their concerns and views considered as the FAA makes aviation decisions that affect them.

At the August 6th NAC meeting Joseph DePete, President, Airlines Pilots Association shared concerns related to reduced separation and higher throughput recommendations for PBN that were proposed. He shared that pushing reduced separation even further, without offsetting new equipage (and training), would leave some pilots having to deal with less room for error without the proper tools to make it safe. He specifically noted that the proposal reduced buffers, and for planes without additional systems, this depended too much on increased pilot workload and situational awareness, which is risky. He stated this would be "safety malpractice".

This type of input is exactly what is needed - input that is timely and provides an opportunity to have the concerns and views considered PRIOR to the FAA making an aviation decision. The NAC did not proceed with the proposal at the last meeting given Mr. DePete's input.

I encourage the NAC to provide input to the FAA's community involvement on page 17 of the 2019-2021 NextGen Priorities Plan. The current Community Involvement process with the FAA is not timely. Unfortunately, communities are not involved until after FAA decisions are made. The recent section 176 report from the FAA on Community Involvement does not seem to correct the lack of timely community involvement. Please consider addressing this so that concerns and views from the community can be considered prior to decision making like Mr. DePete's input was.

On behalf of Palo Alto Citizens, I request that the FAA task the NextGen Advisory Committee to provide its independent advice and recommendations to the FAA on Community Involvement. Thank you.

Ms. Rebecca Ward, Palo Alto, CA

My name is Rebecca Ward. I live in Palo Alto, California.

I would like to share with you how difficult it can be to address avoidable noise issues with the FAA. As you likely know, the San Francisco Bay is an ideal location for arrivals into SFO airport. However, of the four arrivals' routes only one, DYAMD uses the Bay. The other three arrivals, SERFR, BDGEA and PIRAT are concentrated over the heavily populated Peninsula.

This reduced use of the Bay for arrivals began with NextGEN, but what is more frustrating is that since the beginning of the Pandemic, the Bay is being used less for traffic from the east, not more.

The shifting of traffic to communities and off the Bay was recently escalated to the SFO Airport Director and Congressional Representatives. The Airport Director met with Western Region FAA representatives and reported back that the route shifting decisions were made for efficiency by the National Airspace computers.

It is hard to understand why traffic would need to be increased over the peninsula "for efficiency" while reduced over the Bay, when there are far fewer overall flights due to the Pandemic and flights are arriving early.

In addition to this reduced use of the Bay for straight in arrivals, the FAA has reduced use of the "right downwind arrival over the bay" which sent over 50% of BDGEA traffic to the Bay and off the peninsula prior to NextGen. In spite of 2018 commitments to Congressional leaders and communities, this Bay arrival has fallen substantially, even with reduced traffic from the Pandemic. SFO airport also raised this concern in its meeting.

I raise these to your level because it shows how national airspace decisions impact local regions and how difficult it is for even the airport to find who in the FAA made these decisions and why, given the reduced traffic and the obvious community benefits of using the Bay.

Lastly, the FAA has prioritized the implementation of GBAS technology at SFO. The FAA plan is to implement GBAS as an overlay to existing routes. Modeling by the airport showed that the

overlay will exacerbate the noise and concentration. The FAA, SFO and the airlines should use the opportunity GBAS presents, to move traffic to the Bay and off communities.

Thank you for allowing me the time to raise issues. We would very much like to find better ways to work with the FAA and airlines.

Attachment 4

Minimum Capabilities List (MCL) Ad Hoc Team

NAC Task 19-1 Report

To be presented to the NextGen Advisory Committee

November 17th, 2020

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Executive Summary

For more than a decade, it has been recognized that successful implementation of the Federal Aviation Administration (FAA) NextGen air traffic control modernization initiative requires an appropriate level of aircraft equipage that enables the use of core capabilities. Initially a sub-task of the Northeast Corridor NextGen Implementation Work Group, the FAA formally tasked the NextGen Advisory Committee (NAC) on October 4, 2019 with developing a recommendation for a Minimum Capability List (MCL).

The MCL is based on a review of current equipage and identifies the core capabilities necessary for future NextGen operations. It can be simply described as, "what avionics requirements would enable an aircraft being ordered today that will be brought into operation in 2025 and beyond to utilize NextGen FAA ATC capabilities?"

The core Aircraft Enabling Capabilities support the following major areas of ATC modernization in FAA's NextGen program:

- Communications - Data Comm, which gives air traffic controllers and pilots the ability to transmit flight plans, clearances, instructions, advisories, flight crew requests, and other essential messages via text, rather than voice.
- Navigation - Performance Based Navigation (PBN) procedures, combining Area Navigation (RNAV) and Required Navigation Performance (RNP), enable an aircraft to navigate using performance standards on any desired flight path within the coverage of ground- or space-based navigational aids and provides the ability to closely monitor performance during an operation.
- Surveillance - Automatic Dependent Surveillance – Broadcast (ADS-B) that relies on GPS satellites to identify the location of an aircraft more precisely than radar.

Representatives from all segments of the manned aircraft operator community, and aircraft and avionics manufacturers, supported by research from MITRE Corporation, conducted the analysis that led to the development of the comprehensive list. The MCL identifies the "baseline" capabilities, as well as other

supplemental capabilities that operators may choose based on needs for access, efficiency or other reasons associated with making equipage decisions.

An important principle of the recommendation is the intent that the MCL is for prospective application, not a retrofit requirement. However, it is recognized that there may be business case driven decisions that will foster the installation of aircraft equipage in the current aircraft fleet.

The consensus contained in this report provides critical policy guidance as decisions are made by the aviation community and the government in modernization of the National Airspace System (NAS).

Introduction

This report will review the efforts of the Minimum Capabilities List (MCL) Ad Hoc Working Group as tasked by the NextGen Advisory Committee (NAC). The group has derived a list of minimum baseline capabilities which all National Airspace System (NAS) users should incorporate on new aircraft purchases. The goals of this report are to:

1) Explain the need for the MCL,
2) Present the MCL items,
3) Clarify to whom the MCL applies, and
4) Present a high-level outline of MCL costs and benefits

Background

The aviation community has long recognized the need for a list of common aircraft performance capabilities which would allow stakeholders to benefit from NAS modernization and improvements. Without a clear understanding of the correlation between modernization and the common aircraft capabilities required to leverage it, time and resources have been poorly spent. As a result, operators have developed fleets whose performance capabilities vary greatly, which we describe as, “Mixed Equipage.”

Mixed equipage makes it difficult to modernize the NAS. This is reflected in more than half of the NextGen Implementation Working Groups (NIWGs) working on NAC taskings citing mixed equipage as an issue in their findings.

Building on work started in early 2019 by a Northeast Corridor (NEC) NIWG sub-group, a “capabilities” matrix was formed which would eventually become the basis for a comprehensive list of baseline and supplemental forward fit capabilities. When the NAC was briefed on this work in late 2019, they responded with Tasking 19-1: NAS Aircraft Minimum Capabilities List, which commissioned a group of government and industry subject matter experts to identify a list of common aircraft capabilities which both FAA and aircraft operators could support. This report summarizes the work of the MCL working group.

Goal of the MCL

The overarching goal of the MCL effort was to drive industry consensus on what equipage is critical to advancing the NAS into a NextGen state. The following issues were considered:

- Determine which critical SMEs were needed to fully address the issue
- Create a matrix which would form the basis for the required equipage
- Commit to progress on a forward-fit only solution
- Consider what data decision makers need to adopt recommendations
- Determine to whom the MCL should apply
- Define a cost/benefit structure
- Stress the importance of the government-industry partnership to ensure consensus and facilitate progress

The group used existing FAA material as a foundation. The PBN NAS Navigation Strategy and Data Comm Services Roadmap specifically informed the effort and built upon previously established goals for the future of the NAS.

Broad industry participation was needed to ensure that SMEs were available to discuss which capabilities were needed to achieve the desired end state. Operators, aircraft and avionics manufacturers, aviation organizations, labor unions, and government were all represented.

The final product of this collaborative effort is known as the MCL Matrix, which will be reviewed in detail later in this report. The working group also agreed that the required MCL equipage would be solely based on a forward-fit model, and that the group would only provide a framework for retrofit should the benefits later become appealing.

Another important task to achieve our goal was the definition of a “scope” structure, so operators would know to whom the MCL would apply.

Finally, the working group needed to communicate its results in a way which would encourage adoption. This included a cost and benefit analysis which underscores the importance of the government-industry partnership in the MCL.

This partnership can facilitate increased confidence that NextGen facility and infrastructure improvements will be reciprocated by operator equipage investments which deliver the desired NextGen performance capabilities.

MCL Matrix Organization

The MCL document exists as a Microsoft Excel file with seven (7) tabs. These are:

- Baseline Capabilities
- Supplemental Capabilities
- Scope
- Retrofit Applications
- Cost/Benefit Analysis
- NSG Airports (Reference), and
- Glossary

The MCL Matrix is listed on the first two tabs and will be described in this chapter. The other tabbed topics are covered in subsequent chapters of the report.

Baseline Capabilities

The working group considers these four (4) capabilities to be the minimum preferred equipage to fully participate in NextGen airspace initiatives from 2025 and beyond.

The working group recommends that the equipment listed below would be designated as standard equipment by OEMs on all newly manufactured aircraft. Not only will the goal of lowering the mixed equipage ratio in the NAS be achieved, but it will also reduce friction to further implementation of NextGen airspace improvements.

1) PBN: Required Navigation Performance (RNP) for various phases of flight, in addition to Radius to Fix (RF) turn, Scalability, and capability to couple the Autopilot to Baro/VNAV guidance down to LNAV/VNAV minimums
2) Data Comm: FANS-1/A with "Push to Load" over VDL Mode 2 with multi-frequency
3) Surveillance: Mandated ADS-B Out functionality
4) Resilient NextGen Ops: DME/DME/IRU Navigation

The Working Group would like to draw particular attention to three (3) notes which appear at the bottom of the Baseline Capabilities tab:

1) Existing equipage should be maintained - These NextGen technologies are sometimes not equipped on new delivery aircraft. They are not listed as replacements to current equipage like ILS, VOR, etc. but should be viewed as required capabilities above and beyond the normal avionics suite commonly selected today.
2) Existing equipage which could be retired - The group wanted to also recommend equipage which may no longer be of value. One item in this category would ADF equipment.
3) Integration of NextGen Comm/Nav/Surveillance capabilities is extremely important, and no single NextGen enabling category should take precedence over another. All MCL capabilities should be considered integral to each other.

Supplemental Capabilities

These represent an additional thirteen (13) enabling capabilities in addition to those covered on the Baseline tab. The group acknowledges that these capabilities may add value to an operation in specific conditions or circumstances. Although not strictly required to participate in the NextGen NAS, targeted investment in one or more of these applications may increase the margin of safety, enable more efficient operations, or enable operations where none could be accomplished without. The group encourages each operator to review this list and consider investment if it benefits their operation.

1) RNP-AR
2) LPV
3) GLS (CAT I/II/III)
4) HUD
5) Airborne Access to SWIM
6) EFVS/CVS (for credit)
7) Enhanced Position Source (EPS)
8) Tightly Coupled IRU
9) Synthetic Vision (for credit)
10) ADS-B IN / Cockpit Display of Traffic Info (CDTI)
11) Time of Arrival Control (TOAC)

12) ACAS-X
13) DME Navigation to support RNP in all phases of flight

MCL Column Descriptions

Listed below are expanded descriptions of each column:

1. **NextGen Enabling Category**: general description of enabling capabilities
2. **Aircraft Enabling Capability**: the particular enabling category function set desired in NextGen NAS airspace
3. **Key Missing Components**: desired NAS 2025 functionality commonly missing in today's NAS user aircraft
4. **Guidance**: FAA Regulatory and/or RTCA Technical guidance which fully defines the Aircraft Enabling Capabilities
5. **Ops Approval Required / Ops Specification**: Specific FAA Ops Spec approvals required for Aircraft Enabling Capability
6. **Equipment Specification**: FAA Technical Standard Orders (TSO) which apply to required equipment
7. **Benefits**: Improved functionality or "gains" realized in NAS operations
8. **Example Use Cases**: specific NAS applications of realized Benefits
9. **Areas Receiving Benefit**: Specific Areas of Operation (and sometimes specific example airports) which will realize "Benefits"
10. **Ground Investment**: FAA investments on the ground infrastructure
11. **Risks to ROI**: possible impediments, and therefore risks to investment in the Enabling Capability
12. **Risks of Not Equipping**: What will happen (or continue happening) if operators choose not to equip
13. **Possible Future Benefits**: benefits for which specific criteria or guidance is not yet developed, but which have shown keen potential or FAA / industry interest
14. **Desired Improvement**: Specific applications of benefits
15. **Global Requirements**: prospective impact on the global air commerce community, and likely areas requiring further discussion with international regulators and operators. Consideration for the global community could allow adoption of the MCL outside the U.S.

Current MCL Fleet Equipage

A review of mainline and regional aircraft was conducted and the charts below show equipage levels as of Q4, 2019 (Pre-COVID numbers):

Air Transport Aircraft	Total Count	Baseline MCL						
		Approach					Terminal	Enroute
			A-RNP		RNAV (GPS)			
		RNP AR	Capable	Ops Spec	Coupled VNAV	Advisory VNAV only	RNP-1 w RF	RNP-2
WB/NB	5,355	4,827	4,859	4,088	5,130	225	4,859	5,303
Regional	2,033	702	887	509	1,106	927	887	2,021
WB/NB	5,355	90%	91%	76%	96%	4%	91%	99%
Regional	2,033	35%	44%	25%	54%	46%	44%	99%

Air Transport Aircraft	Total Count	Baseline MCL	
		Data Comm	
		DCL	Enroute CPDLC
WB/NB	5,355	3,603	3,134
Regional	2,033	34	31
WB/NB	5,355	67%	59%
Regional	2,033	2%	2%

Air Transport Aircraft	Total Count	Baseline MCL
		Resiliency
		DME/DME/IRU
WB/NB	5,355	5,242
Regional	2,033	705
WB/NB	5,355	98%
Regional	2,033	35%

Scope

One of the larger questions the working group addressed was to whom should the MCL apply? This was a difficult question, as a delicate balance must be struck in its response. If too many operators are included, the MCL would likely encounter fatal resistance to acceptance. Conversely, if too many operators are excluded, then the mixed equipage issue isn't resolved to its fullest potential.

The working group determined that the best way to erect scope around the MCL was by isolating the Baseline capabilities and applying a set of filters unique to each. Recall that our MCL goal is to solve "mixed equipage" issues. This solution does not exclude seeing some operations scoped out of the MCL even though the operators fly fully equipped aircraft. The group also applied some latitude to allow a limited presence of mixed equipage so as not to place undue burden on small operations, as it is considered that these will not significantly impede NextGen efforts.

The group used three primary filtering methods in determining to whom a particular capability would apply:

1. **Airports Flown To or From**. This concept was taken from the PBN NAS Navigation Strategy and the Navigation Service Group (NSG) concept. The role an airport plays in the NAS is used as the primary basis for its assignment to one of six NSG categories. The group considered NSG-1 and NSG-2 airports only. These two groups include approximately 74 airports in the "busiest large hub" and "remaining large hub" categories and are defined by the relatively high number of IFR operations and U.S. enplanements.
2. **Type of Airspace Flown**. This is as simple as it sounds. The group used rule airspace as a defining limit in some filters.
3. **FAA Operations Part or Aviation Organization affiliation**. The group used FAA Parts (i.e. 91, 135) to limit or define participation and used affiliation with aviation organizations, such as A4A or NBAA, where appropriate.

An extract from the Scope Table is shown below:

Aircraft Enabling Capability	Filter A		Filter B		Filter C
PBN • RNP-2 (Enroute)	Flies to/from NSG 1 - 2	and	Flies in Class A Airspace	and NOT	Part 91
PBN • RNP-1 with RF (Terminal SID/STAR)	Flies to/from NSG 1 - 2	and NOT	Part 91		
PBN • RNP APCH w/ RF (Approach) • A-RNP or RNP AR 0.3 w/ RF (Approach) • RNP Scalability • Autopilot-coupled VNAV	Flies to/from NSG 1 - 2	and	Operators (like Part 91, Part 135, 141, etc) whose scope/tempo of IFR operations would cause mixed equipage issues		
Data Comm • DCL	Flies to/from NSG 1 - 2 with DCL Services	and NOT	Part 91*		
Data Comm • Enroute CPDLC Services	Flies to/from NSG 1 - 2	and	Flies in Class A Airspace	and NOT	Part 91, NBAA
• ADS-B Out - **Mandate**	Rule Compliant				
• Resilient NextGen Ops (DME/DME/IRU)	Flies to/from NSG 1 - 2	and NOT	Part 91, NBAA		

It's important to note that while some operators may find themselves scoped out of the MCL, this doesn't imply that they cannot, or in some cases even should equip.

PBN

In the case of RNP-2, the group that operates flying to or from NSG 1 or 2 airports and above 18,000 feet but not under Part 91 rules will need to equip. This is largely due to RNP-2 being an enroute capability targeting more efficient operations above 18,000 feet.

The next capability, RNP-1 with RF turns, is intended for terminal area procedures, such as SIDs and STARs. This capability is scoped to include operators flying to or from NSG-1 or -2 airports, but not Part 91 operators.

The discussion concerning PBN approach capabilities presented more difficulty to achieve group consensus. Similar to previous capabilities, the group first identified operators flying to or from NSG-1 or -2 airports. The next filter required careful consideration. There are some small operations underway, especially at NSG-2 airports, which should not be unduly burdened; however, the benefits for those who do equip must be preserved. Therefore, the group identified and included only those operators whose scope and IFR operations tempo would create mixed equipage friction. Examples included smaller charter operations or flight schools which primarily operate VFR. Their lack of MCL Baseline capabilities will likely not impact PBN operations and it would be unreasonable to expect them to voluntarily equip. However, if that same small charter outfit or flight school grew to encompass a significant number of IFR operations at the airport, then their lack of equipage could be impactful. In this way, these smaller operators may commence operations without equipping, but may grow into MCL scope if their operations expand.

Data Comm

CPDLC-DCL departure clearance capability required a slightly different approach, as we first clarified NSG-1 or -2 airports "with DCL services." The group excluded those operators who mostly serve NSG-1 or -2 airports which lack DCL services. It should be noted that Part 91 operators were excluded. However, while AOPA did not want to obligate its members to expensive FANS 1/A investment, it should be noted that the GA community is keen to investigate alternate methods of receiving departure clearances. For example, should future DCL clearances ever become available on an EFB or smartphone app, AOPA may re-engage with more interest in this Baseline capability.

Scope for enroute CPDLC Services basically mirrors that of RNP-2, the only difference being the addition of NBAA operators to the exclusion filter. Similar to Part 91 operators, acquiring integrated FANS 1/A equipage might prove too costly for some, and this mixed equipage element is frankly not harmful to the investment of those who do equip.

ADS-B Out

As ADS-B Out is an FAA mandate, this filter simply mirrors the FAA rule discriminating whether one needs to equip.

Resilient NextGen Ops

The Baseline capability of GPS resiliency targets operators who fly to or from NSG-1 or -2 airports, but not Part 91 or NBAA operators. This reflects that, up to now, GPS failure events have largely impacted Part 121 scheduled operations.

Retrofit

Retrofit of existing aircraft was a topic which the working group initially sought to avoid as it was not within the scope of the NAC tasking. The MCL continues to be focused on forward-fit only, and this section does **not** change that fact.

However, during deliberations, some participants showed interest in retro-fitting newer aircraft to be MCL-compliant. This applies particularly to aircraft which may have been purchased within the last 5 years and have many years of service life ahead of them. These aircraft could delay the success of the MCL since they are newer aircraft lacking Baseline equipage.

With that in mind, the working group decided to address retro-fit in a creative way. While the group is not recommending a retro-fit, the group examined capabilities which, if absent on an aircraft, could be an impediment to the NAS.

The group broke down all the MCL Baseline capabilities in the table shown below and then created a column labelled “NAS Impediment If Not Equipped.” In this column, an MCL Baseline capability is listed if its absence would be problematic in the future.

The group hopes that in this way it can assist an operator wishing to invest in a retrofit to make informed decisions regarding how that investment is spent.

NextGen Enabling Category	Aircraft Enabling Capability	NAS Impediment If Not Equipped
Performance Based Navigation	• RNP-2 (Enroute) • RNP-1 with RF (Terminal SID/STAR) • RNP APCH, A-RNP or RNP AR 0.3 with RF and Automated RNP Scalability (Apch) • Autopilot-coupled VNAV	• RNP-2 • RNP-1 w/ RF • A-RNP w/ RF • Autopilot-coupled VNAV
Data Comm	• FANS-1/A over multi-freq VDL Mode 2 with "Push to Load"	• DCL in tarmac constrained airports • Future enroute services
Surveillance	• ADS-B Out - **Mandate***	
Performance Based Navigation, Low Vis Ops, Surveillance	• Resilient NextGen Ops (DME/DME/IRU)	

* Note: For operators who were granted Exemption 12555, position source equipage changes are expected over the next five years which may provide the opportunity to retrofit additional MCL Core and Optional capabilities.

Costs and Benefits of the MCL

One of the key elements associated with the third sub-task, *Recommendations on Steps to Encourage MCL Adoption*, is to provide an understanding of the investment outlays and potential return associated with equipping and training for MCL capabilities. From previous discussions with the NAC, it is clear that decision-makers must have reliable information on the costs and benefits associated with each component of the MCL before operators will be able to make equipage commitments.

Methodology

The MCL task team developed the following approach to develop forward-fit cost and benefit information associated with the baseline capabilities in the MCL.

- Costs: Several of the OEMs participating on the MCL task team were asked to provide cost figures for the capabilities in the MCL. This data was to be provided to MITRE, who would then organize and de-identify the data. To be most useful, information from at least two OEMs was required, but input from three OEMs would be preferred.

- Benefits: While there are many projections for benefits associated with MCL capabilities and more broadly with NextGen, these estimates are often dependent on variables which cannot be replicated in the actual operation. The MCL task team determined that a more reliable source of benefits data would be assessments associated with actual implementation of the MCL capabilities. Two sources for these assessments were identified. First, NextGen equipage has been discussed within the NAC for many years. In some cases, those presentations included benefits assessments. That material was referenced to support this subtask. The second and more prominent source for benefits information is the work of the NAC's Joint Analysis Team (JAT). The JAT's responsibility is to provide FAA/Industry consensus assessments of the outcomes associated with implemented NextGen commitments.

Findings

Cost Data

The Working Group asked MITRE to aggregate, de-identify, and analyze pricing information from industry, and then report the results. This was done since MITRE could collect sensitive pricing data utilizing existing NDAs in place with industry and MITRE's history of performing similar roles in previous NAC and other industry/FAA forums.

All information requested, the nature of the information provided, and scope were determined by the working group. MITRE was not asked to contribute to the determination of the information collected, but rather to just aggregate and de-identify the information provided. Below are the results:

<u>Average costs across all models:</u>

- PBN (RNP AR) = $50,000
- DataComm = $94,000
- Surveillance = $13,450
- Resiliency = $0

<u>Raw Range of Costs:</u>

- PBN Baseline Item
  - Range = $0 (Basic) - $317,600
    *Some Narrow body/Regional aircraft and widebody aircraft indicated the capability is basic and therefore pricing range is applicable to the full range of forward fit aircraft
- DataComm (FANS 1/A, VDL Mode 2 with push to load)
  - Range = $0 (Basic) - $318,522
    *All Narrow body/Regional aircraft had a priced option, while only some of the widebody aircraft had priced options (Not all widebody are Basic)
- Surveillance (FAA ADS-B out mandate compliant)
  - Range = $0 (Basic) - $88,000
- Resilient NextGen Operations (DME/DME with IRU)
  - Range = $0 (Basic)
    *All respondents indicated that all in-production aircraft models are fitted with this equipment as part of the Basic aircraft

The range of combined MCL capabilities across all models can vary from $0 to $448,000 per aircraft. Average total cost across all aircraft submitted is $158,000. Important points to remember:

- These are un-negotiated, catalog prices.
- Some aircraft models require Buyer Furnished Equipment (BFE) which was not available at the time this report was due.
- Items with ranges starting at $0 were basic, meaning they are already included in the cost of a particular make/model.
- The Working Group only considered forward-fit. In this scenario, costs are amortized over many years through new aircraft payments.

Benefits Assessments

Performance Base Navigation (PBN)

The MCL task team identified a number of expected benefits from PBN enabling technologies over a myriad of applications in all phases of flight. These applications include RNAV-RNP arrival and departures, Established on RNP (EoR), Optimum Profile Descents (OPDs), RNAV Q/T/Y routes, LNAV/VNAV approach minima, and instrument approaches where ground based NAVAIDs do not exist. Expected benefits from PBN include:

- Additional flight efficiency, such as reduced track miles and more fuel-efficient flight profiles
- Additional throughput enabled by precise, deconflicted arrivals and departures
- Enhanced safety with more predictable flows and stable approaches

The JAT has completed four studies of implemented PBN capabilities associated with the NextGen Joint Implementation Plan. This included analyses of arrival and departure procedures as part of the North Texas Metroplex, EoR at DEN, OPDs at BOS, and OPDs at GYY.

In October 2017[1], the JAT presented the results of its analysis of OPDs implemented at Boston. For the new OPDs, the following benefits were observed:

[1] Meeting summary from the October 4, 2017 NAC meeting, RTCA.

- Fewer Level-offs on arrivals – prior to OPDs aircraft were leveled-off multiple times from enroute to 11,000 ft. After the OPDs were implemented level-offs were kept at 23,000 ft and above.
- For flights that reach cruise altitude outside 200 NM from Boston, vertical profiles improved through increased proportion of continuous descent operations, and shorter time and distance in level flight. Approximately 9.8 gallons fuel savings per flight are attributable to the OPDs.
- For flights that do reach cruise altitude inside 200 NM (includes flights from New York area to Boston), vertical profiles improved through shorter time and distance in level flight. Approximately 6.5 to 8.1 gallons fuel savings per flight are attributable to the OPDs.

The JAT was unable to quantify benefits for the OPDs at GYY. However at the same NAC meeting in October 2017, Boeing Executive Flight Operations presented qualitative benefits, including enhanced safety and efficiency.

In October 2016[2], the JAT presented findings on North Texas Metroplex and Denver EoR implementations. For the North Texas Metroplex, the JAT found the following:

- The Metroplex project did segregate arrival routes between DFW and DAL and added route structure where flights were previously vectored.
- Flight distance increased slightly within 300 nm but flight time was slightly reduced.
- Level segments were reduced and continuous descents increased, particularly for DFW.

In February 2017[3], the JAT updated its findings on the North Texas Metroplex to include fuel savings. DFW arrivals saved $4.5-6.5M annually from reduced level offs, but due to increased flying distances, overall fuel cost for DAL increased by $0.8M annually.

For the DEN EoR implementation, the JAT found that EoR increased utilization of RNP AR approaches from 5.8% of arrivals to 6.6% of arrivals to Denver, an

[2] Meeting summary from the October 5, 2016 NAC meeting, RTCA.
[3] Meeting summary from the February 22, 2017 NAC meeting, RTCA.

increase of 12%. Total distance savings increased to over 52,000 nm annually and flight time savings increased to 282 hours annually.

For the MCL task team benefits discussions, the FAA provided additional information about RNP usage at DEN during 2019. For flights flying the RNP procedures (about 23%) in VMC, the average distance flown on the approach was 22.2 nm verses 30.1 nm for aircraft not flying the RNP procedures. In IMC, the average distance flown was 21.8 nm flights using the RNPs verses 43.8 nm for flights not using the RNP procedures.

There is an obvious and direct correlation between the benefits (time and distance) experienced by equipped RNP operators and the procedure utilization rates. MITRE conducted an analysis[4] for the MCL task team and determined that highly equipped carriers have higher RNP AR utilization rates for their authorized aircraft. Operators with fleets that are more than 75% equipped (and authorized) see utilization rates three times that of carriers that are less than 50% equipped. MITRE's analysis also illustrated how RNP utilization correlates strongly with runway traffic level (see Figure Y). This occurs primarily due to merging and spacing challenges between RNP AR RF leg arrivals and straight-in or non-RNP AR authorized downwind traffic. It is interesting to note that RNP utilization increased sharply with post-COVID declines in traffic level.

[4] MCL Discussion: RNP Utilization Factors, MITRE Corporation, Jul 6, 2020.

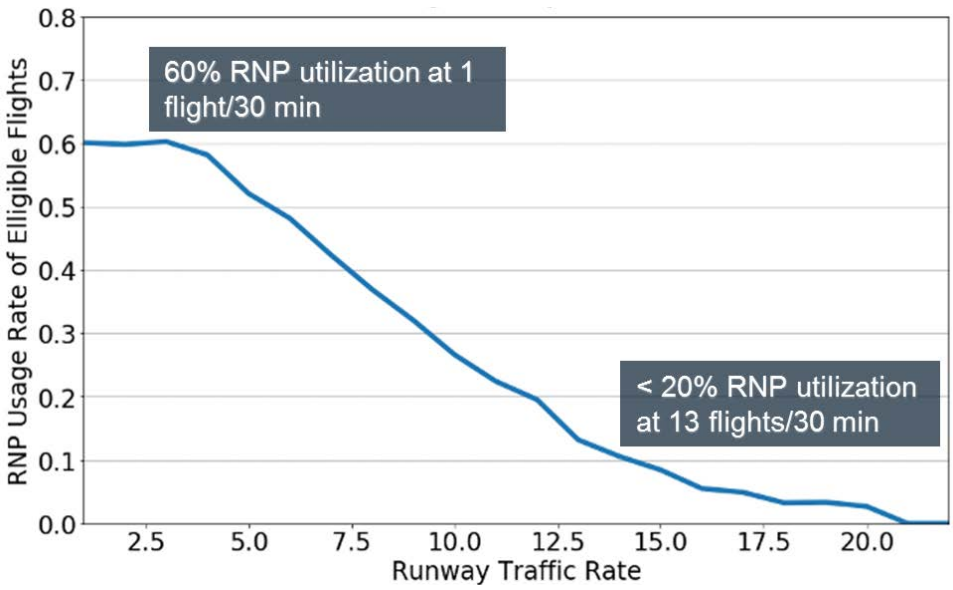

Figure Y. Denver RNP Utilization Rate by Traffic Level in 2017

Data Communications

As part of the MCL task team's deliberations, the following benefits are expected from implementation of tower and enroute data communications.

- On the ground, clearances can be delivered more efficiently with reduced communication errors, resulting in shorter taxi-out times.
- While enroute, re-routes can be accommodated and delivered more accurately, efficiently avoiding weather and congested airspace, resulting in more efficient routing.
- Overall, data communications reduces voice communications, read-back errors, and frequency congestion, resulting in enhanced safety.

At the October 2017 NAC meeting[5], the benefits of pre-departure route revision clearances delivered through data communications were presented. The FAA's data included the following:

- For a sample of airports, taxi-out savings between 0.2 minutes to 8.5 minutes per flight (average 3.8 minutes).

[5] Meeting summary from the October 4, 2017 NAC meeting, RTCA.

- Looking at the network of one large airline, an average taxi-out benefit of 2.8 minutes per flight was identified.

At the same NAC meeting, Southwest Airlines presented data for a three month period in 2017. Over this time period with 73% of its fleet equipped, Southwest experienced a reduction of 13,725 taxi-out minutes.

The Data Communications NextGen Integration Work Group (NIWG) presented the following benefits data to the NAC in August 2020[6], showing achieved benefits from both Tower and Enroute implementations.

- Over the last four years (2016 to present) Tower data communications departure clearance benefits have saved over 2 million minutes of radio time and prevented over a 124,000 read-back errors, enhancing safety. The capability has saved over 1.5 million minutes of airspace user time and over 18 million kilograms of CO_2 Emissions.
- Since 2019, Enroute data communications have saved over 136,000 minutes of communications and mitigated over 36,000 read-back errors.

Surveillance

Since the equipage associated with the Surveillance NextGen Enabling Technology in the MCL was part of the ADS-B Out January 2020 mandate, operational benefits have yet to be enumerated, and therefore specific realized benefit information is not available. For completeness, the following qualitative benefits statements were included in the MCL task team deliberations.

- Improves surveillance in non-radar areas (including surface) and enables reduced spacing, and in select situations reduced separation standards (e.g., 3NM enroute separation)
- Provides more accurate aircraft position data into ATC automation and TFM tools; will enhance safety and increase effectiveness of flow management; more frequent update rate
- Serves as a foundation for ADS-B In and its associated applications, including interval management.

[6] NAC Read-ahead materials for the August 6, 2020 meeting

Resiliency

The aviation community has suffered events which were the result of a loss of GPS onboard the aircraft. These can be the result of GPS hardware/software bugs or jamming of the GPS signal.

Disruptions that occurred ranged from aircraft being unable to fly RNAV SIDs and STARs to aircraft being unable to fly extended ILS approaches. While airlines have not publicly disclosed the losses incurred, each operator should consider their own data.

Since this MCL item is now basic (or no cost) on all production aircraft, the working group did not spend time examining the benefit dollars for this baseline capability.

Cost and Benefit Review

This initial assessment of MCL costs and benefits has identified preliminary elements to answer the questions of how much equipping will cost and its expected return on that investment. There are many variables in the cost and benefit equation, such as which aircraft are being purchased and where those aircraft will fly, which make it impossible for the working group to give one set of numbers.

Benefit assessments based on actual capability implementation (vs. modeled benefit projections) is a sound approach for establishing expected return on investment. NAC data and JAT analyses may need to be augmented with other operational assessments to obtain a more complete benefits outlook, specifically for PBN applications. Operators can use the data in this report to help better understand how to build a business case.

Closing & Recommendations

Neither Industry nor the FAA favors a mandate. In contrast, this MCL effort has been a Government-Industry collaboration which makes recommendations for implementing NextGen improvements for all stakeholders while avoiding a mandate.

If this MCL effort results in no action, we will continue to see investments made by both FAA and Industry whose impact is greatly diminished. To avoid this, there must be a point where Industry and FAA come together with a consistent, common goal to implement NAS improvements on a shorter timescale. This cannot be achieved with the status quo, as both Government and Industry priorities can be pulled in opposing directions without a common equipage plan. The MCL is a step in this direction.

The MCL, however, is not a "silver bullet," as the Working Group only seeks a forward-fit commitment. While this represents a less-painful investment than the retro-fit scenario, it also lengthens the window of time required to significantly reduce the mixed equipage impediment.

While many operators have used the COVID-19 reduced demand environment to retire older, less-capable aircraft, this may very well represent an inflection point in NAS fleet equipage, and therefore a unique opportunity to reduce the mixed equipage impediment. If we agree to adopt the MCL and commit to all new aircraft being MCL Baseline capable, a future without the specter of mixed equipage could be a lot closer than we think. **It is therefore considered that there is no better time than now to make this commitment!**

It should also be recognized there are at least two pathways for MCL adoption: 1) The NAC may acknowledge these results in agreement that a forward fit business case is indeed plausible, and subsequently encourage its adoption by their members; and 2) The NAC may encourage aircraft manufacturers to adopt MCL Baseline capabilities as standard on all U.S. delivered aircraft. Some aircraft are already sold this way, and it has helped operators of those airframes to have common equipage across that fleet.

Finally, the Working Group recommends that if the MCL is successfully adopted, that it be regarded and maintained as a living document. Demands on the NAS will evolve and as they do, some MCL Supplemental capabilities will likely be recharacterized as Baseline. Similarly, newly developed technologies will be identified and should be added to the Supplemental list. Regardless, if Government and Industry continually identify and prioritize common goals for the NAS, we will more successfully implement change together in the future.

The Working Group would like to thank its members for their steadfast participation in its effort to move the NAS forward, and equally for their diligent collaboration in the genesis of this report.

Credits and Acknowledgments

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Glenn Morse	United Airlines
Jonathan Bonds	UPS
Christian Kast	UPS

Glossary of Acronyms and Abbreviations

8900 Flight Standards Information Management System Documentation

AC FAA Advisory Circular

ACAS-X Airborne Collision Avoidance System

ADS-B Automatic Dependent Surveillance – Broadcast

ADS-B In Automatic Dependent Surveillance – Broadcast (Receiving ADS-B Traffic in the Aircraft)

AFP Airspace Flow Program

ANP Actual Navigation Performance

Apch/apchs Approach(s)

ARINC Aeronautical Radio, Inc.

A-RNP Advanced RNP

Arr arrival

ATC Air Traffic Control

ATN Aeronautical Telecommunications Network

ATSU Air Traffic Services Unit

CAVS CDTI (Display of Traffic Information) - Assisted Visual Separation

CDTI Cockpit Display of Traffic Information (referring to ADS-B In)

Cgs ceilings

Chgs changes

CMU/CM Communications Management Unit

CPDLC Controller Pilot Data Link Communications

CPDLC-DCL Controller Pilot Data Link Communications – Departure Clearances

CSPO Closely Spaced Parallel Operations (referring to FAA 7110.XX #)

CTOP/TOS Collaborative Trajectory Options Program / Trajectory Options Set

CVS Combined Vision System

DA/MDA Decision Altitude / Minimum Descent Altitude

Dep departure

DME-DME/IRU Distance Measuring System / Inertial Reference Unit

EFVS Enhanced Flight Vision Systems

EGPWS Enhanced Ground Proximity Warning System

EoR Established on RNP

EPS Engineered Performance Standards

ERAM Enroute Automation Modernization

FANS 1/A Future Air Navigation System

FIM Flight Interval Management

FMC Flight Management Computer

Freq frequency

GDP Ground Delay Program

GNSSU Global Navigation Satellite System Unit

HAT Height above touchdown

HDD Head-Down Display

IAP Instrument Approach Procedure

IMC Instrument Meteorological Conditions

Ldgs landings

Maint maintenance

MCL Minimum Capabilities List

Mins minimums

MMR Multi-mode receiver

Msgs messages

NAS National Airspace System (U. S.)

Nav navigation

NGSS Next Generation Satellite Systems

OEM Original Equipment Manufacturer

OPD Optimized Profile Descent

PBN Performance Based Navigation

PFD Primary Flight Display

PRAIM Predictive RNAV

Q/T/Y Airborne RNAV Routes

Reqd/reqs required/requirements

RNP Required Navigation Performance

ROI Return on Investment

RTCA DO Radio Technical Commission for Aeronautics - Document

RVR Runway Visual Range

SAPR Safety Assurance Process Requirements

SAPT Service Availability Prediction Tool

SAR Search and Rescue

SBAS Surface Based Augmentation System

Scalability Ability of aircraft to scale indicators for various RNP levels

SID Standard Instrument Departure

Spec specification

STAR Standard Terminal Arrival Route

STARS Standard Terminal Automation Replacement System

Svc/svcs service(s)

SWAP Severe Weather Avoidance Plan

SWIM System Wide Information Management

TBO Time Based Operations

TFM Traffic Flow Management

TIS-B Traffic Information Services – Broadcast

TOAC Time of Arrival Control

TSO Technical Standard Order

UDP Unified Delay Program

VDL VHF Datalink

Vis visibility

VMC Visual Meteorological Conditions

WATRS West Atlantic Route System

Appendix A

MCL Matrix (Previously Accepted by NAC)

NextGen Enabling Category	Aircraft Enabling Capability	Key Missing Components	Benefits	Example Use Cases	Areas Receiving Benefit	Ground Investment
Data Comm	• FANS-1/A with "Push to Load" over VDL Mode 2 with multi-frequency	• CMU/CMF/ATSU • VHF Digital Radios • FANS 1/A capable FMC/FMGC	• Shorter ground delay for clearances • Reduced comm errors • Efficient delivery of complex clearances • Reduce long voice comms • Reduced freq congestion • Accurate re-routes • Weather avoidance • Pilot requested re-routes • Enables TBO • CTOP/TOS	• High rate clearances during SWAP • Efficient wx re-routes • Reduced errors in FMS reroute entries • More efficient routing	• NAS ground ops • Enroute ops	• Development / delivery of Data Comm svcs • Enhanced automation and Decision Support tools • Controller training
Surveillance	• ADS-B Out: **Mandate**	• Transponder • Highly accurate position source with integrity	• Enables 3NM enroute separation • Reduced separation in select situations • Improved surveillance in non-radar areas (+ surface) • More accurate position; more frequent update rate • Improved safety via ATC automation and TFM Decision Support tools • Improved Planning and TFM	• 3NM enroute separation • WATRS operations surveillance • Reduced terminal vectoring due to conflict • Enhanced SAR	• Enroute • Terminal • Non-radar environments • Mountainous terrain	• Ground infrastructure • ERAM/STARS enhancements • Controller training • Reduced Spacing

Attachment 5

Performance Based Navigation (PBN) Clarification Ad Hoc Team

NAC Task 19-4 Report

To be Presented to the NextGen Advisory Committee

November 2020

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Executive Summary

In December 2019, the NextGen Advisory Committee received a tasking to provide the FAA (Federal Aviation Administration) with an assessment of a PBN (Performance Based Navigation) baseline, a definition of a PBN NAS (National Airspace System), and the identification of specific PBN desired outcomes at the Core 30 airports (minus HNL, plus TEB).

The PBN Ad Hoc Team's report provides details on PBN baseline capabilities consistent with the equipage outlined in the NextGen Minimum Capabilities List (MCL) and continues to endorse the 2016 PBN National Airspace System Navigation Strategy as the definition of a PBN NAS. The desired PBN outcomes are presented as a set of 48 prioritized PBN proposals. These proposals can serve as the fundamentals needed to achieve the objectives, address requirements, and meet expectations of the NAS NAV Strategy. More immediately, these priorities can be used to refresh the PBN production process and help the FAA move forward on the backlog of procedure requests in the Instrument Flight Procedures (IFP) Gateway.

The PBN Ad Hoc Team wishes to thank the FAA for this tasking and believes that this coordinated effort will provide a pathway forward for the continued implementation of PBN in the NAS and encourages further collaboration to support acceleration of the benefits of PBN to the NAS and its users.

Background

In 2016, the Federal Aviation Administration (FAA) released the Performance Based Navigation (PBN) National Aviation System (NAS) Navigation (NAV) Strategy. Developed with wide collaboration across the aviation community, the strategy document was well received, endorsed by the NextGen Advisory Committee (NAC) and Performance Based Operations Aviation Rulemaking Committee (PARC). This strategy has served as a guide for both the private and public sector to chart a collaborative course that will successfully and continually transition to a PBN-centric NAS.

Through the deliberations of the PBN NextGen Integration Work Group (NIWG) and subsequent conversations in 2019, it became clear to both industry and the Federal Aviation Administration (FAA) that the initial unanimity with the strategy that existed in 2016 has begun to diverge into new interpretations and new aviation business requirements. In discussing these emerging differences within a small workgroup of personnel from FAA and Industry, the team recognized the need to reset expectations, and refocus collective efforts, commitments, and priorities. In December 2019, FAA Administrator Daniel K. Elwell tasked the NextGen Advisory Committee (NAC) with providing advice to the FAA to ensure the aviation community and the FAA remain synchronized in the delivery and use of PBN capabilities and in achieving operational benefits (NAC Task 19-4: Performance Based Navigation (PBN) Clarification included in Appendix A). This tasking included the three components described below:

- Developing consensus agreement on a PBN baseline (FAA-procedures, industry-equipage);
- Developing consensus agreement on a joint definition of a PBN NAS; and
- Developing consensus agreement on a list of specific desired outcomes, based on gaps in a baseline analysis, for the core 30 airports (minus HNL, plus TEB)[1]

In response, the NAC directed the NAC Subcommittee (NAC SC) Chairman to provide a product that addressed the three elements of the tasking letter. Per the tasking letter scope[2], the NAC SC Chairman formed an ad hoc team that contained three Industry members: the two co-chairs of the PBN NIWG representing major and regional air carriers; and a representative from NBAA for business/general aviation.

The FAA provided three subject matter experts (SMEs) from the Air Traffic Organization (ATO) to ensure recommendations to the NAC are executable from an FAA perspective. These SMEs represented the ATO's Mission Support, Project Management Office, and Operations organizations. The FAA also provided an operational SME from the National Air Traffic Controllers Association (NATCA), documentation support from the NAC facilitation team, and analysis support from the MITRE Corporation.

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[1] For simplicity, this subset of airports is referred to as the Modified Core 30 throughout the rest of the report.

[2] Per the FAA tasking letter, the Ad Hoc Team Industry membership was limited to three representatives, and therefore did not include individual aircraft operators, airport operators, or all of the organizations that represent them on the NAC or NAC SC.

This report documents the response of the Ad Hoc Team to the three elements of the FAA's December 10, 2019 tasking letter (see Appendix A).

Methodology Overview

To address the tasking elements, the Ad Hoc Team conducted a series of meetings between February and July 2020. These meetings are summarized below:

- February 2020: Background briefings and further discussion of tasking scope was provided by the FAA SMEs and MITRE.
- March 2020: In early March, the team discussed procedure types to include in PBN Baseline. Airports of interest to the Industry were also discussed. Later in March, PBN Baseline Industry Equipage (data gathered to date) and PBN Baseline FAA Procedures data were presented and discussed. Ad Hoc Team consensus on task elements 1 and 2 was completed.
- April 2020: FAA provided a list of instrument approaches, SIDs and STARs in development or production (Instrument Flight Procedures (IFP) Gateway) for the Modified Core 30 Airports.
- May 2020: Ad Hoc Team Industry members provided an update on efforts to develop their priority list of desired PBN outcomes.
- June 2020: Ad Hoc Team Industry members presented the findings of their gap analysis and the resulting prioritization of the desired PBN outcomes. FAA SME input was requested to ensure the final recommendations are executable from an FAA perspective.
- July 2020: The FAA SMEs provided feedback on scope, risk and planning implications of the Industry proposals. Ad Hoc Team consensus on task element 3 was completed.

Underlying each of these meetings was the necessity for each Industry Ad Hoc Team member to collect and coalesce inputs from their respective constituencies. The three Industry members used the following methods to obtain input:

- For the major air carriers, A4A (Airlines For America) convened a separate but supporting workgroup made up of representatives from the ten A4A member airlines, along with Frontier Airlines and Spirit Airlines. Each air carrier provided Air Traffic Management and Technical Pilot expertise. This group is referred to as the "PBN Way Forward Group" in this report.
- For regional air carriers, through the Regional Operations Council, RAA formed a team of SMEs from each of the participating airlines. This team served as the source for technical and operational input for RAA.
- For business/general aviation, NBAA consulted its staff and key local members on equipage and operating goals.

The Industry members of the Ad Hoc Team unanimously agreed to use the resources of the PBN Way Forward Group to collate material and contribute airline and business aviation perspectives to this final report. The findings and recommendations for all three tasking elements utilized that

resource, and the breadth of the activity is documented in the final report of the PBN Way Forward Group.[3]

It is important to note that the high-intensity months of COVID-19 pandemic in the United States coincided with the execution of this tasking. Despite operational challenges and other response efforts, the Ad Hoc Team and supporting entities were able to keep focus on the required efforts and deliver a timely response.

Element 1: Developing Consensus Agreement on Definition of a PBN NAS

The Ad Hoc Team endorses the NAS NAV Strategy as the definition of a PBN NAS. The introductory remarks of then-FAA Administrator Michael P. Huerta are still relevant and are an accurate reflection of the definition of a PBN NAS:

> "[The PBN NAS Navigation Strategy] builds on the progress of the past decade and refocuses our priorities and milestones to transition to **a truly PBN-centric NAS, that is, a NAS where PBN is used as the basis for daily operations**. It charts a course that will allow the public and private sectors to advance the NAS collaboratively and constructively for the benefit of all aviation stakeholders, including aircraft operators, the traveling public, as well as new entrants such as unmanned aircraft systems and commercial space vehicles."

The Ad Hoc Team recognizes that the delivery of the full suite of benefits from a PBN NAS may be dependent on the implementation of other NAS capabilities as well as successful operational change management. As noted in the NAS NAV Strategy, shifting to time- and speed-based air traffic management is one of the achievements needed to complete the transition to a PBN NAS[4].

Final Recommendation: Reaffirmation of definition of PBN-centric NAS contained in the NAS NAV Strategy, to include the Focus Areas from page 11 of the strategy document:

- Operating with PBN throughout the NAS, using the right procedure to meet the need;
- Using navigation structure where beneficial and flexibility where possible;
- Shifting to time- and speed-based air traffic management;
- Delivering and using resilient navigation services;
- Modernizing the FAA navigation service delivery to reduce implementation time;
- Enabling lower visibility access; and
- Innovating and continuously improving.

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[3] "Final Report of the Major Air Carrier Performance Based Navigation (PBN) Way Forward Workgroup for the FAA's PBN Clarification Tasking to the NextGen Advisory Committee (NAC)," June 2020.

[4] From "Navigation Strategy Overview," page 11 of FAA's 2016 PBN NAS Navigation Strategy.

Element 2: Developing Consensus Agreement on a PBN Baseline

The FAA Tasking Letter identifies two elements that would make up a PBN baseline: instrument flight procedures, to be assessed by the FAA; and aircraft equipage, to be assessed by the aviation community.

PBN Baseline Procedures

In early March, the FAA SMEs presented a list of procedure types that the FAA intended to include in their baseline calculations:

- Area Navigation (RNAV) Standard Instrument Departures (SIDs) and Standard Terminal Arrivals (STARs)
- RNAV Global Positioning System (GPS) approaches
- Required Navigation Performance Authorization Required (RNP (AR)) approaches

The Ad Hoc Team accepted the FAA's list but requested additions to reflect other PBN procedures that currently exist in the NAS, including:

- RNP to xLS (ILS/GLS)
- Advanced RNP (A-RNP) (SIDs, STARs, Approaches)
- Ground Based Augmentation System Landing System (GLS) Approaches
- RNAV Visual Flight Procedures (RVFP)

The last four procedure types listed (RNP to xLS, A-RNP, GLS, and RNAV Visual) are not new concepts developed by the Ad Hoc Team. All but RNAV Visuals are part of the NAS NAV Strategy but it should be noted that while A-RNP procedures exist at some locations in the NAS, they are in various stages of development and maturity.

Final Recommendation: The PBN baseline for procedures should reflect the PBN procedures that currently exist in the NAS.

PBN Baseline Equipage

The NAC Minimum Capabilities List (MCL) was used to identify the PBN capabilities for Approach and Terminal phases. For the major air carriers and regional air carriers a review of the relevant Operations Specifications (Ops Specs) was considered to be the best way to report the current equipage capability of the respective fleets and pilots. Ops Specs are a real-time representation of an air carrier's capability, to include what is equipped, trained and FAA-approved. Table 1 used the information from Ops Specs C052, C063 and C384 (where applicable) along with the total fleet size to calculate equipage percentages. The equipage baseline did not include the basic RNAV terminal capabilities that are nearly 100% for the major air carriers and have been reported by the FAA and MITRE for several years. The data collection focused on MCL approach capabilities, including RNP AR, A-RNP, and coupled VNAV. Advisory VNAV is included in Table 1 to account for aircraft lacking approved vertical guidance for RNAV (GPS) approaches. Additional information on two supplemental items is also included: GLS and LPV (Localizer Performance with Vertical Guidance) capabilities.

Table 1 contains the summary of baseline equipage and capability for the PBN elements of the terminal and approach components of the MCL for the major air carriers and for most of regional

airlines. An additional breakdown by air carrier is provided in Appendix B. The fleet information was updated at the beginning of June 2020. However, it is important to note that the fleet complement decisions are ongoing and may change as the COVID-19 recovery occurs.

Table 1 – Combined Air Carrier Baseline PBN Equipage

		Baseline MCL						Supplemental MCL	
		Approach					Terminal	Approach	
			A-RNP		RNAV (GPS)				
Air Carrier	Counts	RNP AR	Capable	Ops Spec	Coupled VNAV	Advisory VNAV only	RNP-1 w RF	GLS	LPV
Majors	4,644	76%	89%	65%	98%	2%	90%	14%	1%
Regionals	1,881	23%	23%	0%	43%	57%	23%	0%	0%

The approach using Ops Specs to determine a current baseline equipage is not as applicable to general or business aviation, however, there have been cooperative studies between AOPA and MITRE[5]. The analysis shows RNAV and RNP equipage to be relatively high for IFR aircraft (83%-87%, depending on type of aircraft, and over 90% for business aviation jet fleet).

NBAA completed an analysis of a typical day of operations (pre-COVID-19 traffic reduction) at Teterboro Airport. This traffic is representative of business aviation operations into a dense air traffic, Core 30 environment. From that analysis, RNAV and RNP equipage was well over 98%. This is indicative of typical equipage for business aviation operators utilizing Core 30 or NSG1 airports. A-RNP and RNP AR percentages tend to be lower - on the specific day sampled, ~26% of daily TEB operations were A-RNP equipped and ~30% have a retrofit option.

Due to the resiliency requirement for Inertial Reference Unit (IRU) equipment that is used in the case of a GPS system outage, much of the business/general aviation fleet will not be fully equipped for RNP AR approaches. Even for some of the fleet that are RNP AR capable and equipped with an IRU, they cannot fly radius-to-fix (RF) legs due to map display limitations and ultimately would not qualify as equipped. For example, the Bombardier Challenger CL300 with the Proline 21 enhanced flight deck has many similar capabilities to the CL350 variant, except it does not have an IRU, which makes it eligible for A-RNP, but not RNP AR.

Final Recommendation: The PBN baseline for equipage for major and regional air carriers should be collected based on information in the existing Ops Specs.

Element 3: Developing Consensus Agreement on a List of Specific Desired PBN Outcomes

The third tasking element requests a consensus aviation community agreement on a list of specific desired outcomes, based on gaps in a baseline analysis, for the Modified Core 30

[5] From February 13, 2020 MCL meeting presentation by Rune Duke, "AOPA MCL Presentation v2" pages 4-6.

airports. The intent of this element was to identify a set of site-specific recommendations providing a clear portrayal of airline and business aviation PBN priorities with understanding of what is executable from the FAA's perspective. The timeframe for these desired PBN outcomes is 2021 to 2025, described as the "mid-term" in the NAS NAV Strategy.

The Industry Ad Hoc Team members unanimously agreed to use A4A's PBN Way Forward Group augmented with representatives from RAA and NBAA to develop the list of desired PBN outcomes. A set of priority airports (see Appendix C) and specific PBN proposals associated with each airport were identified. These proposals were compared with the list of PBN procedures in development/production supplied by the FAA SMEs. Finally the proposals were assessed for readiness and return, using airline, A4A, RAA and NBAA expertise and experience. The process used is summarized in Appendix D and is documented in full detail in the final report of the PBN Way Forward Group. The resulting 48 PBN proposals, in order of readiness and return scoring, are shown in Table 2.

Table 2 – Desired PBN Outcomes

01 SFO: Amend SSTIK to replace OFFSHORE	25 ORD: Optimized SIDs/STARs
02 DCA: RNAV (GPS) for Rwy 19	26 PHX: Offload RNAV STAR for NE corner
03 CVG: OPDs, CCOs, RNP w RF	27 EWR/TEB: MARS application
04 JFK/LGA: SKORR/GLDMN departures	28 DCA: RNAV (RNP) for Rwy 01
05 ATL: LNAV for parallel ops	29 MEM: xLS transitions and A-RNP to all runways
06 EWR: Align RNAV with ILS; revise RNP Rwy 29	30 DAL/DFW: MARS application
07 LGA: RNAV (GPS) for Rwy 31	31 PHL: RNAV (GPS) for Rwys 09L/R
08 TEB: Rwy 19 offset and RUUDY departure	32 DCA: CLIPR/DEALE optimization
09 SLC: STARs/SIDs in Gateway	33 SEA: RNAV STARs and RNPs from east
10 LAX: A-RNP approaches (enables EoR)	34 HOU: RNAV (RNP) to Rwys 13R, 31L, 22, 04
11 IAH: RNP AR for Rwys 27 & 08L (enables EoR)	35 SLC: Curved approach for Rwy 35
12 TEB: RNAV SID for Rwy 19	36 SLC: RF/TF overlay with xLS (enables EoR)
13 BOS: Rwy 04L GPS offset with VNAV	37 SFO: GLS applications/procedures
14 SEA: ELSO departures	38 SFO/OAK: MARS application
15 SDF: Redesigned SIDs/STARs (enables EoR)	39 FLL: RNP approaches (enables EoR)
16 IAD: Procedures amendments (enables EoR)	40 BOS: RNP(AR) for Rwy 22L with GPS overlay
17 EWR: Replace vectors SIDs	41 MCO: RNP approaches (enables EoR)
18 DAL: Approaches for Rwy 13L/R and 31L/R	42 EWR: .308 procedures for parallel operations
19 TEB: RNAV to replace conventional procedures	43 SFO: .308 procedures for Rwys 19L/R operations
20 PDX: EoR with waiver	44 EWR: GLS applications/procedures
21 BNA: A-RNP approaches (enables EoR)	45 LGA: GLS applications/procedures
22 JFK: Approaches for Rwys 13L/R (enables EoR)	46 JFK: GLS applications/procedures
23 ATL: RF/TF overlay with xLS (enables EoR)	47 IAH: GLS applications/procedures
24 DFW: Offload RNAV STAR for NE corner	48 ATL: GLS applications/procedures

The proposals in Table 2 are based on the input and consensus of the major air carriers (reflected by the inputs of A4A's PBN Way Forward Group), regional airlines (reflected by the inputs of RAA's Regional Operations Council), and business/general aviation (reflected by the inputs of NBAA). The Industry Ad Hoc Team members have identified these 48 proposals as the desired PBN outcomes, serving as the fundamentals needed to achieve the objectives, address requirements, and meet expectations of the NAS NAV Strategy. More immediately, these

priorities can be used to refresh the PBN production process and help the FAA move forward on the backlog of procedure requests[6] in the IFP Gateway.

The Industry Ad Hoc Team members requested input from the FAA SMEs as to which of the proposals were most consistent with current FAA planning. This discussion started in June and clarifications to the FAA's questions have been included in the procedure detail tables in Appendix D. The FAA SMEs indicated their assessment will proceed after delivery of this report, and will ascertain which proposals are beyond the scope of the current tasking (for example if they require additional airspace or infrastructure investments outside the bounds of the FAA's single-site PBN development efforts), or have other operational risk elements that the FAA does not have plans to address. Some of the proposals in Table 2 target airports that were not included in the FAA's tasking letter, specifically cargo hubs. The FAA indicated that these additional airports could be considered on a case-by-case basis and if resources are available.

Final Recommendation: The desired PBN outcomes are represented in these 48 proposals. Request that the FAA complete its assessment of the desired PBN outcomes as soon as practical. Collaborative discussions concerning all 48 PBN proposals will continue, to support additional action in transitioning to a PBN NAS. Subsequent development and/or implementation efforts should start as soon as practical, including competing feasibility studies if needed.

Ancillary Findings for FAA Consideration

As stated previously, the deliberative process was comprehensive and due to the thorough nature of the discussions, there were a number of observations beyond the three elements of the tasking that were uncovered. These topics included an array of items including process improvement, operational scope, future goals, and enabling capabilities. The team acknowledges that these topics are not part of the scope of the tasking; however we believe that they should be noted for action in the future.

<u>Capacity of FAA's Current PBN Implementation Process:</u> The NAS NAV Strategy calls for a level of PBN development that FAA processes and resources may not be able to meet. The prioritized procedures in this document only serve as a starting point, and demand for PBN to support further proliferation will only increase. Constraints must be addressed and other forms of production (e.g. third-party development support) may be needed to augment FAA resource limitations.

<u>Transparency into the PBN Prioritization and IFP Gateway:</u> FAA transparency and accountability for PBN development and implementation is essential. This transparency, at a minimum, should include tracking the status of each proposal after it is logged into the IFP Gateway, communicating an accurate schedule, and coordinating necessary Industry input.

<u>Widespread Deployment of Established on RNP (EoR):</u> EoR is featured prominently in the PBN NAS NAV Strategy and in the results of this effort as well. The Desired PBN Outcomes

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[6] Procedure requests must undergo the normal IFP development process under Order 8260.43, including validation, airport coordination, and scheduling as well as environmental review.

documented in this report include new procedures and adjustments to approaches to enable EoR for over a third of the priority airports. Further criteria work is needed to more fully leverage these capabilities where they can provide benefits and enhance safety at more locations in the NAS.

Expediting MARS (Multiple Airport Route Separation) Standards and Implementation: Along with EoR, MARS has been identified as a priority concept that leverages PBN capabilities. Expediting MARS studies and other research efforts is needed to generate positive outcomes that are expected to increase the utilization of PBN operations across the NAS and enable time-based sequencing and spacing of air traffic.

Broader Airport Consideration: A PBN NAS includes the whole NAS, and prioritization should include all NSG1 and NSG2 airports. The use of the Modified Core 30 list does not fit easily within the NSG structure and should be reconsidered for future PBN prioritization.

NAS-wide Proliferation of PBN: Since the NAS NAV Strategy was published, the FAA and Industry have grappled with challenges to large-scale proliferation of PBN. Concerns associated with mitigation actions have been continually raised, including issues surrounding vertical navigation capabilities. Additional collaborative efforts, specifically addressing these concerns, are underway as part of separate NAC tasking[7].

Closing and Recommendations

The material documented in this report clearly reflects the continued dedication of the aviation community in the support of the NAS NAV Strategy in developing PBN. The consensus recommendations of the Ad Hoc Team associated with the three elements of the tasking include:

- Element 1: Reaffirmation of definition of PBN-centric NAS contained in the NAS NAV Strategy, to include the Focus Areas from page 11 of the strategy document.
- Element 2: The PBN baseline for procedures should reflect the PBN procedures that currently exist in the NAS. The PBN baseline for equipage for major and regional air carriers should be collected based on information in the existing Ops Specs.
- Element 3: The desired PBN outcomes are represented by the 48 proposals in Table 2. Request that the FAA complete its assessment of the desired PBN outcomes as soon as practical. Collaborative discussions concerning all 48 PBN proposals will continue, to support additional action in transitioning to a PBN NAS. Subsequent development and/or implementation efforts should start as soon as practical, including competing feasibility studies if needed.

The Ad Hoc Team also identified the need to continued standards efforts and safety studies to expedite implementation of key concepts (e.g. EoR, MARS) and continued of transparency into the FAA's PBN prioritization efforts. Future prioritization could benefit from consideration of a broader set of airports (NSG1 and NSG2), utilization of the aviation community as an important resource in continued advancement of PBN, and proactive inclusion of all appropriate operator

[7] NAC Task 20-2: Vertical Navigation (VNAV) is included in the August 10, 2020 tasking letter from Dan Elwell.

perspectives in the FAA's efforts to address the broad array of PBN development efforts (e.g. new orders, planning, etc.).

The Ad Hoc Team is confident that the FAA will see the value of these efforts and the positive dialog that this work has started. The information included in this report should provide a path for moving forward and intensify PBN implementation efforts.

Appendix A: FAA Tasking Letter

U.S. Department of Transportation

Federal Aviation Administration

Office of the Deputy Administrator

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

December 10, 2019

Mr. Russell "Chip" Childs
President and Chief Executive Officer
SkyWest, Inc.
444 South River Road
St. George, UT 84790

Dear Mr. Childs:

It has been several years since the publication of the 2016 Performance Based Navigation (PBN) National Airspace System (NAS) Navigation Strategy. Now is an appropriate time to gain further advice from the NextGen Advisory Committee (NAC) to ensure the aviation community and Federal Aviation Administration (FAA) remain synchronized in the delivery and use of PBN capabilities and in achieving operational benefits. The FAA requests further definition and advice from the NAC, in the form of the following task:

Task 19-4: Performance Based Navigation (PBN) Clarification

The NAC is asked to provide aviation community consensus advice by:

- Developing consensus agreement on a PBN baseline (FAA-procedures, industry-equipage);
- Developing consensus agreement on a joint definition of a PBN NAS; and
- Developing consensus agreement, based on gaps in baseline analysis at Core 30 airports (minus HNL, plus TEB), on a list of specific desired outcomes.

Scope:

- FAA will provide MITRE data;
- Limited to three NAC and three FAA participants; and
- Complete work within three months of start.

This advice should be provided to the FAA no later than the summer 2020 NAC meeting in the form of a report. If you have questions, please contact Pamela Whitley, Acting Assistant Administrator for NextGen, at Pamela.Whitley@faa.gov.

Sincerely,

Daniel K. Elwell
Deputy Administrator

Appendix B: Detailed Equipage Information

Major Air Carrier Baseline PBN Equipage

	Baseline MCL						Supplemental MCL	
	Approach					Terminal	Approach	
		A-RNP		RNAV (GPS)				
Air Carrier	RNP AR	Capable	Ops Spec	Coupled VNAV	Advisory VNAV only	RNP-1 w RF	GLS	LPV
Alaska	84%	100%	100%	100%	0%	100%	0%	0%
American	73%	100%	100%	100%	0%	100%	0%	0%
Atlas	0%	44%	0%	82%	18%	44%	0%	0%
Delta	84%	89%	14%	89%	11%	89%	47%	5%
FedEx	63%	100%	63%	100%	0%	83%	0%	0%
Frontier	100%	100%	0%	100%	0%	100%	0%	0%
Hawaiian	0%	0%	0%	100%	0%	0%	0%	0%
JetBlue	100%	100%	100%	100%	0%	100%	3%	0%
Southwest	100%	100%	100%	100%	0%	100%	7%	0%
Spirit	0%	100%	100%	100%	0%	100%	0%	0%
United	77%	77%	59%	100%	0%	87%	28%	0%
UPS	56%	66%	0%	100%	0%	66%	0%	0%

Regional Air Carrier Baseline PBN Equipage

	Baseline MCL						Supplemental MCL	
	Approach					Terminal	Approach	
		A-RNP		RNAV (GPS)				
Air Carrier	RNP AR	Capable	Ops Spec	Coupled VNAV	Advisory VNAV only	RNP-1 w RF	GLS	LPV
Air Wisconsin	0%	0%	0%	0%	100%	0%	0%	0%
Cape Air	0%	0%	0%	100%	0%	0%	0%	0%
CommutAir	0%	0%	0%	0%	100%	0%	0%	0%
Empire	0%	0%	0%	0%	100%	0%	0%	0%
Endeavor	0%	0%	0%	0%	100%	0%	0%	0%
Envoy	0%	0%	0%	54%	46%	0%	0%	0%
ExpressJet	0%	0%	0%	21%	79%	0%	0%	0%
GoJet	0%	0%	0%	0%	100%	0%	0%	0%
Horizon	100%	100%	0%	100%	0%	100%	0%	0%
Mesa	0%	0%	0%	41%	59%	0%	0%	0%
Piedmont	0%	0%	0%	0%	100%	0%	0%	0%
PSA	0%	0%	0%	70%	30%	0%	0%	0%
Republic	100%	100%	0%	100%	0%	100%	0%	0%
SkyWest	31%	31%	0%	31%	69%	31%	0%	0%

The fleet equipage information was originally collected in early 2020 and last updated at the beginning of June 2020. However, it is important to note that the fleet complement decisions are ongoing and may change as the COVID-19 recovery occurs.

Along with the current Ops Specs information, there are some expected future capabilities that should also be noted:

- Through aircraft acquisition, Ops Specs augmentation, and equipment upgrades, UPS expects to increase its approach capabilities to 86% RNP AR and A-RNP capable, 19% LPV capable, and increase the en route RNP 2 capability to 100%.
- With respect to GLS capabilities, Southwest Airlines future Boeing 737 MAX aircraft will all be GLS capable and the airline has started to retrofit its fleet to be equipped to meet requirements for GLS before the end of the mid-term. JetBlue's current and future Airbus NEO aircraft will also be equipped with GLS capabilities. GLS capability is expected to increase as equipped Boeing 737 MAX aircraft are added back into the operation.

Appendix C: Airports

AIRPORT		NSG	Core 30	Modified Core 30	Aircraft Operator Priority
IAD	Washington Dulles International	1	✓	✓	✓
SFO	San Francisco International	1	✓	✓	✓
DCA	Ronald Reagan Washington National	1	✓	✓	✓
PHL	Philadelphia International	1	✓	✓	✓
EWR	Newark Liberty International	1	✓	✓	✓
LAX	Los Angeles International	1	✓	✓	✓
LGA	La Guardia	1	✓	✓	✓
JFK	John F Kennedy International	1	✓	✓	✓
ATL	Hartsfield - Jackson Atlanta International	1	✓	✓	✓
IAH	George Bush Intercontinental/Houston	1	✓	✓	✓
DEN	Denver International	1	✓	✓	✓
DFW	Dallas/Fort Worth International	1	✓	✓	✓
ORD	Chicago O'Hare International	1	✓	✓	✓
CLT	Charlotte/Douglas International	1	✓	✓	✓
BWI	Baltimore/Washington Intl Thurgood Marshall	1	✓	✓	✓
SEA	Seattle-Tacoma International	2	✓	✓	✓
SLC	Salt Lake City International	2	✓	✓	✓
PHX	Phoenix Sky Harbor International	2	✓	✓	✓
MCO	Orlando International	2	✓	✓	✓
MEM	Memphis International	2	✓	✓	✓
BOS	General Edward Lawrence Logan International	2	✓	✓	✓
FLL	Fort Lauderdale/Hollywood International	2	✓	✓	✓
TPA	Tampa International	2	✓	✓	
SAN	San Diego International	2	✓	✓	
MSP	Minneapolis-St Paul Intl/Wold-Chamberlain	2	✓	✓	
MIA	Miami International	2	✓	✓	
LAS	McCarran International	2	✓	✓	
HNL	Honolulu International	2	✓		
DTW	Detroit Metropolitan Wayne County	2	✓	✓	
MDW	Chicago Midway International	2	✓	✓	
HOU	William P Hobby	2			✓
TEB	Teterboro	2		✓	✓
PDX	Portland International	2			✓
BNA	Nashville International	2			✓
SDF	Louisville International-Standiford Field	2			✓
DAL	Dallas Love Field	2			✓
CVG	Cincinnati/Northern Kentucky International	2			✓

Appendix D: Defining Desired PBN Outcomes and Procedure Details

The Industry members for the Ad Hoc Team relied on the thorough and methodical process[8] used by the PBN Way Forward Group to develop a set of desired PBN outcomes for 2021-2025. The process started with each participant (air carrier or organization) identifying their top priority airports. For each priority airport, detailed information on the desired PBN outcomes and procedures was gathered. The aircraft operator consensus identified 48 PBN proposals across 26 airports. Each proposal was evaluated for its potential readiness and expected return. Subjective scoring (high, medium, low) based on a set of specific guidelines was used for this evaluation. From the individual scoring inputs, an average Readiness score and Return score was calculated:

- "Readiness" is meant to reflect the overall ability of the system to use the proposed change. It includes more than just an assessment of risk, by looking at the potential mitigation of risks. For PBN, addressing the operational and technical readiness is crucial. Example readiness considerations include whether the procedure(s) in development, level of equipage, assumed system acceptance, availability of decision support tools (if required), whether policy or criteria changes are required, and if there are community/environmental concerns.
- "Return" is meant to reflect the expected realizable benefit, in particular whether the procedure(s) address both safety and efficiency benefits. It includes an assessment of whether the proposal provides benefit to the majority of operations, and promotes operational goals at local and national levels. It should also include the extent that the proposal supports looking forward to the mid-term and long-term goals of the NAS NAV Strategy.

Figure 1 contains the results of the Readiness and Return scoring efforts. Each point in the plot represents one PBN proposal, with the Readiness scores plotted along the x-axis and the Return scores plotted along the y-axis.

Along with the procedures, there are several operational themes or concepts referenced in the proposals. In many cases, the procedures are priorities because they will enable emerging concepts included in the goals and commitments in NAS NAV Strategy and other NAS planning documents, such as RNP to xLS, A-RNP, EoR, Equivalent Lateral Spacing Operations (ELSO) and MARS.

When reviewing and interpreting the scoring and prioritization results presented in Figure 1, the following points should be considered. The 48 proposals and associated procedures all have a degree of positive return and constructive readiness. The proposals in the upper right portion of Figure 1 have the highest Readiness and Return scores, and could be viewed as a necessary foundation, but limiting focus to those higher scoring proposals is not sufficient to address the mid-term priorities defined by this consensus effort.

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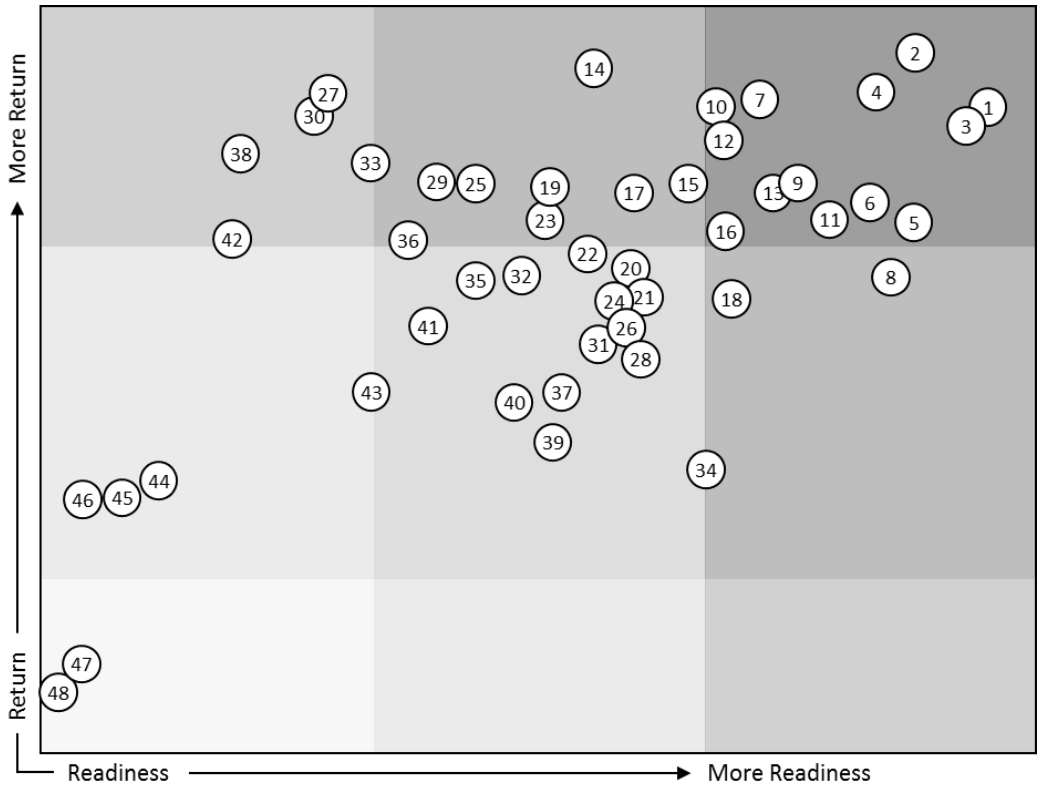
[8] This methodology was developed by the PBN Way Forward effort and was wholeheartedly adopted by the PBN Ad Hoc Team Industry members.

Figure 1: Summary of Readiness and Return Scores



1 SFO: Amend SSTIK and retire OFFSHORE
2 DCA: RNAV (GPS) for Rwy 19
3 CVG: OPDs, CCOs, RNP w RF
4 JFK/LGA: SKORR/GLDMN departures
5 ATL: LNAV for parallel ops
6 EWR: Align RNAV with ILS, revise RNP Rwy 29
7 LGA: RNAV (GPS) for Rwy 31
8 TEB: Rwy 19 offset and RUUDY departure
9 SLC: STARs/SIDs in IFP gateway
10 LAX: A-RNP approaches (enables EoR)
11 IAH: RNP(AR) for Rwys 27 & 08L (enables EoR)
12 TEB: RNAV SID for Rwy 19
13 BOS: 4L GPS offset with VNAV
14 SEA: ELSO in existing departure corridor
15 SDF: Redesigned SIDs/STARs (enables EoR)
16 IAD: Capital Redesign (enables EoR)
17 EWR: Replace vectors SIDs
18 DAL: Approaches for Rwy 13L/R and 31L/R
19 TEB: RNAV to replace conventional procedures
20 PDX: EoR with waiver
21 BNA: A-RNP approaches (enables EoR)
22 JFK: Approaches for Rwys 13L/R (enables EoR)
23 ATL: RF/TF overlay with xLS (enables EoR)
24 DFW: Offload RNAV STAR for NE corner
25 ORD: Optimized SIDs/STARs
26 PHX: Offload RNAV STAR for NE Corner
27 EWR/TEB: MARS application
28 DCA: RNAV (RNP) for Rwy 01
29 MEM: xLS transitions and A-RNP to all runways
30 DAL/DFW: MARS application
31 PHL: RNAV (GPS) for Rwys 09L/R
32 DCA: CLIPR/DEALE optimization
33 SEA: RNAV STARs and RNPs from east
34 HOU: RNAV (RNP) to Rwys 13R, 31L, 22, 04
35 SLC: Curved approach for Rwy 35
36 SLC: RF/TF overlay with xLS (enables EoR)
37 SFO: GLS applications/procedures
38 SFO/OAK: MARS application
39 FLL: RNP approaches
40 BOS: RNP(AR) for Rwy 22L with GPS overlay
41 MCO: RNP approaches
42 EWR: .308 procedures for parallel operations
43 SFO: .308 procedures for Rwys 19L/R operations
44 EWR: GLS applications/procedures
45 LGA: GLS applications/procedures
46 JFK: GLS applications/procedures
47 IAH: GLS applications/procedures
48 ATL: GLS applications/procedures

This section of the appendix includes additional detail and descriptions concerning the PBN proposals presented in Table 2 of the report and in Figure 1 above. The format is as follows:

[#] Airport – Short Proposal Title Proponent: *Airline or Aircraft Operator*	*Summary of the proposal including brief description of desired outcomes/benefits.*	
SIDs: *list SIDs to modify or new SIDs needing development*	STARs: *list STARs to modify or new STARs needing development*	APCHs: *list approaches to modify or new approaches needing development*
Additional Comments: *Further explanation of the proposal and/or cross reference to other workgroups where the proposal has been discussed.*		

The number in brackets (e.g. [1]) preceding the airport identifier and proposal title corresponds to the proposal number in Figure 1.

The information in this section of the appendix is intended to aid the reader in understanding the specifics of the proposals, it is expected that additional questions may arise. The "proponent" is identified in case the FAA or other report readers have questions or require additional explanation.

PBN Proposal Descriptions

[1] SFO – Amend SSTIK to replace OFFSHORE Proponent: United, Alaska	Modify the YYUNG transition on the Metroplex RNAV SID to make it useable for ATC and eliminate FSAP/ATSAP safety concerns	
SIDs: SSTIK	STARs:	APCHs:
Additional Comments: YYUNG transition was intended to replace the conventional OFFSHORE SID. Amending the OFFSHORE so it can be coded for FMS is alternate method to address safety concerns.		
[2] DCA – RNAV (GPS) for Rwy 19 Proponent: American	Complete RNAV (GPS) approach for Runway 19 for access and noise benefit	
SIDs:	STARs:	APCHs: RNAV (GPS) Rwy 19
Additional Comments: Procedures found in IFP Gateway production plan.		
[3] CVG – OPDs, CCOs, RNP w RF Proponent: Atlas	Modified and new STARs (OPDs), SIDs (CCOs), and GPS overlays of RNPs	
SIDs: Modify existing SIDs – BNGLE KENLN CHCLL LOVEY GIPLE ROCKT HAGOL SILKS JBNCH	STARs: Modify existing STARs – CEGRM GAVNN JAKIE SARGO TIGRR	APCHs: new RNP approaches for each runway end (8 total) – RNAV (RNP) Rwy 18L/C/R RNAV (RNP) Rwy 36L/C/ RNAV (RNP) Rwy 27 RNAV (RNP) Rwy 09
Additional Comments: Designs started in 2017 and found in IFP production plan. RNAV (GPS) approaches were modified with TF legs to mimic the RF leg in the RNP approach; ILS procedures would have been updated with the new course fixes.		

PBN Proposal Descriptions (continued)

[4] JFK/LGA – SKORR/GLDMN departures Proponent: JetBlue, Delta	Enable simultaneous use of RNAV SID departures using altitude separation, JFK SKORR and LGA GLDMN departures to increase throughout and reduce noise impacts	
SIDs: enabled by existing procedures; modifications may be needed	STARs:	APCHs:
Additional Comments: This proposal has also been identified as an Industry priority by the NEC NIWG and NAC SC Opportunities discussion group.		
[5] ATL – LNAV for parallel ops Proponent: Delta	Enable LNAV for parallel ops (remove note and authorize minima) to increase efficiency with independent simultaneous operations, and to not cause confusion about the use of LNAV minima during ILS outages; for current straight-in procedures	
SIDs:	STARs:	APCHs: all applicable approaches
Additional Comments: ALPA recommends removal of this item in line with its consistently stated opposition to closely spaced parallel runway operations using LNAV (only) minima. However, ALPA also understands the Ad Hoc Team's intent to preserve the findings that informed this report. ALPA requests that the findings and outcomes from NAC Tasking 20-2 Vertical Navigation inform further action on operations using LNAV (only) minima on closely spaced parallel runways.		
[6] EWR – Align RNAV with ILS; RNP Runway 29 Proponent: United	Align RNAV fix names with ILS/GPS for approaches; and stabilize approach by revising RNP Rwy 29 with updated criteria	
SIDs:	STARs:	APCHs: RNAV (RNP) Rwy 29 RNAV (GPS) Rwy 04L/R RNAV (RNP) Rwy 11 RNAV (RNP) Rwy 22L RNAV (GPS) Rwy 22R
Additional Comments: The RNAV (RNP) Rwy 29 proposal is related to priorities identified in the NEC NIWG and NAC SC Opportunities discussion group. The existing RNP was developed back in 2008; does not have CAT D minima and has wide RF turns due to the older criteria (creates proximity issues with LGA). New bank angle criteria (from PARC NAV WG) and other changes in criteria could produce more acceptable approach.		
[7] LGA – RNAV (GPS) for Rwy 31 Proponent: Delta	Develop public RNAV (GPS) to mimic the Expressway Visual to LGA Rwy 31 to provide stable, repeatable approach	
SIDs:	STARs:	APCHs: RNAV (GPS) Rwy 31 to emulate Expressway Visual
Additional Comments: This proposal has also been identified as an Industry priority by the NEC NIWG and NAC SC Opportunities discussion group.		
[8]TEB – Rwy 19 offset & RUUDY dep Proponent: NBAA	Complete RNAV offset (X) Rwy 19 and update to RUUDY departure providing access and predictability	
SIDs: RUUDY	STARs:	APCHs: RNAV (GPS) Rwy 19 offset
Additional Comments: RUUDY update and Rwy 19 offset approach are both included in IFP Gateway production plan.		

PBN Proposal Descriptions (continued)

[9] SLC – STARs/SIDs in Gateway Proponent: Delta	Complete work on SIDs/STARs in IFP Gateway to address safety concerns with existing procedures	
SIDs: RUGGD TWO	STARs: LEEHY SPAVE	APCHs: RNAV (GPS) Rwy 34L RNAV (GPS) Rwy 35
Additional Comments: Ongoing work with Western Service Area. Procedures found in IFP Gateway production plan.		
[10] LAX – A-RNP approaches Proponent: Southwest	Add A-RNP approach minimums to existing RNAV (RNP) approaches to enable EoR, increase efficiency, and help address community concerns	
SIDs:	STARs:	APCHs: A-RNP for Rwy 06L/R A-RNP for Rwy 07L/R A-RNP for Rwy 24L/R A-RNP for Rwy 25L/R
[11] IAH – RNP AR for Rwys 27 & 08L Proponent: United	Complete RNP AR approaches to Runways 27 and 08L to finish EoR project at IAH, providing flight time and distance savings	
SIDs:	STARs:	APCHs: RNP AR Rwy 27 RNP AR Rwy 08L
Additional Comments: This proposal has also been identified as an Industry priority by the PBN NIWG and in the Barriers to EoR Report.		
[12] TEB – RNAV SID Rwy 19 Proponent: NBAA	Improve departure efficiency with TEB 19 Departure Procedure and implementation of NEC Escape Routes	
SIDs: Rwy 19 RNAV	STARs:	APCHs:
Additional Comments: This proposal has also been identified as an Industry priority by the NEC NIWG.		
[13] BOS – Rwy 04L GPS offset with VNAV Proponent: JetBlue	Provides stabilized approaches and prevents misidentification of the landing runway with GPS offset to Rwy 04L with VNAV minima	
SIDs:	STARs:	APCHs: RNAV (GPS) Rwy 04L
Additional Comments: Minimal offset (2 degree) to ensure alignment with proper runway. This request pertains initially to single runway operations; however, Appendix A of JO 7110.308 includes 04L/04R for simultaneous dependent approaches to closely spaced parallel runways. The procedure will be properly annotated with "LNAV not authorized." for closely spaced parallel operations (similar to SFO procedures), and both wake turbulence separation and approved vertical guidance are required when operating under JO 7110.308.		
[14] SEA – ELSO departures Proponent: Alaska	Reduce ground congestion and expedite departures with ELSO, using the existing departure corridor	
SIDs: new RNAV SIDs – Rwy 16L/C/R RNAV Rwy 34L/C/R RNAV	STARs:	APCHs:
Additional Comments: Designs started in workgroup but shelved outside Gateway.		
[15] SDF – Redesigned SIDs/STARs Proponent: UPS	Optimize profiles, add efficiency, mitigate noise through 4 STARs with EoR approach transitions, 8 SIDS incorporating	
SIDs: 8 new departure procedures	STARs: 8 new arrival procedures	APCHs: 4 transitions (for EoR)

PBN Proposal Descriptions (continued)

[16] IAD – Procedures amendments Proponent: United	Increase efficiency and enhance safety by completing procedure amendments, modify STARs, enable EoR on widely spaced runways	
SIDs:	STARs: Modify existing STARs – CAVLR LEGGO GIBBZ MAPEL HYPER WIGOL	APCHs: RNAV (RNP) Rwy 01L/C/R RNAV (RNP) Rwy 19L/C/R RNAV (GPS) Rwy 30 RNP AR for EoR
Additional Comments: STARs and approaches are in the IFP Gateway production plan. In order to implement triple simultaneous independent approaches, the ILS approaches will need updated altitudes (ILS Rwy 01L/C/R, ILS Rwy 19L/C/R).		
[17] EWR – Replace vector SIDs Proponent: United	Replace vector SIDs with open SIDs, addressing workload concerns and enhancing safety	
SIDs: new open SIDs	STARs:	APCHs:
Additional Comments: Requesting overlaying existing vector SIDs with an RNAV open SID. Can mirror the existing ground track, while using standard RNAV leg types that would be flyable with the FMC.		
[18] DAL – Approaches for Rwy 13L/R and 31L/R Proponent: Southwest	Enhance safety and access with 12 new approaches (ILS, GPS, RNP for each runway); will enable MARS-like operations	
SIDs:	STARs:	APCHs: Rwy 13L/R ILS, GPS, RNP Rwy 31L/R ILS, GPS, RNP
[19] TEB – RNAV to replace conventional procedures Proponent: NBAA	Replace conventional procedures with RNAV for enhanced safety and access: Rwy 01/Rwy 06 SIDs and RNAV STAR to replace LVZ4	
SIDs: Rwy 01 RNAV Rwy 19 RNAV	STARs: RNAV to replace LVZ4	APCHs:
Additional Comments: This Rwy 19 RNAV SID has also been identified as an Industry priority by the NEC NIWG.		
[20] PDX – EoR with waiver Proponent: Alaska, RAA	Enable EoR with waiver to conduct simultaneous dependent approaches, increase use of RNPs and enable efficient operations	
SIDs:	STARs:	APCHs: enabled by existing approaches
Additional Comments: This proposal has also been identified as an Industry priority by the PBN NIWG and in the Barriers to EoR Report.		
[21] BNA – A-RNP approaches Proponent: Southwest	Add A-RNP procedures to enable EoR, increase use of RNPs and provide more flight efficiency	
SIDs:	STARs:	APCHs: A-RNP for Rwy 02L/C/R A-RNP for Rwy 20L/C/R
Additional Comments: This proposal has also been identified as an Industry priority by the PBN NIWG and in the Barriers to EoR Report.		
[22] JFK – Approaches to Rwys 13L/R Proponent: JetBlue	Adjustments to approaches for 13L/R to enable EoR, increasing arrival throughput	
SIDs:	STARs:	APCHs: Modify to meet criteria – RNP AR Rwy 13L RNAV (GPS) 13L
Additional Comments: This proposal has also been identified as an Industry priority by the NEC NIWG.		

PBN Proposal Descriptions (continued)

[23] ATL – RF/TF overlay with xLS Proponent: Delta	RF/TF overlay authorization and xLS transitions to increase use of RNP procedures and added efficiency	
SIDs:	STARs:	APCHs: RNAV (RNP) 08L RNAV (RNP) 10 RNAV (RNP) 26R RNAV (RNP) 28
Additional Comments: Include a TF "overlay" of the downwind turn transition on the RF RNAV (RNP) approaches, similar to application in Las Vegas Metroplex (south downwind), increasing use of the current curved path procedures. Applies to both the ILS and the RNAV (GPS) approaches to the outboard runways (10/28 and 8/26). The RNAV (RNP) approaches may become A-RNP to RNAV (GPS) approaches. Two options for consideration: a true overlay procedure on an RNAV procedure with both RF and TF turns, or a new approach in conjunction with the current RNAV RNP to either RNAV procedures or the ILS; whichever works best for ATC.		
[24] DFW – Offload RNAV STAR for NE corner Proponent: American	Develop an Offload RNAV STAR for the NE corner post to service Rwy 17L/35R	
SIDs:	STARs: New Offload STAR from NE corner post	APCHs:
Additional Comments: NE corner is the busiest corner for DFW traffic - PDARS data shows extensive vectoring in this sector prior to the STAR. Requesting an ATC assigned offload STAR when the airport is in a North flow, and recommend the use of runway transitions to turn the aircraft onto the ILS. Would decrease distance flown by reducing vectoring and the need for fix balancing.		
[25] ORD – Optimized STARs/SIDs Proponent: United	Add efficiency by optimizing PBN and new RNAV/GLS to better use 10R/28L; SID changes to mitigate wrong direction turns	
SIDs: Modify existing RNAV SIDs	STARs: Modify existing RNAV STARs	APCHs: RNAV (RNP) Rwy 10R/18L
Additional Comments: Modifications to STARs support continuing OPDs into TRACON airspace. Focus on heaviest used STARs to maximize benefits. Vertical optimization in C90 airspace enabling higher profiles. For SID changes, issue is created by confusing vector off the ground instructions. RNAV SID may address tower concerns.		
[26] PHX – Offload RNAV STAR for NE corner Proponent: American	Increase throughput by creating an additional offload STAR from the NE to improve traffic management for the busiest corner post for PHX	
SIDs:	STARs: new offload STAR from NE	APCHs:
Additional Comments: EAGUL OPD STAR accounts for approximately 35% of all PHX turbojet arrivals. Up to 25% of that traffic may be routed to this proposed offload procedure. Design would leverage previously developed by Metroplex Study Team.		
[27] EWR/TEB – MARS application Proponent: United, NBAA	MARS arrival-arrival application to deconflict EWR/TEB using TEB6 RNAV transition that is parallel to EWR ILS 11	
SIDs:	STARs:	APCHs: enabled by existing procedures
Additional Comments: This proposal has also been identified as an Industry priority by the NEC NIWG.		
[28] DCA – RNAV (RNP) for Rwy 01 Proponent: Southwest	Enhance safety and access by developing RNAV (RNP) Runway 01	
SIDs:	STARs:	APCHs: RNAV (RNP) Rwy 01

PBN Proposal Descriptions (continued)

[29] MEM – xLS transitions and A-RNP to all runways Proponent: FedEx	Added efficiency with xLS transition from STARs, and address unstable approaches with RNP AR or A-RNP to all runways	
SIDs:	STARs: CONDR HOBRK	APCHs: RNAV (RNP) Rwy 27 RNAV (RNP) Rwy 36L/C RNAV (RNP) Rwy 18L/C/R A-RNP for all runways
Additional Comments: Procedures found in IFP Gateway production plan. Requesting approach transition from the STAR to the ILS or any IAP including an A-RNP to a runway.		
[30] DAL/DFW – MARS application Proponent: Southwest	MARS arrival to arrival application to deconflict DAL/DFW/ADS using RNP approaches in DAL proposal	
SIDs:	STARs:	APCHs: proposed DAL procedures
[31] PHL – RNAV (GPS) for Rwys 09L/R Proponent: American, UPS	Night-time river approach for arrivals to 09L/R to add efficiency and address noise concerns	
SIDs:	STARs:	APCHs: RNAV (GPS) Rwy 09L/R
[32] DCA – CLIPR/DEALE optimization Proponent: American	Optimize existing CLIPR and DEALE STARs, building more efficient paths	
SIDs:	STARs: CLIPR DEALE	APCHs:
[33] SEA – RNAV STARs and RNPs from east Proponent: Alaska	Address delays and inefficiencies with repeatable RNAV STARs and RNP transitions from east, and enhance EoR operations	
SIDs:	STARs: RNAV for east side	APCHs: RNAV (RNP) for east side
[34] HOU – RNAV (RNP) for Rwys 13R, 31L, 22, 04 Proponent: Southwest	RNAV (RNP) Approaches to Rwys 13R, 31L, 22, and 4 to reduce fuel use and increase flight efficiency	
SIDs:	STARs:	APCHs: RNAV (RNP) Rwy 13R RNAV (RNP) Rwy 31L RNAV (RNP) Rwy 22 RNAV (RNP) Rwy 04
[35] SLC – Curved approach for Rwy 35 Proponent: Delta	Replace LDA with curved path approach for Rwy 35, providing vertical guidance to runway end	
SIDs:	STARs:	APCHs: RNAV (RNP) Rwy 35 or RNAV (GPS) EVS Rwy 35
Additional Comments: Request includes Extended Visual Segment (EVS) and an approach with TF turns in the FAS.		

PBN Proposal Descriptions (continued)

[36] SLC – RF/TF overlay for xLS Proponent: Delta	Enhanced safety, throughput and fuel efficiency for downwind ops with RF/TF overlay and xLS, enables independent simultaneous operations and future EoR operations.	
SIDs:	STARs:	APCHs: RNP for Rwy 16L/R RNP for Rwy 34L/R
Additional Comments: Request is for RNAV (RNP) with overlay TF transitions to ILS and RNAV (GPS); similar to application in Las Vegas Metroplex. The RNAV (RNP) approaches may become A-RNP to RNAV (GPS) approaches. Two options for consideration, similar to ATL RF/TF proposal (see #23 above).		
[37] SFO – GLS applications/ procedures Proponent: United	GLS to provide precision approaches to non-ILS runways: 19R, 10L/R	
SIDs:	STARs:	APCHs: GLS overlay RNAV (GPS) Rwy 19L GLS overlay RNAV (GPS) Rwy 19R GLS overlay RNAV (GPS) Rwy 28L GLS overlay RNAV (GPS) Rwy 28R
Additional Comments: Procedures found in IFP Gateway production plan. Proposal also included in Oct 2018 PBN NIWG Rolling Plan.		
[38] SFO/OAK – MARS application Proponent: United	MARS arrival-arrival applications to deconflict SFO and OAK, ensuring schedule reliability	
SIDs:	STARs:	APCHs: enabled by existing procedures
[39] FLL – RNP approaches Proponent: JetBlue, Southwest	RNP procedures to provide flight efficiency and enable EoR (follow-on to Metroplex)	
SIDs:	STARs:	APCHs: previous RNP designs
Additional Comments: For consideration toward end of mid-term (after 2023). Not intended to disrupt ongoing environmental review for Metroplex procedures. Assumed independent value from procedures under review.		
[40] BOS – RNP AR for Rwy 22L with GPS overlay Proponent: JetBlue	Address community concerns and add efficiency with 22L RNP AR approach with GPS overlay (associated with MIT/FAA/MassPort study)	
SIDs:	STARs:	APCHs: RNP AR for Rwy 22L and RNAV (GPS) overlay
[41] MCO – RNP approaches Proponent: JetBlue, Southwest	RNP procedures to provide flight efficiency and enable EoR (follow-on to Metroplex)	
SIDs:	STARs:	APCHs: previous RNP designs
Additional Comments: For consideration toward end of mid-term (after 2023). Not intended to disrupt ongoing environmental review for Metroplex procedures. Assumed independent value from procedures under review.		
[42] EWR – .308 procedures for parallel operations Proponent: United	Add .308 operations for close parallels to increase throughput	
SIDs:	STARs:	APCHs: enabled by existing procedures
Additional Comments: This proposal has also been identified as an Industry priority by the NEC NIWG.		

PBN Proposal Descriptions (concluded)

[43] SFO – .308 procedures for Rwys 19L/R operations Proponent: United	Add .308 procedures to Rwy 19L/R operations to increase throughput, using existing approach procedures.	
SIDs:	STARs:	APCHs: enabled by existing procedures
Additional Comments: Wake turbulence separation and approved vertical guidance are required for 7110.308 operations (consistent with 7110.308 Appendix A).		
[44] EWR – GLS applications/ procedures Proponent: United	Increase access with GLS approaches leveraging PANYNJ investment, e.g. curved path approach for GLS to Rwy 11	
SIDs:	STARs:	APCHs: new/modified GLS procedures
Additional Comments: Proposal also included in Oct 2018 PBN NIWG Rolling Plan.		
[45] LGA – GLS applications/procedures Proponent: Delta	Increase access with GLS approaches leveraging PANYNJ investment, e.g. improved minima through GLS with vertical guidance	
SIDs:	STARs:	APCHs: overlays for: ILS 22, ILS 04, ILS 13, LOC 31
Additional Comments: Proposal also included in Oct 2018 PBN NIWG Rolling Plan.		
[46] JFK – GLS applications/ procedures Proponent: JetBlue	Increase access with GLS approaches leveraging PANYNJ investment, e.g. straight-in approach to Rwy 22 with lower minima	
SIDs:	STARs:	APCHs: GLS overlays for each runway end (Rwys 13L/R, Rwys 22L/R, Rwys 31L/R, Rwys 04L/R)
Additional Comments: Procedures found in IFP Gateway production plan. Proposal also included in Oct 2018 PBN NIWG Rolling Plan.		
[47] IAH – GLS applications/procedures Proponent: United	Increase access with curved path options leveraging GLS	
SIDs:	STARs:	APCHs: new GLS procedures
[48] ATL – GLS applications/procedures Proponent: Delta	Increase access with GLS component added to approaches, provides single approach path in all weather	
SIDs:	STARs:	APCHs: new GLS procedures

Appendix E: Acronyms

AOPA	Aircraft Owners and Pilots Association
APCH	Approach
AR	Authorization Required
A-RNP	Advanced RNP
ATC	Air Traffic Control
ATMC	Air Traffic Management Council
COVID	Coronavirus
DME	Distance Measuring Equipment
EFVS	Enhanced Flight Vision Systems
ELSO	Equivalent Lateral Spacing Operations
EoR	Established on RNP
FAA	Federal Aviation Administration
FMS	Flight Management System
GLS	Ground Based Augmentation System Landing System
GPS	Global Positioning System
IFP	Instrument Flight Procedures
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
IRU	Inertial Reference Unit
LPV	Localizer Performance with Vertical guidance
MARS	Multiple Airport Route Separation
MCL	Minimum Capabilities List
MON	Minimum Operating Network
NAC	NextGen Advisory Committee
NACSC	NextGen Advisory Committee Subcommittee
NAS	National Airspace System
NAV	Navigation
NBAA	National Business Aviation Association
NIWG	NextGen Integration Work Group
NSG	Navigation Service Group
PARC	Performance Based Operations Aviation rulemaking
PBN	Performance Based Navigation
PNT	Position, Navigation and Timing
RAA	Regional Airline Association
RF	Radius to Fix
RNAV	Area Navigation
RNP	Required Navigation Performance
Rwy	Runway
SID	Standard Instrument Departure
SME	Subject Matter Expert
STAR	Standard Terminal Arrivals
TBO	Trajectory Based Operations
TF	Track to Fix
TOC	Tactical Operations Committee
VMC	Visual Meteorological Conditions
VNAV	Vertical Navigation
VOR	Very High Frequency Omni-Directional Range
xLS	ILS/GLS/LPV

Appendix F: PBN Clarification Ad Hoc Team Participants

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