

March 28, 2018

Mr. Ali Bahrami
Associate Administrator for Aviation Safety
Federal Aviation Administration
800 Independence Avenue, SW
Washington, D.C. 20591

Dear Ali,

The Performance Based Operations Aviation Rulemaking Committee (PARC) is pleased to submit the following recommendation for your consideration. In response to your letter dated October 16, 2017, the PARC Steering Group tasked the Navigation Working Group (Nav WG) to address the issues highlighted in the letter. Subsequently the Nav WG stood up the Vertical Navigation Action Team (VNAV AT). This Action Team met on February 21, 2018. Prior to the meeting, invitees were provided a comprehensive list of applicable documents to ensure they all had historical information to bring clarity of purpose for the meeting.

The following document provides background and details the meeting discussion, and provides responses to the letter. In addition, recommendations are submitted from the PARC. A summary of the recommendations are provided below and are further detailed in the following pages.

Recommendations:

1. The technical work relative to RNP to ILS remains valid and should be retained as a basis for further design and implementation considerations.
2. A more robust and streamlined process should be established to obtain relevant aircraft performance data to validate aircraft performance from resources such as MITRE and ASIAS. This information would serve to clear up issues that continually arise regarding aircraft 'real world' performance as well as help substantiate ongoing and future operational implementations.
3. A concept of use for the RNP to xLS designs should be developed by the Nav WG combined with further work on specific design methods for TF overlays where needed.

The PARC appreciates your continued support of our activities and I personally commend the many participants across all lines of business who address a multitude issues, both technical and conceptual to foster progress of NextGen. Please call me if you have any questions or would like to set up a discussion.

Sincerely,



Mark Bradley
Chairman, PARC
404-915-2144

Cc: Mark Steinbicker
Chris Hope
Merrill Armstrong
Mike Cramer
Donna Creasap
Lou Volchansky

Background

The PARC Navigation Working Group formed the VNAV Action Team which met on February 21, 2018 to discuss and address specific requests by FAA AVS-1, which were provided to the PARC via letter on October 16, 2017. The PARC Steering Group produced a Terms of Reference (ToR) to frame the VNAV AT tasking. Highlights of the ToR are as follows:

1. Review operational considerations that mitigate operational risk to ensure aircraft can safely transition from RNAV to xLS guidance.
2. Examples of factors that may be evaluated, but not limited to, are:
 - a. Pilot workload to transfer between guidance modes
 - b. Potential benefits of longer final approach segments
 - c. Effect of temperature adjusted intermediate segment
 - d. Risks associated with dual/parallel operations

Meeting invitees included representatives from Major Operators and Regional Operators, FAA Flight Standards and Aircraft Certification, NATCA, ALPA, NBAA, Honeywell and MITRE.

From a historical perspective, the PARC had conducted analysis and subsequently provided recommendations to AVS-1 that addressed applicable operations that were germane to the meeting agenda. Those included (links to the PARC site copy of each document):

1. [RNP to ILS Action Team Report Revision \(20 March 2012\)](#)
2. [RNP to xLS Recommendation Final \(28 August 2014\)](#)
3. [RNP to ILS Guidance material \(5 October 2015\)](#)
4. [RNP to GLS and RNP to LPV Recommendation \(24 April 2017\)](#)

These documents were also relevant to the discussion:

1. ALPA removal of VNAV requirement letter to John Blair FAA from Captain Steve Jangelis ALPA Safety (March 27, 2017)
2. PARC update NIWG meeting (December 11, 2017)
3. [FAA AVS-1 letter to PARC \(16 October 2017\)](#)

The above documents notwithstanding, it was necessary to revisit and review the previous recommendations/analysis and identify if there were additional considerations. Discussions about advisory VNAV and EoR issues and associated designs were valuable to understand to help make conclusion regarding RNP to ILS. The meeting agenda included these subjects so all in the meeting understood why we were being tasked.

PARC RESPONSE TO AVS-1 REQUEST

List of Invitees (attendees marked with “X”)

Ed Bagden (Republic)	X	Chip Beall (Delta)	X
Andrew Benich (Envoy)	X	Richard Boll (NBAA)	
Mark Bradley (Delta)	X	Steve Bush (Horizon)	X
Mike Cramer (MITRE)	X	Johan Erikssen (Horizon)	
Wes Googe (American)		Marc Henegar (ALPA)	
Al Herndon (MITRE)	X	Tass Hudak (MITRE)	X
Bennie Hutto (NATCA)	X	Jeff Kerr (AFS)	X
Hal McIntosh (PSA)	X	Gary McMullin (Southwest)	X
Barry Miller (AIR)		Darrell Pennington (ALPA)	
Ron Renk (United)	X	Chris Shehi (Honeywell)	
Brian Staples (PSA)	X	Brian Swain (Delta)	X
Brian Townsend (American)	X	Don Wiens (Horizon)	

CONCLUSIONS

The PARC stands by all previous recommendations.

The technical analysis is sound and the analysis and recommendations related to aircraft performance (e.g., lateral and vertical capture variability, TF/RF turn performance, altitude and speed constraints), as well as the design and operational considerations (e.g., minimum length of final, minimum offset of downwind to final, length of temperature compensating segment, guidance mode transition location) remain valid. The methodologies and detailed processes that led to all recommendations are fully captured in their respective reports, located on the PARC Website, the links are given next to each of the reference documents in the list above.

In forming the action team, leadership intentionally invited experts who were not part of the initial analyses. They were therefore unfamiliar with the recommendations and had no specific bias, but brought more business and regional operational experience to the discussions. All invitees were provided with each of the above listed documents as a pre-read approximately one month prior to the meeting.

In addition to discussions specifically about the previous Nav WG recommendations, there were numerous comments made regarding issues that were not specifically technical but were relevant to the implementation of instrument approach procedures, whether RNAV to join an ILS procedure or any other form of instrument approach procedure. These are noted below:

Operational Benefit

Benefits are the foundational driver for implementation of new procedures or procedural concepts. All NextGen programs are predicated on this paradigm. Benefits will vary by stakeholder. There will be tradeoffs in order to facilitate implementation as well as near term and longer-term benefit returns. Traditional benefits such as reduction of block time, distance flown, predictable paths, fuel savings, and airport access, among others, play a role in the implementation of new procedural concepts. The Action Team discussed benefits that could drive the implementation of RNP to ILS procedures as well as RNAV procedures. Path construction using Radius to Fix (RF) legs and Track to Fix (TF) legs were discussed at length.

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The tasking to the VNAV AT requested the group discuss the potential benefits of an “extended final”. Within the context of the Nav WG RNP to xLS operational and design recommendation there were two significant findings. First, the recommendation for design of these procedures includes an intermediate segment which is shallower than the final segment and long enough to assure glideslope capture from below when temperature is above ISA. When aligned with the final segment, this can increase track miles by one to two miles. In designs where an RF is used for the turn to final this intermediate segment can be wrapped along the RF, allowing the RF to end at the FAF and not extending the ground track. In TF overlay designs meant to accommodate earlier RJs the shallow intermediate segment cannot follow the TF turns because the turn anticipation and radius vary depending on the system flying them. Second, in earlier RJ (ERJ-145 HW, CRJ-200 Rockwell) systems transitioning from RNAV guidance to ILS (or LPV) guidance is a manual four step process. The Nav WG testing found that aligning the shallow intermediate with the final combined with no less than a 5 NM final allowed this transition to happen smoothly with no undue cockpit workload being added; hence those two limits are recommended when both RF and TF only aircraft are to use the procedures. The team also recommended that the intermediate segment be allowed to follow the RF for RF only procedures, and that finals shorter than 5 NM not be precluded by the design criteria. The Regional operators in the meeting concurred with these recommendations, stating that their current training would support such a transition to final since they currently train to establish on the final approach course prior to making the mode transitions (this is also a limitation of some systems which require “wings level” to make the mode transition).

The alignment of the temperature compensating segment with the final approach course taken alone may result in longer track miles, hence an apparent negative benefit. But consideration should be given to other possible benefits such as the potential for significant track mile savings in IMC compared to existing ILS approaches. Further, if the procedure enables the proper level of aircraft participation with the addition of “TF only” capable aircraft, then there may be a greater benefit that would supersede the track mile increase, such as predictable flight paths, connectivity directly from a STAR all the way to the runway, etc. Variables such as mix of aircraft capabilities, individual airport characteristics, and benefit analysis will determine the most advantageous procedure designs.

As stated earlier, the PARC stands by the design and operational recommendations from a technical perspective. While it was not within the scope of this tasking for the PARC to stipulate when and where procedures are implemented, and with what design type, The PARC stands ready to continue toward recommendations that would define methods, analysis and processes that would address the issues of when, where and on what objective basis decisions could be made in the future deployment of RNP to xLS and related RF/TF concurrent ops (see recommendation 3 below).

Training

It was acknowledged by the Action Team that there will be a training component for new procedures or procedural concepts. The content of training will logically vary, depending on operation, aircraft, and mission requirements. For example, a fully equipped RNP (AR) aircraft and trained crew will have a different training scope than a general aviation pilot who flies predominantly for recreational purposes in VMC. This has been the case for many years and will not change. Flying an RNP to ILS or RNAV procedure will have a training component. Operators will determine the scope of their training in the same manner that they do today.

Data access

Part and parcel to a benefit analysis is the collection of data that is informative and essential to a benefit case. The Action Team unanimously agreed that the collection of appropriate flight trajectory and

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performance data in a timely manner is essential to decision making relative to certain procedural concept implementations. As such, the recommendation is that PARC work with FAA & appropriate stakeholders to facilitate access to data that will provide credible information for benefit and safety analysis. An example of the importance of streamlining data follows:

During the meeting there were comments regarding fly-ability of procedures that were based on anecdotal comments, or based on data that could not be shared due to sensitivity of aircraft data. It proved difficult to make conclusions based on no factual data. The recent letter from ALPA included numerous concerns regarding advisory VNAV-only capable aircraft. The Action Team discussed the concerns with attendees that fly aircraft using advisory VNAV on a routine basis. Their comments are summarized below:

- Many operators have used advisory VNAV for years, and fly procedures today in that manner.
- There is a training component today that varies between operators, and new evolutions of procedures requiring advisory VNAV could necessitate additional training.
- Depending on the fleet type and variant, some pilots would need to understand the operational crew procedural differences. This would serve as an example of training that must evolve relative to procedural concept evolution.
- Workload issues vary from fleet to fleet, and should be handled within the scope of training.

These and other comments noted issues, which as a whole were not exceptional. Any new concept should include these types of considerations.

Virtually all the safety related concerns noted in the ALPA letter could be better addressed if there were availability of ample supporting data. PARC believes an appropriate process for obtaining data from organizations such as MITRE and ASIAs to validate any flight trajectory, crew workload, or risk assumptions is both necessary and warranted.

Recommendations

1. The technical work relative to RNP to ILS remains valid and should be retained as a basis for further design and implementation considerations.
2. A more robust and streamlined process should be established to obtain relevant aircraft performance data to validate aircraft performance from resources such as MITRE and ASIAs. This information would serve to clear up issues that continually arise regarding aircraft 'real world' performance as well as help substantiate ongoing and future operational implementations.
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