3 February 2021

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

Dear Ali,

The Performance-based Operations Aviation Rulemaking Committee (PARC) is pleased to submit the following recommendation for your consideration. The PARC Navigation Work Group (NAV WG) recently completed a review and analysis of RNAV RNP Approaches (RNP APCH) with extended visual segments. The RNAV (GPS) Z RWY 13L procedure at JFK International airport is this type of approach and was an excellent benchmark to conduct the analysis and thus develop a standard for designs which will enhance efficiencies and safety.

The discussion and recommendation are included in the document. The PARC Steering Group supports this recommendation.

Sincerely,

Mark Bradley
Chairman, PARC

Cc: Mark Steinbicker
Chris Hope
Mike Cramer

Recommended Standards for Implementation of RNP Approach (RNP APCH) Operations Including an Extended Visual Segment

PARC Navigation Working Group

January 2021

Background.

In 2018, the Commercial Aviation Safety Team (CAST) made a direct request to the FAA Administrator for new, public instrument approach operations to JFK International Airport, NY, Runway 13L. The CAST made this request after a series of operational incidents where flight crews had difficulty visually negotiating the extended visual segment that follows the long-standing *VOR or GPS RWY 13L/R* public instrument procedure, in some instances departing grossly from the desired, visual ground track. While an RNP AR approach procedure, the *RNAV (RNP) RWY 13L*, offers a successful alternative to the decades-old VOR or GPS instrument approach procedure, the majority of the operators at JFK lack operational authorization to conduct the RNP AR procedure. Thus, the CAST request sought a new solution, one available to all operators at JFK; a public solution that could provide continuous lateral and vertical guidance to the runway.

In response to the CAST request, an FAA team investigated options for development of alternative, public instrument approach operation to JFK RWY 13L. After considerable collaboration with controllers, operators and aircraft and avionics manufacturers, the FAA team developed a unique, new RNP approach(RNP APCH), today's *RNAV (GPS) Z RWY 13L* (see Figure 1. below). While retaining an extended visual segment requiring turns to align with the landing runway, this procedure uniquely provides named waypoints and associated recommended altitudes in the visual segment. These waypoints enable the aircraft to offer advisory lateral and vertical guidance during the maneuvering the visual segment requires and transition to landing.

This new public instrument approach provides an opportunity for the aircrafts' RNP systems to provide continuous lateral and vertical guidance from the procedure's initial approach fix (IAF) to the runway. The procedure enables this by providing the means for the flight crew to use the RNP system's advisory lateral and vertical guidance (when available) through the procedure's extended visual segment. Use of advisory lateral and vertical guidance in this manner offers the opportunity for the aircraft to provide smooth, continuous lateral and vertical guidance from the procedure's IAF to the runway, meeting the CAST request.

Once the FAA team completed the initial draft of the new instrument procedure, and knowing this procedure would set a new precedent; the team took extraordinary steps to facilitate coordination, understanding and feedback on the draft procedure. These steps included conduct of an Operational Safety Assessment (OSA) at JFK; multiple, internal, FAA-only coordination meetings; multiple, web-based outreach seminars open to all JFK operators; private web-based outreach seminars with individual operators; coordination meetings with aircraft and avionics manufacturers; coordination meetings with navigation database providers (domestic and international); and multiple presentations to numerous PBN forums and working groups.

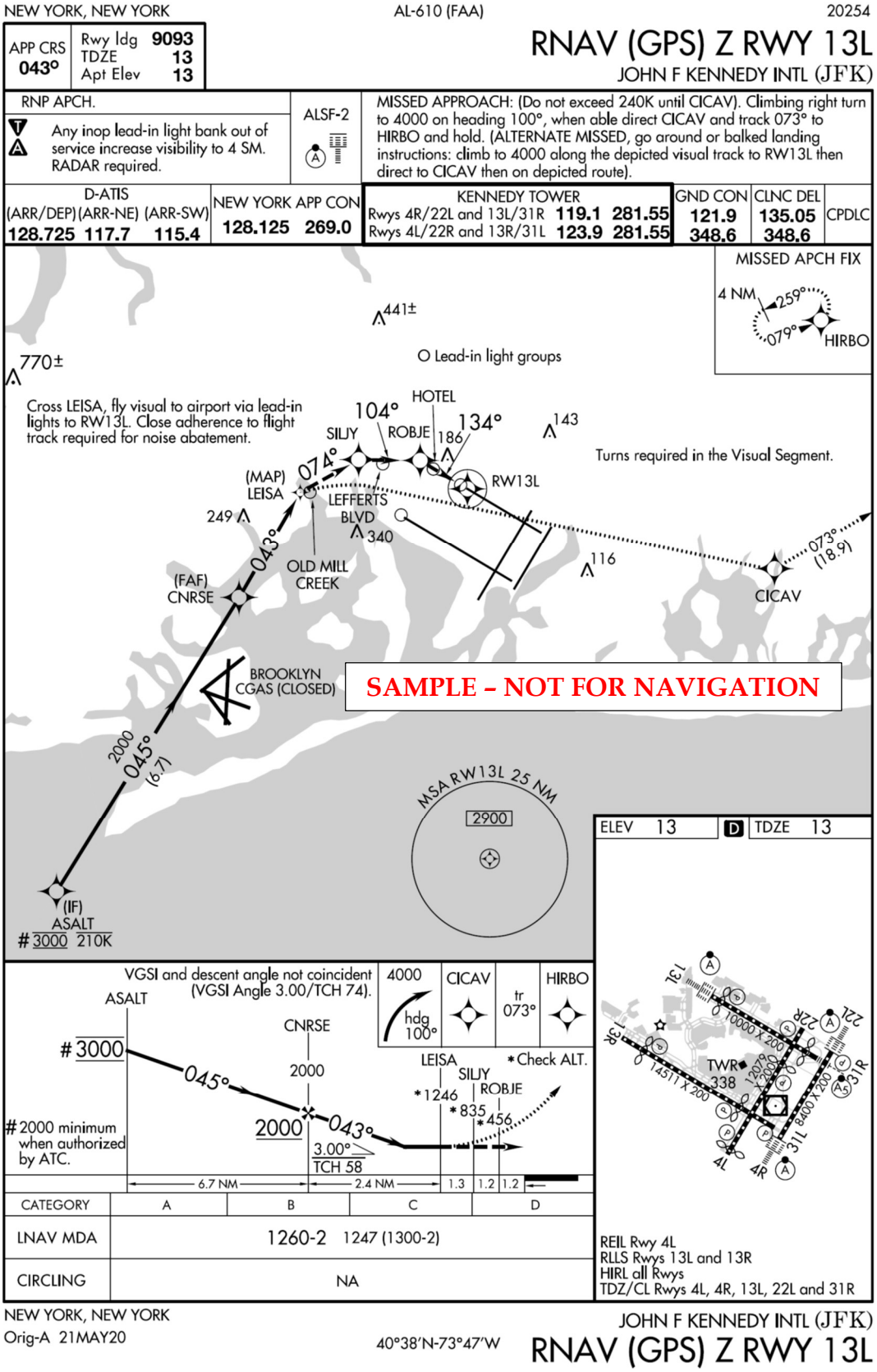
NEW YORK, NEW YORK
AL-610 (FAA)
20254
RNAV (GPS) Z RWY 13L
JOHN F KENNEDY INTL (JFK)
APP CRS 043°
Rwy Idg 9093
TDZE 13
Apt Elev 13
RNP APCH.
Any inop lead-in light bank out of service increase visibility to 4 SM. RADAR required.
ALSF-2
MISSED APPROACH: (Do not exceed 240K until CICAV). Climbing right turn to 4000 on heading 100°, when able direct CICAV and track 073° to HIRBO and hold. (ALTERNATE MISSED, go around or balked landing instructions: climb to 4000 along the depicted visual track to RW13L then direct to CICAV then on depicted route).
D-ATIS
(ARR/DEP) (ARR-NE) (ARR-SW)
128.725 117.7 115.4
NEW YORK APP CON
128.125 269.0
KENNEDY TOWER
Rwys 4R/22L and 13L/31R 119.1 281.55
Rwys 4L/22R and 13R/31L 123.9 281.55
GND CON
121.9
348.6
CLNC DEL
135.05
348.6
CPDLC
MISSED APCH FIX
4 NM
259°
079°
HIRBO
441±
770±
O Lead-in light groups
Cross LEISA, fly visual to airport via lead-in lights to RW13L. Close adherence to flight track required for noise abatement.
HOTEL
104°
134°
SILJY
ROBJE
186
143
Turns required in the Visual Segment.
(MAP)
LEISA
074°
RW13L
LEFFERTS BLVD
340
249
043°
OLD MILL CREEK
116
073°
(18.9)
CICAV
(FAF)
CNRSE
BROOKLYN
CGAS (CLOSED)
SAMPLE – NOT FOR NAVIGATION
2000
045°
(6.7)
MSA RW13L 25 NM
2900
(IF)
ASALT
#3000 210K
ELEV 13
D
TDZE 13
VGSI and descent angle not coincident
(VGSI Angle 3.00/TCH 74).
ASALT
#3000
045°
CNRSE
2000
2000
043°
3.00°
TCH 58
4000
hdg 100°
CICAV
tr 073°
HIRBO
LEISA
*Check ALT.
SILJY
ROBJE
*1246
*835
*456
#2000 minimum when authorized by ATC.
6.7 NM
2.4 NM
1.3
1.2
1.2
CATEGORY
A
B
C
D
LNAV MDA
1260-2 1247 (1300-2)
CIRCLING
NA
TWR
338
13L
13R
22L
22R
31R
31L
4L
4R
10000 X 200
14511 X 200
8400 X 200
REIL Rwy 4L
RLLS Rwys 13L and 13R
HIRL all Rwys
TDZ/CL Rwys 4L, 4R, 13L, 22L and 31R
NEW YORK, NEW YORK
Orig-A 21MAY20
40°38'N-73°47'W
JOHN F KENNEDY INTL (JFK)
RNAV (GPS) Z RWY 13L

Figure 1.

The efforts of the FAA team were essential to a series of practical updates to the draft procedure design, and they enabled flexibility in packing the procedure in the aircraft onboard navigation database products. The outreach also helped many operators prepare for the operational implementation of the new procedure; and many operators developed "company pages" and training materials standardizing their flight crew's procedures for executing this unique instrument approach.

Ultimately, the efforts of the team and the cooperation of everyone they worked with led to the successful implementation of the new RNAV (GPS) Z RWY 13L last winter. Thus far, pilots and operators have provided very positive feedback when weather dictated JFK arrival operations using RWY 13L. However, through the recurrent FAA team meetings, which continue to this day, the team heard constructive criticism and recommendations for improving the design of the procedure after many had an opportunity for further consideration and an opportunity to gain experience with the procedure. Likewise, multiple operators and FAA ATC organizations inquired about future implementations of similar RNP APCH procedures with an extended visual segment at a number of other US airports with currently unmet operational challenges.

Ultimately, given the operational inquiries and requests, members of the FAA team petitioned the PARC Navigation Working Group (Nav WG) to support a new task to develop standards for implementation of future RNP APCH procedures with an extended visual segment in US NAS. The request asked that the WG take the lessons learned from the development of the *RNAV (GPS) Z RWY 13L* procedure and embrace them in the new standards. After achieving agreement on the task within the Nav WG and a presentation of the proposed work to the PARC Steering Group (SG), the SG agreed with the WG's request, and members of WG began work toward new, proposed standards for the development and publication of new RNP APCH procedures with an extended visual segment.

Discussion.

The PARC Nav WG began their effort by documenting the issues and problems the FAA, manufacturers and operators faced during the development and implementation of the JFK *RNAV (GPS) Z RWY 13L*. Consideration of these issues and problem areas then led to robust discussion and due consideration by the WG participants. These discussions led to agreement that some issues were out of scope. As the WG dispositioned the remaining issues and problems, the efforts led to consensus within the WG and recommendations for: a new operational concept for implementing new RNP APCH ops with extended visual segment; new recommendations for FAA RNP APCH procedure design criteria supporting an extended visual segment; new operational terminology and guidance; and a need to define the approved means of compliance for airworthiness eligibility to conduct these unique procedures.

The remainder of this paper will treat each issue the NAV WG addressed individually.

Issues and Recommendations.

Issue: *Provide a means to identify when an RNP APCH procedure includes an extended visual segment and standardize the location of the procedural missed approach point (MAP).*
Discussion: The new *RNAV (GPS) Z RWY 13L* at JFK established the published MAP at the end of the procedure's instrument segment (reference LEISA (MAP) in Figure 1.). The placement of the MAP at this waypoint intends to support aircraft operating at JFK that have either aircraft or avionics limitations requiring the flight crew to disengage the aircraft's autopilot and/or flight director when proceeding beyond the MAP and descending below the MDA. The aircraft with these limitations also often lack continuous LNAV should

the flight crew elect to begin a missed approach. However, while intending to provide a means for the aircraft to offer advisory lateral and vertical guidance in the visual segment, placing the MAP at this waypoint caused confusion for operators of aircraft with continuous LNAV, aircraft and avionics manufacturers and navigation database providers. This confusion led to FAA accepting alternative database coding locating the MAP at the RWY 13L threshold and an update offering new wording for the procedure missed approach instructions including new "ALTERNATE MISSED" instructions (reference Figure 1.).

Recommendation: FAA should standardize the location of the procedural MAP for all RNP APCH procedures with an extended visual segment and place the MAP at the threshold of the landing runway. This should occur through an update to FAA Order 8260.58( ) as part of a larger update to embrace procedure design criteria for an RNP APCH with an extended visual segment, including an extended visual segment requiring turns for runway alignment.

Rationale: Placing the MAP at the runway threshold will eliminate operational confusion and provide a better means to provide a navigation database supporting the procedure. Placing the MAP at the runway threshold is also consistent with the location of the MAP supporting RNP APCH procedures where the flight crew uses the LNAV-only MDA and minimums.

Issue: *Define the RNP APCH operation when a procedure includes an extended visual segment to include the actions a pilot takes when abandoning the procedure at any point from the IAF to the MAP.*

Discussion: One of the most confusing elements of the RNAV (GPS) Z RWY 13L procedure implementation has been the published MAP and flight crew concern about the actions they should take when operating in the extended visual segment and need to abandon the effort to transition to land (for any reason). The original missed approach instructions confused pilots, and repeatedly pilots questioned the FAA team on the actions the ATC expects should they abandon the procedure at or beyond the procedural MAP. While the addition of "ALTERNATE MISSED" instructions helped quell pilots' concerns, standards for conducting future RNP APCH with an extended visual segment should include guidance on expected pilot response when a need arises to abandon the procedure from any point on the procedure from the IAF inbound.

Recommendation: FAA should publish new guidance for pilots and controllers on the actions ATC expects pilots to take when abandoning an RNP APCH with extended visual segment from any point beyond the IAF up to the LTP. This new guidance should clarify that ATC expects the pilot to continue inbound on the procedural lateral path while reporting discontinuing the approach (e.g. "[call sign] going around") and requesting a new ATC clearance. The guidance should clarify that the pilot should not attempt to begin the published missed approach procedure until the aircraft arrives at the published MAP (i.e. arrives at the runway threshold, the standardized procedural MAP location). The guidance should also emphasize the need for the pilot to adhere to any procedural airspeed constraints the extended visual segment may require, as these airspeed constraints may protect the intended turns and desired ground track for the extended visual segment. The guidance should also recommend the pilot discontinue the aircraft's descent in a controlled manner when initiating a go-around during the procedure and avoid using the maximum climb performance unless there is an operational necessity to do so.

Rationale: The introduction of additional RNP APCH operations with an extended visual segment should only occur after the FAA provides a foundation for standardizing the implementation of these new procedures. Standardization can prevent future confusion and concern by pilots and controllers about flight crew actions when they need to abandon an RNP APCH with an extended visual segment at any point from the IAF to the runway threshold.

ISSUE: *Redefine the transition point at the end of an RNP APCH where the visual transition begins.*

Discussion: Traditionally, during the transition from the end of a non-precision approach pilots use a visual descent point (VDP) as a reference point along the procedural lateral path where they ensure compliance with

the requisite visual references to continue inbound in the visual segment to transition to land. However, while an RNP APCH with an extended visual segment is technically a non-precision approach, an RNP APCH with an extended visual segment may require a turn at the end of the straight-in instrument operation to begin the extended visual segment, and the application of a traditional VDP does not support the desired operation. That is, since a turn may begin at the end of the straight-in instrument operation and the procedure intends to enable continuous lateral and vertical guidance to the runway, the aircraft's RNP system will conduct turn anticipation approaching the waypoint defining the end of the instrument operation (reference LEISA in Figure 1.). This means the RNP system will treat the waypoint as a fly-by turn. Given the aircraft will not fly over this waypoint, defining this waypoint as a "VDP" is not appropriate and may create confusion.

Recommendation: The FAA should distinguish the RNP APCH with an extended visual segment by a new, specific identification of the waypoint defining the end of the instrument operation and beginning of the extended visual segment. The PARC Nav WG recommends this waypoint ID become the Visual Guidance Fix (VGF). RNP APCH procedures with an extended visual segment should chart the procedure with the acronym "**VGF**". The FAA should also provide guidance describing the VGF as the waypoint where the pilot must make a decision that adequate visual references permit continuing the approach by following the RNP system's advisory lateral and vertical guidance in the extended visual segment when the aircraft's begins the fly-by transition at the VGF.

Rationale: Use of a Visual Guidance Fix (VGF) as the means to identify the waypoint where the pilot must be prepared to make a decision that sufficient visual references are available to continue the operation and transition to landing by completing the extended visual segment will better support the intended operation. Defining the VGF can also make it clear that the pilot flying must make a decision to either continue or abandon the approach NLT the turn anticipation point for the VGF waypoint.

Issue: *The operational use of lead-in lights as one of the required visual references per CFR Parts 91.171 and 91.175 permitting a pilot to continue an approach operation and transition visually to landing is not clear to all pilots.*

Discussion: The *RNAV (GPS) Z RWY 13L* procedure relies on the pilot use of the lead-in lights to RWY 13L as a visual reference enabling continuing the approach operation beyond the Visual Guidance Fix (VGF), identified as LEISA in Figure 1. Yet, operator and pilot confusion exists with the use of lead-in lights as part of compliance with CFR Parts 91.171 and 91.175. While the current Airman's Information Manual (AIM) offers some clarity on use of lead-in lights in a manner consistent with their intended use at JFK RWY 13L, the guidance is not clear and consistent with in the AIM. Nor do any other guidance documents offer necessary clarity.

Recommendation: To better facilitate implementation of RNP APCH procedures with an extended visual segment, the FAA should expand and clarify the guidance on pilot use of lead-in lights as a visual aid and reference during transition to an extended visual segment enabling compliance with CFR Parts 91.171 and 91.175. The FAA should also standardize to the extent practical the impacts inoperative lead-in lights may have on the visibility requirements for each RNP APCH with an extended visual segment. FAA should then ensure procedure design standards for an RNP APCH with an extended visual segment define the increased visibility requirements for conduct of the approach with the lead-in lights inoperative, using the example provided by the *RNAV Z (GPS) RWY 13L*.

Rationale: Expanding available FAA guidance on operational guidance on pilot use of lead-in lights as part of the requisite visual references enabling compliance with CFR Part 91.171 and 91.175 can eliminate confusion during RNP APCH procedures with an extended visual segment where the transition to landing requires turns and lead-in lights support the turns and runway alignment.

Issue: *Aircraft navigation database providers lack ARINC 424 communication protocols and packing instructions for hybrid RNP APCH procedure designs like the RNAV (GPS) Z RWY 13L.*
Discussion: Implementation of the *RNAV (GPS) Z RWY 13L* at JFK faced significant challenges communicating the intent of the procedure to manufacturers and navigation database providers while enabling a means to provide an aircraft navigation database product consistent with the procedure definition and the desired flight crew operation.
Recommendation: FAA should publish guidance describing the intent of the RNP APCH with an extended visual segment to provide a means for the aircraft's RNP system to provide continuous lateral and vertical guidance from the IAF to the runway threshold. This guidance should include clarity that the procedural path definition in the aircraft's onboard navigation database may use the named fixes and recommended barometric altitudes to facilitate defining and packing a lateral and vertical path definition enabling the flight crew's use of advisory lateral and vertical guidance in the extended visual segment. FAA should also sponsor development of new ARINC 424 communications protocols enabling communication of the Visual Guidance Fix (VGF) and the entirety of the path definition, including the extended visual segment.
Rationale: These actions will eliminate confusion about the efficacy of providing named fixes and recommended barometric altitudes in the procedure package defining the procedure's extended visual segment. This guidance will also better enable provisions for packing the aircrafts' onboard navigation database with a path definition enabling the ability of the aircraft's RNP system to provide continuous lateral and vertical guidance from the IAF to the landing runway.

Issue: *TARGETS automation software does not exist to support development and publication of new RNP APCH procedures with an extended visual segment.*
Discussion: A single, experienced FAA procedure designer manually developed the procedure design and procedure package for JFK's *RNAV (GPS) Z RWY 13L* approach procedure. An unintended consequence of FAA reliance on TARGETS automation for PBN procedure and route designs is the absence of manual procedure design skills within the individuals using the TARGETS automation. The FAA simply no longer retains procedure designers with the skill set necessary to design RNP APCH procedures manually.
Recommendation: FAA should develop TARGETS automation software in parallel with the development of new criteria for FAA Order 8260.58( ) to support publication and implementation of RNP APCH procedure designs incorporating an extended visual segment.
Rationale: Typically, FAA begins efforts to develop TARGETS automation software after formal publication of updates and changes in procedure design criteria. Given recent demand for additional RNP APCH procedures with an extended visual segment, FAA should develop TARGETS automation software in concert with the development of the updates to Order 8260.58( ) as much as practical to avoid delays in implementing these new procedures in the NAS.

Issue: *FAA Order 8260.58( ) requires updates to standardize future RNP APCH procedure design incorporating an extended visual segment.*
Discussion: A single, experienced FAA procedure designer manually developed the procedure design and procedure package for JFK's *RNAV (GPS) Z RWY 13L* approach procedure. The design went through multiple changes and updates as the FAA team responsible for the implementation at JFK received feedback on the design. Likewise, the effort to implement this new, unique RNP APCH procedure stimulated FAA and operator interest in offering similar procedures with an extended visual segment as solutions for airports challenged by environmental and other operational constraints that prevent application of existing procedure design criteria
Recommendation: FAA should update Order 8260.58( ) through application of the lessons learned through design and implementation of the JFK *RNAV (GPS) Z RWY 13L*. The updates to the criteria should embrace the following characteristics and elements:

- To avoid unnecessary proliferation of these unique procedures, every RNP APCH with an extended visual segment shall require justification and acceptance from AFS-400 prior to beginning design. The justification should include rationale why another standard procedure design cannot support the intended landing runway.
- The design shall place the procedure's missed approach point (MAP) at the landing threshold point (LTP).
- The design's placement of the Visual Guidance Fix (VGF) shall ensure the fix location offers an opportunity for the flight crew to meet the requirements of CFR Parts 91.171 and 91.175. The placement shall support either the ability to visually identify the LTP or other suitable visual references (e.g. approach lighting systems or lead-in lights) to support the pilot's decision to continue the operation by visually transitioning to landing.
- The design shall publish a minimum descent altitude (MDA) matching the vertical path's altitude at the VGF.
- The extended visual segment turns shall assume the following design parameters:
    - Maximum airspeed beyond the VGF shall be a maximum of 210 knots, but no less than 185 knots. The design may rely on airspeed as low as 165 knots by exception with justification why the path cannot support a minimum airspeed of 185 knots.
    - The design shall rely on 95th percentile historic winds. Research on directional winds at the airport can waive this requirement as approved by AFS-400.
    - The extended visual segment may apply multiple turns in the visual segment beyond the VGF.
    - The design shall provide a final rollout point (FROP) ensuring the aircraft is wings level, aligned with the landing runway, no lower than 300 FT AGL. The criteria should also include a formula or table defining a means to achieve a FROP no lower than 300 FT AGL.
- The visual area from the VGF to the MAP shall apply the current visual area standards with the exception of the turn construction. To protect turns in the extended visual segment, the criteria shall apply a cross track tolerance of 0.60 NM (two times the RNP value the FAS uses).
- The design shall define the landing minima ensuring the minima supports the pilot's visual transition at the VGF. The visibility minima shall be no less than the distance from the VGF to the LTP or the distance representing the furthest point in the extended visual segment from the LTP, whichever is larger.
- The design can assign light credit for lead-in lights supporting the extended visual segment. However, the design shall not apply light credit for an approach lighting system unless the VGF and lateral path beyond the VGF are in the standard coverage area for the approach light system.

Summary: The PARC Nav WG recommends the SG adopt the criteria and forward the recommendations to the FAA for consideration and implementation. Adopting the criteria will standardize implementation of future RNP APCH operations requiring application of an extended visual segment.