

July 31, 2008

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

Dear Nick:

The PARC RNP SAAAR Update Action Team (AT) has reviewed, analyzed, and reached recommended dispositions for the multiple issues related to AC 90-101 and 8260.52 submitted by PARC members. In the interest of supporting the FAA planned schedule for publication of updates to Advisory Circular (AC) 90-101 *Approval Guidance for RNP Procedures with SAAAR* and Order 8260.52 *United States Standard for Required Navigation Performance (RNP) Approach Procedures with Special Aircraft and Aircrew Authorization Required (SAAAR)*, the PARC directed the team to finalize agreed-upon recommendations and also identify remaining issues upon which the FAA and industry had not reached consensus and/or require further analysis.

The details of the AT output are contained in a set of files linked by a single summary spreadsheet which lists all the issues, along with a deliberation history and supporting notes for each. As noted, there is technical supporting information for the conclusions contained in various briefings, documents, and spreadsheets. These are all linked to the issues by the primary issue identifier contained in the summary spreadsheet. The spreadsheet may be found on the PARC website.

The most fundamental recommended and accepted change to the 8260.52 follows.

- 1) Revise final approach segment (FAS) to missed approach segment (MAS) obstacle clearance surface (OCS) design criteria to match ICAO RNP (AR) criteria.

The following changes to Order 8260.52 are desired by some AT members but require further analysis and/or discussion.

- 1) Removal of the extended straight segments around DA, to be replaced by training for those aircraft / crews where the flight control system reverts to track hold on go-around,
- 2) Removal of the added bank angle margin for design construction of the minimum radius of RF turns based on a sample analysis of winds compared to the criteria wind table and an analysis of control margins,

- 3) Development of a procedure design method to determine if/whether inhibit of DME reversion must be performed for a given procedure (replacing the blanket inhibit required now in the AC),

The fundamental recommended and accepted change to AC 90-101 follows.

- 1) Rewrite Appendix 5 for crew and dispatcher training to remove redundancies, clarify processes and divide the material into more logical sections, with the proposed revisions supplied in total by the action team,

The following change to AC 90-101 is still desired by some AT members but requires further analysis and/or discussion.

- 1) Recommendation to add material to pilot training to mitigate lack of extended straight segments around DA on aircraft without TOGA to LNAV (supporting recommendation #1 above for 8260.52).

There are many other substantive changes, but most were considerably less controversial and hence are not summarized in this letter.

There will need to be continued work on some issues tabled for this first update, as well as added work to resolve issues that arose too late in the process to be solved in time for the FAA desired update schedule. These additional issues are summarized below:

- 1) The database validation process detailed in the Appendix 3 material of the AC appears to place too high a burden on operators, as noted by NBAA. The PARC has asked us to try to improve the validation process in a way that could resolve this issue but still maintain safety standards necessary for the subject operations.
- 2) NBAA also brought up instances of procedures not being designed to the best possible minima per the philosophy envisioned in the 8260.52 criteria. We have been asked to help devise and publish a design methodology flow chart and rules for making choices about using the tools (higher gradient, telescope, etc.).
- 3) Procedure design criteria for course reversal holding patterns as a means to join an RNP SAAAR procedure.
- 4) Maximum descent rates and high temperature limits for RNP SAAAR. This area of the criteria is substantially limiting at high altitude airports and involves the trade-off between realized descent rates, NTSB recommended maximum descent rates and temperature.
- 5) Applicability of glideslope qualification surface (GQS) to RNP SAAAR and limiting availability of SAAAR procedures due to transitory obstacles.
- 6) New material related to the conditions under which applicants must evaluate flight technical error (FTE) to comply with the AC.
- 7) Operator qualification requirements regarding numbers of approaches and their complexity to demonstrate SAAAR capability. The action team combined information from the body of the AC and other sections into new appendices 6 and 7 to address the issues (Issues 31, 32 & 62).

As you may have determined by this point, this effort was complex and difficult in balancing the technical, operational and practical concerns of all members of the Action Team. I have to give much credit to Mike Cramer's leadership and the spirit of collaboration of the group in reaching a reasonable set of actions and compromises for this set of changes. Lastly, work will continue on other relevant issues as we continue to understand ways to improve the means and criteria for RNP implementation.

Sincerely,

A handwritten signature in blue ink, appearing to read "Dave Nakamura". The signature is fluid and cursive, with a long horizontal stroke at the end.

Dave Nakamura
Chairman, PARC

Cc: J. McGraw
M. Steinbicker
M. Cramer
PARC



U.S. Department
of Transportation
**Federal Aviation
Administration**

Advisory Circular

**Subject: APPROVAL GUIDANCE FOR
RNP PROCEDURES WITH SAAAR**

**Date: 12/15/05
Initiated by: AFS-400**

AC No: 90-101

APPENDIX 5. Training & qualification

1. INTRODUCTION. The operator must provide training as outlined here for pilots and dispatchers in the flight planning and operation of RNP SAAAR approach procedures. This training must provide sufficient detail on the aircraft's navigation and flight control systems to enable pilots to identify issues affecting the RNP capability of the aircraft and take appropriate action. Required training must include both knowledge and skill assessments of pilot and dispatcher duties. An individual must have completed the appropriate training before engaging in RNP SAAAR operations. A thorough understanding of the operational procedures and best practices is critical to the safe operation of aircraft during RNP SAAAR operations. A combination of instructional media may be used to satisfy these training requirements.

a. Pilot Training

(1) Each operator is responsible for the training of pilots for the specific RNP SAAAR operations conducted by the operator. Operators must include RNP SAAAR regulatory requirements and procedures in their flight operations and training manuals (as applicable). This material must cover pertinent aspects of the operator's RNP SAAAR operations including the applicable FAA authorization (Operations Specifications, Management Specifications or Letter of Authorization).

(2) Flight training must include training and, where appropriate, checking modules representative of the type of RNP SAAAR operations the operator will conduct. Operators that use Advanced Qualification Programs (AQP) may conduct evaluations in Line Oriented Flight Training (LOFT) scenarios, Selected Event Training (SET) scenarios or a combination of both. The operator may conduct required flight training modules in Flight Training Devices, Aircraft Simulators, and other enhanced training devices as long as these training mediums accurately replicate the operator's equipment and RNP SAAAR approach operations.

b. Part 121, 125, 129, 91K, and 135 Pilot Qualification Training.

(1) Operators must address initial RNP SAAAR training and qualifications during initial, transition, upgrade, recurrent, differences, or stand-alone training and qualification programs in a respective qualification category. The qualification standards assess each pilot's ability to properly understand and use RNP SAAAR approach procedures (RNP SAAAR Initial Evaluation). The operator must also develop recurrent qualification standards to ensure their

pilots maintain appropriate RNP SAAAR knowledge and skills (RNP SAAAR Recurrent Qualification).

(2) Operators may address RNP SAAAR operation topics separately or integrate them with other curriculum elements. For example, an RNP SAAAR pilot qualification may key on a specific aircraft during transition, upgrade, or differences courses. General training may also address RNP SAAAR qualification (e.g., during recurrent training or checking events such as recurrent proficiency check/proficiency training (PC/PT), line oriented evaluation (LOE) or special purpose operational training (SPOT)).

(3) **Credit for Use of an operator's existing approved RNP training program.** Operators intending to receive credit for RNP training, when their proposed program relies on previous training (e.g., Special RNP Approach Procedures) must receive specific authorization from their Principal Operations Inspector (POI) or equivalent regulatory authority. In addition to the current RNP training program the operator will need to provide differences training between their existing RNP training program and the RNP SAAAR training requirements.

c. Flight Dispatcher Training. Dispatchers must have completed the appropriate training course before engaging in RNP SAAAR operations. This material must cover all pertinent aspects of the operator's RNP SAAAR operations and must include:

- (1) Understanding of regulatory requirements and procedures for the different types of RNP SAAAR procedures that their operator flies including the applicable FAA authorization (Ops Specs, MSpecs or LOA).
- (2) The ability to find, use and properly interpret informational sources to ensure GPS availability and accuracy for RNP procedures at the destination, alternate and en route alternates, for the expected time of use. Understanding of aircraft equipment capabilities and the effects of MEL requirements, aircraft performance, and navigation signal availability on RNP SAAAR capabilities.

2. PILOT TRAINING PROGRAMS. RNP SAAAR training must address the material listed in paragraphs 3, 4 & 5. For recurrent programs, the curriculum need only address new, revised, or emphasized items.

3. THEORY / KNOWLEDGE / DEFINITIONS. RNP SAAAR ground training must cover RNP SAAAR systems, operation, classifications, and limitations. Training must include general knowledge and operational application of RNP SAAAR instrument approach procedures.

This training must address the following specific elements:

- a) Definitions of RNAV (RNP), RNAV (GPS), RNP, RNP SAAAR, , containment ,and the differences between RNAV and RNP.

- b) Knowledge of RNP charting. Pilots must be able to identify applicable minimums, temperature limitations, non-standard climb gradients, RF segments, speed restrictions and missed approach RNP requirements.
- c) The ability to determine the availability of the desired RNP value(s) at the destination, alternate and en route alternates, for the expected time of use.
- d) Understanding of the different components that contribute to Total System Error and their characteristics (e.g., effect of temperature on baro-VNAV, drift characteristics when using IRU with no radio updating).
- e) Aircraft Performance. Planned flight performance of the aircraft must be compared to the required flight performance of the RNP procedure to be flown. This includes speed limitations and/or any non-standard climb gradients required.
- f) Understanding alerts that may occur from the loading and use of improper RNP values for a desired segment of an RNP SAAAR procedure.
- g) Understanding any performance and/or equipment requirements that may exist to achieve a specified RNP, e.g. requirement to use autopilot or autothrottles below a specified RNP. When and how to terminate RNP navigation and transfer to traditional navigation (e.g., due to loss of RNP and/or required equipment). Knowledge of any operational limitations if ANP degrades or RNP is lost prior to or during an approach (this should include pilot procedures outside the FAF versus inside the FAF).
- h) How bank angle restrictions, wind and ground speed affect turning flight (including complying with any charted limitations) impacting the ability to remain on the course centerline and safely complete an RNP SAAAR procedure.

4. PILOT PROCEDURES. These should encompass normal and abnormal operating procedures, responses to equipment annunciations, failures, alerts, and any limitations on RNP operation. Training must also address contingency procedures for loss or degradation of RNP capability. The flight operations manuals approved for use (e.g., Flight Operations Manual (FOM) or Pilot Operating Handbook (POH)) should contain this information.

This training must address the following specific elements:

- a) Review of modifications to company documents for RNP SAAAR operations, such as Company Flight Manual, Flight Operations Manual, etc. Knowledge of which checklist items need to be accomplished prior to and during RNP SAAAR approach procedures.
- b) Briefings for all RNP SAAAR procedures including RNP Approach and Missed Approach profiles and normal procedures. Knowledge of any additional briefings or review cards that may be required or available prior to commencing an RNP SAAAR procedure.

- c) **Speed Control.** Pilots must comply with charted airspeed limitations. In the absence of charted airspeed limitations, the maximum airspeeds shown in Appendix 4 Table 1 apply for all turns. These speed restrictions cannot be waived by ATC.
- d) **Approach Monitoring.** Pilots must understand and ensure compliance with the parameters associated with an RNP SAAAR approach, such as: ANP vs. RNP, cross track error and requirements to stay on vertical path or available VGSI to the runway. Pilots must also understand factors that affect aircraft ability to maintain lateral and vertical path and how to correct deviations from path.
- e) **RNP SAAAR Equipment Components, Controls and Displays.** Training must include discussion of RNP, symbology, operation, controls, displays and equipment or software differences between aircraft they are qualified to fly.
- f) **Applicable pilot responses to annunciations, cautions, alerts and limitations.**
- g) **Programming and operating the FMC, autopilot, auto throttle/auto thrust, Radar, GPS, INS, EFIS (including moving maps), and TAWS in support of RNP SAAAR procedures.**
- h) **Assuring the FMC database and RNP SAAAR approach procedures are current and contain required navigational data.**
- i) **How to select RNP values appropriate for different phases of flight and RNP SAAAR instrument procedures (if required).**
- j) **Temperature Compensation.** For systems which do not provide temperature compensation (or the feature is not used), the temperature limits on the chart must be observed
- k) **MEL Operating Provisions.** Pilots must understand MEL requirements supporting RNP SAAAR operations.
- l) **Procedures for verifying that current local altimeter is set before beginning an RNP SAAAR procedure, including any operational limitations associated with the source(s) for the altimeter setting and the latency of checking and setting the altimeters approaching the FAF.**
- m) **The events that trigger a missed approach including deviations beyond limits from path and any issues that may apply during the missed approach e.g., lateral steering mode following initiation during a turn or shortly after rollout from a turn, timely re-engagement of LNAV, and the critical importance of the pilot maintaining track to within plus/minus 1xRNP between the time of initiation and the time of reengaging LNAV.**

- n) Impact of loss of GPS during a procedure and understanding the performance issues and limitations associated with reversion to radio updating. How to control the navigation updating modes related to RNP operations.
- o) Air Traffic Control (ATC) procedures unique to RNP SAAAR operations. Pilots should understand the implications of interrupted approaches in the radar environment, e.g. being vectored off an approach and then vectored back on the approach. Consideration should also be given to the non-radar environment, where pilots may be required to hold on the approach as published and then resume the approach. Pilots should understand how to resume both lateral and vertical path. The flight crews must receive instruction on the need to advise ATC immediately when the performance of the aircraft will no longer support an RNP operation.

5. ABNORMAL / FAILURES. This training must address the following specific elements:

- a) Pilot contingency procedures for a loss of RNP capability during an approach. Training should emphasize contingency actions that achieve separation from terrain and obstacles. The operator should tailor these contingency procedures to the RNP SAAAR procedures they will fly.
- b) Pilots must also know what navigation sensors form the basis for their RNP operations, and they must be able to assess the impact of failure of any avionics or a known loss of external system(s).
- c) Knowledge of Malfunctions. Pilots shall be trained to recognize, evaluate and take appropriate action for any system or instrument failures that affect RNP operations prior to or during an RNP SAAAR approach. Examples of failures that could degrade the RNP capability of the aircraft:
 - (1) Autopilot failure
 - (2) Autothrottle / Autothrust failure
 - (3) GPS failure
 - (4) Right or Left FMC failure
 - (5) Dual FMC failure
 - (6) TAWS warning
 - (7) Engine Failure

6. SIMULATOR / FLIGHT TRAINING. In addition to ground training, pilots must receive appropriate training in the operation of RNP SAAAR approach procedures. This training must

be in concert with OEM documentation if it exists. Operational training must include RNP SAAAR procedures; flight deck equipment and display setup for RNP SAAAR procedures; recognition of the aural advisories, alerts and other annunciations that impact an RNP SAAAR approach procedure; and the timely and correct responses to loss of RNP capability in a variety of scenarios embracing the breadth of the RNP SAAAR procedures the operator plans to use.

Such training may also use approved flight training devices or simulators.

- a. **Selection of Approaches for Training.** Selection of approaches for use in training shall reflect a variety of approaches to allow pilots to become familiar with the set up of approaches with different requirements, minimums, lateral and vertical paths. Approaches should be selected from the approaches that pilots will actually fly. For example, if procedures containing RF (Radius to Fix) legs are to be flown, then approaches with those leg types shall be used.

Use of Site Specific Simulator Visual. It is also highly recommended that any simulator visual databases used be site specific (as opposed to a generic visual) when performing RNP approach training. Credit can be given during Initial Qualification for training with site specific simulator visuals.

- b. **Flight Training Brief, Debrief or Simulator Session.** The following items shall be addressed to ensure understanding:

- (1) RNP SAAAR Approach Setup

- a) FMC / CDU (Control Display Unit) setup
- b) FMC / CDU failure conditions and recognition
- c) Lateral / Vertical Guidance Information
- d) Maximum Deviations & how they are represented
- e) Use of Map Displays
- f) Required Equipment and mitigations for failures
- g) FAA Approved Requirements
- h) Any Emergency issues
- i) Capability to fly RNP after an engine failure
- j) Single engine, sole source power
- k) RNP Engine Failure Turn Procedure Requirements and construction if necessary
- l) Ground Proximity Warning / Escape

- (2) Unplanned Issues

- a) Loss of VNAV Path and requirements to regain path
- b) Radar vector off LNAV Path and restrictions to regaining path (No Direct to RF legs on Boeing 737's, etc.)
- c) Consideration of the effects of an engine failure and the critical importance of maintaining aircraft control so as to remain within the RNP lateral and vertical path

(3) Approach Briefing

- a) FMC / Chart Crosscheck
- b) Verify Waypoint Names & Sequence, Speed Restrictions, Crossing Altitudes and Glide Path
- c) Glide path and Lateral path issues (configuration, landing weight, performance, winds, etc.)
- d) Missed Approach Requirements

(4) Missed Approach Briefing

- a) RNP Engine Failure Turn Procedure
- b) Immediate turn scenarios – Turn Radius (Bank angle vs. Speed)
- c) Go Around Considerations: Track Hold Issues, lateral steering mode during initiation in a turn or shortly after rollout from a turn, timely re-engagement of LNAV, and the critical importance of the pilot maintaining track to within plus/minus 1xRNP between the time of initiation and the time of reengaging LNAV.
- d) Missed Approach requiring RNP less than 1.0

c. Flight training must include:

RNP SAAAR INITIAL Training. With no prior RNP approach experience, each pilot must complete at least four RNP approach procedures – two as pilot flying and two as pilot monitoring. These four RNP approach procedures shall employ the unique SAAAR characteristics of the operator's approved procedures (i.e., RF legs, RNP missed). Two approaches must be flown to the DA(H) and two approaches must result in an RNP missed approach procedure. Two of the above approaches will include interrupted approaches resulting in one approach with vectors to resume the approach and one approach resulting in a hold at an initial approach fix or transition fix.

Pilots with prior experience in RNP or RNAV approach operations may receive credit for all or part of this requirement provided the current operator's procedures are similar and require no new pilot skills that must be trained in a training device or simulator.

RNP SAAAR RECURRENT Training. Each pilot must complete at least two RNP approach procedures – one as pilot flying and one as pilot monitoring. These two RNP approach procedures shall employ the unique SAAAR characteristics of the operator's approved procedures (i.e., RF legs, RNP missed). One approach must be flown to the DA(H) and one approach must result in an RNP missed approach procedure. One of the above approaches will include either an interrupted approach resulting in vectors to resume the approach or a hold at an initial approach fix or transition fix.

An RNP procedure may be substituted for any required precision or non-precision approach.



U.S. Department
of Transportation
**Federal Aviation
Administration**

Advisory Circular

**Subject: APPROVAL GUIDANCE FOR
RNP PROCEDURES WITH SAAAR**

**Date: 12/15/05
Initiated by: AFS-400**

AC No: 90-101

APPENDIX 6: OPERATOR QUALIFICATION

1. NEW RNP SAAAR OPERATOR INTERIM AUTHORIZATION

An operator will be authorized to conduct RNP SAAAR approaches under an Interim authorization. Table 1 contains the minimum time period and minimum number of approaches an operator must complete during the interim authorization, which will be removed after completion of the applicable time period and number of approaches and upon FAA review of the reports from the RNP SAAAR monitoring program.

Note 1: RNP SAAAR operators with experience of equivalent RNP approaches may receive credit toward the interim authorization requirements.

Note 2: Experienced RNP SAAAR operators operating new or upgraded aircraft types/systems, derivative types, or different aircraft types with identical crew interface and procedures, may use reduced interim authorization periods as determined by the CHDO/FSDO.

Note 3: In unique situations where the completion of the required number of successful approaches could take an unreasonably long period of time due to factors such as a small number of aircraft in the fleet, small number of crews, limited opportunity to use runways having appropriate procedures, , a reduction in the required number of approaches may be considered on a case-by-case basis.

Type of RNP SAAAR Approach	Previous RNAV or RNP Experience			Weather required
	None	RNAV	RNP	
SIMPLE	90 days ¹ 100 approaches	60 days ² 10 approaches	None	IFR to published minimums
COMPLEX	90 days 100 approaches ³	60 days 50 approaches	25 approaches	Visual conditions ⁴

Table 1: Interim Authorization Period

- a. **Types of Approaches Considered in this Document.** RNP SAAAR approaches are broken down as follows for training and operational purposes:

SIMPLE	<p>No RF legs, generally a straight in or overlay type of approach. Terrain is generally not a consideration.</p> <p>(Example: OKC Oklahoma City, Oklahoma)</p>
COMPLEX	<p>Single or multiple RF legs, abnormal vertical angles, noted on the Instrument Approach Procedure as “Dual RNP Systems required”, lateral tracks that do not line up with the runway, or designated as requiring a special airport qualification.</p> <p>(An abnormal vertical angle is defined as < 2.5° for any category aircraft or > 3.1° CAT D > 3.6° CAT C > 4.2° CAT B > 5.7° CAT A)</p> <p>(Example: Washington-Reagan National (DCA), Juneau (JNU), Alaska)</p>

¹ 90 days provides a suitable validation period for Operator’s entire RNP operation.

² 60 days assures a minimum of one navigation database rollover and validation of nav database checking process.

³ Complex approaches may be credited toward the Simple authorization on a 1:1 basis.

⁴ Visual conditions are here defined as a ceiling of not less than 1000’ above the IAF and not less than 3 miles visibility with ground contact in daytime conditions. Night operations authorized provided sufficient illumination exists to avoid natural and man-made obstacles. Night “black-hole” approaches over unlighted terrain are not authorized.

TABLE 2 – Types of Approaches Considered in this Document

- b. Previous experience levels** are defined as follows:
 - None:** Operator has no authorization/experience with RNAV or RNP operations.
 - RNAV:** Operator is authorized to conduct RNAV approach operations in the same aircraft type.
 - RNP:** Operator has RNP approach experience in a different airplane, and is simply adding a new airplane to their original authorization.

- c.** Qualification for Complex approaches will also result in qualification for Simple approaches. (e.g. Completion of 100 Complex approaches for an operator with no previous experience would satisfy the requirements for both Simple and Complex approach types.)

- d.** If an airplane is new to RNP operations (no other operator has received final authorization in that airplane model and type), then the requirements of Table 1 are doubled.

- e.** If an operator already has equivalent RNP experience then all above Interim Authorization requirements shall be waived.

2. FINAL AUTHORIZATION

The DHDO/FSDO will issue OpSpecs, Mspecs, or LOA authorizing use of lowest applicable minima after operator satisfactorily completes the appropriate interim authorization period and number of approaches as outlined in Table 1.