

AERONAUTICAL CHARTING MEETING
Charting Group
Meeting 23-02 – October 24-26, 2023

RECOMMENDATION DOCUMENT

FAA Control #23-02-383

Subject: Identification of Radius to Fix Legs on Instrument Flight Procedures

Background/Discussion:

Pilots are required to ensure that the instrument flight procedure that is coded in the navigation database matches the published procedure, especially RNAV, RNP, RNP APCH, A-RNP, and RNP AR APCH terminal procedures (ref. AC 90-101A, 90-100A, 90-105A, 90-107). This includes verification of leg type, track, distance between waypoints.

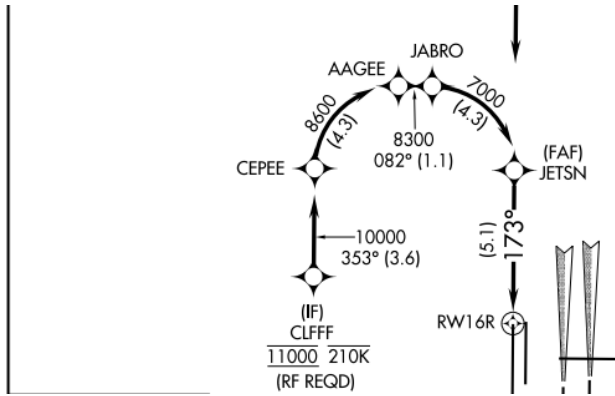
A terminal procedure will identify when radius-to-fix (RF) legs are used in a segment of the procedure (ODP, SID, STAR, or an instrument approach's initial, intermediate, final, or missed approach segment) by the annotation "RF" in the PBN requirements box:

DME required. RNP APCH - GPS. From HOBOA or KLOCK: RF

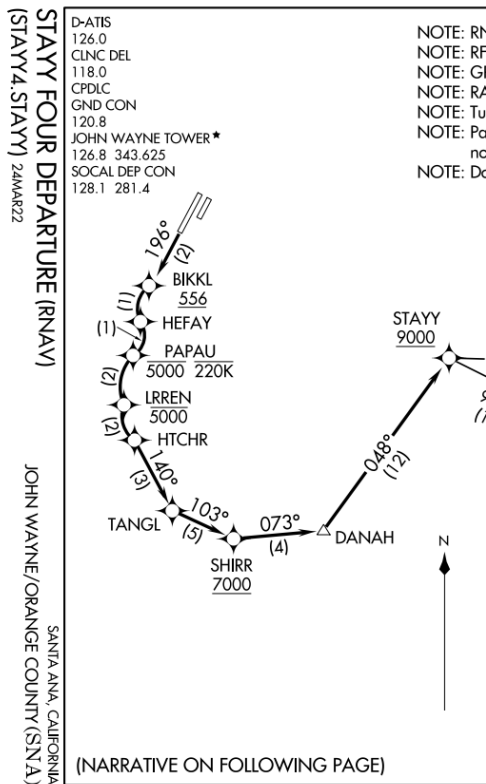
Prior to the implementation of the PBN requirements box, an "RF REQD" note was published on the Planview:

(IF)
CLFF
11000 210K
(RF REQD)

However, these notes only inform the pilot that RF leg capability is required to fly the procedure or a segment of that procedure. It does not tell the pilot which legs on that procedure are coded as RF legs, as opposed to track-to-fix (TF) legs. In many cases, it is clear from the procedure's Planview that a leg is an RF leg, for example, the segment shown below from the RNAV (RNP) 16R at Denver (DEN):



However, small turn radius combined with short mileage segments may make it difficult to discern if the leg is a RF leg or a TF leg, as this example of the STAYY Four at Santa Anna (SNA) shows:



Since an RF leg does not have constant track, no track angle is shown with an RF leg. Therefore, it could be reasonably assumed that a segment shown on an approach, SID/ODP, or STAR is an RF leg if no track angle is shown. However, the current IAC spec allows for the omission of the track angle on short, TF legs when the track angle does not change. In this case, the repeated track angle is not shown:

Positioning, type size and style shall be as specified for terminal routes. If the terminal route occurs where the procedure track can't be broken, i.e., after the start of the procedure profile, the route information will be stacked with a 9 point type course value when space allows, or leadered where it does not. Leadered information may contain only altitude, and distance if the course value would repeat the final approach course shown. All leadered information will be stacked together in 7 point type.

Figure 3.13 Procedure Track Type



Therefore, the omission of a track angle does not in and of itself indicate that the leg in question is an RF leg.

Recommendations:

RF legs will be increasingly used in the future on RNP SIDs, RNP STARs, RNP APCH procedures, and procedures where the Advanced RNP (A-RNP) NavSpec is applied. As result, there needs to be a positive way for pilots to confirm that the depicted leg is an RF leg verses a TF leg.

NBAA recommends the IAC spec be amended to include a track angle with all TF legs, and further state that the absence of track angle on a procedure segment is indicative of an arc segment, either an RF leg, DME arc segment, etc. Since DME arc segments are not used on RNP procedure, it would be abundantly clear that an arc segment on this procedures is an RF leg.

Once the IAC Spec is amended, the Terminal Procedures Publication (TPP) legend can also be amended to annotate that the lack of a track angle published with a procedure segment on an approach, SID/ODP, or STAR is indicative of an arc segment, either a DME arc for conventional procedures or an RF leg with RNP procedures.

Finally, the AIM/AIP, Instrument Flying Handbook, and Instrument Procedures Handbook can be amended to call attention to means to identify an RF leg, and that these legs may be identified by the omission of a track angle on instrument flight procedures.

Benefits:

- 1) Would adoption of the recommendation prevent or reduce the likelihood of occurrence of accidents or incidents?

The AC requirements to ensure that the navigation database matches the published procedure is necessary to ensure procedure conformance. This confirmation is required to ensure that procedure is flown as intended.

- 2) Would adoption of the recommendation mitigate a known or potential safety hazard?

If a coding error occurs, the pilot cross check of the published procedure against the navigation database is mitigation to the safety hazard of not flying the procedure as designed. This recommendation facilitates this mitigation.

- 3) Would adoption of the recommendation resolve a known or potential issue creating operator or Air Traffic Control system errors?

None.

- 4) Would adoption of the recommendation increase operational or system efficiencies?

No

- 5) Would any additional benefits be recognized by adoption of the recommendation?

Will permit pilots to meet their obligations under the applicable advisory circulars for RNP procedures with RF legs.

Comments:

The recommendation affects:

1. The Interagency Cartographic (IAC) Specifications
2. Terminal Procedures Publication – Legend
3. Aeronautical Information Manual and Aeronautical Information Publication
4. Instrument Flying Handbook and Instrument Procedures Handbook

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MEETING 23-02

Rich Boll, NBAA, presented a new recommendation for a charted indication of radius-to-fix (RF) legs on terminal procedures. He said he talked with a group of industry tech pilots, and they agreed that on some of the procedure charts it is difficult to tell which segments are RF legs and which are track-to-fix (TF) legs. Pilots are required to ensure that the instrument flight procedure that is coded in the navigation database matches the published procedure. This includes verification of leg type, track, and distance between waypoints. The PBN box equipment requirements will give indications of when you are flying a leg that contains an RF segment, however the pilot may not be able to tell which segment is RF.

NBAA recommends that the Interagency Air Committee (IAC) specification be amended to state that a track angle will always be shown on all TF legs and that the absence of track angles on a procedure segment is indicative of an arc segment, either an RF leg or a DME arc segment. Since DME arc segments are not used on RNP procedures, it would be clear that an arc segment on an RNP is an RF leg. He said the Terminal Procedures Publication (TPP) legend can also be updated to state that the lack of a track angle published with a procedure segment on an approach, departure, or STAR is indicative of an arc segment. Finally, Rich recommended that the Aeronautical Information Manual, Aeronautical Information Publication, Instrument Flying Handbook, and Instrument Procedures Handbook should be updated to explain this distinction.

Jeff Rawdon, FAA/AFS-420, clarified that this recommended change is only for the planview, not for the profile view.

Krystle Kime, FAA/AJV-A222, said Terminal Charting will have to do some research, but she would be surprised if there are any charts that have both RF and TF legs that don't already have a bearing on every TF route. She also pointed out that on Instrument Approach Procedure RNP procedures, TF and RF legs are depicted differently within the profile view of the chart. TF portions are indicated with a track value above the line and RF portions do not contain a track value. For additional clarity, the TPP legend was recently updated to provide an example of an RNP profile with annotated TF and RF segments. Rich said he sees Krystle's point, but he needs to confirm this point is acceptable with pilots.

Doug Willey, ALPA, said he has also experienced issues with identifying the legs. He said it is made even more confusing because there is inconsistent placement of the note "RF REQD" on the charts. Joel Dickinson, FAA/AFS-410, responded that Flight Standards anticipated this issue and hoped to fix it by moving the note to the PBN box. As the charts are updated, the "RF REQD" notes will all be moved to the PBN box. Another safeguard is that if a pilot looks at this procedure and tries to select the RF leg in the Flight Management System (FMS) on an aircraft that is not capable of RF, it will not be included as an option. Diane Adams-Maturo, FAA/AFS-420, said putting the "RF REQD" note in the PBN box has been documented in the FAA Orders 8260.19 and 8260.46 and said it will take a while for all charts to meet the criteria, but they should all have PBN boxes eventually.

Bill Tuccio, Garmin, said he doesn't understand the issue. Pilots must comply with ATC clearance, which is based on the chart. If you can't look at the chart and tell whether it is a straight line or a turned line, you still must comply with ATC. Bill thinks the way things are done currently is adequate. Rich said the problem is there is still a requirement to validate the FMS against the chart.

Rich asked Doug whether the absence of a track angle makes it explicit that it is not a straight line but is curved. Doug can live with the solution in the long run, but thinks it needs to be emphasized through pilot guidance. Rich said he would be satisfied with a TPP legend change to explain that a track angle will always be shown on TF legs and that the absence of track angle on a procedure segment is indicative of an arc segment, either an RF leg or a DME arc.

Jennifer Hendi, FAA/AJV-A250, said additional internal discussion is needed and she will take this issue to the ACM Recommendation Review Group. Pending that outcome, Krystle and Jennifer will talk about updating the IAC specifications and will also discuss adding something to the planview legend.

STATUS: OPEN

ACTION: Jennifer Hendi, FAA/AJV-A250, will take this issue to the ACM Recommendation Review Group for further discussion.

ACTION: Krystle Kime, FAA/AJV-A222, and Jennifer Hendi, FAA/AJV-A250, will work any necessary Interagency Air Committee (IAC) specification changes.