AERONAUTICAL CHARTING FORUM
Instrument Procedures Group
April 29, 2014

HISTORY RECORD

FAA Control # 14-01-315

Subject: 90 Degree Airway-to-RNAV-IAP Course Change Limitation; Arrival Holds

Background/Discussion: Historically, TERPs has permitted course changes as large as 120 degrees from airways onto feeder routes or initial approach segments of SIAPs. This limit remains unchanged for SIAPs other than RNAV SIAPs with the recent TERPS change 26. However, FAA Order 8260.58 limits the course change for RNAV SIAPs from airways to feeder routes or initial segments to 90 degrees. NBAA has been unable to determine the rationale supporting the reduction in the turn angle limit on RNAV SIAPs. Since the AIM (ref: Sec.1-2-3) and AC 90-108 permit using RNAV systems to navigate the feeder segment of conventional SIAP, NBAA assumes that any issues concerning turn angle limitations would be reflected by a similar limitation being included in the recent change 26 to the TERPS. Given that RNAV systems are frequently used to navigate these segments, we believe than any issues arising from the use of the 120 degree turn angle limit would be well known and reported to industry.

The RNAV SIAP feeder limitation has resulted in arrival note restrictions where none previously existed. In addition, arrival holding patterns are being created by Aero Nav Services on an ad hoc basis to provide some relief from this restriction. Arrival holding patterns for this purpose become de facto course reversal holding patterns, but such use of an arrival holding pattern requires a clearance from ATC in addition to an approach clearance. This typical use of arrival holding patterns as an ATC traffic management tool is not generally understood by pilots. The expanded use of the arrival holding pattern is tool supporting SIAP segment entry is less understood nor is it adequately explained in FAA guidance for pilots or controllers.

A recently implemented example is on the Dillon, Montana (KDLN) RNAV (GPS) Runway 17 SIAP, for an arrival on Victor Airway 343 from the south (illustrated in the attachment)*. Note that the course change from V-343 northbound onto the JOXIT feeder route is 101 degrees and prohibited by the JOXIT note. Instead, the JOXIT arrival holding pattern shown on the approach chart is an implicit course reversal to permit entry onto the JOXIT feeder route arriving on V-343 from the south.

NBAA conducted a simulation of the JOXIT configuration using a Garmin G-3000 trainer. We did this at 265 KIAS at 15,000 in an ISA atmosphere with no winds aloft. As a test, we intentionally “violated” the procedure note limitation by arriving at JOXIT from the south on V-343 and turned on to the feeder segment. The avionics simulation made a very good flyby of JOXIT. We also did this JOXIT flyby at a 120 degree angle and at 310 KIAS. Again, the result was a very good flyby at JOXIT. However, when we arrived at JOXIT from the south on V-343 and entered the charted arrival hold at 15,000, 265 KIAS (descending to 14,000 in the hold) the avionics could not correctly sequence the turn from the hold to the JOXIT feeder route. The simulation did not attempt to start the turn to the west until having overflown JOXIT, thus treating it like a “fly over” WP.

Further discussions with business aviation avionics OEMs reveal that holding pattern waypoints are often treated as “fly over” waypoints when an “EXIT HOLD” command is executed. Therefore, most RNAV system exiting the arrival hold will over-fly the waypoint, then turn to rejoin the feeder segment. While NBAA has no concerns with this methodology, we fail to see where an advantage is gained by using arrival holds to mitigate the reduction of feeder-to-airway turn angle limits. We believe that air traffic and pilots are better served if RNAV turn angle limitations remain unchanged from the current 120 degree limit for both conventional and RNAV SIAPs unless compelling evidence is furnished by FAA demonstrating that the expanded limit results in RNAV aircraft exiting protected airspace during the leg change.

Recommendations: AFS-420 should commission a simulation study of both the 90 degree and 120 degree turn limits when RNAV equipment is used to navigate an airway-to-feeder route segment. The study should also evaluate the performance of RNAV systems when an arrival hold is used in lieu of a larger turn angle limit, and in particular the RNAV system performance leaving the holding fix (which are often treated as “fly-by” waypoint when exiting the hold) and joining the feeder route. NBAA believes such simulations will validate that a 120 degree course change is far preferable to an arrival hold “course reversal.”

If the FAA determines that it must retain the limit on airway to feeder (or initial segment) RNAV SIAPs to 90 degrees because of RNAV system performance, then consideration should be given to placing the same limit non-RNAV SIAPs since today RNAV systems are largely used to navigate these routes in lieu of the ground-based NAVAID. In addition, definitive, comprehensive policy needs to be provided to AeroNav Services that gives objective guidance about when arrival holding patterns must be included in original or revised RNAV and ground-based SIAPs. Consideration should also be given to establishing speed limitations on SIAPs that will allow the use of RNAV systems while supporting the existing120 degree turn angle limit.

Finally, detailed guidance must be provided to both pilots and ATC about the use of “course reversal” arrival holding patterns on SIAPs in circumstances such as provided by the KDLN-JOXIT example.

Comments: This affects policy guidance to Aero Nav Services, the Aeronautical Information Manual, the ATC Handbook, and the TERPS and PBN Orders. An FAA simulator study by the FAA should be the first order of business on this issue, and should be promptly completed.

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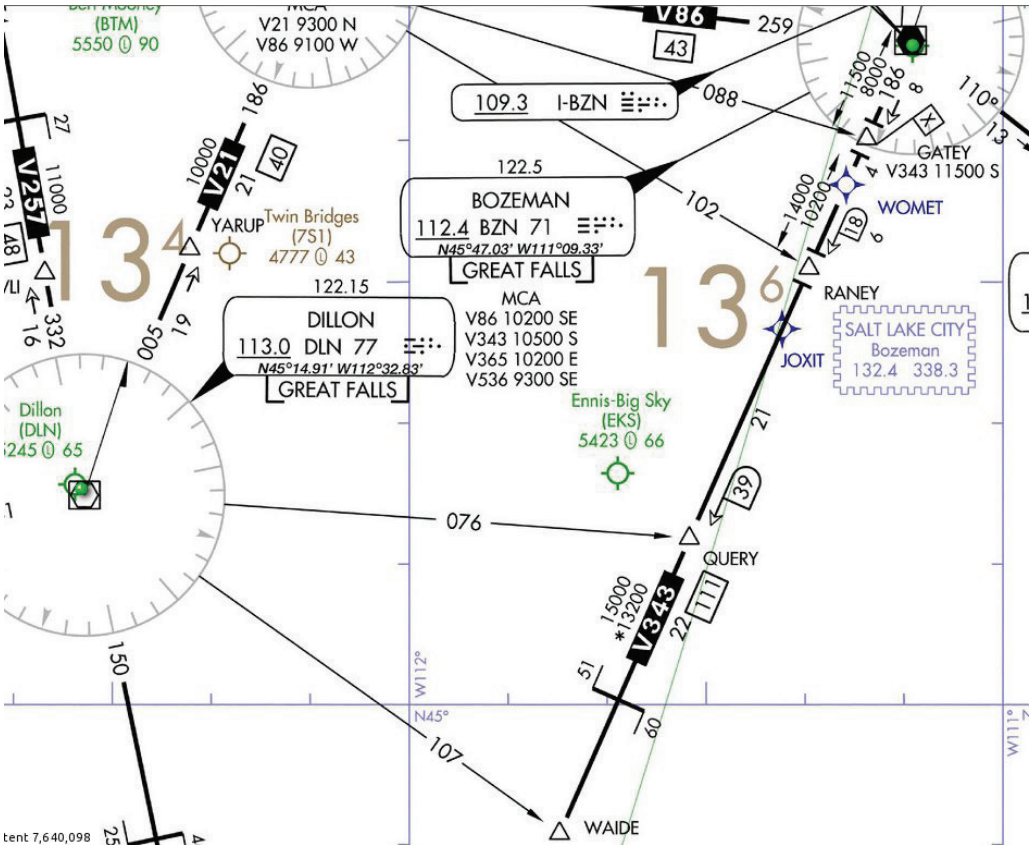
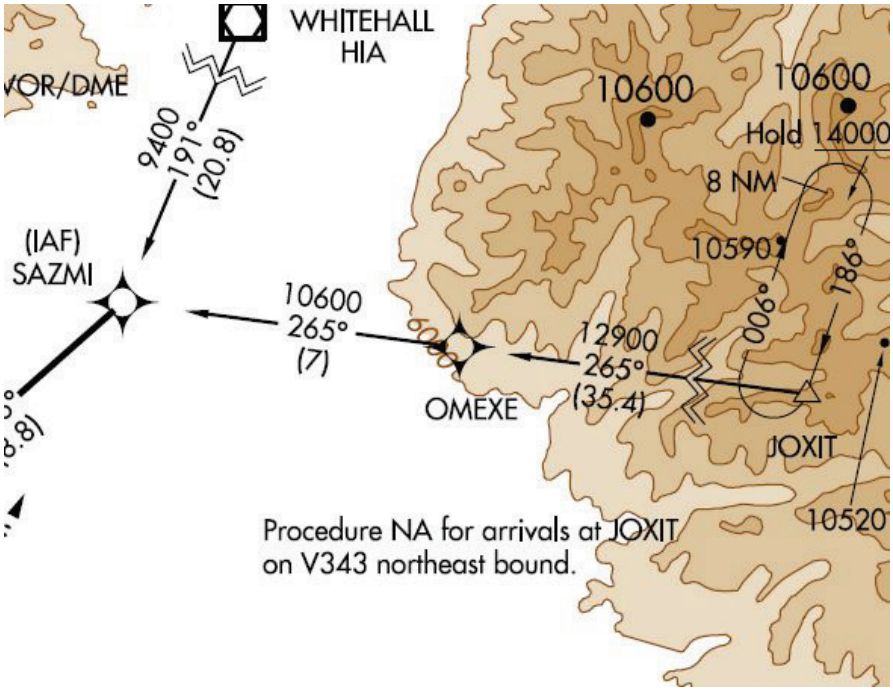
Date: March 21, 2014

V-343/JOXIT Feeder WP, Dillon, Montana



*Note: A very recent change to V343 removed JOXIT from the airway structure. However, the issue remains since the limitation is reflected on SIAP chart and is found on other procedures within the NAS.



Initial Discussion – MEETING 14-01: New issue presented by NBAA. John Kernaghan, NBAA, asked for justification as to why conventional arrivals can use a 120 degree turn for intercept and RNAV are limited to only 90 degree, despite the fact that RNAV systems are approved for and are used successfully to navigate the feeder segment of conventional approaches. He also voiced, with aid of the example shown, that often a holding pattern over the intersection course reversal seems to create more problems than solutions. NBAA would like it evaluated. Mark Steinbicker, AFS-470 (View) discussed the last decade of operational experience/variability of path for wide angle of turn. Due to evidence of path repeatability, the angle was cut from 120 to 90 degrees. Mark is hesitant for a few specific instances to change the NAS standard. He feels there has been sufficient analysis done, that no more is needed, and suggests looking for other mitigations or techniques to alleviate concerns. There is also a waiver process that can be used in limited circumstances. Rick Dunham, AFS-420, advised this is an open agenda item at US-IFPP.

Status: AFS-420 (US-IFPP) will continue to work issue and advise ACF of decision. Item Open (AFS-420-US-IFPP)

MEETING 14-02: Tom Schneider, AFS-420, briefed that the US-IFPP decision was to maintain status quo and recommends that no further work be done on the issue. Rick Dunham, AFS-420, said attempting to harmonize the intercept between RNAV and conventional was problematic due to the anecdotal data which indicates greater than 90 degree turns for RNAV provide flight track problems. The decision was made to leave the rules and guidance as-is, pending further study. Tom asked Rich Boll, NBAA, how this issue works with new agenda item on RNAV substitution (14-02-317). Rich responded that the issues are different. Rich mentioned older RNAV procedures with 90 degree design intercepts that exceed these limits due to MagVar changes. The group discussed containment issues and the fact that pilots are now flying these procedures with RNAV.RNAV does turn anticipation (FB) and conventional assumes fly over (FO). The concern is that the area assessed for obstacles is very different. There was the suggestion of coding as FO, but that adds area outside of the turn.. Discussion ensued, with Rick committing to AFS-420 taking the issue back to the US-IFPP again for consideration.

Status: AFS-420 will return to US-IFPP for further discussion. **Item Open:** AFS-420 (US-IFPP)

MEETING 15-01: Tom Schneider, AFS-420, (View) said issue was brought to US-IFPP for discussion. Rick Dunham, AFS-420, said initial discussion was to harmonize to 90 degrees to simplify for procedure design and standardize across the board vs.120 degrees which presented some airspace issues. The question becomes the magnitude of the problem and how many resources will be required to resolve it. Decision is to place on hold and work at a later date. The item will remain open in the ACF and US-IFPP. AFS-420 will brief when any progress is made. Rich Boll, NBAA, indicated his one main concern is MagVar change resulting in exceeding a 90-degree airway intercept turn.

Status: AFS-420 will brief when any progress is made. **Item Open:** AFS-420

MEETING 15-02: Rick Dunham, AFS-420, said there has been no resolution and the issue is tabled UFN. Tom Schneider, AFS-420, added it is an open agenda item in the US-IFPP and if there are any developments, AFS-420 will brief the ACF at that time.

Status: Follow action being taken at US-IFPP. **Item Open:** AFS-420.

MEETING 16-01: Tom Schneider (AFS-420) briefed this issue had been on hold, but FAA Orders 8260.3C and 8260.58A are now published and now AFS-420 and the US-IFPP (Item 14-01-22) will be working the issue. (View) The lead is Gary Petty (AFS-420), and he was planning on forming a working group in May. Tom requested that suggestions/comments be sent to AFS-420 for consideration.

Status: Open item at the US-IFPP and a working group will be formed by Gary**. Item Open:** AFS-420

MEETING 16-02: Tom Schneider (AFS-420) briefed VIEW slide provided by OPR Gary Petty (AFS-420). The US-IFPP agreed to form a working group to address this issue, however John Bordy (AFS-420) stated the group has not convened yet due to higher priority issues. Rich Boll (NBAA) again voiced his concern that PBN procedures are limited to a maximum turn of 90 degrees, while 120-degree turns are allowed on conventional procedures, even though most conventional procedures are being flown with RNAV systems. Tom said the FAA does not believe this issue presents a safety concern and although it may be a factor for a number of procedures, most are high enough where it is not a TERPs concern. Item will remain open and US-IFPP progress followed.

Status: Open item at the US-IFPP and a working group will be formed by Gary Petty**. Item Open:** AFS-420

MEETING 17-02: John Bordy (FAA Flight Procedure Standards Branch), briefed this item discussed at the US-IFPP and a working group subsequently met to discuss the issue. It was determined Flight Standards has no desire to change the conventional 120-degree limitation. Flight Standards believes over time the differences between RNAV and conventional procedures will be reduced as RNAV procedures become more common and conventional procedures get replaced. Rich Boll (NBAA) showed (VIEW) the BIH RNAV(GPS) Y RWY 12 and discussed procedure entry (or lack thereof) and his belief that as more RNAV procedures are added, the 90-degree limitation will reduce procedure entry capabilities. John indicated he believes there is no desire by Flight Standards to allow turns greater than 90 degrees for RNAV. Rich believes the RNAV procedure design technique needs to consider placement of fixes on airways so as to minimize the elimination of procedure entry restrictions. John and Tony Lawson (Aeronautical Information Services) indicated they could look into the specific design

issues with the BIH RNAV (GPS) Y RWY 12 procedure to see if the entry limitations could be eliminated and provide an update via email. AJV-5 will look at any specific design issues on this specific procedure. John reiterated the FAA is not going to look at conventional requirements changes. Tony mentioned initial layouts normally come from the RAPT checklists. John indicated he would look into policy related to how checklists are developed (specifically related to the identification of IAF locations and design guidance) and determine if improvements areas could be identified to increase availability of procedure entries. Rich asked if the IFPP could provide a formal response on why it's not possible to increase the 90-degree limitation for RNAV turns.

Action Items:
John Bordy and Tony Lawson will look at any specific design issues on the BIH RNAV (GPS) RWY 12 procedure to determine if redesign could improve procedure entry and provide an update via email.
John Bordy to determine if design guidance is needed to assist both the RAPT and procedure designers in locating fixes on airways.
John Bordy will ask the chair of the US-IFPP (Thomas Nichols) to provide a response to Rich on why it's not possible to increase the RNAV 90-degree turn limitation.

Status: Item will remain open and an update on actions provided at next ACF.

Meeting 18-01: John Bordy (FAA Flight Procedure Standards Branch) briefed this item was discussed at US-IFPP 18-01 and closed. John indicated the FAA does not intend to increase permissible turns for RNAV procedure from a maximum of 90 degrees to a maximum of 120 degrees. He also indicated the FAA does not intend to reduce the maximum allowable turn for conventional procedures from 120 degrees to 90 degrees. The FAA believes over time the number of conventional procedures that include turns of more than 90 degrees will gradually reduce as the VOR infrastructure is reduced and as PBN procedures become more commonplace.

Action Items: AFS-420 management will send an explanatory note to Rich Boll (NBAA) on the rationale to not pursue the issue.

Status: Item closed.