**AERONAUTICAL CHARTING MEETING**
**Charting Group**
**Meeting 21-02 – October 26 - 28, 2021**

**RECOMMENDATION DOCUMENT**

**FAA Control #21-02-362**

**Subject: Un-Codable Departure Procedures & Vector Segments**

- Rev 1: Including changes to address early feedback from NBAA and consultation with Garmin ARINC NDB working group SME
- Rev 2: Updated recommendations to consider depicting Vector segments differently from the conventional (VHF/NDB) and RNAV segments

**Background/Discussion:**

The ARINC 424 specification is the industry standard for how departure procedures should be coded by the Type 1 database suppliers for use by the Type 2 FMS vendors and flight planning software. The FAA has several departure procedures which are designed in a way which are not compatible with the ARINC 424 Attachment 5 rules, and therefore they are not in any FMS databases or flight planning software today. When these departure procedures are not in the FMS database or flight planning software, the pilots are forced to load a flight plan one waypoint at a time, which increases pilot workload and increases the changes of errors when executing the published departure procedure.

There are two ARINC 424 Attachment 5 rules which these uncodeable departure procedures are breaking which we think the FAA should address with changes to the procedure design criteria to prevent.

1. More than one path for the same runway transition

The ARINC 424 & FMS packing specifications uses the following 3 key fields for a departure transition:

| # | ARINC 424 Field | Example |
|---|---|---|
| 1 | SID Identifier (5.9) | ROCKY1 |
| 2 | Route Type (5.7) | 1 – Runway Transition |
| 3 | Transition Identifier (5.11) | RW05R |

One example of an FAA departure procedure which has more than one path for the same runway transition is the KIND ROCKY ONE DEPARTURE. The runway transitions have multiple headings to RADAR vectors for the departing aircraft to fly as well as different runway instructions based on aircraft type.

For example, the RW05R transition has three different options:

- RW05R (Turbojets Only – DME Required) Heading 050°:
  - Climb on heading 050° to I-OQV 0.3 DME then on assigned heading 050° or 070°. Maintain 5000. Thence …
- RW05R (Turbojets Only – DME Required) Heading 070°:

- Climb on heading 050° to I-OQV 0.3 DME then on assigned heading 050° or 070°. Maintain 5000. Thence …

- RW05R (Propeller Only):
  - Climb on assigned heading. Maintain 3000. Thence ….

There are similar problems with the RW23L & RW23R transitions.

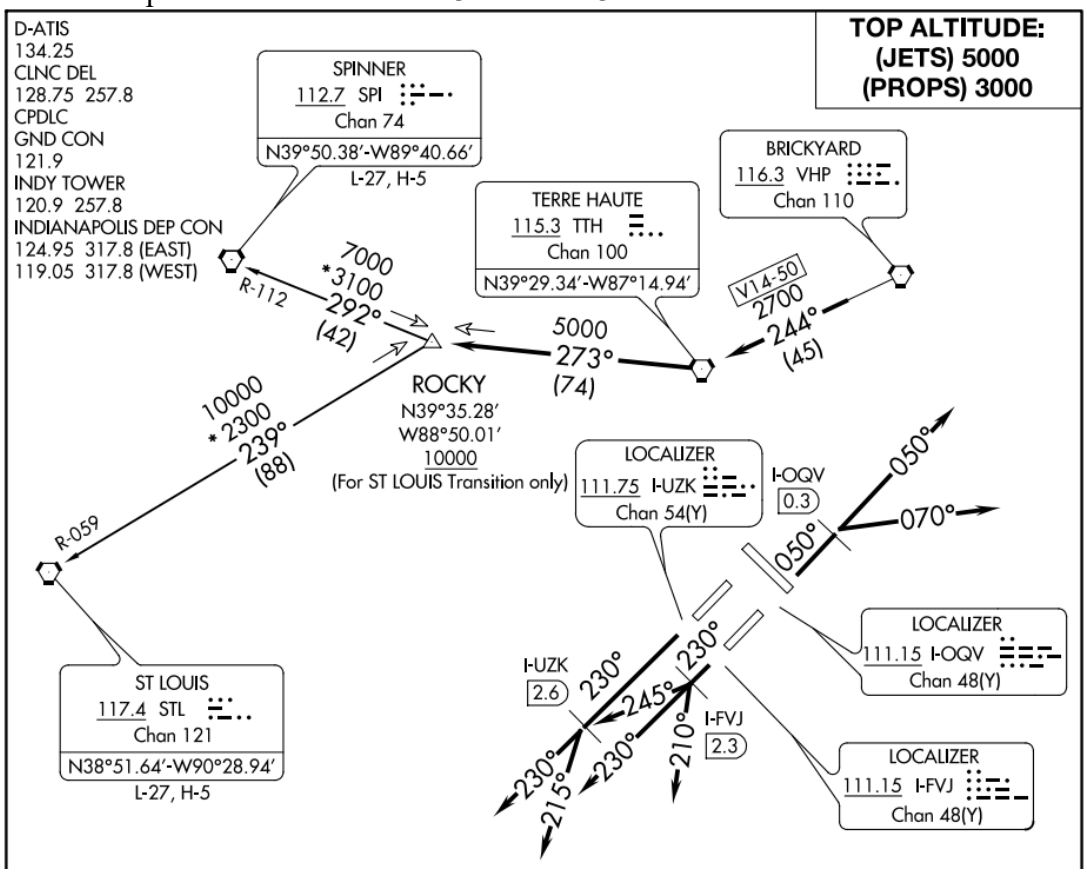


*Figure 1: KIND ROCKY1 d-TPP*

Another example is the KLMO WNGSS ONE DEPARTURE (RNAV). The runway transitions include a range of headings. For example, RW11 says to fly an ATC assigned heading "between 030° CW 160°".

(WNGSS1.WNGSS) 20086

WNGSS ONE DEPARTURE (RNAV) AL-9041 (FAA)

VANCE BRAND (LMO)
LONGMONT, COLORADO

DEPARTURE ROUTE DESCRIPTION

TAKEOFF RUNWAY 11: Climb on a heading between 030° CW 160° as assigned by ATC. Thence. . . .

TAKEOFF RUNWAY 29: Climbing right turn on a heading between 030° CW 110° as assigned by ATC. Thence. . . .

*Figure 2: KLMO WNGSS1 d-TPP Departure Route Description*

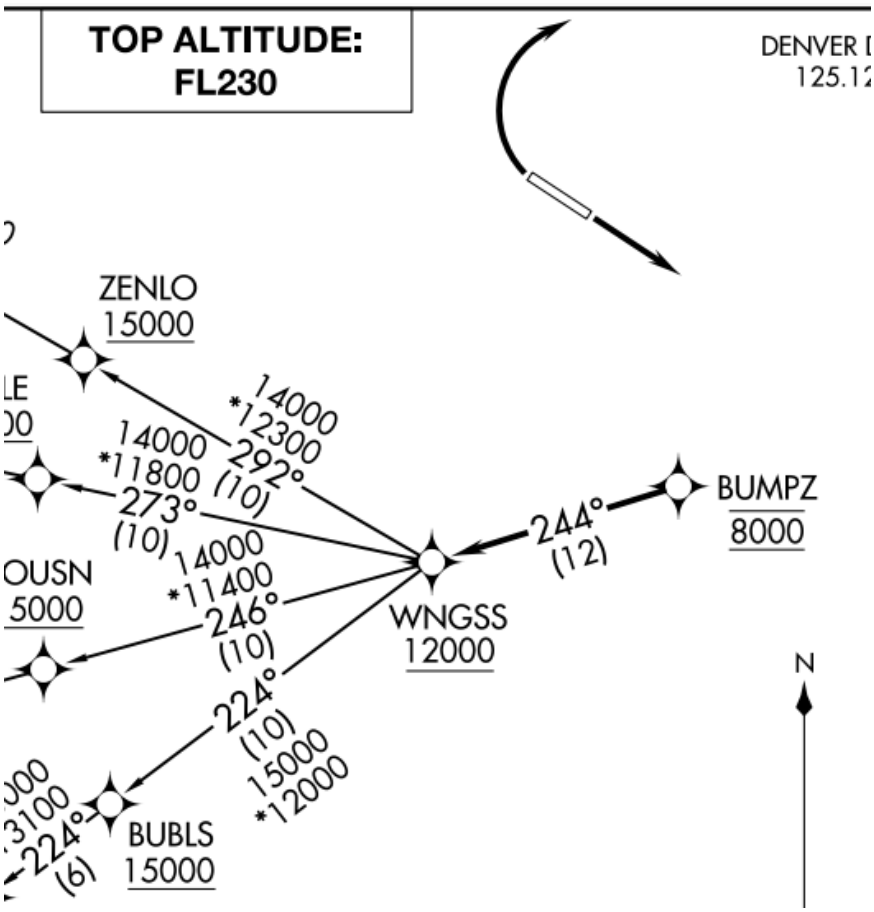


*Figure 3: KLMO WNGSS1 d-TPP Chart*

2. Enroute transitions which do not start at a common point

The ARINC 424 Attachment 5 Rule 4.10 requires all enroute transitions must start at the same fix.

**4.10** A SID which consists of Enroute Transitions only can be coded with a single IF leg as a Route Type 1 or 2, followed by the required Route Type 3 coding. The fix on which the IF leg is coded must be the first fix in all of the Enroute Transitions. The Transition Identifier must be coded in accordance with Chapter Five, Section 5.11. In the cases where all the Enroute Transitions do not begin at the same fix, but where most begin at the same fix then a partial SID may be coded.

*Figure 4: ARINC 424 Attachment 5 Rule 4.10*

An example of an FAA departure which does not have a common point for all the Enroute transitions is the KFLL FORT LAUDERDALE EIGHT DEPARTURE. Looking at the departure route description, there are three different enroute starting fixes:

- DHP VORTAC: 4 transitions
- VKZ VOR/DME: 2 transitions
- FLL VOR/DME: 1 transition

AARPS TRANSITION (FLL8.AARPS): From over VKZ VOR/DME on VKZ R-353 to AARPS.
BEECH TRANSITION (FLL8.BEECH): From over FLL VOR/DME on FLL R-104 to BEECH.
BNGOS TRANSITION (FLL8.BNGOS): From over DHP VORTAC on DHP R-321 to BNGOS.
FREEPORT TRANSITION (FLL8.ZFP): From over DHP VORTAC on DHP R-055 to MIDNT then on ZFP R-257 to ZFP VOR/DME.
HURCN TRANSITION (FLL8.HURCN): From over VKZ VOR/DME on VKZ R-324 to HURCN.
MNATE TRANSITION (FLL8.MNATE): From over DHP VORTAC on DHP R-195 to MNATE.
VACAY TRANSITION (FLL8.VACAY): From over DHP VORTAC on DHP R-348 to VACAY.

*Figure 5: KFLL FLL8 Departure Route Descriptions*

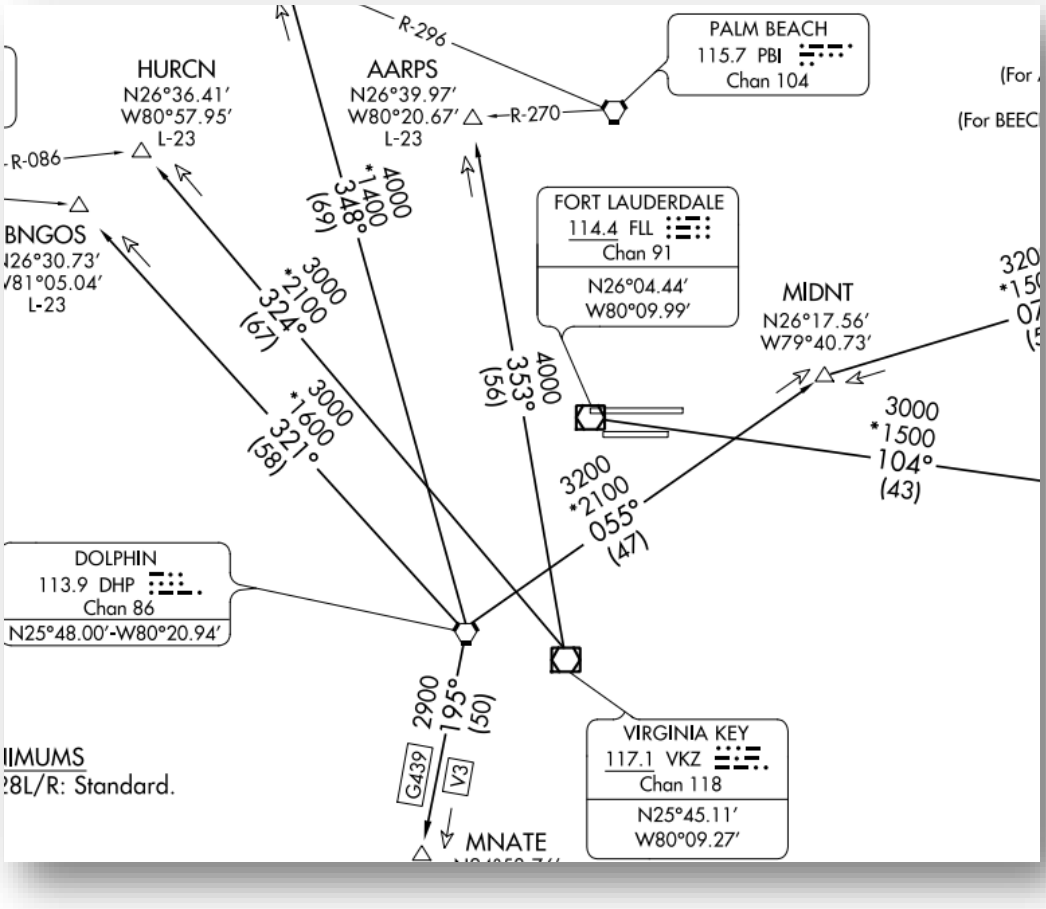


*Figure 6: KFLL FLL8 d-TPP Chart*

These SIDs contain vector segments which are supported by the ARINC 424 specification even though most legacy systems can not support them. Our intent is to not to change the procedure designer's options to describe the air traffic requests for the departure route description, but to better define the vector segments from the conventional & RNAV segments.

Another problem is that Garmin pilots expect to see the coding in the FMS when the FAA chart has a solid black line. We continue to receive a lot of customer complaints when a procedure, or a portion of procedure, is not included in their navigation database. Therefore, it would help with customer / pilot complaints if the vector segments were depicted differently from the conventional (VHF/NDB) and RNAV segments. This would allow us to communicate that vector segments are not supported in all airborne systems, but that conventional and RNAV segments are expected to be supported by most airborne systems.

**Recommendations:**

Garmin recommends changing the SID design criteria so that multiple runway paths and multiple enroute transition starting points are not allowed on conventional & RNAV segments. We would also like to see the vector segments depicted differently from the conventional and RNAV segments.

1. Each non-vector SID runway transition shall only allow one path for all aircraft

If requested by ATC, additional information should be provided as textual procedure notes by using the "or assigned by ATC" instruction but should not affect the single path from the runway. For example, the following rewording would work for the KIND ROCKY1 RW05R transition: "Climb on heading 050° to I-OQV 0.3 DME then *on heading 050° or assigned by ATC*. Maintain 5000." This would allow a heading-to-manual (VM) termination leg to be coded on an initial 050° heading but would allow the aircraft to fly any ATC assigned instructions before they can go direct to the next flight plan fix.

2. All non-vector SID enroute transitions shall start at the same fix

3. Chart the vector transitions differently than the conventional and RNAV procedure segments:

    - Option 1: Do not show leg lines at all for the vector transition segments

In Option 1, only the fixes will be charted and the departure route description (DRD) will contain the text needed to interpret the vector segment path. In the cases where the vector runway transition switches to a Conventional or RNAV routes, and the vector transition paths will not be shown, the Conventional / RNAV route would stand-out and would match the sections available in most flight planning & flight management systems.

    - Option 2: Chart the vector transition path with a new terminal route line type

In Option 2, a new charting depiction for the vector SID procedure legs will indicate the start & end of the vector portions of a SID. This is important to indicate where the conventional / RNAV portion of the SID begins. For example, the charted long dashed line on approaches indicate a visual flight path to distinguish from the final approach (solid thick line) and the missed approach (short dashed line).

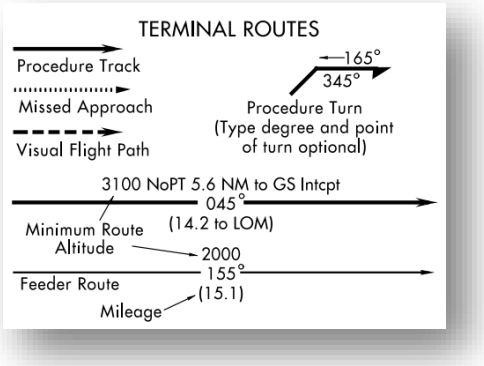


*Figure 7: Terminal Routes from d-TPP Front Matter*

**Comments**:

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**Meeting 21-02:** Steve Madigan and Joshua Fenwick, Garmin, briefed the issue from the RD slides. Some departure procedures violate coding rules and are therefore not included in navigation databases. Steve provided the Indianapolis Intl ROCKY ONE departure slide as an example, noting the multiple ground tracks off the runway on departure. These cannot be adequately coded into a database for use with an FMS. Steve then showed the Longmont WINGS ONE departure slide that has a range of possible headings on departure, which will not allow coding predictable FMS paths across the ground. Steve stressed Garmin is not advocating against vector departures, or to make all codeable. Steve identified another problem area is en route transitions that do not start at a common point, with an example of the FORT LAUDERDALE EIGHT departure slide. This procedure has multiple transitions starting at multiple different waypoints and VORs, so there is no common point. Garmin recommends (slide) changing design criteria to no longer allow multiple runway paths and multiple en route transition starting points on conventional and RNAV segments. They would suggest vector segments be displayed differently and showed a recommendation for vector and non-vector transition segments. Joshua added there is currently no way to distinguish the vector segment from the other segments, and suggested ideas like using a different line style and/or thickness to differentiate and remove confusion. Garmin would like to help and/or join any work groups on possible changes, and can take these changes back for ARINC 424 work groups. Editor's note: Garmin updated the RD as discussed prior to and during the meeting, and the updated version was used for these minutes. Gary Fiske, FAA ATC Procedures (Terminal) Team (AJV-P310), pointed out for the database providers that there are many variations of SIDs, but if the SID name says "vector," it is a vector SID. Gary added he would prefer the initial turn arrows on these SIDs not be used, since they may imply something not intended by the designer. Dan Wacker, FAA Flight Procedures and Airspace Group (FPAG), said he would like to look at these recommendations in the Departure Working Group (DWG), adding he thinks there may be necessary coding changes but does not see that criteria changes would be needed. Jeff Rawdon, FPAG, concurred with the DWG taking on this effort. Rich Boll, NBAA, said defining an RNAV path off the ground is unnecessary confusion. Rich added many Garmin systems no longer have DME and cannot identify DME fixes on charts, and Joshua agreed that is part of the problem. Rich pointed out the conventional Fort Lauderdale procedure, noting the original SID concept was an abbreviated ATC clearance, but many have multiple points. Gary added Fort Lauderdale and Miami procedures are being revised with a metroplex project, pointing out the designers can chose not to chart all the radials, many of which may not be used, thereby reducing coordination. Gary added RNAV pilots should file RNAV SIDs procedures, not conventional. Joshua said vector SIDs could be coded, but this is not done. Bennie Hutto, NATCA, said the Agency allows for some coding on conventional procedures, but that can be problematic since the procedure may not be flight checked and that there may be a discontinuity if the coding is not validated for flight. Joshua agreed and will bring this back to the ARINC waypoints. Lev Prichard, Allied Pilots Association, said he looks forward to what SIDs will look like with safety considerations off the ground, and pilot workload issues since the crew has to manually enter a large amount of data. Lev prefers either an open SID concept with RNAV WPs or for the SID to display no lines off the ground indicating vectors will be utilized off the ground. Joshua agreed, stressing Garmin wants to reduce crew workload. Rich reminded all that these are conventional SIDs, meant to be flown that way, not as RNAV SIDs. Lev said it could be a culture issue, with many thinking the procedure(s) should be RNAV, adding American Airlines wants their pilots to only use FMS. Rich wondered if maybe all conventional SIDs/STARs should be

decommissioned. John Barry, FAA Aircraft Certification, agreed that conventional procedures are "messy." John Collins, Foreflight, said his Garmin equipment uses two sources of data: Jeppesen and Garmin, and they act differently on these type SIDs and added the non-turbine/turboprop general aviation aircraft typically are assigned conventional procedures, with the turbine/turboprop aircraft being issued the RNAV SIDs. Lev concurred with John's point, and suggested this should be a consideration for the Departure Working Group. Jeff noted that since the group seemed in favor of the issue, it would be continued on future agendas, with status reports provided at future meetings.
**Actions:** Issue accepted for continuation on the agenda. The Agency will review the proposal and report decisions and status at the next ACM.

**Status:** Item open

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**Meeting 22-01:** Jeff Rawdon, FAA Flight Procedures and Airspace Group (FPAG), briefed the issue (slide). The Departure Working Group (DWG) is already working this so there was no ACM Recommendation Review Group (ARRG) review necessary. Dan Wacker, FPAG, briefed that the DWG reviewed this with the current application in the NAS. They felt it would be detrimental to air traffic to mandate all conventional procedures have a codeable common route, where for years they have had a radar vector common route. If something needs to be coded it should go to ARINC, and possibly be coded as a radar splay with multiple initial fixes. The DWG does not want to take on the initial RD request, but recommends a look at updating coding for RNAV to include a radar vector common route. John Collins, Foreflight, said there are not a large number of affected procedures, and said Garmin already provides coding for these. Boeing/Jeppesen does not code them since there is no defined ARINC 424 standard. John said the KCLT KNIGHTS TWO departure form would be a good example of how to code these. Dan said radar vector SIDs do not have transitions by current criteria, since they are designed to be hand flown. Joshua Fenwick, Garmin, agreed the number of affected procedures is small. Dan said vector SIDs do not have common points, and were never intended to. Joshua asked if the FORT LAUDERDALE EIGHT SID is a radar vector SID, since it shows many routes and looks like a non-radar vector SID. Dan noted the departure route description says to expect radar vectors to the appropriate transition. These have been done for a long time and are not an issue, they just can't be coded. Gary Fiske, FAA ATC Procedures (Terminal) Team (AJV-P310), said Air Traffic will not support redesign efforts as stated in the RD on these, since the procedures work well. There are RNAV off-the-ground SIDs that are being used more often than the radar vector SIDs at many of these locations already. Some could be redesigned if there is a confusing chart issue. Joshua asked if the recommendation is to close the item, and Dan said yes, adding he will look at going back to ARINC coding to investigate if there is a way, if the common route is a radar vector with multiple initial fixes. Joshua asked if the charting portion of the RD to show the radar vector transitions differently would be addressed. Kevin Allen, American Airlines, said coding from an initial fix on the transition would appear to be an easy solution with aircraft flying radar vectors, to be followed by the assigned route. Dan said that has been looked at, and for example, at DFW nobody goes to the VOR, so this wouldn't be a clear solution. John said although you will not ever fly to the VOR, it can still be coded and you will intercept the route later. Dan pointed out RD has three issues. The ACM decided to reject the first two RD issues,

and the DWG will work the third RD recommendation issue to chart the vector transitions differently than the conventional and RNAV procedure segments and report back.

**Actions:** Original RD has three recommendations. The first two are rejected, and the DWG will work the third recommendation and report status as the issue is considered.

**Status:** Item open.

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**Meeting 22-02:** Jeff Rawdon, FAA Flight Procedures and Airspace Group (FPAG), briefed the issue (slide). The Departure Working Group (DWG) is looking into the third recommendation on the RD which is the only recommendation still under consideration. Dan Wacker, FPAG, briefed the current allowance for conventional procedures to have multiple initial departure fixes (IDFs) is still needed by Air Traffic. The DWG has no intention to convert conventional departures that have these into RNAV-only procedures. The DWG is considering changing RNAV departure criteria to allow multiple IDFs and this will involve ARINC coding. Joshua Fenwick, Garmin, discussed the third recommendation of his RD involved a way of charting the transitions differently; a vector leg would be communicated differently than the rest of the procedure. Dan did not think the vector leg initial runway departure transitions join the procedure. Joshua wanted the vector portion considered differently if charted. Dan said there is a TERPS evaluation for the initial departure heading and the intent for future criteria is to move toward a range of headings as assigned on departure. The solid line from the airport is a transition segment and would be part of the procedure. Joshua said the vector transition is not codable and not in the FMS, and that is confusing. Dan said the example RNAV procedure being discussed is an open SID where an RNAV path terminates in a VM leg, then goes to an IDF and continues from there. Joshua added if Air Traffic wants multiple paths that would be fine, but since multiple transitions cannot be coded, you must be able to distinguish when the heading to vector portion ends and the RNAV portion starts. Gary Fiske, FAA ATC Procedures (Terminal) Team (AJV-P310), said these vector path lines are for only for illustration purposes and Air Traffic does not want them coded. Joshua agreed and discussed the possibility of a different line type representation on the chart. Dan said the recommendation is to leave these as is, since coding is provided on the RNAV portion, and the lines on the chart are general pilot information. Dan believes AOPA and NBAA wanted the information on the charts for pilot situational awareness. Dan does not want charting based on RNAV alone since there can be various non-coded information for the pilots on the procedure. Jeff asked if the DWG considered changing line weights on the charts, and Dan advised they did not since that might create confusion for the pilots to know if they were actually on the procedure. Gary said he does not want different line weights and Dan added he has not heard of any complaints from pilots. Joshua said they are receiving complaints and questions about loadable portions in their databases and Dan asked if that could instead be a training or awareness issue. Joshua restated that a different line weight might help. Dan said the departure starts at the runway, but the codable portion may not. Dan said STARs currently have similar depictions. Dan added he would bring the issue back to the DWG for further discussion on possibilities for addressing the recommendation. Joshua is concerned about adding more headings to the procedure and would like to consider not charting certain portions until beyond the vector portion of the procedure.

**Actions:** Dan Wacker will facilitate further discussions in the Departure Working Group and will provide updates at ACM 23-01.

**Status:** Item open

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**Meeting 23-01:** Jeff Rawdon, FAA Flight Procedures and Airspace Group (FPAG), briefed the summary, actions, and status from the (slide). Due to higher priority work no additional progress has been made on this issue since the previous meeting. Dan Wacker, FPAG, will continue to work the issue as time allows in the Departure Working Group.
**Actions:** Dan Wacker will facilitate further discussions in the Departure Working Group and will provide updates at ACM 23-02.

**Status:** Item open

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