AERONAUTICAL CHARTING FORUM
Instrument Procedures Group
October 23, 2012

HISTORY RECORD

FAA Control # 12-02-304

Subject: FMS Coding of SIDs Containing Multiple or Differing Runway Transitions

Background/Discussion:

> ***NOTE:*** *This agenda item is submitted by Jeppesen on behalf of individuals who represent organizations which share a common interest and concern. These organizations include the FAA, Garmin, and Jeppesen. The information in this document was excerpted from emails and meeting notes following a series of exchanges and a teleconference on the subject. Please refer to the following documents provided as attachments which support this document.*
> - *TAMPA 5 Departure (AeroNav Chart)*
> - *TAMPA 5 Departure (Jeppesen Chart)*
> - *TAMPA 5 Departure (FAA Procedure Source 8260-15B - Page 1)*

Most conventional terminal procedures are codeable and are provided in commercial navigation databases to support efficient flight operations and reduced pilot workload. When SIDs mandate two different sets of initial climb instructions (runway transitions) for parallel runways; e.g., one set for “Jets” and another set for “All Other” aircraft, it presents problems for navigation database coding. Refer to the attached TAMPA 5 DEPARTURE as a classic example.

The design of the TAMPA 5 SID (TPA5.TPA) involves two different runway transitions for parallel runways 19L and 19R; one set for “Jets” and another set for “All Other” aircraft. Existing capabilities of the navigation database coding and corresponding electronic displays can accommodate only one runway transition per runway per departure - for either "Jets" or "All Others" - but not for both.

While the focus of this agenda item is the TAMPA 5 Departure, procedures exist at other airports where more than one runway transition has been defined, typically dependent on aircraft type, but which cannot be coded or distinguished as such in the database because of incompatibilities between the procedure’s design and existing navigation database procedure coding capabilities.

With existing coding capabilities there is no way to uniquely identify multiple runway transitions since they would share the same runway identifier. Therefore database providers such as Jeppesen are only able to code one runway transition per runway per departure procedure. Jeppesen’s practice is to code the transition which supports Jet or Turbojet aircraft. This is done in consideration of operational impact.

Using the navigation data provided, avionics manufacturers such as Garmin are not able provide a label or other type of indication on their FMS displays that would otherwise indicate to the pilot that multiple transitions sharing the same identifier may exist.

Main concerns:

1) Pilots assigned a procedure where a transition is not available in their database must manually enter the desired transition into the FMS, assuming they realize multiple or differing transitions exist as depicted on the corresponding chart.

2) The possibility exists for a pilot to overlook the situation and attempt to fly a transition which is not applicable to his aircraft.

The latter scenario happened recently in Tampa, FL when a pilot was cleared for the TAMPA 5 SID. The pilot, flying a Turboprop airplane, took off from Runway 19L but incorrectly flew the procedure in his installed database. The path he flew was the path for Jet aircraft. The airplane subsequently crossed the extended centerline of parallel Runway 19R. This drew the attention of an alert airline crew and departure control.

The issue was reported to Garmin. Follow up discussions between Garmin, the FAA, and Jeppesen occurred. The root cause of the incident was determined to be the incompatibility of the design of this conventional procedure with respect to navigation database capabilities. It was also realized the same situation could apply to other conventional procedures of similar design which involve differing flight paths, lateral or vertical, based on different aircraft types.

Summary notes from Sep 25, 2012 telecon between FAA, Garmin and Jeppesen:

Jeppesen noted that the TAMPA 5 Departure has been coded since Cycle 1101 and some of these similar types of procedures (e.g. Vector SIDs) have been "code-able" only in the last three years or so.

FAA notes there will be even more reliance on the FMS under the Next Gen concepts, so removing [conventional, non-RNAV] procedures that are "codeable" may not be the best long term mitigation.

Most agree there is typically less opportunity for human error when a procedure can be loaded from the database versus manually loaded. This same idea is captured in the AC90-105 where a flight crew cannot fly an RNP procedure unless it is retrieved from a suitable database.

There is no unique bit or flag in the ARINC 424 protocol to communicate that only the Jet procedure [runway transition] is coded, or that another procedure [runway transition] may exist but has not been coded.

Jeppesen notes that they code the Jet procedures [runway transitions] and not others because they can associate only one transition per runway for any individual procedure. Under coding regulations and RTCA/DO-200A rules, Jeppesen cannot add to the procedure identifier so they cannot code "Jet" procedures and then code "All Others" under a different identifier.

With these types of procedures where alternate procedures [runway transitions] exist, it is more common to have altitude differences than course differences. As such the TAMPA 5 course selection based on aircraft type is not considered typical.

It was noted that while TAMPA 5 uses "Jet" and "All Others" as the discriminator for different courses and altitudes in the procedure. It is not known how many other discriminators exist or could be used. Another such differentiator is found at KORD (Chicago, IL) with the OHARE6 SID where DME capability is the differentiator.

Actions agreed upon in the Sep 25, 2102 telecon between FAA, Garmin, and Jeppesen:

1. *Jeppesen agreed to present the issue to the Aeronautical Charting Forum (ACF).*
2. *Jeppesen, for Cycle 1210 (eff 18 Oct 2012), agreed to provide a NavData Change Notice indicating that only "Jet" procedures are coded where other Non-Jet procedures [transitions] also exist.*
3. *Jeppesen, for Cycle 1211, agreed to remove the 19L and 19R runway transitions of the TAMPA 5 departure since the "Jet Only" status of the coded data cannot be communicated at the point of use.*
4. *Jeppesen agreed to adjust the internal coding specifications to look for and remove other similar transitions or procedures as changes are received by source prompting revision (new spec to be applied on an "as revised" basis).*
5. *FAA agreed to support further investigations to change current and future instrument procedures that provide more than one procedure [transition] that cannot be coded into the database so cockpit automation can distinguish them.*
6. *Garmin agreed to provide service literature to owner/operators/OEMs that highlight the issue and remind the flight crew to evaluate the flight plan entered into the FMS with the charted procedure.*

Recommendations: The conclusion of the individuals involved in the Sep 25, 2012 teleconferece was that the subject would be presented ACF for review, discussion and recommendations.

Comments: This recommendation affects FAA Order 8260.46.

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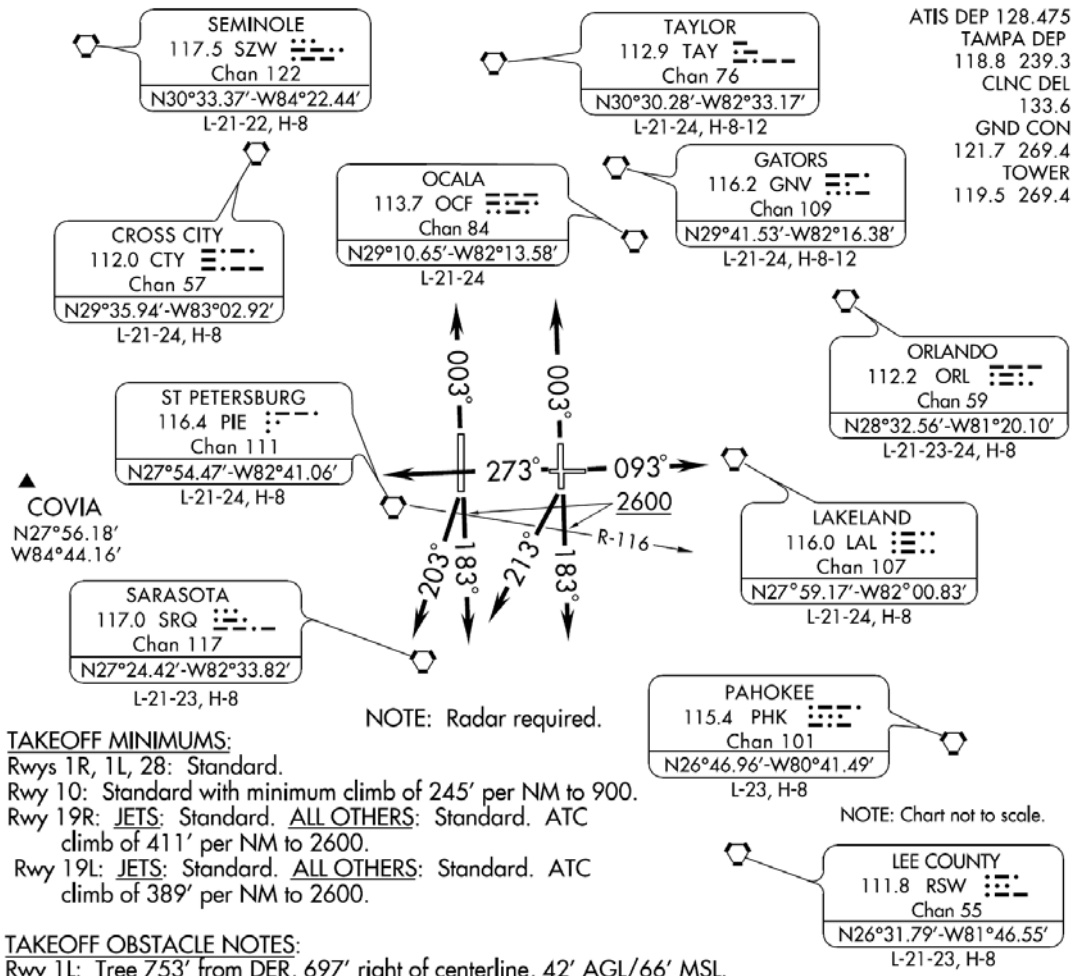
Date: October 5, 2012

TAMPA FIVE DEPARTURE

TAMPA INTL (TPA)
TAMPA, FLORIDA

ATIS DEP 128.475
TAMPA DEP
118.8 239.3
CLNC DEL
133.6
GND CON
121.7 269.4
TOWER
119.5 269.4



NOTE: Radar required.

NOTE: Chart not to scale.

TAKEOFF MINIMUMS:
Rwys 1R, 1L, 28: Standard.
Rwy 10: Standard with minimum climb of 245′ per NM to 900.
Rwy 19R: JETS: Standard. ALL OTHERS: Standard. ATC climb of 411′ per NM to 2600.
Rwy 19L: JETS: Standard. ALL OTHERS: Standard. ATC climb of 389′ per NM to 2600.

TAKEOFF OBSTACLE NOTES:
Rwy 1L: Tree 753′ from DER, 697′ right of centerline, 42′ AGL/66′ MSL.
Rwy 1R: Powerlines 2091′ from DER, 1018′ right of centerline, 50′ AGL/84′ MSL.
Rwy 10: Trees beginning 1282′ from DER, 1′ right of centerline, up to 106′ AGL/118′ MSL.
Tower 4214′ from DER, 266′ right of centerline, 105′ AGL/145′ MSL.
Ground 135′ from DER, 494′ left of centerline, 30′ MSL.
Trees beginning 1643′ from DER, 205′ left of centerline, up to 103′ AGL/114′ MSL.
Rwy 19L: Antenna on building 3279′ from DER, 1160′ left of centerline, 145′ AGL/155′ MSL.
Building 4755′ from DER, 1523′ left of centerline, 146′ AGL/155′ MSL.
Rwy 19R: Trees beginning 482′ from DER, 578′ right of centerline, up to 33′ AGL/37′ MSL.

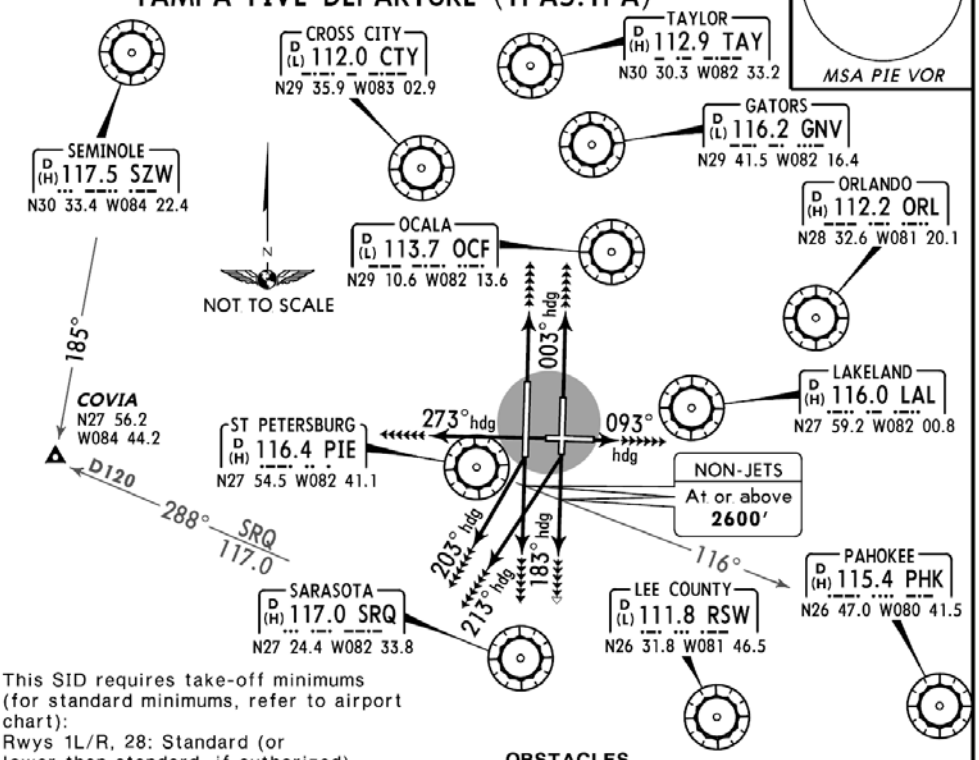
DEPARTURE ROUTE DESCRIPTION

TAKEOFF RWYS 1L/R: Climb heading 003°, or as assigned by ATC, Thence...
TAKEOFF RWY 10: Climb heading 093° , Thence...
TAKEOFF RWY 19L: JETS: Climb heading 213°, Thence... ALL OTHERS: Climb heading 183° to cross PIE R-116 at or above 2600, Thence...
TAKEOFF RWY 19R: JETS: Climb heading 203°, Thence... ALL OTHERS: Climb heading 183° to cross PIE R-116 at or above 2600, Thence...
TAKEOFF RWY 28: Climb heading 273°, Thence...

Expect radar vectors to join filed/assigned route. JETS: Maintain 6000. ALL OTHERS: Maintain 3000. Expect clearance to filed altitude/flight level within 10 minutes after departure.

TAMPA Departure (R) 118.8	Apt Elev 26′	Trans level: FL180 Trans alt: 18000′ **RADAR required.**

TAMPA FIVE DEPARTURE (TPA5.TPA)



This SID requires take-off minimums (for standard minimums, refer to airport chart):
Rwys 1L/R, 28: Standard (or lower than standard, if authorized).
Rwy 10: Standard (or lower than standard, if authorized) with minmum climb of 245′ per NM to **900′.**
Rwy 19L: JETS: Standard (or lower than standard, if authorized).
ALL OTHERS: Standard (or lower than standard, if authorized). ATC climb of 389′ per NM to **2600′.**
Rwy 19R: JETS: Standard (or lower than standard, if authorized).
ALL OTHERS: Standard (or lower than standard, if authorized). ATC climb of 411′ per NM to **2600′.**

Gnd speed-KT	75	100	150	200	250	300
245′ per NM	306	408	613	817	1021	1225
389′ per NM	486	648	973	1297	1621	1945
411′ per NM	514	685	1028	1370	1713	2055

OBSTACLES
Rwy 1L: Tree 753′ from DER, 697′ RIGHT of centerline, 42′ AGL/66′ MSL.
Rwy 1R: Powerlines 2091′ from DER, 1018′ RIGHT of centerline, 50′ AGL/84′ MSL.
Rwy 10: Trees beginning 1282′ from DER, 1′ RIGHT of centerline, up to 106′ AGL/118′ MSL. Tower 4214′ from DER, 266′ RIGHT of centerline, 105′ AGL/145′ MSL. Ground 135′ from DER, 494′ LEFT of centerline, 30′ MSL. Trees beginning 1643′ from DER, 205′ LEFT of centerline, up to 103′ AGL/114′ MSL.
Rwy 19L: Antenna on building 3279′ from DER, 1160′ LEFT of centerline, 145′ AGL/155′ MSL. Building 4755′ from DER, 1523′ LEFT of centerline, 146′ AGL/155′ MSL.
Rwy 19R: Trees beginning 482′ from DER, 578′ RIGHT of centerline, up to 33′ AGL/37′ MSL.

RWY	INITIAL CLIMB	ALTITUDE
1L/R	Climb heading 003° or as assigned by ATC.	JETS: **MAINTAIN 6000′** ALL OTHERS: **MAINTAIN 3000′**
10	Climb heading 093°.	
19L	JETS: Climb heading 213°. ALL OTHERS: Climb heading 183° to cross PIE R-116 at or above **2600′.**	
19R	JETS: Climb heading 203°. ALL OTHERS: Climb heading 183° to cross PIE R-116 at or above **2600′.**	
28	Climb heading 273°.	

ROUTING

EXPECT RADAR vectors to join filed/assigned route. EXPECT clearance to filed altitude/flight level within 10 minutes after departure.

CHANGES: None.

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U.S. DEPARTMENT of TRANSPORTATION – FEDERAL AVIATION ADMINISTRATION

GRAPHIC DEPARTURE PROCEDURE (DP)

Bearings, headings, courses, tracks, and radials are magnetic. Elevation and altitudes are in feet MSL. Altitudes are minimum altitudes unless otherwise indicated. Ceilings are in feet above airport elevation. Distances are in nautical miles. Visibilities are in statute miles or feet RVR unless otherwise indicated. Graphic depictions attached.

DP Name	Number	DP Computer Code	Superseded Number	Dated	Effective Date
TAMPA	FIVE	TPA5.TPA	FOUR	05 JUN 2008	13 JAN 2011

TYPE: SID

DP ROUTE DESCRIPTION:

TAKEOFF RWY 1L/R: CLIMB HEADING 003.00, OR AS ASSIGNED BY ATC, THENCE...

TAKEOFF RWY 10: CLIMB HEADING 093.00, THENCE...

TAKEOFF RWY 19L: **JETS**: CLIMB HEADING 213.00, THENCE... **ALL OTHERS:** CLIMB HEADING 183.00 TO CROSS PIE R-116 AT OR ABOVE 2600, THENCE...

TAKEOFF RWY 19R: **JETS**: CLIMB HEADING 203.00, THENCE... **ALL OTHERS:** CLIMB HEADING 183.00 TO CROSS PIE R-116 AT OR ABOVE 2600, THENCE...

TAKEOFF RWY 28: CLIMB HEADING 273.00, THENCE...

...EXPECT RADAR VECTORS TO JOIN FILED/ASSIGNED ROUTE. **JETS:** MAINTAIN 6000. **ALL OTHERS:** MAINTAIN 3000. EXPECT CLEARANCE TO FILED ALTITUDE/FLIGHT LEVEL WITHIN 10 MINUTES AFTER DEPARTURE.

TRANSITION ROUTES (GRAPHIC DEPICTION ONLY):

Transition Name	Transition Computer Codes	From FIX/NAVAID	To FIX/NAVAID	Course	Distance	MEA	MOCA	Crossing Altitudes/Fixes

QUALITY CHECKED

Initial Discussion - MEETING 12-02: New recommendation presented by Ted Thompson, Jeppesen, on behalf of Jeppesen, Garmin, and FAA. The issue revolves around the coding of SIDs with multiple climb out instructions for the same runway. Ted briefed that most conventional SIDs are able to be coded and are provided in commercial navigation databases to support efficient flight operations and reduced pilot workload. When SIDs mandate two different sets of initial climb instructions (runway transitions); e.g., one set for "Jets" and another set for "All Others", it presents problems for navigation database coding. The TAMPA 5 DEPARTURE (TPA5.TPA) was presented as an example, although it is not unique - multiple climb out instructions from a single runway are common throughout the NAS. The design of the TPA5.TPA involves two different runway transitions for parallel runways 19L and 19R; one set for "Jets" and another set for "All Others"; however, it was noted that it is not known how many other discriminators exist or could be used. For example, the OHARE 6 DEPARTURE at KORD (Chicago, IL) uses DME capability as the differentiator. Ted emphasized that existing capabilities of the navigation database coding and corresponding electronic displays can accommodate only one runway transition per runway per departure. Since database providers, such as Jeppesen, are only able to code one transition per runway per departure procedure, under ARINC coding capabilities, Jeppesen's practice is to code the transition which supports Jet or Turbojet aircraft. Ted stated that there will be even more reliance on the FMS under the NexGen concepts; therefore, removing [conventional, non-RNAV] procedures that are not able to be coded may not be the best long term solution. As a result of all the concerns, Jeppesen agreed to present the issue before the ACF-IPG. The general discussion indicated that the problem is valid and perhaps separate procedures should be developed in these cases. Mark Cato, ALPA, concurred and added that admittedly, there will be an increased number of procedures published, but an increased safety margin will also be achieved. Josh Fenwick, AeroNavData, Inc., stated that he supports designing separate procedures; however, the ARINC 424 specification was updated to accommodate this type of procedure source and allows for a procedure with multiple types of transitions (Jet Only, Turboprop Only, etc.) to be coded as multiple procedures, one for each type of aircraft. Tom Schneider, AFS-420, briefed that corrective action has already been initiated on this issue. The following stipulation, which should resolve the issue, has been added under design constraints as new paragraph 2-1d(7) in Change 3 to Order 8260.46:

> (7) Do not establish DPs containing more than one initial departure route from the end of a runway to support different types of aircraft (jet, turbo-prop, etc.) or different equipment requirements (DME, non DME). Where this is necessary, separate procedures must be developed.

The group consensus is that the proposed change will resolve the issue and AFS-420 will track the change until published. ACTION: AFS-420.

MEETING 13-01: Tom Schneider, AFS-420, briefed that the recommended guidance to resolve the issue was included in Change 3 to FAA Order 8260.46, which was signed on December 31, 2012 and recommended the issue be closed. Ted Thompson, Jeppesen, asked Tom to confirm if the policy specifically addressed a point of clarification that Brad Rush, AJV-3, had raised at ACF meeting 12-02 in that the revised policy should address transitions which differ in either lateral or vertical paths (e.g., prop vs. turbojet climb gradients or altitude restrictions). Tom responded that he believes the current verbiage is clear in specifying ".... one initial departure route from the end of a runway. . . . ". Tom could not recall any instances where different vertical paths would apply; however, he

agreed to check with Brad (who was not present at this ACF) to see if his point was adequately addressed. Ted stated he wanted to make sure that loop was closed when he reported back that the agenda item had been closed and all aspects accounted for.

> ***Editor's Note:*** *Post meeting coordination between Brad Rush, AJV-3B and Tom Schneider, AFS-420 indicates that "lateral/vertical" should be added to FAA Order 8260.46 verbiage to eliminate any possible confusion. Tom will amend the policy in the next iteration of paragraph 2-1d(7) of the Order to read: " (7) Do not establish DPs containing more than one initial departure route* ***(lateral or vertical)*** *from the end of a runway to the end of the SID, to support different types of aircraft (i.e., jet, turbo-prop, etc.) or different equipment requirements (DME, non DME). Where this is necessary, separate procedures must be developed." In the interim, Brad has agreed to issue internal guidance within AeroNav Products to ensure this concern is allayed*

Issue CLOSED.