ARINC 424 NDB

Draft 3 of Supplement 21
Discussion

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ZERO AS VDA

V.1

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SUMMARY
The FAA distributed in August 2014 a Special Airworthiness Information Bulletin regarding 0° (zero) coding as approach Vertical Descent Angle (VDA). This discussion item aims at assessing the FAA coding with regard to A424 rules.

1.0   INTRODUCTION/ BACK GROUND

This item had already been discussed during the January 2013 NDB meeting (presentation made by J. GORMAN). There was a consensus within the group to make no change to the ARINC 424 specification. The FAA withdrew the proposal at that time and reported that they will aim at publishing the VDA.

Nevertheless, the FAA distributed in august 2014 a Special Airworthiness Information Bulletin stating that 0° (zero) will be added in the A424 coding for the approaches where the vertical advisory guidance is not applicable. The FAA recommended the operators to assess with their navigation equipment manufacturers the impact of such a coding on their navigation equipment.

Upon customer requests, Airbus assessed the impact on the FMS and came to the conclusion that this modification may induce additional operational/safety issues compared to the former situation. In fact, with 0° coding as VDA, vertical approach path built by the FMS may be inconsistent both in final approach segment and in the visual one. In the former situation, the issue faced by the FAA impacts only the visual part of the approach (see appendix 1).

2.0   DISCUSSION and or ACTION

Airbus thinks that this method of coding:
1) Is not compliant with A424 rules (as per the 2013's discussion)
2) Brings additional issues instead of resolving existing one

Possible solutions:
1) Either the topic to be addressed at procedure publication level. Published VDA should clear the obstacles (conclusion of 2013 NDB meeting).
2) Or the topic to be addressed at operational level: pilot has the responsibility to not use advisory VNAV when the chart shows "Descent angle NA". No change in the current procedure charting and no change in the ARINC 424 specification.
3) Or address the topic in the ARINC 424 specification. For instance, the field 5.222 "GNSS/FMS Indicator" may be used to indicate that the VNAV advisory navigation is not authorised (see proposition of change in appendix 2).

Question to FAA: Since the discussion held in 2013 and the corresponding conclusion, was there any new event that prompted the FAA to urge the publication of 0° as VDA and to issue the corresponding Special Airworthiness Information Bulletin? Is VDA publication deemed not possible for these approaches?

Depending on the answer provided by the FAA, the Navigation Database Working Group is invited to:

1) Confirm that a change in the A424 rules is necessary (as per 2013's conclusion on this topic).
2) If a change is requested, discuss the best way to answer this topic with minimum impact on existing navigation systems.

Appendix 1 :

FAA
Aviation Safety

SPECIAL AIRWORTHINESS INFORMATION BULLETIN

SUBJ: FMS and GPS Equipment Advisory Vertical Guidance with no Published Vertical Descent Angle	SAIB: HQ-14-25 Date: August 26, 2014

This is information only. Recommendations aren't mandatory.

Introduction

This Special Airworthiness Information Bulletin (SAIB) alerts airframe manufacturers, navigation equipment manufacturers, and aircraft operators of any aircraft using Instrument Approach Procedures (IAPs) without a published vertical descent angle. This SAIB is not intended to prevent or inhibit manufacturers from providing advisory vertical guidance on IAPs.

At this time, the airworthiness concern is not an unsafe condition that would warrant airworthiness directive (AD) action under Title 14 of the Code of Federal Regulations (14 CFR) part 39.

Background

The Federal Aviation Administration (FAA) believes advisory vertical guidance can aid the pilot when flying the final approach segment of IAPs without a glideslope or an approved glide path. As a result, there were multiple public requests for the FAA to publish vertical descent angles on these IAPs. Many manufacturers then chose to use the published vertical descent angle when providing advisory vertical guidance for these IAPs.

The types of IAPs the FAA publishes with a vertical descent angle to help provide advisory vertical guidance include: 1) conventional IAPs (i.e., very-high frequency omni-directional receiver (VOR), localizer-type directional aid (LDA), simplified directional facility (SDF), etc.); and 2) required navigation performance IAPs titled "RNAV (GPS) RWY XX" with stand-alone lateral navigation (LNAV) and/or localizer performance without vertical guidance (LP) lines of minima.

The published vertical descent angle and navigation equipment-generated advisory vertical guidance offers no guarantee of meeting altitude constraints. Advisory vertical guidance does not guarantee obstacle protection or compliance with procedural altitudes. Advisory vertical guidance solely offers an aid to help pilots establish a continuous, stabilized descent during the final approach of the IAP and avoiding the traditional "dive and drive" method. Pilots must use the primary barometric altimeter to comply with all air traffic clearances and altitude constraints.

When the FAA charts these IAPs, they do not show a vertical descent angle in the profile view.

BURLINGTON, WISCONSIN
Orig 19SEP13
42°41'N-88°18'W
BURLINGTON MUNI (BUU)
RNAV (GPS) RWY 11
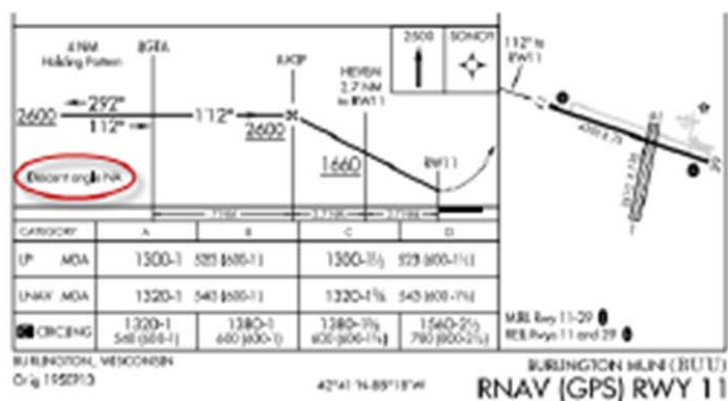
The charts currently include the following statement: **"Descent Angle NA"**. Like flying any other IAP, the pilot must see and avoid any obstacles in the visual segment during transition to landing.

The affected IAPs may create a hazard if the pilot continued to reference the advisory vertical guidance while transitioning to the visual segment of the approach. To avoid creating a possible hazard, FAA procedure designers began excluding a vertical descent angle from these IAPs and coding a "0" (zero) in the appropriate ARINC 424 database format specifications to communicate the absence of the vertical descent angle.

Some flight management systems (FMS), multi-mode receivers (MMR), and GPS navigation equipment may experience unintended consequences if they attempt to use a "0" (zero) from the packed, onboard navigation database for the vertical descent angle. Examples of navigation equipment unintended consequences from a "0" (zero) in the packed navigation data include:

- Using the "0" (zero) and generating problematic, inaccurate vertical path guidance.
- Loading the IAP to the navigation system's flight plan, but then failing to generate any horizontal or vertical guidance when the approach becomes active.
- Creating a "divide by zero" mathematical error preventing the navigation equipment from loading the IAP or, functioning properly when the system loads the IAP.
- Generating nuisance cockpit alerts for "low glidepath angle".
- Assuming a "0" (zero) is invalid because the angle is too low then automatically defaulting to a three degree (3°) angle.
- "Rejecting" the affected IAPs during the database packing process and removing them from the onboard navigation database; making the IAPs unavailable from the onboard navigation database when pilots attempt to select them.

Recommendations

The FAA recommends operators and pilots carefully review departure, destination and alternate airport IAPs during pre-flight operations. During this review, operators and pilots should look for IAPs published with no vertical descent angle and charted with the statement: **"Descent Angle NA"** or **"Descent Angle NA – Obstacles"** in the profile view of the procedure. For these IAPs, the FAA recommends finding and planning to use another IAP (if available) not affected by this airworthiness concern.

Contact your navigation equipment manufacturer to determine if your installed navigation equipment and operating software load is adversely affected by coding a "0" (zero) when no vertical descent angle is published:

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- If the navigation equipment is not affected, no further action is necessary.
- If the manufacturer offers a new modification or other solution, the FAA recommends making the modification as soon as possible.
- If the manufacturer reports coding a "0" (zero) has unintended, negative consequences, and no current solution is available, avoid using this type of IAP.

For aircraft and navigation equipment manufacturers, the FAA recommends determining what product lines and operating software loads (if any) are affected by FAA procedure designers coding the vertical descent angle as "0" (zero). Describe to users of affected navigation equipment any immediate actions operators or pilots should take to resolve anomalous behavior. The latest revision of FAA AC 20-138, Chapter 4 contains additional airworthiness information on advisory vertical guidance through installed avionics.

For Further Information Contact

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5.222 GNSS/FMS Indicator (GNSS/FMS IND)

Definition/Description: The GNSS/FMS Indicator field provides an indication of whether or not the responsible government agency has authorized the overlay of a conventional, ground based approach procedure with the use of a sensor capable of processing GNSS data or if the procedure may be flown with FMS as the primary navigation equipment. The field is also used to indicate when an RNAV procedure has been authorized for GNSS-based vertical navigation or advisory vertical navigation.

Source/Content: The Indicator will be selected from the table below.

Indicator Definition	Field Content
Procedure Not Authorized for GNSS or FMS Overlay.	0
Procedure Authorized for GNSS Overlay, primary Navaids operating and monitored.	1
Procedure Authorized for GNSS Overlay, primary Navaids installed, not monitored. Example: Procedure Title includes (GPS) or (GNSS)	2
Procedure Authorized for GNSS Overlay, Procedure Title includes GPS or GNSS	3
Procedure Authorized for FMS Overlay	4
RNAV (GPS), RNAV (RNP) or RNAV (GNSS) Procedure SBAS use authorized; SBAS-based vertical navigation authorized	A (Note 1)
RNAV (GPS), RNAV (RNP), RNAV (GNSS) or RNAV Visual Procedure, SBAS-based vertical navigation NOT Authorized	B (Note 2)
RNAV (GPS) RNAV (RNP), or RNAV (GNSS) Procedure, SBAS-based vertical navigation use not published	C (Note 3)
RNAV (GPS) RNAV (RNP), or RNAV (GNSS) Procedure within the SBAS operational footprint, but SBAS-based vertical navigation NOT Authorized	D (Note 4)
Conventional procedure, RNAV (GPS), RNAV (GNSS) or RNAV Visual Procedure, advisory vertical navigation NOT Authorized	E (Note 5)
Stand Alone GPS (GNSS) Procedure	P
Procedure Overlay Authorization not published	U

Note 1: The GNSS/FMS IND of A indicates that the RNAV (GPS) or RNAV (GNSS) or RNAV RNP procedure is authorized for SBAS-based vertical navigation.

Note 2: The GNSS/FMS IND of B indicates that the RNAV (GPS), RNAV (GNSS), RNAV RNP or RNAV Visual procedure is not authorized for SBAS-based vertical navigation. Advisory vertical may be provided.

Note 3: The GNSS/FMS IND of C indicates that the RNAV (GPS) or RNAV (GNSS) or RNAV RNP use of SBAS-based vertical navigation has not been published.

Note 4: The GNSS/FMS IND of D indicates that the RNAV (GPS) or RNAV (GNSS) or RNAV RNP is SBAS authorized only for lateral navigation. Advisory vertical may be provided.

Note 5: The GNSS/FMS IND of E indicates that the conventional procedure, RNAV (GPS), RNAV (GNSS), or RNAV Visual procedure is not authorized for advisory vertical navigation.

Used On: Airport and Heliport Approach Procedure Records
Length: 1 character
Character Type: Alpha/numeric