AEEC

Together "We Set the Standard."

To	NDB Subcommittee	**Date**	February 15, 2017
From	Sam Buckwalter sam.buckwalter@sae-itc.org tel +1 443-454-0584	**Reference**	17-021/NDT-170 lth

Subject **Working Paper Circulation**
NDB Subcommittee
March 7-9, 2017, Cocoa Beach, Florida

Attachments

	Subject	Source
1.	IFPP Report	Jeppesen
2.	Initial Missed Approach Leg with Immediate Turn	Airbus
3.	Consecutive Vertical Angel Coded on the FAF of an ILS/GLS Approach	MITRE
4.	Overfly for Beginning Fix of RF Leg	Jeppesen
5.	Route Type Qual 3 Field Cleanup	Jeppesen
6.	Update to Attachment 5, Rule 6.3.6.4	Jeppesen
7.	Alt Desc Codes V, X, and Y	Jeppesen
8.	GBAS/GLS Term Use	Jeppesen
9.	Beginning Leg of PINS Departures	Jeppesen
10.	Level of Service SBAS References	Jeppesen
11.	Change to Center Fix Field	Lufthansa System Flight Nav
12.	Change to Rule 7.1.7, Attachment 5	Lufthansa System Flight Nav
13.	Runway Declared Distances	Lufthansa System Flight Nav

	14. Editorial Changes	Lufthansa System Flight Nav
	15. Placement of FAF	Lufthansa System Flight Nav
	16. Changes to Customer Code Field	Lufthansa System Flight Nav
	17. Country Code Enumeration	Lufthansa System Flight Nav

Comments & Inquiries

The staff welcomes comments on the attached material. Comments should be directed to Sam Buckwalter.

Attachment 1

Attachment 1

JEPPESEN
A BOEING COMPANY

AEEC NDB Meeting, Location, March 7 - 9, 2017

ICAO IFPP Briefing

Stephen Moody
ICAO IFPP ARINC Member
March 2017

ICAO IFPP Briefing

PBN to xLS – design work is still underway. They moved the expected completion date out to 2018, effective 2020. The work includes:

- RF leg ending at the IF (FACF)
- RF leg ending at the FAP requiring shallower Baro VNAV of 2 deg prior to 3 deg GS intercept

There is a discussion paper that will provide additional details.

GBAS/GLS Phraseology paper – The term GBAS will be used when referring to a system, and GLS will be used when referring to an approach procedure. GLS will be used in the naming of the procedure.

There is a corresponding proposal paper that aligns our use of the terms GBAS and GLS.

RNAV Visual Procedures - Visually guided approach procedures were finally presented at IFPP-13. There was much discussion regarding RNAV Visual procedures and ICAO could not see a way forward with this concept due to the multiple requirements of the pilot. The pilot would need to keep eyes out the window to satisfy the visual requirement, and monitor the magenta track line which requires the pilot to be looking at inside equipment. In order to drive convergence in the design of these procedures, a concept of operations (CONOPS) was developed by the FLTOPS Panel to explain the newly named “visual manoeuvring using prescribed tracks supplemented by RNAV “VPT (RNAV)”. This will leverage the existing VPT criteria.

ICAO IFPP Briefing

Helicopter WG status report. Doc 8168 Volume 1 is updating to support amendment 6 helicopter updates. They have been working on VNAV angles that are greater than 6.0, up to 9.0. The FAA has promised to do a lateral analysis at RNP 0.3.

From the ICAO IFPP 13 meeting. The proposed criteria for allowing operators to enter IMC in the visual segment (PinS departure) as well as the proposed criteria for lowering the VSDG/VSDA for the manoeuvring VS (PinS departures/approaches) were considered premature by the Helicopter Working Group (HWG) and they would need additional revision. The revision of both will be considered new tasks to be further progressed by the HWG under the maintenance activities.

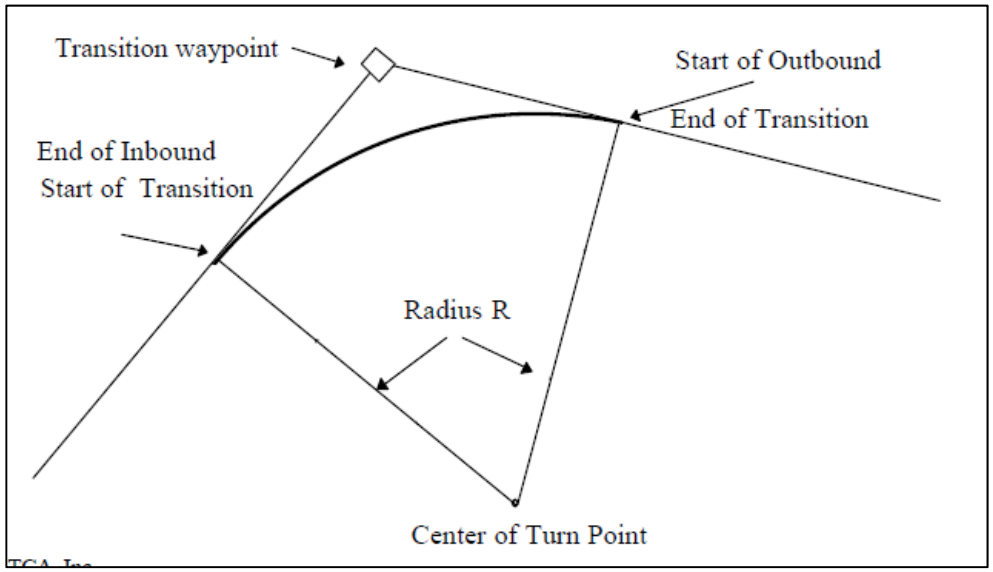
RNP Holding - was discussed and the question was asked if it would be useful. The group decided that RNP holding would be valuable and should be used. ATM working group is also looking to determine if there is enough benefit to develop the criteria.
No Update

RNP AR Departure - Nav Spec is in work.

ICAO IFPP Briefing

FRT – Fixed Radius Transition - Fixed radius transitions were intended to define transitions along airways in the case where separation between parallel routes is also needed during a turn and the fly-by transition is not compatible with the separation criteria.

Figure 3-1
RTCA DO-201A



The FRT concept was initially introduced by Eurocontrol because of its intended benefits, such as improvement in airspace usage through closely spaced parallel routes. However with the advent of the free route airspace concept, the FRT notion is no longer be needed by Eurocontrol. The suggestion was to continue investigating in cooperation with the PBNSG. In the event that no operational requirement is discovered, the FRT concept will not move forward.

ICAO IFPP Briefing

SID and STAR transitions concept - The ATM working group is working on the concept of transitions on SIDs and STARs. Their work seems to reflect the ARINC 424 transition concepts so there should be no problem with implementation.

Procedure Design Magnetic Variation – The adoption of this process is slow going and changes often. The ICAO working paper is going to be rewritten and submitted for the inclusion in the IFPP14, effective 2020. If the paper gets approved, the promulgation will be limited to PBN procedures that are published with either formal tabular or textual descriptions.

PBN initial segments –PANS-OPS revision clarified that PBN initial segments may be designed using the following navigation specifications:

- RNAV 1
- RNP 1
- RNP 0.3 (Helicopters).

PBN initial segment may be used in the design of a non-PBN instrument approach procedure, such as an ILS or GLS.

ICAO IFPP Briefing

Naming Waypoints on PBN Procedures – A State had reported that there was some pilot confusion due to the waypoint naming convention that they were using. This lead to discussions within the IFPP and an update to PANS-OPS, Vol. II to allow the five alpha-numeric code to be based on multiple factors as follows:

The five-alphanumeric name-code may be based on factors appropriate to the airspace in which they are used, such as:

- Characters from the airport location identifier
- Unique characters indicting the use of the significant point such as “F” for FAF
- Combinations of numbers and/or letters that create the geographical uniqueness of the designation;
- No more than three numbers with the alphabetic characters being taken from the airport designator.

During the ICAO IFPP discussions regarding this paper, I stressed that States should not use the ARINC 424 naming conventions to name their waypoints as this limits how data providers can name other fixes at those airports.

ICAO IFPP Briefing

The new **ICAO PANS-AIM** document will replace much of the current Annex 15 document and will include a “Data Catalog” in digital form, which will eventually replace all current methods of publication, including charting and tabular descriptions.

Subject	Property	Sub-Property	Type	Description	Note	Reference
Runway				A defined rectangular area on a land aerodrome prepared for the landing and take-off of aircraft. (Annex 14)		
	Designator		Text	The full textual designator of the runway, used to uniquely identify it at an aerodrome/heliport. E.g. 09/27, 02R/20L, RWY 1.		Annex 15 App 1 AD 2.12 1) Annex 14 I 2.5.1 a)
	Nominal length		Distance	The declared longitudinal extent of the runway for operational (performance) calculations.		Annex 15 App 1 AD 2.12 3) Annex 14 I 2.5.1 a)
	Nominal width		Distance	The declared transversal extent of the runway for operational (performance) calculations.		Annex 15 App 1 AD 2.12 3) Annex 14 I 2.5.1 a)
	Geometry		Polygon	Geometries of RunwayElement, RunwayDisplacedArea and RunwayIntersection		AMDB
	Centre line points					
		Position	Point	The geographical location of runway centre line at each end of the runway, at the stopway and at the origin of each take-off flight path area, and at each significant change in slope of runway and stopway	Definition from Annex 4 3.8.4.2	Annex 14 I App 5 A5-1 Annex 4 Ch 3 and 4, 5 AMDB
		Elevation	Elevation	The elevation of the corresponding centre line point. (See Annex 14 I 2.3.2: — for non-precision approaches … any significant high and low intermediate points along the runway shall be measured to the accuracy of one-half metre or foot…)		Annex 14 I 2.3.2 Annex 14 I App 5 A5-2 Annex 4 Ch 3 and 4, 5 AMDB
		Geoid undulation	Height	The geoid undulation at the correspoding centre line point		AMDB
	RWY exit line					AMDB
		Exit guidance line	Line	The geographical location of the runway exit line		Annex 14 AMDB
		Colour	Text	Colour of runway exit line		AMDB
		Style	Text	Style of runway exit line		AMDB
		Directionality	Code List	Directionality of RWY exit line (one-way or two-way)		AMDB
	Surface type		Text	The surface type of the runway defined as specified in Annex 14 Volume I		Annex 15 App 1 AD 2.12 4) Annex 14 I 2.5.1 a)

Attachment 2

Attachment 2

ARINC 424 NDB

Draft 1 of Supplement 22
Discussion

Location Cocoa Beach, Florida
March 7-9, 2017

Initial missed approach leg with immediate turn

V1.0

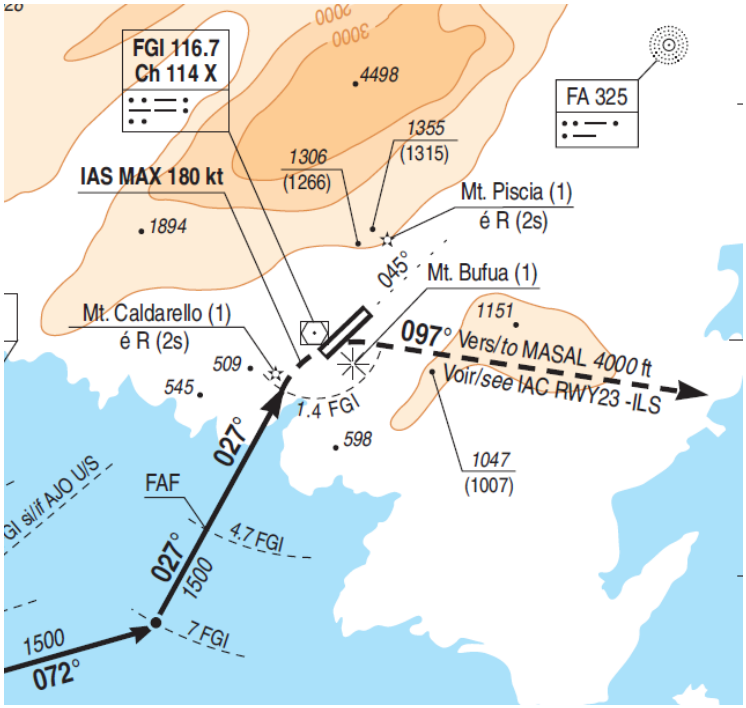
Pau LATORRE, Airbus

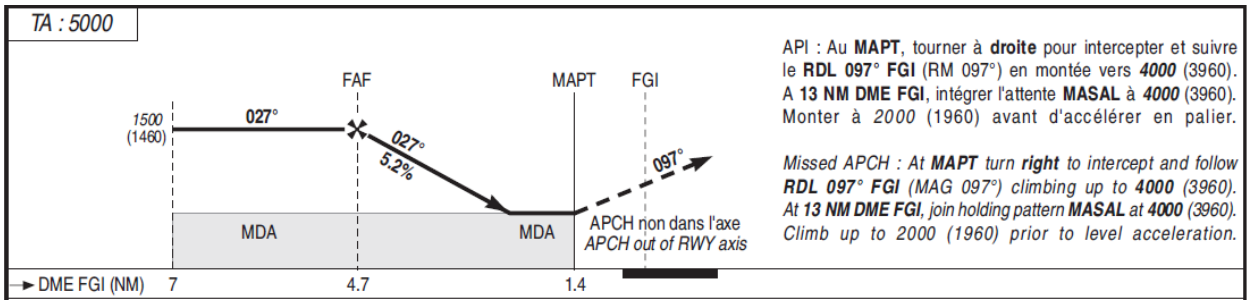
SUMMARY
Airbus wishes to raise awareness on the operational impact of the rules for xA as the first leg of the missed approach. In cases where the runway axis is offset more than 15° from the final approach course the coding rules may induce misleading guidance commands. Consequently Airbus proposes the group to discuss on the suitability of these coding rules for aircraft operations.

1.0 INTRODUCTION/ BACK GROUND

Airbus wishes to raise awareness on the operational impact of the rules for xA as the first leg of the missed approach. This discussion originates from an observation raised during a flight test at LFKF VOR05 approach.

As presented in the figure below this approach calls for a final approach course of 027°, whereas the runway axis is at 045°. Consequently after the MAP a right turn will be performed by the crew, in visual references with AP OFF. In case of missed approach a further 097° right turn shall be performed (missed approach instructions below)





During the aforementioned flight test it was noticed that upon initiating a go-around manoeuvre at low height above the runway (after the final right turn), the aircraft Flight Director commanded an immediate left turn (instead of the missed approach's right turn to 097° expected by the crew).

In such a scenario where the aircraft guidance is not understood, typical crew reaction (and consistent with Airbus training and golden rules) is to take over control from the AP/disregard FD guidance. This reaction may be "amplified" by challenging terrain surrounding the airfield (as is the case for LFKF).

After study of the approach coding it was noticed that the first leg of the missed approach is coded as a CA with the same course as the final approach segment (027°) and ending altitude 490 feet.

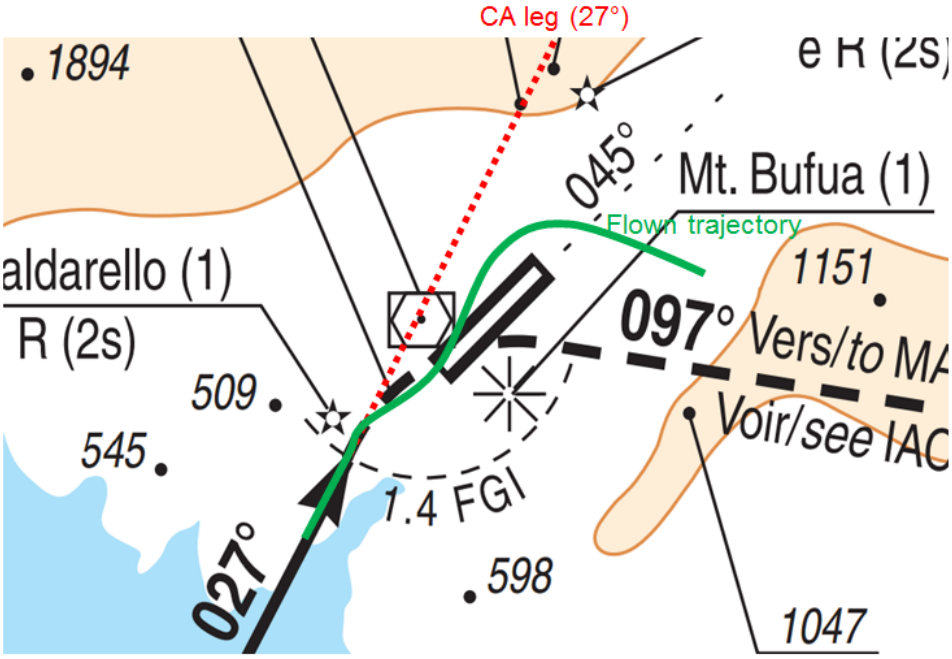
If the Go-Around is performed before the MAP:

- Then the A/C will be laterally guided on the active approach leg until the MAP is sequenced
- Followed by guidance onto the xA (aligned with this last leg) if the termination altitude of the xA has not already been reached
- No undue roll order will occur

If the Go-Around is performed after the MAP:

- Then the crew will have started to align the A/C with the runway axis (AP OFF)
- The FMS will therefore command an immediate turn to try and guide the A/C back onto the active Missed Approach xA leg (visible with the FD roll bar if AP is not re-engaged)
- In the case of the LFKF approach, we can see that this turn can be in the opposite direction from the Missed Approach briefing (immediate right turn) and be very confusing for the crew.

Operationally the highest impact is experienced on the second case where the roll order will be commanded after MAP sequencing, and thus further into the final approach (lower height above the runway).



The coding in this manner of the CA originates from the following requirement of ARINC 424 (issue 21):

> ***9.3.1.5***
>
> *When an immediate turn is specified in an ILS, MLS, or GLS missed approach, or if the source describes a turn greater than 15 degrees from the final approach course, without an altitude specified before the turn, as the first leg of a missed approach, a course from or heading to an altitude (CA, FA, VA) leg must be coded as the first leg of the missed approach and must include a command to climb before the turning leg, using the final approach course for the leg heading or course. The altitude will be coded as a minimum altitude, at least 400 feet above the airport elevation and the leg will terminate at that altitude.*

Based on the scenario presented Airbus considers that two negative impacts are derived from the coding in this type of approach:

1. It seems the goal of the section highlighted in yellow is to prioritize climbing over commanding a turn on the go-around (thus achieving clearance over runway before guiding laterally).

   From the case in LFKF VOR05 it can be concluded that, in such a scenario, the requirement can lead to an opposite effect by generating undue roll commands in the most sensitive part of the final approach (lower height).

2. Also as presented in the LFKF scenario, based on the approach / missed approach geometry, the coding can induce guidance commands to the opposite side of the briefed missed approach. These may seem misleading to the flight crew.

In addition Airbus considers the overall wording of the requirement should be polished (e.g. redundancy of "*as the first leg of a missed approach").*

2.0 DISCUSSION

It seems the approach presented in this document proves the requirements in 9.3.1.5 do not correctly take into account some operational aspects.

Airbus requests the group's position on whether these rules satisfy the operational needs and if further detail could be added to req 9.3.1.5 in order to avoid cases such as the one presented.

Attachment 3

Attachment 3

ARINC 424 NDB

Draft 1 of Supplement 22
Discussion

Location Cocoa Beach, Florida
March 7-9, 2017

CONSECUTIVE VERTICAL ANGLE CODED ON THE FAF OF AN ILS/GLS APPROACH

V.0

Sam Miller, MITRE

SUMMARY
Attachment 5 Section 7.1.7 requires that the approach vertical angle must also be coded on the final approach fix (FAF) on those ILS/GLS approaches that have unique descent constraints. Most ILS/GLS approaches do not require the vertical angle on the FAF and the guidance provides for that case. However, data providers may not be following the Section 7.1.7 guidance and instead coding the angle on the FAF on all ILS/GLS approaches. That action conflicts with the new PBN/RNP procedure designs which incorporate a radius-to-fix leg to intercept the ILS/GLS localizer and glideslope. This discussion/position paper recommends that the data providers amend their processes to comply with the existing ARINC 424 guidance.

1.0 INTRODUCTION/ BACK GROUND

The requirement to code the approach vertical angle on some ILS FAFs was implemented in ARINC 424-15 in response to OEM and FMS manufacturer's requests. At that time, some FMS's VNAV algorithms allowed the aircraft to descend too early to the FAF altitude on some unique approaches where the obstruction clearance altitude was somewhat higher than the FAF or glideslope intercept altitudes. Subsequently, 424-20 requires that the same vertical angle coded for the final approach segment also be added to the FAF for those approaches that had unique descent constraints just prior to the FAF. The resulting text in Attachment 5, Section 7.1.7 states:

> *For approach procedures with an electronic glideslope, the vertical angle must be coded in both the Final Approach Fix and the fix, which carries the missed approach point coding, except when the altitude 1 and altitude 2 at the FAF are identical, in which case the vertical angle is omitted on the FAF. The FAF record carries the Final Approach Fix waypoint description code of F in position four of that field. The missed approach point fix carries the waypoint description code of M in this position four. The vertical angle will be the published glideslope angle for the installation or procedure.*

The resulting VNAV path ensured that the aircraft would intercept the glideslope early and remain above obstructions. It is important to note that such approaches were, and continue to be, a minority design as compared to those procedures which do not require the vertical angle on the FAF. A survey revealed that valid reasons for adding the vertical angle include:

> Designs with a course reversal
> Obstruction clearance requirements between the IAF and FAF
> Close FAF (short final segment due to navaid location)
> Long final segment (by design)

2.0 DISCUSSION and or ACTION

Performance Based Navigation (PBN) is encouraging the use of navigation specifications and procedures which enhance safety and efficiency. One such new design is an RNP-to-xLS approach design in which a radius to fix (RF) leg is used to maneuver the aircraft from downwind, on a predictable and repeatable path, to intercept the final approach track. The procedure design requirements are detailed in FAA Order 8260.58A Appendix C, *United States Standard for Performance Based Navigation (PBN) Instrument Procedure Design*. The design incorporates a shallow intermediate segment from the IF to the FAF such that the glideslope is captured from below in accordance with accepted flight crew procedure. The design assures that operations in extreme (high delta ISA) temperature environments will capture from below.

When the approach vertical angle is also coded on the FAF, the aircraft guidance will construct the descent path to the FAF using the coded vertical angle. Subsequently, the shallow segment of the RNP-to-xLS design is inhibited and correct capture of the glideslope cannot be guaranteed.

Specific to this position paper, Section 7.1.7 states that the vertical angle on the FAF should be omitted "*…when the altitude 1 and altitude 2 at the FAF are identical…*" When ALT1 and ALT2 are the same, there are no unique descent path constraints between the IF and FAF as described above. This scheme provides for the majority of ILS/GLS approaches that do not require the vertical angle on the FAF. The RNP-to-xLS is included in this group of procedures. When the vertical angle on the FAF is omitted, the aircraft vertical guidance constructs the descent geometry to comply with the published altitude constraints. Also, the RNP- to-xLS would be free to execute a shallow descent segment and ensure the glideslope is captured from below.

Therefore, this paper recommends that data providers comply with Attachment 5 Section 7.1.7. When the vertical angle is coded appropriately, all ILS/GLS procedures, including the RNP-to-xLS designs, will be flown as intended by the procedure designer.

3.0 Changes as depicted

None

Attachment 4

Attachment 4

ARINC 424 NDB

Draft 1 of Supplement 22
Proposal

Location Cocoa Beach, Florida
March 7-9, 2017

OVERFLY FOR BEGINNING FIX OF RF LEG

V1.0

Stephen Moody, Jeppesen

SUMMARY
This paper updates paragraphs 6.11.2 and 8.7.3 to align with other rules that restrict the use of the overfly waypoint desc on the beginning or ending fix of an RF leg.

1.0 INTRODUCTION/ BACK GROUND

Portions of the Attachment 5 paragraphs 6.11.2 and 8.7.3 seem to be in conflict with other RF leg rules that restrict the use of the overfly waypoint desc at the beginning or the ending fix of an RF leg.
For example, Paragraph 3.17.1.c states “The Y or B indication for a Flyover Waypoint must not be used on fixes that begin or terminate on an RF leg.”

2.0 DISCUSSION and or ACTION

If I read paragraphs 6.11.2 and 8.7.3 correctly, it is suggesting that if an approach transition ends at the FACF and the Final Segment begins with an IF-RF, that the ending fix of the approach transition must be overflown. Doesn’t this functionally break the other no-overfly rules.

The changes proposed remove the overfly requirement from the end of the approach transition.

3.0 Changes as depicted (Track Changes is Helpful)

6.11.2 The track from the FACF to the FAF, where an FACF exists, is coded with TF or RF legs. The RF leg is not allowed as the first leg of the approach coding according to the Beginning/Ending Leg Table. The preferred coding when an approach starts with a precision arc is IF at the FACF, followed by RF to the FAF. According to the rules on RF legs, this will require that a straight line, fix terminated approach transition to the FACF has been included. The track in the transition must be tangent to the arc. ~~and the fix at the end of the transition must be overflown.~~ The rule also does not exclude the use of an RF leg in between FAF and the final TF leg of the approach. Such RF legs will be coded with the 4th character of the Waypoint Description field blank.

8.7.3 The track from the FACF (when coded) to the FAF is coded with TF or RF legs. The RF leg is not allowed as the first leg of the approach coding according to the Beginning/Ending Leg Table. The preferred coding when an approach starts with a precision arc is the use of an IF leg at the FACF or FAF, followed by RF to the FAF or MAP. According to the rules on RF legs, this must require that a straight line, fix terminated, approach transition to the FACF or FAF has been included. The track in the transition must be tangent to the arc. ~~and the fix at the end of the transition must be overflown.~~ The rule also does not exclude the use of an RF leg in between FAF and the final TF leg to the missed approach point. Such RF legs must be coded with the 4th character of the Waypoint Description field blank.

Attachment 5

Attachment 5

ARINC 424 NDB

Draft 1 of Supplement 22
Proposal

Location Cocoa Beach, Florida
March 7-9, 2017

ROUTE TYPE QUAL 3 FIELD CLEANUP

V1.0

Stephen Moody, Jeppesen

SUMMARY
This paper proposes changes that would cleanup the route type qual 3 field implementation that was proposed during the Zurich meeting.

1.0 INTRODUCTION/ BACK GROUND

There was a working paper to add a route type qualifier 3 field presented at the Zurich meeting by Martin Zillig that seems to have not been completely implemented in 424-21. In the meeting report, the paper was attachment 4.

2.0 DISCUSSION and or ACTION

I reviewed the Martin's paper against 424-21, which led to the changes proposed in section 3.0 of this paper. Most were minor edits, but the STAR Qual 2 value of E - RNP PBN Nav Spec was missing.

3.0 Changes as depicted (Track Changes is Helpful)

4.1.9.2 Airport SID/STAR/Approach Primary Extension Continuation Records

119	Route Qualifier 1 (1)	Note 1	5.7
120	Route Qualifier 2 (1)	Note 1	5.7
121	Route Qualifier 3 (1)	Note 1	5.7
122 thru 123	Reserved (2)		~~5.293~~

5.7 Route Type (RT TYPE)

Table 5-5 – Airport and Heliport SID Record

Note 5: Implied that Database Supported RNAV is required. Qualifier W and X can be used in conjunction with Qualifier 1 set to P and SID route type 1, 2, or 3. Qualifier 2 to be set to D when procedure chart is not annotated with Proceed Visually or Proceed VFR.

~~**Note 6: Implied that Data Base Supported RNAV is required. Qualifier W and X can be used in conjunction with Qualifier 1 set to P and SID route type 1, 2, or 3. Qualifier 2 to be set to D when procedure chart is not annotated with Proceed Visually or Proceed VFR.**~~

Table 5-6 – Airport STAR (PE) and Heliport STAR (HE) Records

RNAV PBN Nav Spec		D (Note 2)	
RNP PBN Nav Spec		E (Note 3)	
FMS Required		F (Note 1)	
Conventional Arrivals		G	

RNP 1 PBN Nav Spec			E
RNP AR PBN Nav Spec			F ~~(Note 4)~~
A-RNP (Advanced RNP) PBN Nav Spec			A

Attachment 6

Attachment 6

ARINC 424 NDB

Draft 1 of Supplement 22
Proposal

Location Cocoa Beach, Florida
March 7-9, 2017

UPDATE TO ATTACHMENT 5 SECTION 6.3.6.4

V1.0

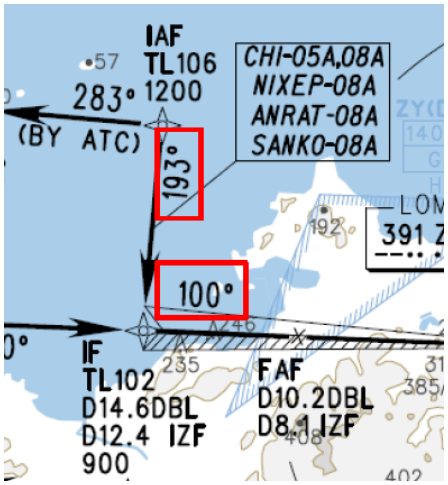
Kyle Phillips, Jeppesen

SUMMARY
Discuss and propose new wording to section 6.3.6.4 in Attachment 5 that will allow for intercepts of greater than 90 degrees when provided by source.

1.0 INTRODUCTION/ BACK GROUND

The current wording of section 6.3.6.4 may suggest that any intercept, regardless of path terminator type, cannot intercept the IF/FACF at an angle greater than 90°.

While most procedure source around the world intercepts the IF/FACF at or below 90°, there are some examples where the intercept at the IF/FACF may be over 90°. The below is one such example which can be found in China. With the addition of RNAV transitions into ILS final being more and more common, there may be a growth of procedures that may intercept the IF/FACF at angles slightly over 90°.



2.0 DISCUSSION and or ACTION

Amend the wording of 6.3.6.4 to take into consideration newer ILS procedure designs and to better define the intercept tolerance. The changes proposed will allow an angle greater than the current limit of 90° to be coded if provided by source documentation if the distance from the FACF and FAF is of sufficient distance to allow the aircraft to successfully intercept and track the localizer before reaching the FAF. Proposed distance is 4nm but can be amended based on discussion.

3.0 Changes as depicted (Track Changes is Helpful)

6.3.6.4 Legs ending in an intercept will ideally be at angles of 30 degrees to the track intercepted. Angles ~~between 10 and 90 degrees~~greater than 30 degrees may be coded as required by source documentation, provided the resulting intercept is within the reception area of the localizer and the distance between the FACF and FAF is at or greater than 4NM.

Attachment 7

Attachment 7

ARINC 424 NDB

Draft 1 of Supplement 22
Discussion

Location Cocoa Beach, Florida
March 7-9, 2017

ALT DESC CODES V, X, AND Y

V1.0

Stephen Moody, Jeppesen

SUMMARY
This paper requests a discussion that asks the users of the ARINC 424 data how the end user was going to use the altitude desc codes of V, X, and Y, and if it makes sense to apply these codes to the FAF sequence of an approach procedure also.

1.0 INTRODUCTION/ BACK GROUND

There has been recent discussion about the use of the waypoint descript codes of V, X, and Y, specifically regarding why they were limited to only step-down fix sequences.

V	At altitude on the coded vertical angle in the second Altitude field and at or above altitude specified in first Altitude field on step-down fix waypoints.
X	At altitude on the coded vertical angle in the second Altitude field and at altitude specified in the first Altitude field on step-down fix waypoints.
Y	At altitude on the coded vertical angle in the second Altitude field and at or below altitude specified in the first Altitude field on step-down fix waypoints.

Note: The codes V, X, and Y are used with all fixes defined in government source as step-down fixes and from the FACF inbound on final approach coding. There can be two altitudes provided on every fix in final approach coding. Altitude 1 is the altitude and constraint specified at the fix, the so-called procedure altitude. Altitude 2 is the 'at' altitude on the coded vertical path at the fix. See rules for fix altitude coding in Attachment 5 of this specification.

2.0 DISCUSSION and or ACTION

I would like to discuss the following questions.

a. What is the use case for the V, X, and Y altitude descript codes? How were they intended to be used by the end user?

b. Why were they limited to step-down fix sequences? I can see a use for these codes on the FAF sequence of non-precision approaches (dependant on the answer to question a.)

3.0 Changes as depicted (Track Changes is Helpful)

None

Attachment 8

Attachment 8

ARINC 424 NDB

Draft 1 of Supplement 22
Proposal

Location Cocoa Beach, Florida
March 7-9, 2017

GBAS/GLS TERM USE

V1.0

Stephen Moody, Jeppesen

SUMMARY
ICAO has clarified how the terms GLS and GBAS should be used in the PANS-OPS Volume II document. This paper proposes changes to the ARINC 424 use of the terms to align with the ICAO use of the terms.

1.0 INTRODUCTION/ BACK GROUND

During the ICAO IFPP 13 amendment cycle, an effort was made to clarify when the term GLS should be used in PANS-OPS Volume II, and when the term GBAS should be used. This resulted in the following understanding:

- GBAS will be used when referencing a system
- GLS will be used when referencing an approach procedure

2.0 DISCUSSION and or ACTION

I have reviewed every instance of the terms GLS and GBAS and I found 3 instances that would need to change to reflect the ICAO understanding of the use of the terms. These instances are included in section 3.0 of this paper.

3.0 Changes as depicted (Track Changes is Helpful)

2.2.4 Precision RNAV Terms
Final Approach Segment (FAS) Data Block
The FAS Data Block defines the lateral and vertical paths and associated criteria for the final approach segment of a SBAS (FAS) Data Block or ~~GBAS~~ GLS Approach Procedure.
Within an ARINC 424 output file, FAS Data Block data is carried in the Path Point Record and the two terms have been used interchangeably.

4.1.29 GLS Record (PT)
This record contains a sequential listing of all GNSS Landing Systems (GLS) approaches, including the slope, course, and reference path idents of the GLS approach. A GLS approach is identified by its ident and channel. Note that several GLS approaches can be supported by a single differential ~~GLS~~ GBAS ground station.

5.7 Route Type (RT TYPE)

Table 5-8 – Airport Approach (PF) and Heliport (HF) Records

GPS (GNSS) required, DME/DME to RNP xx.x not authorized	J (Note 2)		
~~GBAS~~ GLS Procedure	L (Note 2)		
DME Not Required for Procedure	N (Note 5)		

Attachment 9

Attachment 9

ARINC 424 NDB

Draft 1 of Supplement 22
Proposal

Location Cocoa Beach, Florida
March 7-9, 2017

BEGINNING LEG OF PINS DEPARTURES

V1.0

Stephen Moody, Jeppesen

SUMMARY
This paper updates paragraph 4.14 in Attachment 5 to remove the requirement that a PinS Departure must begin with an IF leg at the IDF.

1.0 INTRODUCTION/ BACK GROUND

At the 424 meeting in Tucson 2014, CMC proposed several changes to the document to support the coding needs of Helicopter PinS procedures. One of these changes added a new rule into attachment 5, section 4, that required the Initial Departure Fix (IDF) fix leg to contain an IF path and terminator.

During subsequent discussions within the ICAO IFPP about allowing ARINC 424 legs to be coded prior to the IDF on PinS Departures it was realized that always starting the PinS Departure using an IF leg at the IDF was not a recognized way forward with all participants. Some people were for it and some were against the idea of 424 coding in the visual segment of the departure.
For example, the path and terminator for the IDF sequence could be a CF or a DF leg, depending on the procedure.
There is a lot of PinS Departure source that already requires a CF or DF for the IDF sequence, so I am not sure what middle ground they will find during these discussions.

From the FAA perspective, they are currently working on PinS departure criteria that will support using DF or CF legs into the IDF.

2.0 DISCUSSION and or ACTION

I am proposing that paragraph 4.14 in attachment 5 be removed to support many of the existing procedures and to align with the new criteria that the FAA is working on.

3.0 Changes as depicted (Track Changes is Helpful)

~~4.14 The first leg of a Point-in-Space SID must be coded as an IF leg where the associated fix is coded as the Initial Departure Fix.~~

Attachment 10

Attachment 10

ARINC 424 NDB

Draft 1 of Supplement 22
Proposal

Location Cocoa Beach, Florida
March 7-9, 2017

LEVEL OF SERVICE SBAS REFERENCES

V.10

Stephen Moody, Jeppesen

SUMMARY
This paper proposes replacing the term SBAS in the 5.275 Level Of Service paragraph with the term PBN. This change will also remove the SBAS authorization statement which will remove any conflict with SBAS Authorization indicators between paragraph and 5.222 GNSS/FMS Indicator.

1.0 INTRODUCTION/ BACK GROUND

There has been some confusion regarding how the interpret the "authorized for SBAS" statement that was included in the Definition /Description of paragraph 5.275. I believe that one interpretation indicated that if there was a LNAV/VNAV Level of Service name populated, and was 'Authorized' (paragraph 5.276), then the GNSS/FMS Indicator field (5.222) must also be set to code 'A' SBAS Use Authorized.

I don't think that was the original intention for the Level of Service Name field. I think that the Level of Service Name field was only to provide the level of service name for a procedure.

Only the GNSS/FMS Indicator field should be indicating when a PBN procedure has been authorized for GNSS-based vertical navigation for a procedure.

2.0 DISCUSSION and or ACTION

To clarify the intent of paragraph 5.275, I replaced the use of the term SBAS in most places with PBN. If we discuss and agree on the intent of 5.275, the action would be to review section 3 of this paper.

3.0 Changes as depicted (Track Changes is Helpful)

5.275 Level of Service Name (LSN)

Definition/Description: The "Level of Service Name" field identifies the official procedure level of service based on published procedure operating minimums information for PBN Approach Procedures. ~~authorized for SBAS.~~

Source/Content: The field will be derived from official government. The table below shows examples of PBN Level of Service Names. ~~for SBAS.~~

Level of Service Name (Note 1)
LPV (Note 2)
LPV 200 (Note 2)
LP (Note 2)
LNAV
LNAV/VNAV

Used On:	Procedure Data Continuation Records
Length:	10 characters (Note 3)
Character Type:	Alpha

Note 1: The Level of Service Names of LPV, LPV200, LP, LNAV/VNAV, and LNAV are derived from available industry documentation in use at the time Supplement 20 was published. Other terminology to describe these procedures may be in use.

Note 2: At the time Level of Service was originally introduced, the only ~~SBAS~~ PBN Level of Service published for which there was a FAS Block provided category was LPV. Subsequently, other criteria and terminology has been developed and this is reflected in the examples above. As there can be only one procedure with a SBAS FAS Datablock for a given runway, the Level of Service Names LPV, LPV200 and LP are provided as appropriate in the field named FAS Block Provided Level of Service Name in Sections 4.1.9.5 or 4.2.3.5 while the other Level of Service Names are provided in dedicated fields in those paragraphs. It should be noted that it is possible for

LNAV/VNAV and/or LNAV to be authorized ~~for SBAS~~ either with or without a FAS Datablock provided and therefore these Level of Service Names are always carried in the dedicated field.

Note 3: The 10 character fields are left justified. Any remaining columns are filled with blanks. When the paired Level of Service Authorized field (Sections 4.1.9.5 or 4.2.3.5, and 5.276) is set to N (Not Authorized), the entire10-character Level of Service Name field should be blank.

Attachment 11

Attachment 11

ARINC 424 NDB

Draft 1 of Supplement 22

Proposal

Location Cocoa Beach, Florida

March 7-9, 2017

CHANGE TO CENTER FIX FIELD

V.1

Martin Zillig, Lufthansa Systems FlightNav

SUMMARY
This proposal includes changes to the allowed RF center fixes and the MSA reference coding rules, both defined in the Center Fix field (5.144). The proposal also includes a small change to the ARC coding rule 3.13 in attachment 5.

1.0 INTRODUCTION / BACK GROUND

The current text in 5.144 defines the use of the center fix field depending on the usage. One problem is that the MSA reference could be on different records, based on the path terminator coded on the FAF record. Furthermore, if used in SID/STAR and approach transitions, the MSA reference will always be coded in the first sequence. In the final approach, it is coded on the FAF record, except if the FAF record has an RF leg, then it is also coded on the first sequence.

The second point is the requirement that the RF center fix must be a terminal waypoint (PC record). In earlier versions of 424, the text very clearly required this, however, since 424-19, the definition no longer show this requirement, but the Source/Content part still has such a remark.

5.144 Center Fix (CENTER FIX)

Definition/Description: When used on Airport and Heliport MSA Records, the Center Fix field represents the MSA Center; that point on which the MSA is predicated. When used on Terminal Procedure Records, it can be used in three ways:

1. When the terminal procedure has an MSA defined, the field will contain the identifier of the fix on which the MSA is predicated. This will serve as a pointer to the specific MSA Record. This pointer will be populated on the Final Approach Fix (FAF) Record for Approach Procedures unless the government source MSA is “by transition” in which case the pointer is populated on the first leg of each transition. For SIDs and STARs, this pointer will be populated on the first leg of each transition which it applies.
2. When the terminal procedure has a TAA defined, the field will contain the identifier of the fix on which the TAA Sector is predicated. This will serve as a pointer to the specific TAA Record. This will be populated on the first record for each approach transition.
3. When used in a terminal procedure record defined by an RF Path Terminator, the field will contain the fix that defines the center of the constant rate turn. If the RF Leg terminates at the FAF, where the MSA Center Fix information would normally be found, the RF Center Fix takes priority and the MSA Center Fix pointer will be moved to the FACF record.

Source/Content: When used as MSA Center, the field will contain the identification of the navigation facility, Enroute Waypoint, Terminal Waypoint, Runway, Airport Reference Point or Heliport Reference Point, upon which the MSA coverage radius is predicated. Such content will be derived from official government sources. When used as a TAA IAF Waypoint, the field contains the official identifier of the waypoint for which the TAA Sector is defined. They will be derived from official government sources. When used as Radius Center, the field will contain the identification of the Terminal Waypoint used to define the center point of the RF turn.

Used On:	Airport and Heliport MSA Records, Airport and Heliport TAA Records, Airport and Heliport SID/STAR Approach Procedure Records
Length:	5 characters max
Character Type:	Alpha/numeric

2.0 DISCUSSION and or ACTION

I would like to propose to change the text to mandate that the reference to the MSA will be coded on the first sequence regardless of the procedure type.

Furthermore, I would like to propose to remove the “terminal waypoint” requirement for RF path terminator center fix.

Finally, I would propose to change the rule about when to use AF or RF legs, so that for non DME arcs specified in source, the RF leg must be used.

3.0 Changes as depicted

5.144 Center Fix (CENTER FIX)

Definition/Description: When used on Airport and Heliport MSA Records, the Center Fix field represents the MSA Center; that point on which the MSA is predicated. When used on Terminal Procedure Records, it can be used in three ways:

4. When the terminal procedure has an MSA defined, the field will contain the identifier of the fix on which the MSA is predicated. This will serve as a pointer to the specific MSA Record. For Approach Procedures, ~~This~~ this pointer will be populated on the first leg of the final approach coding, ~~Final Approach Fix (FAF) Record for Approach Procedures~~ unless the government source MSA is “by transition” in which case the pointer is populated on the first leg of each transition. For SIDs and STARs, this pointer will be populated on the first leg of each transition which it applies.
5. When the terminal procedure has a TAA defined, the field will contain the identifier of the fix on which the TAA Sector is predicated. This will serve as a pointer to the specific TAA Record. This will be populated on the first record for each approach transition.
6. When used in a terminal procedure record defined by an RF Path Terminator, the field will contain the fix that defines the center of the constant ~~rate turn~~radius arc. ~~If the RF Leg terminates at the FAF, where the MSA Center Fix information would normally be found, the RF Center Fix takes priority and the MSA Center Fix pointer will be moved to the FACF record.~~

Source/Content: When used as MSA Center, the field will contain the identification of the navigation facility, Enroute Waypoint, Terminal Waypoint, Runway, Airport Reference Point or Heliport Reference Point, upon which the MSA coverage radius is predicated. Such content will be derived from official government sources. When used as a TAA IAF Waypoint, the field contains the official identifier of the waypoint for which the TAA Sector is defined. They will be derived from official government sources. When used as Radius Center, the field will contain the identification of the navigation facility, Enroute Waypoint or Terminal Waypoint used to define the center point of the RF turn.

Used On:	Airport and Heliport MSA Records, Airport and Heliport TAA Records, Airport and Heliport SID/STAR Approach Procedure Records
Length:	5 characters max
Character Type:	Alpha/numeric

Furthermore, the following paragraph in attachment 5 should be updated as follows:

3.13 When coding arc paths, the choice of AF or RF is defined by source documents. When the source defined arc is a DME arc, the AF leg is the preferred leg type, for non DME arcs, the RF leg must be used. ~~ARC Center is a VHF Navaid of the types VORDME or VORTAC and the path is defined as a DME ARC, the AF leg must be used instead of the RF leg.~~

Attachment 12

Attachment 12

ARINC 424 NDB

Draft 1 of Supplement 22

Proposal

Location Cocoa Beach, Florida

March 7-9, 2017

CHANGE TO 7.1.7 IN ATTACHMENT 5

V.1

Martin Zillig, Lufthansa Systems FlightNav

SUMMARY
This proposal removes duplicate text in rule 7.1.7.

1.0 INTRODUCTION/ BACK GROUND

The current text in 7.1.7 repeats the definition of FAF and missed approach point, which both are defined in other places.

7.1.7	For approach procedures with an electronic glideslope, the vertical angle must be coded in both the Final Approach Fix and the fix, which carries the missed approach point coding, except when the altitude 1 and altitude 2 at the FAF are identical, in which case the vertical angle is omitted on the FAF. The FAF record carries the Final Approach Fix waypoint description code of F in position four of that field. The missed approach point fix carries the waypoint description code of M in this position four. The vertical angle will be the published glideslope angle for the installation or procedure

2.0 DISCUSSION and or ACTION

If the group agrees that the second part of the rule is repeating information defined in other parts of the document, I would propose to remove the complete second part. This should make it clearer and easier to read.

3.0 Changes as depicted (Track Changes is Helpful)

7.1.7 For approach procedures with an electronic glideslope, the vertical angle must be coded in both the Final Approach Fix and the fix, which carries the missed approach point coding, except when the altitude 1 and altitude 2 at the FAF are identical, in which case the vertical angle is omitted on the FAF~~. The FAF record carries the Final Approach Fix waypoint description code of F in position four of that field. The missed approach point fix carries the waypoint description code of M in this position four. The vertical angle will be the published glideslope angle for the installation or procedure~~

Attachment 13

Attachment 13

ARINC 424 NDB

Draft 1 of Supplement 22

Proposal

Location Cocoa Beach, Florida

March 7-9, 2017

RUNWAY DECLARED DISTANCES

V.1

Martin Zillig, Lufthansa Systems FlightNav

SUMMARY
Add fields for the runway declared distances, i.e. TORA, TODA, ASDA and LDA to the runway continuation record.

1.0 INTRODUCTION/ BACK GROUND

Some applications require accurate distances which are available for take-off and landing from the ARINC 424 data file. Currently, only overall runway length, displacement values and stopway dimensions are provided in the 424 file. These values are not sufficient to accurately represent the required data.

2.0 DISCUSSION and ACTION

I do see two possible ways to include these values in the 424 file. One would be to use the existing Runway continuation record (4.1.10.2) or a new declared distance continuation record could be created, especially if the concept of declared distances could be expanded in the future.

This proposal includes the fields in the already existing record.

3.0 Changes as depicted (Track Changes is Helpful)

4.1.10.2 Runway Continuation Records

Column	Field Name (Length)	Reference
1 thru 21	Fields as on Primary Records	
22	Continuation Record No. (1)	5.16
23	Application Type (1)	5.91
24 thru 92	Notes (69)	5.61
93 thru 96	Runway Surface Type (4)	5.302
97	Runway Surface Code (1)	5.249
98 thru 101	Starter Extension (4)	5.312
102 thru 106	TORA	5.xxx
107 thru 111	TODA	5.xxx
112 thru 116	ASDA	5.xxx
117 thru 121	LDA	5.xxx
~~102~~ 122 thru 123	Reserved (Expansion) (~~22~~2)	
124 thru 128	File Record No. (5)	5.31
129 thru 132	Cycle Date (4)	5.32

5.57 Runway Length (RUNWAY LENGTH)

Definition/Description: The Runway Length field defines the total length of the runway surface for the runway identified in the records' Runway Identifier field.

Source/Content: Runway lengths are derived from official government sources and are entered in feet with a resolution of one foot. The value represents the overall length of the runway, with no regard for displaced thresholds~~. It does not include~~, starter extensions, stopways, overruns~~,~~ or clearways. Available landing lengths and take-off runs are not necessarily identical to this runway length. These distances are provided in the Runway Continuation Records. As the latitude/longitude information in the runway record reflects the Landing Threshold Point of the runway identified in the record, which may or may not be displaced, there is no direct correlation between the Runway Length provided in the record and a value calculated based on these latitude/longitude values.

Used On:	Runway Records
Length:	5 characters
Character Type:	Numeric
Examples:	05000, 07000, 11480

5.xxx TORA

Definition/Description: Take Off Run Available is the declared distance value which is available for take-off ground roll.

Source/Content: The TORA value will be derived from official government sources and shown in feet. Starter extension distances are not included in the TORA distance and may be added if a starter extension is available. A value of 00000 indicates that the runway is not usable for take-off. A blank field means that no value is declared in source.

Used On:	Runway Continuation Records
Length:	5 Character
Character Type:	Numeric
Examples:	02900, 10000

5.xxx TODA

Definition/Description: Take Off Distance Available is the declared distance value which is available for take-off over a 50ft obstacle. Typically, the TODA equals the TORA plus clearway.

Source/Content: The TODA value will be derived from official government sources and shown in feet. Starter extension distances are not included in the TODA. A value of 00000 indicates that the runway is not usable for take-off. A blank field means that no value is declared in source.

Used On:	Runway Continuation Records
Length:	5 Character
Character Type:	Numeric
Examples:	02900, 10000

5.xxx ASDA

Definition/Description: Accelerate Stop Distance Available is the declared distance value which is available in case of an aborted take-off. Typically, the ASDA equals the TORA plus stopway.

Source/Content: The ASDA value will be derived from official government sources and shown in feet. Starter extension distances are not included in the TODA distance and may be added if a starter extension is available. A value of 00000 indicates that the runway is not usable for take-off. A blank field means that no value is declared in source.

Used On:	Runway Continuation Records
Length:	5 Character
Character Type:	Numeric
Examples:	02900, 10000

5.xxx LDA

Definition/Description: Landing Distance Available is the declared distance value which is available for landing. Typically, the LDA equals the runway length minus the threshold displacement distance.

Source/Content: The LDA value will be derived from official government sources and shown in feet. A value of 00000 indicates that the runway is not usable for landing. A blank field means that no value is declared in source.

Used On:	Runway Continuation Records
Length:	5 Character
Character Type:	Numeric
Examples:	02900, 10000

Attachment 14

Attachment 14

ARINC 424 NDB

Draft 1 of Supplement 22

Proposal

Location Cocoa Beach, Florida

March 7-9, 2017

EDITORIAL CHANGES

V.1

Martin Zillig, Lufthansa Systems FlightNav

SUMMARY
A few editorial changes that should be corrected

1.0 INTRODUCTION/ BACK GROUND

When reviewing ARINC 424-21, I noticed a few mistakes.

2.0 ACTION

Please consider the following changes as editorial changes.

3.0 Changes as depicted (Track Changes is Helpful)

Chapter 3, title of the new Section/Subsection Airport Helipad:

3.2.4.18 Airport ~~Heliport~~ Helipad Section (P), Subsection (H)

The Airport Helipad Subsection file should contain the all government published Helipads associated with the airports referenced in Section 3.2.4.1.

There are a few mistakes in chapter 4:

4.1.9.3 Airport SID/STAR/Approach Flight Planning Continuation Records

This Continuation Record is used to indicate the Leg Distance for each segment of the Route.

Column	Field Name (Length)		Reference
1 thru 38	Field as on Primary		
39	Continuation Record No. (1)		5.16
40	Application Type (1)		5.91
41 thru 74	Blank (Spacing) (34)		
75 thru 78	Leg Distance (4)		5.260
79 thru 118	Reserved (Expansion) (40)		
119	Route Qualifier 1 (1)	Note 1	5.7
120	Route Qualifier 2 (1)	Note 1	5.7
121	Route Qualifier 3 (1)	Note 1	5.7
122 thru 123	Blank (Spacing) (2)		
124 thru 128	File Record No. (5)		5.31
129 thru 132	Cycle Date (4)		5.32

Note 1: Columns 119 thru 121 (Route Qualifier 1, 2, and 3) are required to match the Primary Record to the Continuation Record(s). This non-standard column sorting sequence was selected to preserve the Primary Record for SID/STAR/Approach Records as much as possible as these new fields were introduced in Supplement 14.

4.2.3.1 Heliport SID/STAR/Approach Primary Records

Column	Field Name (Length)	Reference
1	Record Type (1)	5.2
2 thru 4	Customer/Area Code (3)	5.3
5	Section Code (1)	5.4
6	Blank (Spacing) (1)	
7 thru 10	Heliport Identifier (4)	5.6
11 thru 12	ICAO Code (2)	5.14
13	Subsection Code (1)	5.5
14 thru 19	SID/STAR/APP Identifier (6) Note 1	5.9, 5.10
20	Route Type (1)	5.7
21 thru 25	Transition Identifier (5)	5.11
26	Procedure Design Aircraft Category or Type	5.301
27 thru 29	Sequence Number (3)	5.12
30 thru 34	Fix Identifier (5)	5.13
35 thru 36	ICAO Code (2)	5.14
37	Section Code (1)	5.4
38	Subsection Code (1)	5.5
39	Continuation Record Number (1)	5.16
40 thru 43	Waypoint Description Code (4)	5.17
44	Turn Direction (1)	5.20
45 thru 47	RNP (3) Note 4	5.211
48 thru 49	Path and Termination (2)	5.21
50	Turn Direction Valid (1)	5.22
51 thru 54	Recommended Navaid (4)	5.23
55 thru 56	ICAO Code (2)	5.14
57 thru 62	ARC Radius (6)	5.204
63 thru 66	Theta (4)	5.24
67 thru 70	Rho (4)	5.25
71 thru 74	Magnetic Course (4)	5.26
75 thru 78	Route Distance/Holding Distance or Time (4)	5.27
79	Recommended Navaid Section (1)	5.4
80	Recommended Navaid Subsection (1)	5.5
81	Inbound/Outbound Indicator (1)	5.298
82	Reserved (Spacing) (1)	
83	Altitude Description (1)	5.29
84	ATC Indicator (1)	5.81
85 thru 89	Altitude (5)	5.30
90 thru 94	Altitude (5)	5.30
95 thru 99	Transition Altitude (5)	5.53
100 thru 102	Speed Limit (3)	5.72
103 thru 106	Vertical Angle (4)	5.70
107 thru 111	Center Fix or TAA Procedure Turn Indicator (5)	5.144 or 5.271
112	Multiple Code or TAA, Sector Identifier (1)	5.130 or 5.272
113 thru 114	ICAO Code (2) Note 3	5.14
115	Section Code (1) Note 3	5.4
116	Subsection Code (1) Note 3	5.5
117	GNSS/FMS Indicator (1)	5.222
118	Speed Limit Description (1)	5.261
119	Route Qualifier 1 (1) Note 2	5.7
120	Route Qualifier 2 (1) Note 2	5.7
121	Route Qualifier 3 (1) Note 2	5.7
~~121~~ 122	Preferred Multiple Approach Indicator (1)	5.306
~~122 thru~~ 123	Reserved (Expansion) (~~2~~1)	
124 thru 128	File Record Number (5)	5.31
129 thru 132	Cycle Date (4)	5.32

Note 1: For approach route idents including Multiple Indicators, see Section 5.10.

Note 2: Columns 119 ~~and~~ thru ~~120~~ 121 (Route Qualifier 1, 2, and ~~1~~3) are required to match the Primary Record to the Continuation Record(s). This non-standard column sorting sequence was selected to preserve the Primary Record Layout for SID/STAR/Records as much as possible as these new fields were introduced in Supplement 14.

Note 3: When columns 107 thru 116 are providing a reference to a MSA or the center fix for an RF leg, all of the columns are used. When they are providing a reference to a TAA, only columns 107 thru 112 are used and 113 thru 116 are blank.

Note 4: If there is only one set of RNP criteria for the RNAV procedure, that criteria is provided in the RNP value field for Primary Record. Otherwise, the Primary Record contains one consistent set of RNP values for the least restrictive RNAV operating criteria and not a mix of RNP values for different RNP operating criteria.

4.2.3.2 Heliport SID/STAR/Approach Primary Extension Continuation Records

Column	Field Name (Length)		Reference
1 thru 38	Fields as on Primary Records		
39	Continuation Record Number (1)		5.16
40	Application Type (1)		5.91
41 thru 43	Procedure TCH (3)		5.67
44 thru 60	Blank Spacing (17)		
61 thru 65	Procedure Design Mag Var (5)	Note 2	5.39
66	Procedure Design Mag Var Indicator (1)	Note 2	5.291
67 thru 71	Procedure Referenced Fix Ident (5)	Note 3	5.299
72 thru 73	ICAO Code (2)		5.14
74	Section Code		5.4
75	Subsection Code		5.5
76 thru 80	Procedure Referenced Fix Ident (5)	Note 3	5.299
81 thru 82	ICAO Code (2)		5.14
83	Section Code		5.4
84	Subsection Code		5.5
85 thru 89	Procedure Referenced Fix Ident (5)	Note 3	5.299
90 thru 91	ICAO Code (2)		5.14
92	Section Code		5.4
93	Subsection Code		5.5
94 thru 98	Procedure Referenced Fix Ident (5)	Note 3	5.299
99 thru 100	ICAO Code (2)		5.14
101	Section Code		5.4
102	Subsection Code		5.5
103 thru 104	CAT A Radii (2)		5.292
105 thru 110	Reserved (6)		
111	Special Indicator		5.307
112 thru 115	Reserved (4)		
116 thru 118	Vertical Scale Factor (3)		5.293
119	Route Qualifier 1 (1)	Note 1	5.7
120	Route Qualifier 2 (1)	Note 1	5.7
121	Route Qualifier 3 (1)	Note 1	5.7
~~121~~ 122 thru 123	Reserved (~~3~~2)		
124 thru 128	File Record Number (5)		5.31
129 thru 132	Cycle Date (4)		5.32

Note 1: Columns 119 ~~and~~ thru ~~120~~121, (Approach Route Qualifier 1, 2 and ~~2~~3) are required to match the Primary Record to the Continuation Record(s). This non-standard column sorting sequence was selected to preserve the Primary Record for SID/STAR/Approach Records as much as possible as these new fields were introduced in Supplement 14.

Note 2: When government source provides Procedure Design Mag Var at the procedure level, a single Primary Extension Continuation Record will be provided, associated to the first sequence in each transition and the Procedure Design Mag Var Indicator will be set to P. This is consistent with the intent of this continuation record. When government source provides Procedure Design Mag Var the leg level, a Primary Extension Continuation Record will be provided associates with each sequence of each transitions and the Procedure Design Mag Var Indicator will be set to L.

Note 3: When government source provided more than ~~on e~~four Procedure Referenced Fix Ident, multiple Heliport SID/STAR/Approach Primary Extension Continuation Records will be provided.

4.2.3.3 Heliport SID/STAR/Approach Flight Planning Continuation Records

This Continuation Record is used to indicate the Leg Distance for each segment of the Route.

Column	Field Name (Length)	Reference
1 thru 38	Fields as on Primary Records	
39	Continuation Record Number (1)	5.16
40	Application Type (1)	5.91
41 thru 74	Blank (Spacing) (34)	
75 thru 78	Leg Distance (4)	5.260
79 thru ~~123~~118	Reserved (Expansion) (~~45~~40)	
119	Route Qualifier 1 (1) Note 1	5.7
120	Route Qualifier 2 (1) Note 1	5.7
121	Route Qualifier 3 (1) Note 1	5.7
122 thru 123	Blank (Spacing) (2)	
124 thru 128	File Record Number (5)	5.31
129 thru 132	Cycle Date (4)	5.32

Note 1: Columns 119 thru 121, (Approach Route Qualifier 1, 2 and 3) are required to match the Primary Record to the Continuation Record(s). This non-standard column sorting sequence was selected to preserve the Primary Record for SID/STAR/Approach Records as much as possible as these new fields were introduced in Supplement 14.

4.2.3.4 Heliport SID/STAR/Approach Flight Planning Continuation Records

Deleted by Supplement 19.

4.2.3.5 Heliport Procedure Data Continuation Record

The Heliport Procedure Data Continuation Record is used to provide Level of Service information for RNAV Approach Procedures. Level of Service and Authorization are based on source provided operating minimums as described in Sections 5.275, 5.276, and 5.296 of this document. This Continuation Record is provided once per procedure as a Continuation to Primary Approach Procedure Record that contains the encoding for Final Approach Fix (FAF) of the procedure.

Column	Field Name (Length)		Reference
1 thru 38	Fields as on Primary Record		
39	Continuation Record Number (1)		5.16
40	Application Type (1)		5.91
41	FAS Block Provided		5.276
42 thru 51	FAS Block Provided Level of Service Name (10)		5.275
52	LNAV/VNAV Authorized (1)		5.276
53 thru 62	LNAV/VNAV Level of Service Name (10)		5.275
63	LNAV Authorized (1)		5.276
64 thru 73	LNAV Level of Service Name (10)		5.275
74	Remote Altimeter Flag (1)		5.308
75 thru 88	Blank (Spacing) (14)		
89	RNP Authorized (1)		5.276
90 thru 92	RNP Level of Service value (3)		5.296
93	RNP Authorized (1)		5.276
94 thru 96	RNP Level of Service value (3)		5.296
97	RNP Authorized (1)		5.276
98 thru 100	RNP Level of Service value (3)		5.296
101	RNP Authorized (1)		5.276
102 thru 104	RNP Level of Service value (3)		5.296
105 thru 118	Blank (Spacing) (14)		
119	Route Qualifier 1 (1)	Note 1	5.7
120	Route Qualifier 2 (1)	Note 1	5.7
121	Route Qualifier 3 (1)	Note 1	5.7
~~121~~ 122 thru 123	Blank (~~3~~2)		
124 thru 128	File Record Number (5)		5.31
129 thru 132	Cycle Date (4)		5.32

Note 1: Columns 119 ~~and~~ thru ~~120~~ 121 (Approach Route Type Qualifiers 1, 2 and ~~2~~3) are required to match the Primary Record to the Continuation Record(s). This non-standard column sorting sequence was selected to preserve the Primary Record for SID/STAR/Approach Records as much as possible as these new fields were introduced in Supplement 14.

Table 5-1 – Section and Subsection Encoding Scheme

Section Code	Section Name	Subsection Code	Subsection Name
A	MORA	S	Grid MORA
D	Navaid	Blank	VHF Navaid
		B	NDB Navaid
		T	TACAN Duplicates
E	Enroute	A	Waypoints
		M	Airway Markers
		P	Holding Patterns
		R	Airways and Routes
		S	Special Activity Areas
		T	Preferred Routes
		U	Airway Restrictions
		V	Communications
H	Heliport	A	Reference Points
		C	Terminal Waypoints
		D	SIDs
		E	STARs
		F	Approach Procedures
		H	Helipads
		K	TAA
		S	MSA
		P	SBAS Path Point
		V	Communications
P	Airport	A	Reference Points
		B	Gates
		C	Terminal Waypoints
		D	SIDs
		E	STARs
		F	Approach Procedures
		G	Runways
		H	Helipads
		I	Localizer/Glideslope
		K	TAA
		L	MLS
		M	Localizer Marker
		N	Terminal NDB
		P	SBAS Path Point
		Q	GBAS Path Point
		R	Flt Planning ARR/DEP
		S	MSA
		T	GLS Station
		V	Communications
R	Company Routes	Blank	Company Routes (Master Airline File)
		A	Alternate Records
		H	Helicopter operation Routes (Master Helicopter File)
T	Tables	C	Cruising Tables
		G	Geographical Reference
		~~N~~	~~RNAV Name Table~~
		V	Communication Type
U	Airspace	C	Controlled Airspace
		F	FIR/UIR
		R	Restrictive Airspace

Table 5-5 – Airport and Heliport SID Record

Qualifier Description	Qualifier 1 Field Content	Qualifier 2 Field Content	Qualifier 3 Field Content
DME Required	D		
GNSS Required	G		
Radar Required	R		
Helicopter SID from Runway	H		
Point-in-Space (PinS) SID	P		
RNAV PBN Nav Spec		D (Note 2)	
RNP PBN Nav Spec		E (Note 1)	
FMS Required		F (Note 3)	
Conventional Departures		G	
PinS Departure - Proceed Visually		W (Note 5)	
PinS Departure - Proceed VFR		X (Note 5)	
RNAV 5 PBN Nav Spec			Z
RNAV 2 PBN Nav Spec			Y
RNAV 1 PBN Nav Spec			X
B RNAV			B
P RNAV			P
RNP 2 PBN Nav Spec			D
RNP 1 PBN Nav Spec			E
RNP AR PBN Nav Spec			F (Note 4)
A-RNP (Advanced RNP) PBN Nav Spec			A
RNP 0.3 PBN Nav Spec			G
PBN Nav Spec unspecified			U
VOR/DME RNAV			V

Note 1: Departure Procedures designed and published based upon an ICAO PBN RNP Navigation Specification. Qualifier 3 must be coded with D, E, F, A, G, or U.

Note 2: RNAV Departures designed and published based upon an ICAO PBN RNAV Navigation Specification will be coded with a qualifier 3 Z, Y, X, B, P, or U. RNAV Departures not based upon PBN will be coded with a qualifier 3 U or V.

Note 3: Used when the government authority has designated a Departure as FMS.

Note 4: The Qualifier F indicates that the departure is an RNP AR procedure. Implied GNSS required. Qualifier F used with SID route type 0 will designate an RNP AR Engine Out SID. Qualifier F can be used in conjunction with SID route type 1, 2 or 3, provided the corresponding SID transition is AR.

Note 5: Implied that Database Supported RNAV is required. Qualifier W and X can be used in conjunction with Qualifier 1 set to P and SID route type 1, 2, or 3. Qualifier 2 to be set to D when procedure chart is not annotated with Proceed Visually or Proceed VFR.

~~Note 6: Implied that Data Base Supported RNAV is required. Qualifier W and X can be used in conjunction with Qualifier 1 set to P and SID route type 1, 2, or 3. Qualifier 2 to be set to D when procedure chart is not annotated with Proceed Visually or Proceed VFR.~~

Table 5-6 – Airport STAR (PE) and Heliport STAR (HE) Records

STAR Route Type Description	Field Content
STAR Enroute Transition	1
STAR or STAR Common Route	2
STAR Runway Transition	3

Qualifier Description	Qualifier 1 Field Content	Qualifier 2 Field Content	Qualifier 3 Field Content
DME Required	D		
Radar Required	R		
GNSS Required	G		
Helicopter STAR to Runway	H		
Continuous Descent STAR	P		
RNAV PBN Nav Spec		D (Note 2)	
RNP PBN Nav Spec		E (Note 3)	
FMS Required		F (Note 1)	
Conventional Arrivals		G	
RNAV 5 PBN Nav Spec			Z
RNAV 2 PBN Nav Spec			Y
RNAV 1 PBN Nav Spec			X
B RNAV			B
P RNAV			P
RNP 2 PBN Nav Spec			D
RNP 1 PBN Nav Spec			E
RNP AR PBN Nav Spec			F ~~(Note 4)~~
A-RNP (Advanced RNP) PBN Nav Spec			A
RNP 0.3 PBN Nav Spec			G
PBN Nav Spec unspecified			U
VOR/DME RNAV			V

Note 1: Used when the government authority has designated an Arrival as FMS.

Note 2: RNAV Arrivals designed and published based upon an ICAO PBN RNAV Navigation Specification will be coded with a qualifier 3 Z, Y, X, B, P, or U. RNAV Arrivals not based upon PBN will be coded with a qualifier 3 U or V.

Note 3: Arrival Procedure designed and published based upon an ICAO PBN RNP Navigation Specification. Qualifier 3 must be coded with D, E, F, A, G, or U.

Table 5-10 – Circle-to-Land Procedures Identifier

Column	Contents	
1-3	Circling Procedure Ident (See below).	
4		
	A thru Z or 1 thru 9	A government source provided procedure suffix or ~~not~~ a multiple indicator
5-6	Blank	

Typo in the title of 5.312:

5.312 Starter Extension

Definition/Description: Starter Extension means an area made available for take-off, prior to the normal runway end at the beginning of the takeoff run. Starter extensions are established where additional takeoff distance, takeoff run or accelerate-stop distance is required, but physical limitations do not allow provision of the mandatory runway strip or width.

Source/Content: The Starter Extension will be derived from official government sources and shown in feet (See **Error! Reference source not found.Error! Reference source not found.**).

Used On:	Runway Records
Length:	4 Character
Character Type:	Numeric
Examples:	0900, 1000

Finally, the original text concerning conditional altitude termination somehow survived in attachment 5. The rules used to be 2.3, but it was moved to the leg sequencing table and to rule 1.3.1 in attachment 5, therefore, rule 2.3 could be deleted.

Attachment 5

2.3 ~~Use of a C in the Altitude Description field (5.29) may only be used in SID records and there only with the following leg types:~~

~~CD, CF, CR, FC, FD, TF, VD, VR~~

~~The conditional termination altitude can be coded in columns 90 through 94 of the SID record. If a +, - or blank is coded in the Altitude Description field, input of a second altitude must imply a condition altitude termination.~~Removed with supplement 22.

Thank you for reading to the end.

Attachment 15

Attachment 15

ARINC 424 NDB

Draft 1 of Supplement 22

Proposal

Location Cocoa Beach, Florida

March 7-9, 2017

PLACEMENT OF FAF

V.1

Martin Zillig, Lufthansa Systems FlightNav

SUMMARY
Clean-up of chapter 2, definitions of terms, and coding rules governing the placement of the FAF.

1. INTRODUCTION/ BACK GROUND

There seem to be a slight inconsistency in the definitions of terms in chapter 2. As an example, the IAF and IF are just defined what these terms mean, while the FAF and others are defined including description of when and where to code them, the same definitions are repeated in attachment 5.

These differences, but mostly the wording which defines the Final Approach Fix (FAF) has led to a number of discussions.

Final Approach Fix (FAF)

The FAF is a waypoint located at a position that represents the Final Approach Fix or Final Approach Point defined in the government procedure source and or procedure design documentation. For non-precision approach procedures, including non-precision localizer based procedures, the waypoint will be located at the fix designated by the government source as the procedure FAF, when one is published. When none is published, the FAF waypoint will be established according to the rules defined in Attachment Five of this specification. For precision localizer-based procedures, the coded FAF will be at the OM position, when an OM is present and located on the localizer beam center, or at the glideslope intercept point.

Specifically, the sentence marked in yellow is understood by some people to be applied in case no FAF is published in source, while other people believe the FAF should be placed at the OM position every time.

Furthermore, rule 6.2.5.3b in attachment 5 has a slightly different wording:

6.2.5.3b	For Localizer and GLS based approach procedures, establish the FAF, when none is provided by source, at the nominal outer marker position.

2. DISCUSSION

In order to clarify the situation, I would like to propose the following changes to the ARINC 424 document:

1. Chapter 2, clean up the textual definitions where required and remove the coding rules.
2. Clarify the rules in attachment 5, e.g. rule 6.2.5.3b.

3. Changes as depicted

Final Approach Course Fix (FACF)

The FACF is a waypoint located at the beginning of the Final Approach Coding. If a FACF exists, it must be the first waypoint of the Final Approach Coding. Rules governing when and where a FACF is coded are contained in Attachment Five of this specification. ~~For Localizer-based Approach Procedures, the location of the FACF is on the localizer beam center, usually at a distance of 2 to 8 NM from the coded FAF. If the government source provides a named fix or an unnamed fix that is designated as the IF within this distance range or beyond this range, but within the published reception range of the localizer, it will be designated as the FACF. For non-localizer based procedures, if an FACF is coded, the FACF will be positioned 8 NM or less from the coded FAF. A government source provided named fix or unnamed fix designated, as the IF will be used. For localizer based procedures, if the government source does not include a named fix or unnamed fix designated as IF at a suitable location, the FACF will be a database waypoint created to meet the criteria established above.~~

Final Approach Fix (FAF)

~~The FAF is a waypoint located at a position that represents the Final Approach Fix or Final Approach Point defined in the government procedure source and or procedure design documentation. For non-precision approach procedures, including non-precision localizer based procedures, the waypoint will be located at the fix designated by the government source as the procedure FAF, when one is published. When none is published, the FAF waypoint will be established according to the rules defined in Attachment Five of this specification. For precision localizer-based procedures, the coded FAF will be at the OM position, when an OM is present and located on the localizer beam center, or at the glideslope intercept point.~~

The Final Approach Fix or Final Approach Point is a fix designated by government source documentation as the fix at which the Final Approach Segment of the approach begins. An Approach Procedure must have exactly one FAF. Rules governing where the FAF/FAP is coded and how one is established if none is published are contained in Attachment Five of this specification.

Initial Approach Fix (IAF)

An Initial Approach Fix is that fix designated by the government source documentations as the fix at which the Initial Approach segment begins. An Approach Procedure may have no IAF or multiple IAFs ~~waypoints~~.

Intermediate Fix (IF)

An Intermediate Fix is a fix designated by government source documentation as the fix at which the Intermediate Approach Segment of the approach begins. An Approach Procedure may have no IF, one IF or multiple IFs. If the government source provides a named fix or an unnamed fix that is designated as the Intermediate Fix, such a position could be coded as the FACF. Rules governing a FACF is coded at the published IF are contained in Attachment Five of this specification.

Missed Approach Point (MAP)

~~The MAP is the coded waypoint at which the Missed Approach Procedure begins. This waypoint can be a fix designated in government source documentation as the MAP or the Landing Threshold Point. The location of this point is determined by the rules in Attachment Five.~~

A Missed Approach Point is a fix designated by government source documentation as the point at which the Missed Approach Segment of the approach begins. This may be at a fix or at a Decision Altitude. A coded Approach Procedure must have exactly one MAP. Rules governing where the MAP is coded and how one is established if none is published are contained in Attachment Five of this specification.

Attachment 5

6.2.5.3b	For Localizer and GLS based approach procedures, establish the FAF, when none is provided by source, at the nominal outer marker position. If no nominal outer marker position is published in source, use the glide slope intercept position.

Attachment 16

Attachment 16

ARINC 424 NDB

Draft 1 of Supplement 22

Proposal

Location Cocoa Beach, Florida

March 7-9, 2017

CHANGE TO CUSTOMER CODE FIELD

V.1

Martin Zillig, Lufthansa Systems FlightNav

SUMMARY
The Customer/Area Code field should allow numbers

1. INTRODUCTION/ BACK GROUND

Currently, ARINC 424 defines the Customer/Area field as Alpha. However, since a long time, the use of the airline code for tailored content is no longer sufficient. Most airlines have different tailored data based on aircraft types instead of one tailored data set per airline.
This is handled by using a two character airline identifier and a multiple code, typically a number. As an example, tailored data for Lufthansa are coded as “LH1”, “LH2” etc. and not as “DLH”.

In addition, the mentioned IATA airline codes are only two characters long, while the three character airline codes are published by ICAO, in Doc 8585. Furthermore, some airlines are using numbers in their IATA code, e.g. Germanwings is using “4U”.

Current text from ARINC 424:

5.3 Customer/Area Code (CUST/AREA)

Definition/Description: The Customer Area Code field permits the categorization of standard records by geographical area and of tailored records by the airlines for whom they are provided in the master file. Several record types do not adhere to the established geographical boundaries. There is no AREA in such records.

Source/Content: AREA Codes should be derived from **Error! Reference source not found.**~~Figure 5~~**Error! Reference source not found.**~~-1~~. Airline codes should be derived from the standard list of abbreviated identifiers maintained and published in the IATA Airline Coding Directory. On Company Route and Preferred Route Records, an additional AREA field is used as a pointer to the AREA in which the Route Segment is located. For records, which do not follow geographical boundaries, the field is blank. For Preferred Routes, the field content is PDR.

Used On:	All records with content as defined above.
Length:	3 characters max
Character Type:	Alpha
Examples:	Areas - USA, CAN, EUR Customer - UAL, DAL, TWA Preferred Routes - PDR

2. ACTION

The current 424 should be changed to show the current coding practices and updated to current standards. Please consider the following change.

3. Changes as depicted

5.3 Customer/Area Code (CUST/AREA)

Definition/Description: The Customer Area Code field permits the categorization of standard records by geographical area and of tailored records by the airlines or airline subsets for whom they are provided in the master file. Several record types do not adhere to the established geographical boundaries. There is no AREA in such records.

Source/Content: AREA Codes should be derived from **Error! Reference source not found.**~~Figure 5~~**Error! Reference source not found.**~~-1~~. Airline codes should be derived from ICAO Doc 8585 for the three letter code or the ~~standard list of abbreviated identifiers maintained and published in the~~ IATA Airline Coding Directory for the two character code. On Company Route and Preferred Route Records, an additional AREA field is used as a pointer to the AREA in which the Route Segment is located. For records, which do not follow geographical boundaries, the field is blank. For Preferred Routes, the field content is PDR.

Used On:	All records with content as defined above.
Length:	3 characters max
Character Type:	Alpha/numeric
Examples:	Areas - USA, CAN, EUR
	Customer - UAL, DAL, ~~TWA~~DLH, UA1, DL3, LH8
	Preferred Routes - PDR

Attachment 17

Attachment 17

ARINC 424 NDB

Draft 1 of Supplement 22

Discussion

Location Cocoa Beach, Florida

March 7-9, 2017

COUNTRY CODE ENUMERATION

V.1

Martin Zillig, Lufthansa Systems FlightNav

SUMMARY
This working paper addresses the ICAO CODE field (5.14) and the enumeration included in the XSD schema.

1.0 INTRODUCTION / BACK GROUND

ARINC 424 defines in 5.14 that this field is used to further categorize data within an area code. Further, it is defined that the codes “may be found in ICAO Doc 7910”, and that the US is further divided in more manageable parts K1-K7. No further specification is provided.

Reading the text in 5.14, I believe the field is used for filtering, e.g. to “select all airports in Switzerland (LS)”, as well as to uniquely reference data records that would have the same identifier, e.g. Enroute waypoint “TIGER” which is published several times in different countries.

In the xml version (previously known as 424A), this field is now published as an enumeration, which presents a list of valid codes.

Over the years, there have been updates to the list of country codes we use. Apparently, different data houses are using a different set of codes.

Checking the list provided in the xsd files, I came up with a few questions.

2.0 DISCUSSION and or ACTION

First of all, is it necessary to publish such a list? If a new code is required, would we need to create a custom xsd until 424 is updated to reflect the latest changes?

Is the enumeration required to provide the names of the country? If so, wouldn’t it be better to provide a table with the codes and names, i.e. a new Section/Subsection Tx?

If we agree that we need such an enumeration, I would like to clean the list up, base it on ICAO 7910 and only add a very limited number of codes that are necessary.

If the field is used for filtering, I believe it should be aimed to reduce multiple codes for the same country as much as possible. Examples would be Australia which is listed with many codes that are not in ICAO Doc 7910.

Also, could the non-English names be removed? Or include them for each entry.

3.0 Changes as depicted

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