ARINC 424 NDB
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Proposal

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ALLOW CODING OF TENTHS OF A DEGREE IN TRUE COURSES

V.1

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SUMMARY
ICAO is proposing to increase track, course, bearing and heading resolution from full degrees to 0.1 degrees for coding purposes. ARINC 424 can accommodate this as all relevant fields have the resolution of 0.1 degrees. However, only when the values are magnetic values. In case a true value must be encoded in the magnetic course field, the position of the tenth is replaced with the letter T, e.g. Course 147.7 degrees True is encoded as "147T".

1.0 INTRODUCTION/ BACK GROUND

The Integration Working Group (IWG) subgroup for the ICAO Instrument Flight Procedure Panel (IFPP) is working on a change to require tenths of degrees resolution for courses, tracks, bearings and headings. Both for magnetic as well as for true values.

In ARINC 424, all relevant fields are already including tenths of degrees. However, only for magnetic values. For true values, the tenth is replaced with the letter "T" to indicate it is a true value.

2.0 DISCUSSION and or ACTION

The first part is to clarify the Magnetic/True Indicator field (5.165).

Then, remove the letter "T" in the position of the tenth of a degree in the Outbound Magnetic Course field (5.26) in the terminal procedure records.

5.26 Outbound Magnetic Course (OB MAG CRS)

Definition/Description: Outbound Magnetic Course is the published outbound magnetic course from the waypoint identified in the record's Fix Ident field. In addition, this field is used for Course/Heading/Radials on SID/STAR Approach Records through requirements of the Path Terminator and coding rules contained in Attachment 5 of this specification.

Source/Content: Values from official government sources will be used when available. The field contains magnetic information expressed in degrees and tenths of a degree, with the decimal point suppressed. For route and procedure segments published in degrees true, the last character (tenths position) of the field will contain the character T. See Section 5.165 of this document for more information on degrees true information.

Used On:	Airport and Heliport SID/STAR/Approach, Enroute Airway and Flight Planning Arrival/ Departure Data Records
Length:	4 characters
Character Type:	Alpha/numeric
Examples:	2760, 0231, 194T

Due to the requirement to be consistent between procedure records and ILS/MLS/GLS records, the same change is done to 5.47 (LOC BRG) and 5.167 (MLS AZ BRG), and ultimately to 5.58 (RWY BRG).

This way of specifying a value to be true will be indicated after this change by

- Procedure segments: via the PDMV (5.290) field
- ILS: via the declination
- GLS: via the magnetic variation
- MLS: via the magnetic variation
- Runway: via the airport magnetic variation

As an example of the proposed change, this is how the Localizer Bearing looks after the the change:

5.47 Localizer Bearing (LOC BRG)

Definition/Description: The Localizer Bearing field defines the magnetic bearing of the localizer course of the ILS facility/GLS approach described in the record.

Source/Content: Localizer courses, derived from official government sources, are entered into the field in degrees and tenths of a degree, with the decimal point suppressed. For localizer courses published with the intent to be used as true courses, the localizer station declination or GLS magnetic variation must be set to true.

After this part of the change, the Inbound and Outbound Magnetic Course fields on the Enroute Airway record and the Inbound Holding Course field on the Holding Pattern record remain.

For the airway records, I would like to include an additional field to specify if both fields, or any one of them, or none is given in true.

5.XXX Magnetic/True Course Indicator

Definition/Description: The Magnetic/True Course Indicator field specifies whether the inbound and outbound course fields on the record are provided as magnetic or true values.

Source/Content: A code from the following table. The field will be blank if the inbound and outbound course fields contain magnetic course values.

Field Content	Description
I	The Inbound Magnetic Course is provided in TRUE
O	The Outbound Magnetic Course is provided in TRUE
T	The Inbound and Outbound Magnetic Courses are provided in TRUE

Used On: Enroute Airways Records.
Length: 1 character
Character Type: Alpha

This new field would be inserted in the Enroute Airway Primary Record

4.1.6.1 Enroute Airways Primary Records

Column	Field Name (Length)	Reference
1	Record Type (1)	5.2
2 thru 4	Customer/Area Code (3)	5.3
62	Blank (Spacing) (1)	
63 thru 66	Theta (4)	5.24
67 thru 70	Rho (4)	5.25
71 thru 74	Outbound Magnetic Course (4)	5.26
75 thru 78	Route Distance From (4)	5.27
79 thru 82	Inbound Magnetic Course (4)	5.28
83	Magnetic/True Course Indicator ~~Blank (Spacing)~~ (1)	5.XXX
84 thru 88	Minimum Altitude (5)	5.30
89 thru 93	Minimum Altitude (5)	5.30
123	Route Qualifier 3 (1)	5.7 Note 2
124 thru 128	File Record No (5)	5.31
129 thru 132	Cycle Date (4)	5.32

Finally, there is one more field which still has the tenth of a degree replaced with "T" for true courses, the Holding Pattern record.

5.62 Inbound Holding Course (IB HOLD CRS)

Definition/Description: The Inbound Holding Course field defines the inbound course to the holding waypoint.

Source/Content: Inbound holding courses derived from official government sources are entered into the field in degrees and tenths of a degree, with the decimal point suppressed. For holding courses published with true bearings, the last character of this field contains a T in place of tenths of a degree.

Used On: Holding Pattern records
Length: 4 characters
Character Type: Alpha/numeric
Examples: 0456, 1800, 3034, 347T

Unfortunately, there is no other means to specify that a holding inbound course is magnetic or true. Even worse, when the Garmin proposal to add a defining navaid to the Holding Pattern record is accepted, there is only some space free in front of the continuation record number, which I believe is not acceptable.

4.1.5.1 Holding Pattern 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	Subsection Code (1)	5.5
7 thru 10	Region Code (4)	5.41 Note 1
11 thru 12	ICAO Code (2)	5.14 Note 1
13 thru 27	Blank (Spacing) (15)	
28 thru 29	Duplicate Indicator (2)	5.114
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 No. (1)	5.16
40 thru 43	Inbound Holding Course (4)	5.62
44	Turn Direction (1)	5.63
45 thru 47	Leg Length (3)	5.64
48 thru 49	Leg Time (2)	5.65
50 thru 54	Minimum Altitude (5)	5.30
55 thru 59	Maximum Altitude (5)	5.127
60 thru 62	Holding Speed (3)	5.175
63 thru 65	RNP (3)	5.211
66 thru 71	Arc Radius (6)	5.204
72 thru 74	Vertical Scale Factor (3)	5.293
75 thru 77	RVSM Minimum Level (3)	5.294
78 thru 80	RVSM Maximum Level (3)	5.295
81	Leg Inbound/Outbound Indicator (1)	5.298
82 thru 98	Reserved (Expansion) (17)	
99 thru 123	Name (25)	5.60
124 thru 128	File Record No. (5)	5.31
129 thru 132	Cycle Date (4)	5.32

In order to include the required data, I added a Holding Pattern Primary Extension Record, and created a new field, the Holding Pattern Mag Var. This new field is the same as the Procedure Design Mag Var, only for holdings.

Depending on the group's preferences, maybe some of the additional new fields for the holding navaid introduced by the Garmin proposal could be moved to the continuation record as well, or the holding magvar could be included in the primary record instead.

3.0 Changes as depicted (Track Changes is Helpful)

5.26 Outbound Magnetic Course (OB MAG CRS)

Definition/Description: Outbound Magnetic Course is the published outbound magnetic course from the waypoint identified in the record's Fix Ident field. In addition, this field is used for Course/Heading/Radials on SID/STAR Approach Records through requirements of the Path Terminator and coding rules contained in Attachment 5 of this specification.

Source/Content: Values from official government sources will be used when available. The field contains magnetic **or true** information expressed in degrees and tenths of a degree, with the decimal point suppressed. For **en**route ~~and procedure~~ segments published in degrees true, ~~the last character (tenths position) of the field will contain the character T~~**the Magnetic/True Course Indicator will be coded to specify that the value in this field is a true course**. See Section 5.~~165~~**xxx** of this document for more information on degrees true ~~information~~**coding**. **For procedure segments published in degrees true, the procedure design magnetic variation (PDMV) will be coded to true, see Section 5.290 of this document for more information.**

Used On:	Airport and Heliport SID/STAR/Approach, Enroute Airway and Flight Planning Arrival/ Departure Data Records
Length:	4 characters
Character Type:	~~Alpha/n~~**N**umeric
Examples:	2760, 0231~~, 194T~~

5.28 Inbound Magnetic Course (IB MAG CRS)

Definition/Description: Inbound Magnetic Course is the published inbound magnetic course to the waypoint in the Fix Ident field of the records in which it is employed.

The HX group of Path Terminator codes is used to provide racetrack type course reversal flight paths. Government publications for these course reversals include an inbound magnetic bearing. The SID/STAR/Approach Procedures records do not include a dedicated field for this inbound course. Instead, the information is included in the Outbound Magnetic Course field of such records.

Source/Content: Values from official government sources will be used when available. The field contains magnetic **or true** bearing in degrees and tenths of a degree, with the decimal point suppressed. ~~For routes published with true courses, the last character of this field will contain a T in place of tenths of a degree.~~ **For enroute segments published in degrees true, the Magnetic/True Course Indicator will be coded to specify that the value in this field is a true course. See Section 5.xxx of this document for more information on degrees true coding.**

Used On:	Enroute Airways ~~r~~**R**ecords
Length:	4 characters
Character Type:	~~Alpha/n~~**N**umeric
Examples:	2760, 0231~~, 194T~~

5.47   Localizer Bearing (LOC BRG)

Definition/Description: The Localizer Bearing field defines the magnetic bearing of the localizer course of the ILS facility/GLS approach described in the record.

Source/Content: Localizer courses, derived from official government sources, are entered into the field in degrees and tenths of a degree, with the decimal point suppressed. For localizer courses published with the intent to be used as true courses, the ~~last character of this field will contain a T in place of tenths of a degree~~ **localizer station declination or GLS magnetic variation must be set to true**.

Used On:	ILS, GLS ~~f~~**R**ecords
Length:	4 characters
Character Type:	~~Alpha/n~~**N**umeric
Examples:	2570, 0147, 2910~~, 347T~~

5.58   Runway Magnetic Bearing (RWY BRG)

Definition/Description: The magnetic bearing of the runway identified in the runway identifier or pad ident field of the record is specified in the Runway Magnetic Bearing field.

Source/Content: Runway magnetic bearings derived from official government sources are entered into the field in degrees and tenths of a degree, with the decimal point suppressed. For runway bearings published with the intent to be used as true bearings, ~~the last character of this field will contain a T in place of tenths of a degree~~ **the magnetic variation of the airport record must be coded as true**. ~~When used on helipad records, it usually will contain the bearing of a former fixed wing runway that has been converted to helicopter use only or when a specific bearing to approach a particular helipad has been provided by government source.~~

Used On:	Runway ~~and Helipad~~ Records
Length:	4 characters
Character Type:	~~Alpha/n~~**N**umeric
Examples:	1800, 2302, 0605~~, 347T~~

5.62   Inbound Holding Course (IB HOLD CRS)

Definition/Description: The Inbound Holding Course field defines the inbound course to the holding waypoint.

Source/Content: Inbound holding courses derived from official government sources are entered into the field in degrees and tenths of a degree, with the decimal point suppressed. For holding courses published with true bearings, ~~the last character of this field contains a T in place of tenths of a degree~~ **the holding pattern mag var must be coded as true**.

Used On:	Holding Pattern records
Length:	4 characters
Character Type:	~~Alpha/n~~**N**umeric
Examples:	0456, 1800, 3034~~, 347T~~

5.165 Magnetic/True Indicator (M/T IND)

Definition/Description: The field has multiple definitions. For Airport and Heliport Primary Records, it is used to indicate that all bearing and course detail for that airport/heliport are included in the database with a reference to either Magnetic North or to True North. The field is blank in Airport/Heliport Record when the database contains a mix of magnetic and true bearing or course information for the airport. The Magnetic/True Indicator field is also used to indicate if the Course From and Course To fields of the Cruise Table record and the Sector Bearing fields of the MSA and TAA record are in magnetic or true degrees.

Source/Content: In Airport/Heliport Records, the field will contain the alpha character M if all bearing and course detail for the airport/heliport are provided in magnetic or the alpha character T if all bearing and course detail for the airport/heliport are provided in true. Setting the airport/heliport to T ~~does not indicate~~**implies** that **all** courses and bearings at that airport/heliport ~~do not need to be coded as~~ **are provided in** true. ~~True coding of courses and bearings must still comply with the true coding described in those sections.~~ The field will be blank if bearing and course data are provided in a mix of magnetic and true for the airport. **True coding of courses and bearings must also comply with the true coding described in the respective fields.** Cruise Table Courses, MSA, and TAA Sector Bearings will be derived from official government source. The field will contain the alpha character M if the Course From/To or Sector Bearings are magnetic. It will contain the alpha character T if the courses/bearings are true.

Used On:	Airport, Heliport, Cruise Table and Airport and Heliport MSA Records, and Airport and Heliport TAA Record
Length:	1 character
Character Type:	Alpha

5.167 MLS Azimuth Bearing (MLS AZ BRG) MLS Back Azimuth Bearing (MLS BAZ BRG)

Definition/Description: The MLS Azimuth Bearing and the MLS Back Azimuth Bearing fields define the inbound magnetic final approach course assigned to the center of the Azimuth or Back Azimuth Coverage (see Section 5.172).

Source/Content: The fields are populated with the inbound magnetic course information derived from official government source documents, generally the inbound course for a given approach procedure to a given runway considered the primary use of the MLS facility. The values are provided in degrees and tenths of degrees with the decimal point suppressed. Should the source value be provided with the intent to be used only in degrees true, the ~~last character of the field will contain a T in place of the tenths of a degree value~~ **magnetic variation of the MLS must be set to true**.

Used On:	MLS and MLS Continuation records
Length:	4 characters
Character Type:	Numeric
Examples:	0550, 0155~~, 015T~~

5.XXX Magnetic/True Course Indicator

Definition/Description: The Magnetic/True Course Indicator field specifies whether the inbound and outbound course fields on the record are provided as magnetic or true values.

Source/Content: A code from the following table. The field will be blank if the inbound and outbound course fields contain magnetic course values.

Field Content	Description
I	The Inbound Magnetic Course is provided in TRUE
O	The Outbound Magnetic Course is provided in TRUE
T	The Inbound and Outbound Magnetic Courses are provided in TRUE

Used On: **Enroute Airways Records.**
Length: **1 character**
Character Type: **Alpha**

5.XXY Holding Pattern Mag Var (HPMV)

Definition/Description: The Holding Pattern Mag Var field specifies the angular difference between True North and Magnetic North which is applied to the holding inbound course.

Source/Content: Holding Pattern Mag Var is obtained from official government sources and is understood to be the Epoch Year value used when the holding pattern was last revised. This value may differ from magnetic variation data in the primary record of the airport with which the holding pattern is associated with or any individual navaids or waypoints which are used as the holding pattern fix. Updating of this value is based only on holding pattern source data change. In case no such value can be obtained from official source, the field may be left blank. Position one of the field contain an alpha character taken from the table below. Positions 2 thru 5 carry the angular difference value expressed in degrees and tenths of a degree with the decimal point suppressed. When Position one is set to T, Positions 2 thru 5 will be all zeros.

Field Content	Description
E	Procedure Designed based on Magnetic Variation (angular difference) that is East of True North
W	Procedure Designed based on Magnetic Variation (angular difference) that is West of True North
T	Procedure Designed based on True North

Used On: **Holding Pattern Primary Extension Continuation Record**
Length: **5 characters**
Character Type: **Alpha/numeric**
Examples: **E0140, E0007, T0000**

4.1.5.3 Holding Pattern Primary Extension Continuation Records

Column	Field Name (Length)	Reference	Required
1 thru 38	Fields as on Primary Records		Y
39	Continuation Record No. (1)	5.16	Y
40	Application Type (1)	5.91	Y
41 thru 45	Holding Pattern Mag Var (5)	5.XXY	
56 thru 123	Blank (Spacing) (68)		
124 thru 128	File Record No. (5)	5.31	Y
129 thru 132	Cycle Date (4)	5.32	Y

4.1.6.1 Enroute Airways 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	Subsection Code (1)	5.5
7 thru 13	Blank (Spacing) (7)	
14 thru 18	Route Identifier (5)	5.8
19	Reserved (1)	Note 1
20 thru 25	Blank (Spacing) (6)	
26 thru 29	Sequence Number (4)	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 (1)	5.5
39	Continuation Record No. (1)	5.16
40 thru 43	Waypoint Description Code (4)	5.17
44	Boundary Code (1)	5.18
45	Route Type (1)	5.7
46	Level (1)	5.19
47	Direction Restriction (1)	5.115
48 thru 49	Cruise Table Indicator (2)	5.134
50	EU Indicator (1)	5.164
51 thru 54	Recommended NAVAID (4)	5.23
55 thru 56	ICAO Code (2)	5.14
57 thru 59	RNP (3)	5.211
60	**Section Code (1)**	**5.4**
61	**Subsection Code (1)**	**5.5**
62	Blank (Spacing) (**1**)	
63 thru 66	Theta (4)	5.24
67 thru 70	Rho (4)	5.25
71 thru 74	Outbound Magnetic Course (4)	5.26
75 thru 78	Route Distance From (4)	5.27
79 thru 82	Inbound Magnetic Course (4)	5.28
83	**Magnetic/True Course Indicator** ~~Blank (Spacing)~~ (1)	**5.XXX**
84 thru 88	Minimum Altitude (5)	5.30
89 thru 93	Minimum Altitude (5)	5.30
94 thru 98	Maximum Altitude (5)	5.127
99 thru 101	Fix Radius Transition Indicator (3)	5.254
102 thru 104	Vertical Scale Factor (3)	5.293
105 thru 107	RVSM Minimum Level (3)	5.294
108 thru 110	VSF RVSM Maximum Level (3)	5.295
111 thru 114	Reserved (4)	
115	Blank (Spacing) (**1**)	
116 thru 120	**Maximum Altitude (5)**	**5.127**
121	Route Qualifier 1 (1)	5.7 Note 2
122	Route Qualifier 2 (1)	5.7 Note 2
123	Route Qualifier 3 (1)	5.7 Note 2
124 thru 128	File Record No (5)	5.31
129 thru 132	Cycle Date (4)	5.32