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CONCEPT FOR RNAV/GROUND-BASED CHARTING SYMBOL CONSISTENCY AND HIERARCHY

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SUMMARY

This Working Paper presents a recommendation for consistent charting of ground-based fixes vs. RNAV waypoints, and a method for indicating additional fix functions such as compulsory/on-request position reporting, and/or RNAV fly-by/fly-over requirements. This concept was developed and agreed upon by members of the Government/Industry Aeronautical Charting Forum, RNAV Transition Working Group.

1 BACKGROUND

1.1 This Working Paper outlines a developing charting problem related to rapid expansion of RNAV information on aeronautical charts, and presents recommendations proposed by the United States Government/Industry Aeronautical Charting Forum, RNAV Transition Working Group.

1.2 Aircraft using GPS/RNAV can navigate equally well to any waypoint, VOR, NDB, or ground-based fix/intersection without the need for ground-based navigation equipment. GPS/RNAV-equipped aircraft treat all points as waypoints, and do not differentiate between them in flying and navigating to them. However, aircraft using only ground-based navigation equipment cannot navigate to or use RNAV waypoints, and it is important for flight safety that chart symbology clearly indicate to non-RNAV pilots the type of navigation equipment required to fly/navigate to any point. This means that ground-based navigation points must be visually distinguishable from GPS/RNAV waypoints on charts.

1.3 In addition, in order to provide situational awareness between charts used in different phases of flight, it is recommended that a charting hierarchy be used in chart symbol selection. This charting hierarchy would lead to consistent chart symbol selection based on how the point is originally defined (NAVAID, ground-based fix or RNAV/GPS waypoint), and not based on a particular use of the point within a specific procedure or operation. If a point exists as a NAVAID or a ground-based fix, it should be charted as such on all charts on which it appears.

2 DISCUSSION

2.1 ICAO and IACC charting specifications use a triangle symbol to indicate an enroute reporting point. The triangle symbol indicates ATC position reporting (either as requested or compulsory), and does not indicate the type of navigation equipment required to fly/navigate to the point. These “reporting points” are normally ground-based fixes over land, and offshore they are generally defined by geodetic coordinates. ATC position reporting requirements are a separate issue from the navigation equipment required to fly/navigate to a point.

2.2 With GPS/RNAV now being used more commonly, non-RNAV/GPS equipped pilots need to be able to clearly distinguish ground-based points from RNAV-based waypoints. Additionally, charting symbols should clearly indicate the difference between RNAV-based waypoints and ground-based fixes so that the RNAV-equipped pilots can quickly identify the basic navigation equipment requirements for any point in the event of GPS/RNAV system failure. The waypoint symbol should be limited to those points where only a GPS/RNAV system can navigate to the point. A NAVAID symbol or triangle should be used to indicate that the point may be flown/navigated to by ground-based navigation equipment.

2.3 Another aspect of this issue that supports a hierarchical, ground versus GPS/RNAV-based concept, is the goal; consistently identified by aviation industry working groups, of harmonization between paper charts and electronic displays. One of these working groups, the Society of Automotive Engineers (SAE), recommends in its SAE ARP 5289 electronic symbol set that a triangle be used to indicate an intersection and a four-pointed star be used to indicate a waypoint, no specific symbol is contained in this symbol set to indicate a "reporting point." The SAE recommended electronic symbol set has also been adopted by RTCA Special Committee 181, for inclusion in DO 257. The recommendations contained in this proposal would harmonize paper charts with the recommended SAE electronic symbol set.

2.4 The proposed concept in this paper uses three basic symbol types (i.e., NAVAID, triangle and waypoint) to indicate the basic type of navigation equipment required to use a navigation point. Slight consistent symbol modification of the three basic symbol types would indicate any secondary functions of compulsory or on-request position reporting, and (for RNAV procedures) any fly-by or fly-over requirement. It is recommended that filling in the center of the point would indicate compulsory position reporting, and leaving the point unfilled would indicate on-request position reporting. Adding a circle around a point (on RNAV procedures) would indicate a flyover requirement, and no circle around a point would indicate standard RNAV fly-by requirements.

3 RECOMMENDATIONS

3.1 Enroute Charts

3.1.1 On enroute charts, it is necessary to indicate the basic type of navigation equipment needed to use any point on the chart. On enroute charts the following charting criteria is recommended:

a) Expand the definition of the Annex 4 charted triangle, to indicate an enroute fix defined by ground-based navigational aids (intersection of VOR radials, DMEs, etc). The triangle may also indicate an Air Traffic communication requirement.

b) A fix required only for RNAV operations or identifiable and useable only by RNAV systems, should be indicated by the use of the waypoint symbol. The waypoint symbol may also indicate an Air Traffic communication requirement.

c) On-request position reporting at any NAVAID, triangle or waypoint will be indicated by leaving the center of the appropriate chart symbol open. Compulsory position reporting at any NAVAID, triangle or waypoint will be indicated by filling-in the center of the appropriate chart symbol.

3.2 RNAV Instrument Procedure Charts

3.2.1 On RNAV terminal procedures, a charting hierarchy is necessary to enhance pilot situational awareness when transitioning between enroute and instrument procedure charts, and to reduce chart clutter. On RNAV terminal procedures the following charting criteria is recommended:

a) Any enroute NAVAID or fix that is charted on the RNAV procedure, will be charted with the same symbol that is used for that point on the enroute chart.

b) When any NAVAID (terminal or enroute) is used as a waypoint on an RNAV procedure, it will be charted with the appropriate NAVAID symbol and alpha identification but need not include any NAVAID tuning information (i.e., frequency, Morse code, etc.).

c) When an enroute fix is used as a waypoint on an RNAV procedure, it will be charted with the same symbol that is used for that point on the enroute chart but need not include any ground-based fix defining details (crossing radials, DME values, etc.).

d) Any charted NAVAID, triangle or waypoint used as a flyover waypoint on an RNAV procedure, will be charted with the appropriate navigation symbol enclosed by a circle.

3 ATTACHMENT

CHEZZ RNAV Departure Procedure – This attachment shows how the NAVAID/intersection/waypoint hierarchy concept would be applied to a specific RNAV instrument procedure. All points on the procedure are treated as waypoints by RNAV systems. NAVAIDs are depicted with the NAVAID symbol, and charted Enroute intersections are depicted with a triangle.

Heirarchy Concept