

CHANGES TO THE PRESENT ARINC 424 RULES ON APPROACH CODING

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Need for Tactical Branching on RNAV Approaches

One of the main purposes of the effort is RTCA SC-181 is to evolve the rules and regulations for future air navigation. As the world moves from ground based navigation aids to GPS and other forms of RNAV it appears that with proper supporting technical effort and new equipment, air safety can be significantly improved and at the same time increase the capacity of the ATC system. This effort provides the promise of the equivalent of a precision ILS approach to every runway served by commercial aircraft.

Recent work by the Flight Safety Foundation has shown that non-precision approaches continue to be a factor in a significant percentage of approach and landing accidents. The need to descend to a MDA and then maintain level flight until in position to continue the descent to landing has been the cause of many accidents in the past. The FSF and the ATA FMS task force have strongly recommended a constant angle descent on all approaches with the missed approach initiated immediately at MDA. This eliminates the risk of the level segment near the ground. This also means that the missed approach is initiated prior to the end of the runway on all non-precision approaches.

SC-181 has worked to develop arrival routing concepts that will allow the pilots to fly the most expeditious routing from the enroute phase to the approach and landing. Effort has been made to use all the capabilities of existing RNAV equipment to achieve precision or near-precision approach guidance from the FAF to the MAP. However, the present coding rules from ARINC 424 have prevented providing track and vertical guidance to touchdown because the routing must continue past the MAP following the missed approach procedure in both track and vertical. These rules provide guidance only for the missed approach that is initiated from the MAP only. They do not provide guidance for a missed approach that is required after a rejected landing or a touch and go required by a landing beyond the touchdown zone. In addition, a fixed MAP does not apply where the missed approach on a precision approach is variable based on on-board equipment, ground equipment and crew qualifications.

This approach has worked in the past because very few approaches were actually flown using the RNAV equipment alone. It was either an ILS, VOR or NDB approach where the FMS provided some support by providing a visual display of the approach track on the NAV Display and was then standing by to provide missed approach guidance in the remote case that is was required. With an ILS approach track and vertical guidance were available right to touchdown and was used by nearly all pilots to maintain a stabilized approach and provide for a consistent landing in the touchdown zone. This is especially important as aircraft have become larger and longer which has increased the likelihood of tail strikes unless the aircraft is stabilized in the correct attitude just prior to the flare.

In the future as GPS is available to provide vertical guidance and curved path guidance, there is a significant need to provide track and vertical guidance all the way to touchdown for all approaches and for the missed approach to be available from where ever the pilot is required or finds it necessary to initiate the missed approach. Without being able to change the present 424 rules aviation will continue to have accidents in the visual phase the approach after the pilot has the legal requirements to continue because the Runway Environment is in sight but visual cues are not adequate to precisely fly the aircraft without additional guidance. In extended conversations at SC-181 meetings with many FMS

engineers and approach designers, it has been apparent that many of those very familiar with approach construction did not really understand the problems that the pilot faces when landing in significant reduce visibility. We presently bridge that gap by using the ILS localizer and glideslope to our best advantage all the way to touchdown. If the ILS signal simply disappeared at minimums, many pilots would make a missed approach rather than continue if the weather was at or near the require visibility for the approach.

To solve this problem, there must be change to the present rules in ARINC 424 to allow a branch in every approach to that the pilot can use guidance all the way touchdown or in the alternative select the missed approach when ever it is required. Presently there is a form of branching on FMS approaches in that you can select various transitions from enroute to the FAF. This type of branching is selected before the approach is executed into the FMS and could be described as non-tactical branching. The type of branching that is required would be pilot selectable during the approach and could be described as tactical branching. This will require a change to 424 rules and some minor changes to present FMS equipment but it would open up significant benefits.

There are many benefits that tactical branching will provide:

1. All approaches would have the benefits of a present ILS in that track and vertical guidance would be available to touchdown on every approach.
2. Proper missed approach guidance would be available at any point during the approach through the touchdown.
3. This would allow for a different missed approach procedure for a missed approach initiated early in the approach from the missed approach procedure that might be required for an aborted landing.
4. If an engine-out missed approach required different procedures than an all-engine missed approach, this could be available to the pilot.
5. This would eliminate the circling approach as we now know it, because the entire approach path to the touchdown would be available, with some parts even curved path segments flown in visual conditions.
6. This concept also should apply for takeoff, in that at those airports where the engine-out departure is different from the normal departure, the pilot could select the engine-out procedure if it was required after takeoff.

This concept of Tactical Branching is necessary for the future of RNAV procedures in the real world. Many airports today have very difficult approach procedures to certain runways because of terrain, traffic or noise abatement considerations. Tactical Branching would allow approach guidance to continue to the touchdown on every approach and still provide appropriate missed approach guidance when needed. We must keep in mind that nearly 99.99% of all approaches result in a landing. We cannot design 100% of all RNAV approach procedures for only a missed approach.