JEPP'S BRIEFING

The Chart Clinic – Eleventh in a Series

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Imagine, for a moment, that you are flying DC-3s over the bush country of Africa or the jungles of South America in the 1940s and 1950s. NDBs were the main radio navigation aid and formed the few airways that did exist. And, failures of NDB ground stations in those days were not uncommon. VORs were starting to appear in the late 50s, but they were few and far between.

When the airway structures were being put together in early aviation, many governments simply provided the NDBs and connected them with only an airway name – and that's it. Airway A-1 (amber 1) would be published with the airway designator and sometimes a minimum reception altitude, but rarely would an altitude be provided for just obstacle clearance. This would mean that a minimum altitude would be provided for normal operations, but with an engine failure, there was no minimum altitude which provided obstacle clearance. When talking to pilots who flew in that era, they will almost always tell you about the numerous engine failures they had during their careers.

Pilots in those days started to ask Jeppesen to provide minimum obstacle clearance altitudes because of all the engine failures. Airlines needed them for drift down information. But governments weren't prepared to provide the information – and most countries still don't provide minimum obstacle clearance altitudes even today.

MORAs

The answer? We created MORAs – minimum off route altitudes. There are two types of MORAs – one is called a route MORA and the other is the grid MORA. Because of the imprecise navigation provided by NDBs and the ADFs used in the airplanes, the early route MORAs provided an obstacle clearance within 10 nautical miles on both sides of the airways and within a 10-nautical mile radius around the ends of the airways. The 10-nautical mile criteria is with us today. To create the route MORAs today, the enroute chart compilers at Jeppesen analyze the visual aeronautical charts for each respective location around the world to determine the ground elevations below the airways to produce the route MORA for each airway segment.

Not only did engines fail, but the NDBs and ADFs did also. But even more peculiar was the fact that some governments would turn their NDBs off if they thought no one was using them at the moment. It saved power, and no one would have to stand by the electrical generator to run the NDB.

This meant that even though the NDB was not very precise, sometimes they weren't even there. In that case, even the 10-nautical mile radius wasn't adequate. So – the grid MORA was created. The grid MORAs provided (and still do) an obstacle clearance altitude within a latitude and longitude grid block, usually of one degree by one degree.

Obstruction Criteria

In order to provide one standard for the whole world, the minimum vertical distance between the MORA and the highest obstacle along the route was determined to be either 1,000 feet or 2,000 feet, depending on the elevation of the terrain and obstacles below. When flying over precipitous terrain and when flying at higher altitudes, the amount of error between indicated altitude and true altitude increases. As a result, 1,000 feet of obstacle clearance was provided for the lower altitudes. For all terrain and obstacles greater than 5,000 feet, it was decided to create an obstacle clearance of 2,000 feet.

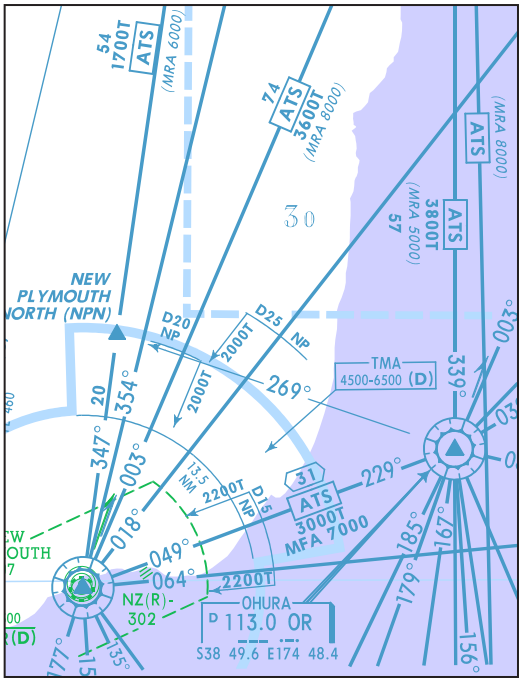
On Jeppesen charts, all MORA altitudes which are 6,000 feet or lower have an obstacle clearance of 1,000 feet. If the MORA altitudes are 7,000 feet or greater, the obstacle clearance is 2,000 feet.

Meanwhile, the FAA was also creating minimum altitudes that took into consideration the effects of precipitous terrain. The FAA created designated mountainous terrain which included a large portion of the western United States and some areas in the east. When the FAA creates minimum altitudes, they also use 2,000 feet of obstacle clearance, but the 2,000 feet only applies in designated mountainous terrain. There are some cases where the FAA provides obstacle clearance as low as 1,600 feet in the designated mountainous terrain area. The 1,600-foot value can be used when there are very good local altimetry sources and when the local terrain is not very precipitous.

In 1995, the FAA and the military liked the concept of the MORA and decided to create a similar concept. One of the difficulties with the MORA is that it provides *only* obstacle clearance. MEAs in the United States provide not only obstacle clearance, but they also provide a minimum altitude for reception of both navigation aids and communication, and they also are within controlled airspace.

Because the FAA and the military wanted the minimum altitudes to imply *only* obstacle clearance, they created a new minimum altitude called the Off Route Obstacle Clearance Altitude (OROCA) which meets the same criteria as Jeppesen's MORAs. One exception is that the OROCA provided by the FAA now includes 2,000 feet of obstacle clearance altitude only in designated mountainous terrain areas. The OROCA is also only provided in the United States by the FAA. The MORAs on Jeppesen charts in the United States are the same altitudes as the OROCAs.

An interesting irony? The MORAs which were created in the late 1940s have now again become very important. Engines and navigation are much more reliable, so they are not needed as much as they were for emergencies. But, with GPSs and FMSs, direct routes are flown off airways, and the only available minimum altitudes are the MORAs.

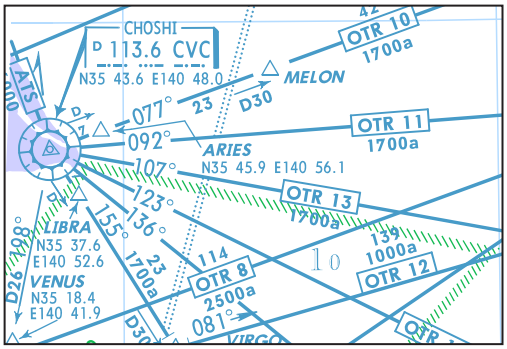


The grid MORAs are found on all the enroute and area charts. (This is not done in some areas where incomplete surveys of the terrain are provided by a government.) In the illustration above, northwest of the Ohura VOR in New Zealand, the value of 30 indicates that the MORA in the latitude/longitude grid bounded by S38° to S39° and E174° to E175° is 3,000 feet above sea level. The large numbers indicate the altitude in thousands of feet and the small number is the altitude in hundreds of feet.

In the illustration at the top of next column, east of the Chosi (Japan) VOR, the oceanic route OTR 11 has an altitude designated as 1700a. The letter "a" to the right of the altitude value indicates that this is a route MORA. There are not as many route MORAs as there were in the past because governments are specifying more minimum route altitudes than before.

Minimum Enroute Altitudes

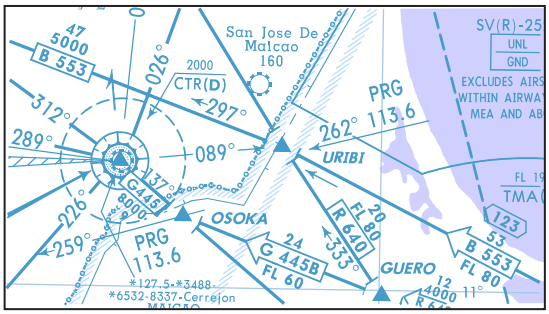
As an interesting note, the International Civil Aviation Organization (ICAO) does not have MEA as an official abbreviation. The MEA's are used only by the United States, Canada, and a few other countries.



In the United States, both the minimum enroute altitude (MEA) and the minimum obstruction clearance altitude (MOCA) are provided by official FAA sources. These altitudes are not provided by all governments, however. In the illustration at left, north of the Ohura VOR, the ATS (Air Traffic Service) route shows 3800T. The New Zealand government supplies a minimum obstacle clearance altitude, but not an MEA. The MOCA is 3,800 feet. There is no MEA on this route, but there is a minimum reception altitude (MRA) indicated by the MRA 5000 in parentheses. Northwest of the Ohura VOR are numbers 2000 followed by the letter T. These are associated with DME rings of 15, 20 and 25 nautical miles from NP. When these are depicted, this means the minimum obstacle clearance altitude inside these rings is 2,000 feet. These are used frequently in Australia and New Zealand as a way of indicating the minimum altitude when arriving at an airport and not flying on the airways.

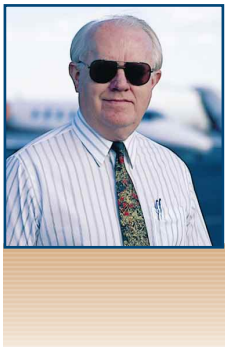
Note that the airway north of Ohura is simply labeled ATS which means it is an air traffic service route. *It does not have a unique airway identifier!* This means it has no way of getting into the airborne databases since it can't be uniquely identified.

In many countries, the minimum altitudes to be flown on airways are not really altitudes – instead they are flight levels. In the third illustration, shown below, the minimum altitude for B 553 is 5,000 feet on the northwest end of the airway and the minimum is flight level 80 on the southeast end of the airway. When the minimum is FL80, this means the altimeter will read 8,000 (feet) with the altimeter set to 29.92" or 1032.5 hectoPascals. The philosophy changes when you change from the Columbia to Venezuela when flying in South America. Most airways in Europe also have minimum flight levels instead of minimum altitudes.



We have many areas that need worldwide standardization. Minimum altitudes for airways is one of them.

In the next article we will conclude the discussion of enroute charts.



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