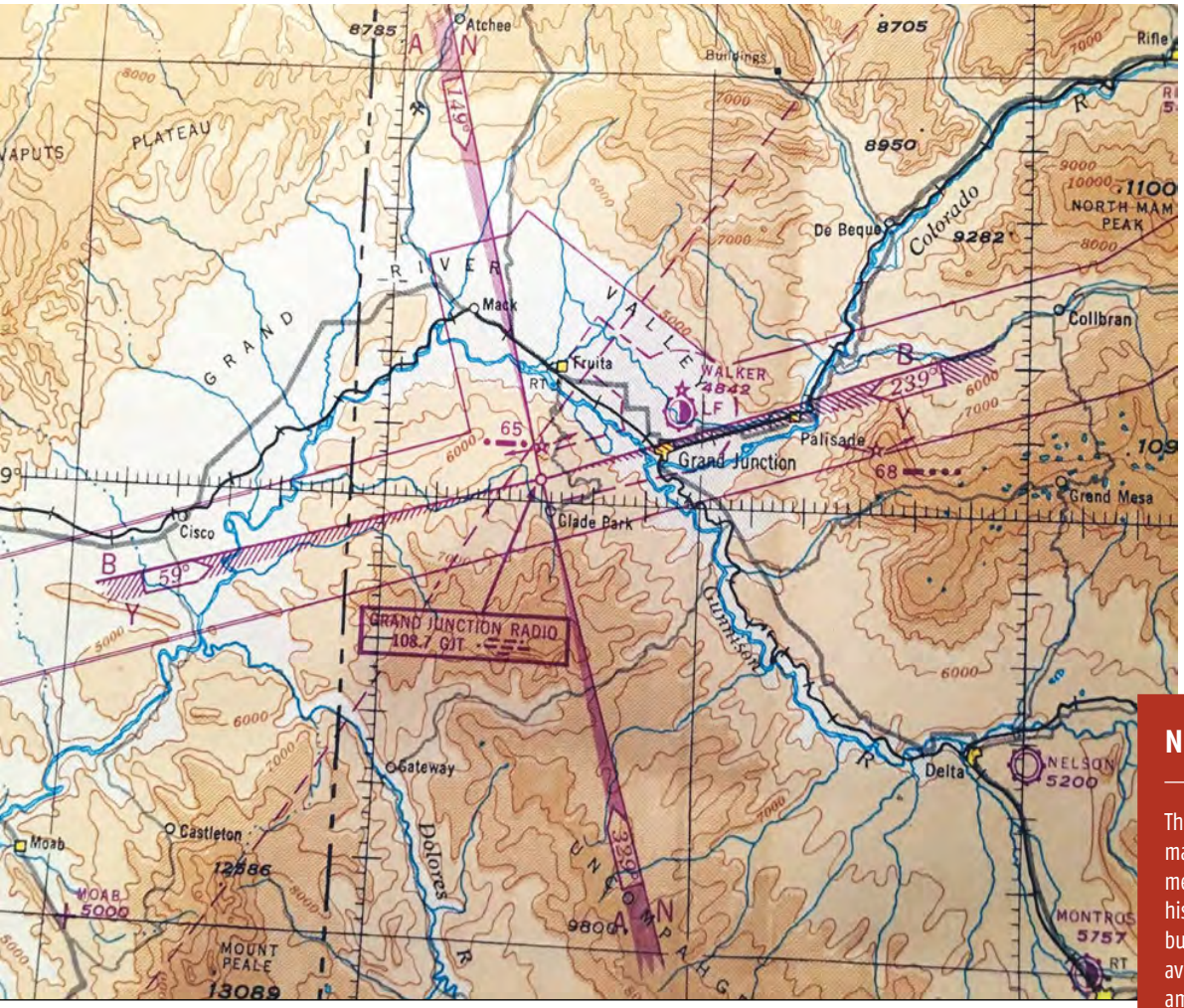
JEFF SKILES
COMMENTARY / CONTRAILS

The Visual Aural Radio Range

A mysterious navigational aid from aviation's past

BY JEFF SKILES

A COUPLE OF MONTHS ago I wrote a column discussing the four-course range (*Sport Aviation*, November 2016). Judging from the flood of reader e-mails I have received, it may be my most popular column ever. For those of you who missed the column, the four-course range was a navigation system that was used for almost half a century and was the primary means of cross-country radio navigation until the VHF omni-directional radio range (VOR) made its appearance in the late 1940s.



DOTS AND DASHES

The four-course range was exactly that, an aural system that identified four distinct courses from a station like an "x" or a "plus" sign. Pilots would determine their position by listening to the Morse code signals for A (dot dash) and N (dash dot) through their headphones. Where the signals overlapped, a steady tone was created as the two signals merged. This was the on-course signal, and the aircraft, in the vernacular of the day, was riding the beam.

It was a simple system, and all that was necessary for its use was a low-frequency AM radio receiver

NOTE:

The chart used in this column and many more like it were provided to me courtesy of Robert Doughty and his late brother-in-law and Oshkosh buddy Walter Book. Robert is keeping aviation history alive with this amazing collection of charts.

capable of listening in the 190-535 kHz range (just below the commercial AM radio band). No other airborne equipment was necessary.

The four-course range did have a few disadvantages however. It was an on-course navigational aid, meaning if pilots were on course, it kept them on course. It was less valuable for determining their position when OFF-course where position was unknown. If pilots weren't on the beam, they would simply receive the same Morse code signal, dot dash for instance, whether they were northwest or southeast of the station. Complicated, time-consuming bracketing procedures would be necessary to determine their exact position. Also, since the signal was emitted on the low-frequency band it suffered from various maladies such as course bend due to mountain or shore effect and signal skip at night where pilots might find themselves receiving an entirely different station far off in the distance that happened to share the same frequency.

VISUAL AURAL RADIO RANGE

As I was writing the four-course range column I happened to receive a package of aeronautical charts dating from the mid-1940s from a reader. In the western states these charts displayed the four-course ranges with two legs formed by the usual merging of the A and N Morse code signals, but with the opposing two legs formed by B (dash dot dot dot) and Y (dash dot dash dash). The B and Y would seem to lead to a hodgepodge of an aural identifier, not a steady tone. I didn't understand what kind of four-course range this might be. Readers informed me that I had not found a four-course range at all but an entirely different form of navigation aid that existed only briefly in this country named the visual aural radio range (VAR).

The VAR was designed to be an improvement over the four-course range and did solve several of the four-course range's shortcomings. Its only failure was in being operationally deployed at the wrong time. The VOR was developed so closely on the heels of the VAR that only a few visual aural ranges were ever placed into service.

While so little is written about the VAR that it is hard to support any kind of accurate accounting, it appears that as few as 60-70 VARs were built. Contrast this with the more than 1,000 VORs that have existed in this country alone and the 3,000 around the world. When they were introduced, the VARs were placed where they could be most useful as sentinels on the transcontinental airway routes. These airways were coded green and red for the routes that connected the east with the west and blue and amber for those routes connecting the north and south.

For a very short time the VAR served as the backbone of our national airway system. It bridged the gap between the four-course range and the VOR while incorporating elements of both.

LOOKS LIKE A FOUR-COURSE RADIO RANGE

On the chart the VAR looks very much like a four-course range, which is why I mistook it for one so readily, but it functioned quite differently. The VAR operated on VHF frequencies as VORs do today. This was to solve the many problems of low-frequency signals mentioned earlier, particularly at night. But, because the VARs used VHF frequencies, their range was limited to line of sight. Depending on an aircraft's height above the ground this restricted their signals to perhaps 50 miles from the station.

The VAR didn't require pilots to listen continuously for an audio signal through their headset. Like the four-course range, the station emitted a directional signal, but unlike the four-course range this signal could be read by an early onboard course deviation indicator (CDI). The needle of the CDI would deflect into the sector, blue or yellow, that the aircraft was flying. The blue sector, the B on the chart, was always the northern two quadrants on an east/west air route or the western two on a north/south airway. The CDI functioned in much the same way as a localizer today except for the fact that the VAR course was much wider.

At approximately 10 degrees off course the needle would reach full deflection, and then pilots would only know that they were in the blue section (north or west of course) or the yellow (south or east). Much like with a full deflection of a localizer needle pilots would have little more information to fix their position than with a four-course range. This is where the audio function entered into the picture. As a separate function the VAR emitted a standard AN signal on the course perpendicular to the visual course. This allowed pilots to fix the specific quadrant that they were in.

LOST AND FOUND

For instance, let's say a pilot tuned in the Grand Junction VAR station in the picture at the beginning of this column (note the VHF frequency) and had a full-scale blue deflection on the indicator. If the pilot then listened to the audio transmission and heard a dot-dash (A), he would know that he was somewhere in the northwest quadrant of the range. To cross the Grand Junction VAR, he would pick up a southeast heading and eventually would either center the VAR indicator needle as he intercepted the western leg of the range, or he would hear the dot dash become a steady tone indicating that he had intercepted the northern aural leg. In either case he would know which direction to head to fly inbound to Grand Junction. In its simplest form the visual legs acted like a VOR with only two fixed courses, and the aural A or N was like a to/from indicator on a CDI. This new functionality allowed a pilot to find a location even while off course with the VAR needle pegged.

SHORT-LIVED TECHNOLOGY

If all this sounds confusing to you, then you will understand why the development of the VOR only a couple years later was such a godsend to aeronautical navigation. The first visual aural radio range was installed in New Jersey in 1944, but within the decade VOR technology began relegating the VAR to the aeronautical history books.

For a very short time the VAR served as the backbone of our national airway system. It bridged the gap between the four-course range and the VOR while incorporating elements of both. However, it was only a half-step forward and therefore was quickly eclipsed by better technology. The last visual audio range was decommissioned in the United States sometime around 1960, and like its predecessor, the four-course range, it is now lost to time. EAA

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