Use your user waypoints

Creating do-it-yourself navigation fixes

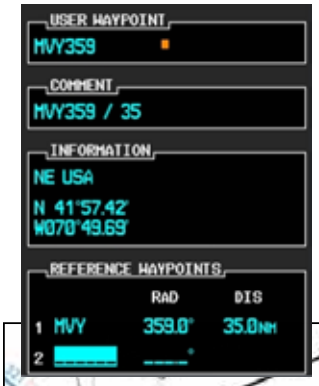
BY NEIL SINGER

USER WAYPOINTS (UWPTS) may seem like a marginally useful parlor trick, but for serious IFR flying they are indispensable. The fact is, there are not named waypoints for every point in space to which ATC may wish to send us, so pilots are occasionally forced to create them. Unfortunately, creation and utilization of UWPTs often receives little or no teaching time during an initial type-rating course, and UWPTs are used infrequently enough that even pilots who've been introduced to them often forget the concept by the time it's needed again.

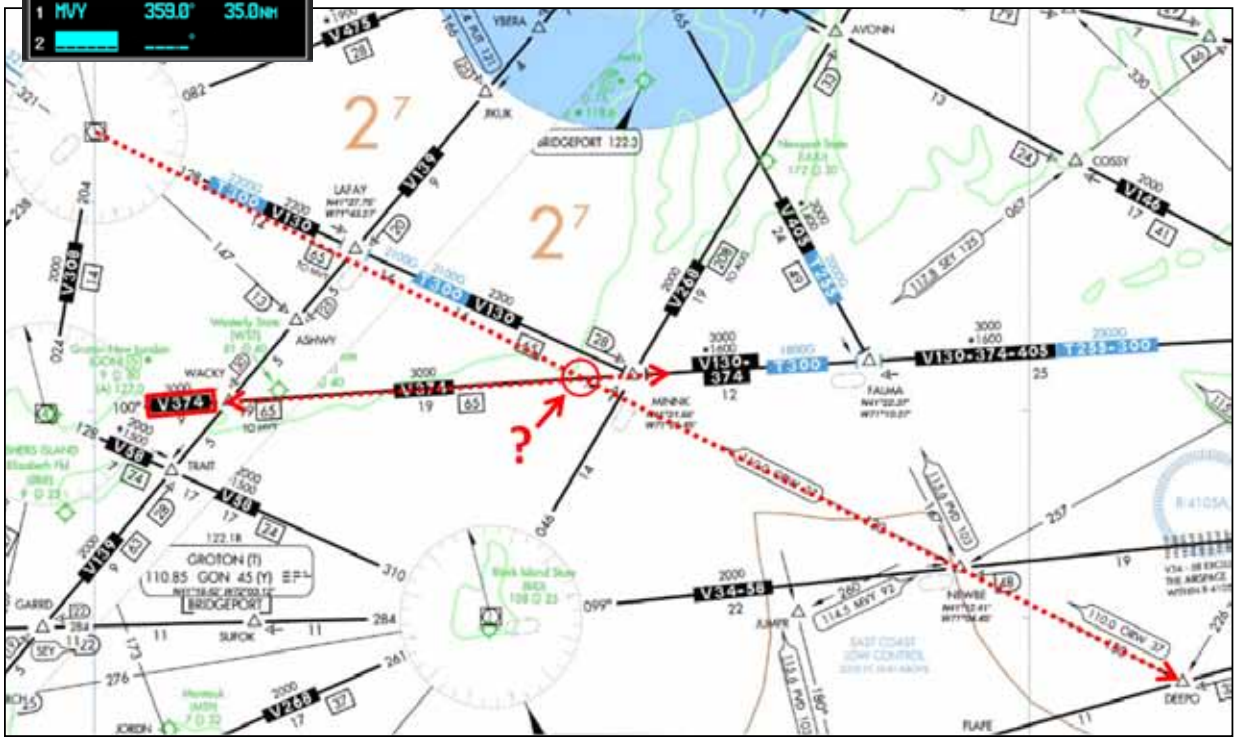
The two avionics systems found in the field of in-production light jets handle the creation of UWPTs very differently, but the underlying theory is the same for both. The Collins Pro Line 21 system allows for direct entry of user waypoints into an active flight plan via entry of a "code" that tells the system the details of the UWPT. The system will name the UWPT for the pilot automatically after it is created.

Garmin avionics, in contrast, have the pilot first name the UWPT, then use a menu-based pop-up screen to determine the UWPT details. What the pilot names the UWPT has no bearing on where it is defined as existing. That said, the name of the UWPT will appear in the flight plan and on the MFD moving map, so naming it something logical, in reference to the clearance, will improve situational awareness.

Both systems have three primary methods of defining the location of UWPTs: latitude/longitude, radial/distance, and



WITH GARMIN AVIONICS, you first give the user waypoint a name, then define it. In the case at left, it's 35 nm from the Martha's Vineyard VOR's 359-degree radial. In the situation below, you've been cleared to fly Victor 374 from the Groton VOR to join the Norwich VOR's 130-degree radial (the red circle on the low-altitude en route chart) to the Deepo intersection. That's nice, but there's no Norwich 130-degree radial on the chart! You'll have to create a user waypoint by naming a radial/radial fix. In this case: the junction of the Groton 100-degree and the Norwich 130-degree radials.



radial/radial. What method is used depends on the type of clearance received; usually only one will work for a given job.

Latitude and longitude UWPT creation is straightforward: tell the system the latitude/longitude to which to navigate. This method is typically used in two scenarios—flying to a private airport and flying an oceanic route. Private airports are not typically found in the built-in database of an avionics suite, so the pilot must enter them manually using the published latitude and longitude.

For flight across the large oceanic stretches, routes are typically assigned based on whole-number latitude and longitude. For example, flying from Goose Bay, Canada, to Iceland, a pilot may be cleared via a named intersection near the Canadian border, then 58 degrees N-50 degrees W, 61 degrees N-40 degrees W, 63 degrees N-30 degrees W, and finally another named intersection approaching Iceland. The three latitude/longitude waypoints will need to be manually entered into the flight plan. Garmin systems require inputting the full latitude/longitude while creating the waypoint—while the Collins system allows for a shortcut if the waypoint only uses whole number of degrees, as the example does.

This shortcut is based on the ARINC convention for abbreviating latitude/longitude coordinates. Based on the four possible combinations of hemispheres (North and West, North and East, South and West, South and East), a single letter (N/E/S/W) is used with four numbers. For example, our first waypoint, 58 degrees N-50 degrees W, would be abbreviated 5850N, with "N" telling the system we are using North latitude and West longitude. Latitudes only range between zero and 90 degrees, so two digits suffice, but longitude can range from 0 to 180 degrees. To allow for this, with longitudes greater than 99 degrees, the letter is moved to the middle of the grouping. Thus, 58 degrees N-150 degrees W is inputted as 58N50.

Radial/distance UWPTs require a reference waypoint, from which the desired radial and distance are computed. The reference waypoint can be anything known by the system—not just a VOR, but also an intersection, airport, or even another previously defined UWPT. A basic example of the need for a radial/distance UWPT would be to comply with the clearance "Cleared to Martha's Vineyard Airport via direct the MVY 359-degree radial 35 DME fix, direct MVY." There is no named fix at the MVY 359/35 DME, so a UWPT must be created there for the pilot to be able to fly "direct-to" it, with MVY VOR as the reference waypoint. The Collins entry for this UWPT is "MVY359/35."

A clearance to fly a radial outbound from a VOR or NDB indefinitely is another occasion for a radial/distance UWPT. This type of clearance may be used by ATC in a busy terminal area to sequence departures, or as part of an obstacle departure procedure to keep an aircraft in a low-terrain area until reaching sufficient altitude. For example, if a pilot needed to "proceed via the ABC VOR 330 degrees until reaching 6,000 feet, then turn right on course," a UWPT would provide an elegant method of compliance.

First the pilot would create a UWPT based on the ABC VOR, 330-degree radial, and 100-nm distance. Then by placing this UWPT after the ABC VOR, the pilot could fly the course from ABC to the UWPT, and would be flying the 330-degree radial. The 100-nm distance is chosen to ensure it's far enough from the VOR that the pilot will not reach it, but not so far as to introduce great circle distortions.

Radial/radial UWPTs are most often used when a clearance is assigned to join or depart an airway via a VOR radial, and no named intersection exists where the two cross. For example, flying from Teterboro to Nantucket, a clearance reads in part, "GON V374 to join the ORW 130-degree radial to DEEPO intersection." Looking at an en route chart, there is no named fix where the ORW 130-degree radial intercepts V374; it will need to be created as a UWPT.

As the term radial/radial implies, two reference waypoints will be need to create the UWPT, with a radial defined from each. The first is obvious; ORW will serve as the reference waypoint, 130 as the desired radial. To determine the second, we need to see what defines V374 in the vicinity of the ORW 130-degree radial crossing location. Looking at the en route chart, V374 is defined by the 100-degree radial from the GON VOR; these will serve as the second reference point and radial. The Collins code for this would be "ORW130/GON100." With this UWPT defined and created, the flight plan will take us from GON to our UWPT, then to DEEPO, and the clearance will be accurately flown. **AOPA**

NEIL SINGER is a Master CFI with more than 7,200 hours in 15 years of flying.