Practical G1000 Tips from a Cirrus Pilot

by Norbert Vorstädt

NORBERT VORSTÄDT made his first flight in a Cirrus in 2004 and has since explored the American, Canadian and European skies with his wife Rosina. They have visited many places on a pilot's bucket list including Alaska, Atlantic Canada and the Swiss Alps, in which they have kept a blog about their travels at www.vorstaedt.de. Being a software developer by profession, Norbert loves to analyze user interfaces of aviation devices. He makes frequent use of the G1000 Trainer which eventually led to his book "The G1000 Exercise Book" describing practical ways of becoming proficient on the G1000 or regaining currency after periods of inactivity. His book is available on Amazon and Apple Books. Questions and comments can be sent to Norbert at: TheG1000ExerciseBook@gmail.com

The advent of avionics systems like the Garmin G1000 has made navigation so ridiculously easy that aviators of the past would be jealous of us. They wouldn't be able to believe the degree of perfection navigation has reached today.

Nevertheless, occasionally cockpit automation has some surprises for us, particularly for pilots like me who do not fly regularly, but in seasonal chunks. Admittedly, my situation is kind of unique. I live in Germany but usually visit the U.S. twice a year for a couple of weeks of intense flying.

Together, my wife and I, who luckily is as enthusiastic about flying as I am, have visited almost every region in the U.S. and Canada over the past 20 years, mostly flying a Cirrus SR22. As we don't own an airplane, we rent from flying clubs and cope with whatever avionics the aircraft offers; but about two-thirds of our flight time has been in G1000 cockpits. We have seen this system develop from its early versions to what it is today. As a diligent note keeper, I have collected an entire notebook full of remarks about kinks in the G1000's user interface, deficiencies of my understanding of the system, and all the mistakes I have made. In this article, I want to share some of these notes and tips with you.

If I could name a single tool that has helped me over the years, it is Garmin's G1000 Trainer software, also called the Perspective Trainer, in the version customized for the Cirrus SR22. About a month before we go on one of our extended trips, I start practicing with it and become proficient again in the G1000's "buttonology." The $35 I paid for this software was one of the best investments I've ever made. If you happen to have the G1000 Trainer installed on your PC at home, you might want to use it to reconstruct the following scenarios.

As a warmup, I start with an easy instrument departure.

Joining an Airway on Departure

The majority of instrument flight training is dedicated to instrument approaches, not without reason. But as simple as many departure scenarios look, they

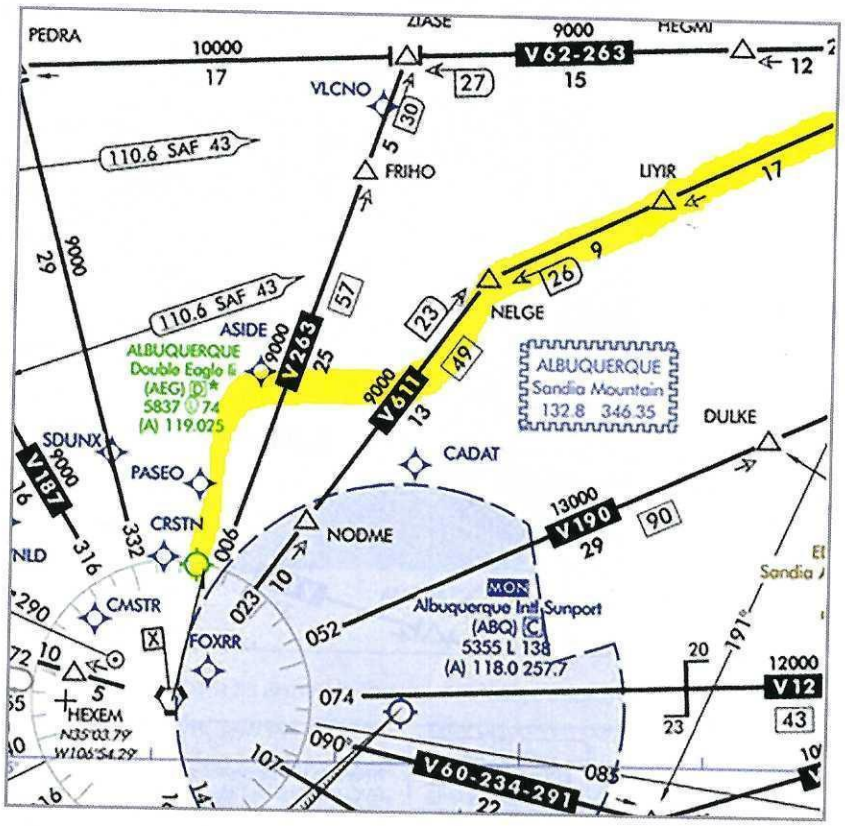
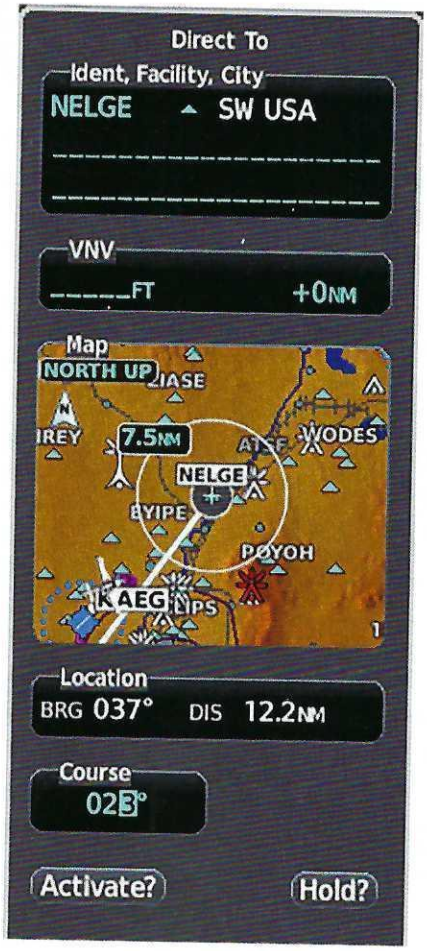


Figure 1: Joining V611 south of NELGE intersection. »

can sometimes hold a surprise or two. One of these surprises greeted me when departing the Albuquerque Double Eagle II Airport (KAEG) to the north. After some initial vectors, we were just north of the airport when ATC asked me to join V611 direct NELGE intersection (see Figure 1, upper right). This was not totally unexpected, as NELGE was the first waypoint of my flight plan. I had expected to receive vectors ending in "proceed direct NELGE," and now had to quickly program the G1000 to join V611.

The easiest way to join V611 south of NELGE is certainly to add another waypoint before it, for example, NODME or ABQ, then activate the leg to NELGE and arm NAV mode ... and that's what I did. Thankfully my wife was my co-pilot and I could delegate that to her. Let's consider alternative methods for a moment. How about doing a direct-to NELGE and setting an inbound bearing of 023, which is the ABQ radial leading to NELGE (see Figure 2, right)?

Clue No. 1: Radials are not identical to magnetic bearings! Airway V611 runs along the ABQ 023 radial, but this line



« *Figure 2: Direct-to dialog with course set to 023°.*

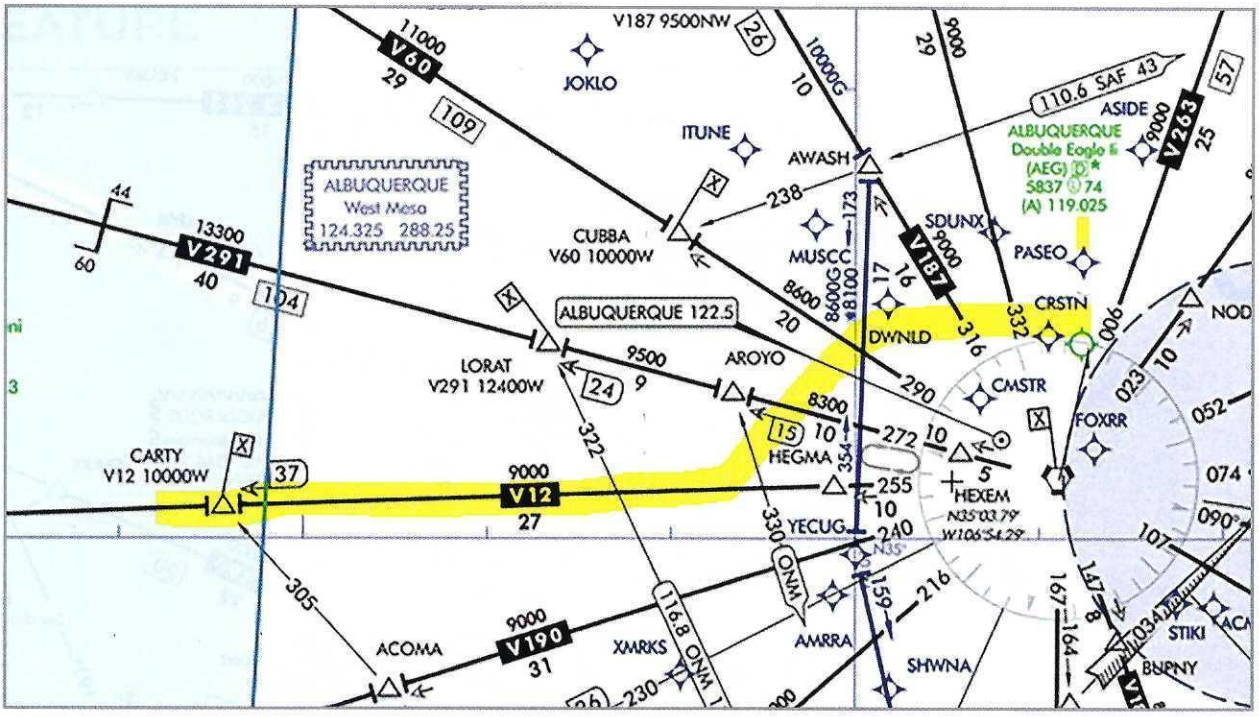


Figure 3: Joining V12 east of CARTY intersection.

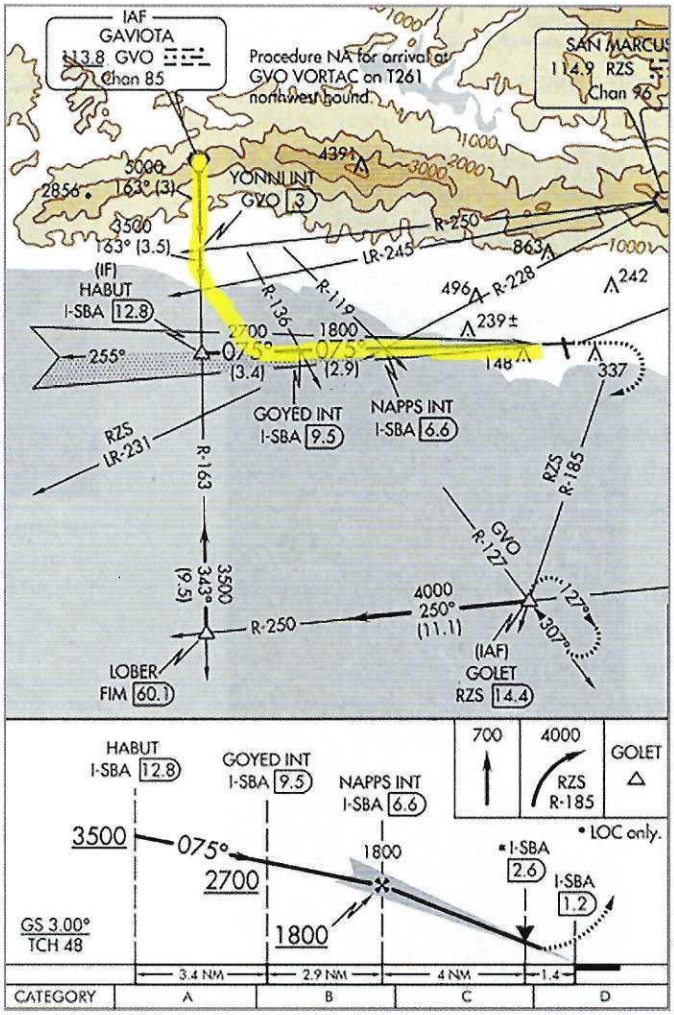


Figure 4: Excerpt of ILS 07 Approach into KSBA.

happens to have another magnetic bearing, namely 028°. A difference of 5 degrees! Surprised? So was I.

Why are VOR radials not perfectly aligned with magnetic bearings? The reason is that the magnetic field of Mother Earth changes; at most places only some arc minutes per year, but that adds up. When the ABQ VOR was installed in 1965, the magnetic variation at this location was 13°E. Back then, it was calibrated for magnetic north, and its radials were perfectly aligned with the magnetic bearings. Looking at a current sectional chart, today's magnetic variation is about 8.5°E – the reason for the five-degree difference between today's radials and bearings of the ABQ VOR. Why does the Federal Aviation Administration (FAA) not re-adjust our VORs to keep both in sync? Besides being very labor-intensive, this would mean redefining all airways each year. Consider that the ABQ radial 023 is

still running over the same geographical locations as it did in 1965. It's just no longer on a bearing of 023.

Besides these interesting findings about VOR radials, what did I learn from this little surprise on departure?

Tip #1: If my first waypoint is at a bend of an airway, I will always include the previous waypoint in my G1000 flight plan as well. In our example, I would have programmed NODME, NELGE, SAF ...

What if the first waypoint is not at the bend of an airway but in a straight segment? Doesn't the same problem arise also in this case? Let's, for example, assume that our first waypoint is CARTY on V12 (see Figure 3, left). Fortunately, when we set a direct-to CARTY, the G1000 will correctly intercept the airway, even if our intercept point falls before CARTY. Hence, the above tip only needs to be followed when the first waypoint is at a point where the airway changes direction.

Intercepting an Intermediate Approach Leg

In the second scenario, we'll look at a more straightforward ILS approach into Santa Barbara, California, and see what can go wrong in a situation when you least expect it. I was sim-flying the ILS 07 approach into KSBA, coming from the north via the Gaviota VOR (GVO), when the following happened (see Figure 4, left).

I loaded and activated the ILS 07 into the G1000, selecting the GVO transition. When near YONNI intersection, I received instructions from my virtual ATC to descend to 2,700 feet, fly heading 140, and was cleared for the approach. That put me on a course that intersected the final approach course about halfway between HABUT and GOYED (see figure 5, above). I activated this leg and pressed the APR key on the autopilot, whereupon

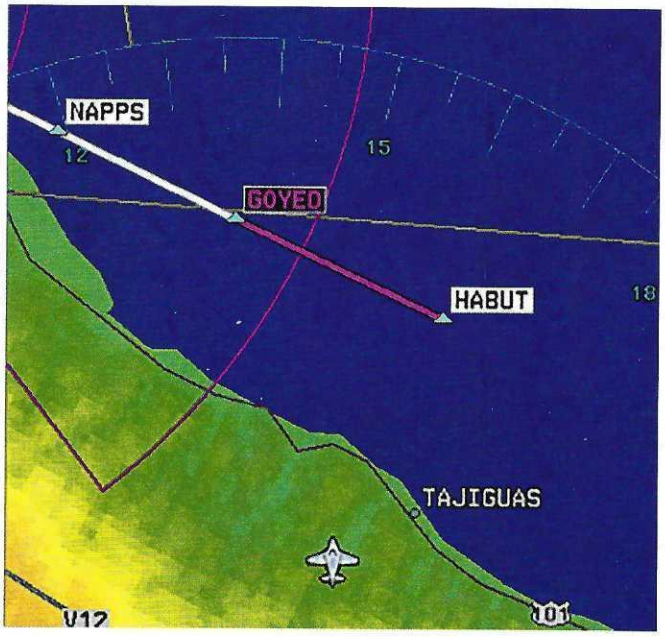


Figure 5: Intercepting leg HABUT – GOYED

LOC and GS were shown as armed in the AFCS status box. The correct ILS frequency had been loaded into NAV1 and NAV2 and properly identified. I expected the G1000 to intercept the final approach course and the CDI to auto-switch to LOC1 mode, neither of which happened! What had gone wrong?

Had GOYED been the final approach fix, everything would have happened to plan. But GOYED is an intermediate fix, hence the auto-switch to LOC1 did not work. Why did the G1000 not intercept the final approach course, but fly right through it? The current navigation source was still GPS, and the autopilot was waiting for the localizer signal to become active, which never happened as I was still in GPS mode. This is an example where manually switching the CDI from GPS to LOC1 would be appropriate. The following technique would have avoided this mishap:

Technique 1: While still in heading mode on a 140 heading, press the CDI softkey on the PFD to switch manually to LOC1 navigation source.

Let's step back for a second and ask: Why did I even consider pressing the APR key in this situation? The answer is I have always thought of APR mode as being an advanced version of NAV mode, just with a higher sensitivity in lateral direction and with vertical guidance. This might be true for some autopilots, but not the GFC700. It treats NAV and APR very differently. So, it's important to understand these differences:

- NAV mode intercepts whatever navigation source is momentarily selected. Had I gone into NAV mode, the GFC700 autopilot would have intercepted the leg HABUT – GOYED just fine.

- APR mode is not so indiscriminate. The G1000 tries to be "smart" about the APR key. It does, for example, not intercept a GPS leg outside the context of an approach procedure. APR mode always intercepts the navigation source that is called for by the selected approach procedure, not the one that is currently selected as a navigation source.

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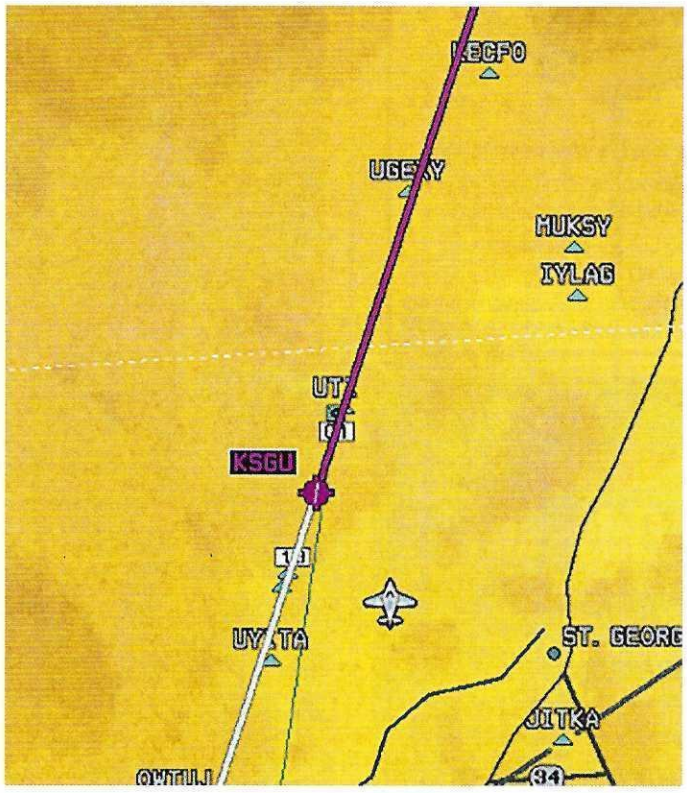


Figure 6: Using OBS mode for a visual approach into KSGU.

There are two lessons to be learned from this example: (1) APR mode is not just an extension of NAV mode by adding vertical guidance, but a specialized mode reserved for flying approaches. (2) Press APR only after the navigation source prescribed by the approach procedure has been switched to – automatically or manually.

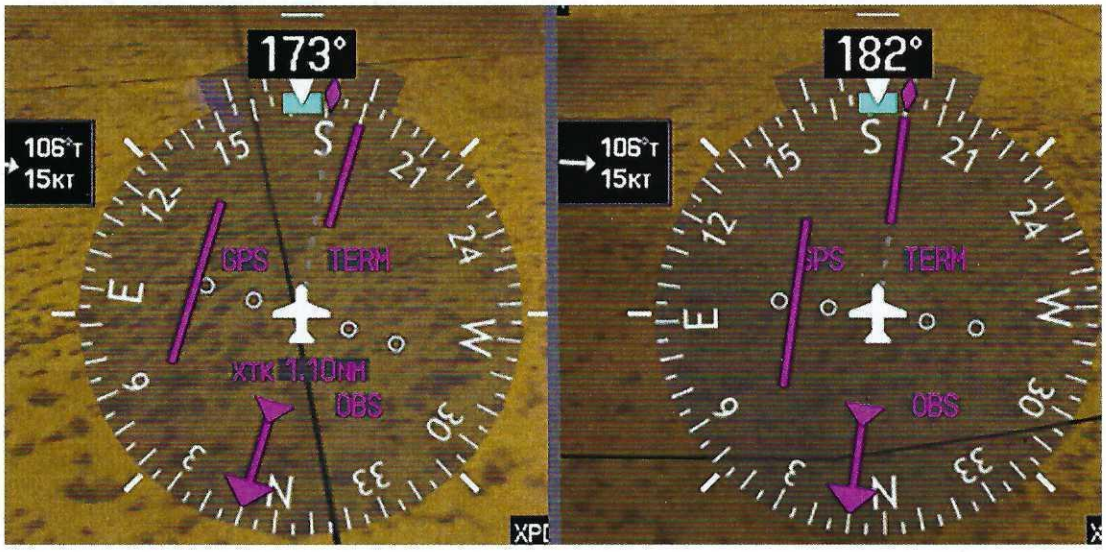
Here is yet another solution to the original problem, and the one I would prefer in hindsight:

Technique 2: Instead of activating the leg HABUT – GOYED, I could select vectors-to-final for the approach. The CDI will immediately be switched to LOC1, and all I have to do is simply press the APR key on the autopilot panel to arm the intercept – straight and simple.

Vectors-to-final has (for a long time) been frowned upon by some flight instructors, and that was justified in the times when the GNS430 or the early G1000 deleted all intermediate waypoints from the flight plan when vectors-to-final was selected. Newer software versions don't do that anymore. The example above demonstrates how valuable vectors-to-final can indeed become.

Tip #2: Be careful when intercepting an intermediate leg of an ILS and use one of the techniques described above.

Figure 7: Cross-Track Error display



OBS Mode for Visual Approaches

My next tip was inspired by a Papua, New Guinea bush pilot. Flying a precise traffic pattern into a typical bush location is sometimes a challenge due to the lack of landmarks like roads and power lines. Instead, the dirt runway is often surrounded by a lot of uniformly looking jungle. For orientation purposes, this pilot uses OBS mode when approaching his next destination, setting the runway direction as course. This produces a similar magenta line as in vectors-to-final mode, which helps visualize the exact courses for downwind, base and final approach (see Figure 6, left).

It also shows an exact readout of the cross-track error on downwind, showing how far your downwind leg is offset from the desired inbound course (see Figure 7, lower left). Note that in the image, the CDI is slightly below full-scale deviation, which in terminal mode corresponds to an offset of 1.0 mile. For higher offsets, the amount will be displayed in numbers as shown on the left side. What helps further is that you can easily find the ideal wind correction by bringing the dashed gray line in correlation with the course needle.

What keeps us from using this simple technique when flying visually into an unfamiliar field? Perspective+ systems offer an even more elegant variation: visual approach guidance, which also offers informational vertical guidance. If you don't have Perspective+ in your cockpit, this method may at least help you fly a precise pattern geometry, and that is often the recipe for consistently good landings.

Tip #3: Use OBS mode with your destination airport as target point and course set to your landing runway's direction to improve situational awareness and fly a precise pattern. ⊕