High flying with Garmin's GNS-430

***George Irvin**, honeymooning with his new Garmin, tells us how it is for him.*

What's the best way to meet the BRNAV requirement? Everybody has a different strategy. Some have already invested in the early BRNAV-compliant Garmin and King boxes. Others are waiting to see what the next round of technological innovation brings. Here's mine.

Start from Scratch

Earlier this year I tore out my avionics stack, junked four good King NAV and COMM boxes and a reliable Garmin 150, and replaced the lot with a GNS 430 and an FM immune KX-125 NAV-COMM. It cost a fortune but, after a mountain of research and calculations, I figured it would save me money. Why? Not only does the GNS 430 meets the TSO C129a specification for enroute (A2a) and approach (A1a) use, but it incorporates FM immunity, 8.33 MHz spacing, has a built-in annunciator unit and is the only GPS which promises WAAS compatibility.

In fact, if money is not a constraint, you can buy two GNS-430s. Not only do you get FM immunity and 8.33 on both boxes, you can "crossfill"; ie, set up a high resolution approach on one box and "push it through" to the other when you need it.

Don't Spend the Same on Less

As to those of us with a budget constraint, true, you can get a BRNAV compliant GPS set for less than half the price. But by the time you've added the annunciator and added FM filters to your existing NAV-COMM stack, you will have spent the same money for less capability. If you do your calculations carefully, you'll find that the worst solution is RAYE: replace-as-you-earn. Fiddling with your avionics stack each time a new requirement comes into force will cost a fortune in labour alone, not to mention the teething problems which invariably accompany mating a new box to a stack of old ones.

Besides, Garmin tells me that mine is the first GNS-430 to be installed outside the United States—I shall be dining out on that fact alone for months!

What You Get

What do you get for the large sum of money laid out on a GNS-430? Basically, you get a high-end NAV, COMM and GPS bundled together with a 'supertwist' colour display visible from all angles under all lighting conditions.

Although the set has a lot of knobs and buttons, they are well laid out and make intuitive sense. The left side of the display shows the active and reserve COMM and NAV frequencies. The single concentric two-knob arrangement is used to dial in frequencies as on any standard box, while pushing on the knob toggles between NAV and COMM modes. There are separate volume knobs for each (pushing on the COMM volume knob engages automatic squelch), and next to the volume knobs are clearly-labeled buttons allowing the selected frequencies to be pushed through; ie, activated.

The right side of the display is slightly more complicated, but easily mastered by anybody who has used even handheld GPS. The concentric knob on this side is used both to move around the menu pages—about which more below—and to select the GPS identifier for a VOR, NDB, waypoint or airport. Pressing in on the knob activates the highlight cursor.

Arrayed above this knob are four buttons labelled D (direct to), Menu, CLR (clear) and ENT (enter). Suppose you want to go direct to BISKO—dial it in with the knobs. Your display then asks you whether you want BISKO in the UK or Afghanistan, highlight 'UK' and press ENT. The right-hand display on the screen shows the waypoint you have selected, the direct track to it, the distance and the ETE (these can be customized according to preference). If you decide not to go to BISKO after all, highlight it and press CLR … et voilá!

Arrayed along the bottom of the box you'll find five more buttons: CDI, OBS, MSG, FPL and PROC. The CDI button enables you to toggle between GPS and non-GPS mode; ie, it determines whether your CDI and A/P are driven by GPS or by traditional ground-based facilities. The OBS allows you to suspend the autoscroll feature of your flight plan. The MSG button has a small box on the screen above it that blinks if there is a message—press the button to see the message, press it again and the message disappears.

FPL stands for flight plan. This is a button that you will use repeatedly to enter new flight plans or, in conjunction with the MENU button, to store and activate a new flight plan, change an existing one, reverse its order or whatever. Finally, the PROC (procedure) button will call up a selection of SIDs or STARs and insert the one you select into your flight plan.

Menu Driven Interface

Like all GPSs, you'll be familiar with this box once you can get around the menu. There are four basic menu pages and each has a collection of sub-pages. If you get lost, Garmin

has added a handy feature: depress ENT for 2 seconds and you will be returned to your default CDI display.

A clockwise twist of the outer knob will give you the map display while a clockwise twist of the inner (larger) knob will take you to the 'nearest' group of pages. Thoughtfully, the top page of 'nearest' is the nearest airport page—so if a pushrod emerges through the cowling, or if your passenger complains of strange chest pains, you'll know exactly where to go. I shall spare you details of the remaining 24 sub-pages, except perhaps to mention that Garmin have thoughtfully included a few blank pages—perhaps for future direct connection to the Internet to read your e-mail or to watch an MPEG inflight movie.

Let's Go Flying

Having explained the basics, let's fly with it. Here is where you encounter the main paradox of GPS. For long trips and long legs, this box is truly God's gift to single-crew IFR operations. (Once you replace the usual "SD/C" in the equipment box of your flight plan with "SYRD/C", alert controllers will route you direct to some point several hundred miles away.) Select and activate "direct to" NIZ , engage GPS mode and the NAV mode on your autopilot and you'll get to your destination flying a great circle route. (Don't forget to have a passenger wake you up every hour to switch tanks.)

But beware! For the shorter routes most of us fly, GPS can actually *increase* you work load considerably. You must still set up all the usual frequencies, identify them, set the course using the OBS … and then make sure it's all set up the same way on your GPS. Add some unstable IMC, lots of R/T chatter and an unexpected routing change and things can get very busy indeed.

Back to flying. Suppose you have planned a flight from Rotterdam to Biggin Hill and have already entered EHRD, COA, KOK, DVR, and EGKA into your GPS using the FPL function, then activated the plan using the menu. While taxiing out, tower gives you a clearance that includes a 'COA Alpha' departure. Press PROC, highlight SID and you'll find COA A listed. Activate it and it will appear on the map or CDI display.

After take-off, set GPS and switch to the NAV function of the A/P. Sit back while your GNS-430 flies a COA Alpha departure and the programmed routing at cruise.
Then, an hour later when approaching DVR, London tells you to expect an ALKIN 2C arrival. Press PROC, highlight the ALKIN 2C STAR and, once again, it will be inserted automatically into your plan. And if you are given a shortcut direct to DET for vectors onto the ILS, press "direct to" and dial in DET, then press PROC and select 'VECT ILS21' from the menu.

Make sure you have set up the ILS correctly on the NAV side and switched from GPS to VLOC. As you near the FAF, press OBS if the runway is in sight. If you don't press OBS, missed approach guidance will appear on CDI and map displays in case you have to go around!

The Map Display

That brings us to the map display. Whether you are flying an enroute leg, an approach or even a holding pattern, toggling between the CDI and the map is enormously valuable since it in effect guarantees you'll maintain positional awareness. Not only will the desired waypoints be displayed, but you can easily create waypoints of your own; eg, it only takes a couple of minutes to create the IAF, the steps and an FAF. Do this for an NDB approach and, in effect, you create a LOCDME backup!

A useful feature of the colour display is that the active leg is always displayed in magenta. (Land is black, water is blue and airspace boundaries green.) The display can be set so that the aeroplane icon is always traveling upwards (the professional option), or if you prefer, to the "North upwards" display option; ie, if you're flying West, the aeroplane icon will move from right to left.

The map scale can be varied from 1000 nm to 0.1 nm. As you approach your destination, both the map and the CDI will become more sensitive and by scaling down the map manually, you can 'see' the approach runway. Moreover, to 'declutter' the map; simply press the CLR button and the detail will go from maximum (showing you labeled roads, towns railways like a quarter mil') to navaids, intersections and airports only in three steps.

Safety Features

The GNS-430 has a number of useful safety features. The large colour display gives excellent positional awareness — on approach in solid IMC, being able to see the runway and its extended centerline is a great morale booster. For that matter, you can 'see' your holding pattern over an NDB. As you approach the NDB, press OBS (which stops scroll-through) and switch to map mode. You can now fly 'round and 'round the hold watching yourself do so. If you set your OBS to the desired inbound course, simply fly outbound for (say) 2 nm allowing for drift; then turn onto and intercept the inbound course. In effect, any NDB hold can be turned into a VOR-DME hold!

Early models of the GNS-430's for the US market had a built-in battery giving you limited navigational assistance should you experience total electrical failure.(Current models do not have a battery so I carry a backup handheld G-90 with an 18 hour battery life.)

If you loose your gyro, rotating the inner knob twice switches you to the compass display, which looks like the old-fashioned strip compass. You can turn to any heading you desire without worrying about the wet compass and timed turns. At a pinch, you can 'customise' this page to show you altitude and airspeed readout and set the QNH (in hPa or inches) so that should you loose your pitot-static system, you will still have speed and (approximate) altitude information. Or if you loose your engine(s) while cruising along at FL120 with the map resolution set to 50 nm, you'll know that almost any airport on your map is within gliding distance.

Moreover, twisting the outer knob to the 'nearest airport' page gives you a complete list to choose from together with distance, QDM, runway lengths and ATC frequencies—— another invaluable aid when flying above a cloud deck, or in IMC or at night!

Lending a Hand

Garmin have obviously given lots of thought to common mistakes that pilots make when under pressure. If you have just finished setting up a frequency on NAV1 and forgotten to push the highlight cursor back to COMM, it will default to COMM within 30 seconds. If you are in GPS mode and are using an active flight plan, as you approach a VOR (within 0.1 nm to be precise) a reverse video message will flash indicating the next heading to set up on the OBS. If you forget to do this, the MSG box will flash once you've passed the VOR reminding you once again to set up the correct heading. (Sensibly, the system still requires you to use the OBS.)

If you're approaching Biggin Hill and have chosen to load the ALK2C STAR from the PROC menu, the map will show you the full STAR. You'll then be prompted for the approach—say the ILS for Rwy-22 at Biggin which Thames radar has just told you to expect. Once you load ILS-22, the correct ILS frequency will automatically pop into the NAV1 standby window waiting to be pushed through and identified. Within 20 miles of the ILS, the CDI scale will gradually adjust so make the needle increasingly sensitive.

Suppose, furthermore, that the approach selected is not a GPS approach but that you've forgotten to switch from GPS mode to old-fashioned VLOC mode— the GNS-430 will do it for you automatically and a message will flash reminding you that the CDI and map displays are to be used for backup guidance only.

And of course, since the box has RAIM, should you loose the minimum necessary satellite coverage, the unit will tell you so. The unit even incorporates a RAIM-hole prediction program!

The Downside

What are the drawbacks? The most obvious is the sticker price—and don't forget to add the cost of buying 12 data cards a year to keep the database current. Note that the FAA allows you to use the unit with a non-current database for enroute guidance—but not for GPS approaches—as long as you've checked the NOTAMs for the route. The JAA appears to be moving in the same direction. (One omission: given the massive data capacity of the GNS-430, surely Garmin could include airport taxiways; unless you know the airport well, taxiing around a major airport at night can be a harrowing experience.)

On the maintenance side, I had some teething problems with COMM1 and NAV1 but these appear to have been sorted out. Nevertheless, a lot of avionics packed into a small space inevitably generates heat. Although the unit has an external fan, whether heat-sensitivity will prove a long term problem remains to be seen.

More generally, some would argue that with such a box, pilots will rely excessively on GPS. I find this argument unconvincing—learning how to use this new technology not

only gives you an extra level of redundancy, it improves your navigation. After all, that is why BRNAV compliance is now mandatory above FL 095. Doubtless when VORs were first introduced, some thought them dangerous because one might loose the ability to navigate by NDBs and radio ranges.

Questions Remain

Two important questions remain unanswered. First, how user-friendly is the GNS-430 when flying GPS overlay approaches (particularly those requiring course reversal and/or difficult missed approach procedures). For a DME-arc approach there's no problem; the box flies it effortlessly. What about flying a course reversal? According to the Garmin manual, in approach mode the GNS-430 goes through course reversal automatically—and it will fly a hold without your needing to press OBS *if the hold is specified as part of the approach*. (It will even recommend the correct hold entry procedure!)

Since we in Europe have very few authorised GPS approaches, it's too soon to answer the question in practice— though I find the map display is so good as to make any approach a piece of cake.

Second, will the box live up to its promise of DGPS; ie, precision approaches using LAAS or WAAS. Again, it's too early to say because DGPS has not yet arrived. When it does, though, Garmin will have to make good on its compatibility claims. Mind you, the same cannot be said for compatibility with Europe's DGPS variant , EGNOS—now grandly christened 'Galileo'——since no paperwork has yet appeared on it. (Chances are that by the time it does arrive around 2010, you'll have fully amortised the GNS-430.) So any authorized GPS non-precision approaches you can now fly use information from US satellites, and the same is likely to be true of any precision approaches developed in the EU in the next decade.

In sum, although the new GNS-430 still has some hurdles to negotiate, this box clearly leads the field. Coupled to an A/P it becomes a truly sophisticated FMS, opening up a whole new dimension of IFR flight. Go for it!