Avionics for International Operations

BY JOSEPH E. (JEB) BURNSIDE

Most pilots and aircraft owners have considered flying to international destinations at least once in their aviation careers. Canada, Mexico and various Caribbean islands are popular international destinations for U.S. pilots, and these "foreign" countries see a lot of N-registered aircraft coming and going. When considering these destinations, issues like Customs requirements, survival gear, the slight differences in operating rules, proof of appropriate insurance and various aircraft documents are often the most critical concerns for U.S. operators. In fact, if your aircraft is already equipped for Instrument Flight Rules (IFR) operations in U.S. airspace, you shouldn't have any concerns about the avionics in your panel when planning to visit a Mexican resort, Bahamian island or Canadian hunting lodge.

For flights to other international destinations, however, the picture can change substantially. Depending on the type of aircraft you're flying, the altitudes you plan to use and your destinations, you'll need to think long and hard about the avionics requirements you'll face and how to meet them. Equipping your aircraft to meet the various international airspace and operational requirements isn't hard and doesn't have to be expensive, but wading through the thicket of national, international and regional requirements can be complicated. In this brief glance at what additional avionics you may need to consider, we'll look at what's required for various aircraft types, the different en route environments and the airspace you may plan to use. We'll try to keep this simple, and presume your aircraft is already equipped and FAA-approved for IFR operations in the U.S. This "baseline" includes a Mode C transponder, an approach-certified GPS navigator, plus ILS and DME capability.

What Do You Fly?

When considering the equipment required for international flight operations, the type of aircraft you fly can be more important than where you're going. For example, if you want to take an IFR-approved piston twin to Europe from the United States, your principal avionics concern might be installing an HF radio for communicating with ATC while en route. But if you fly a turboprop or business jet, especially an older one, and you want to use the most efficient cruising altitudes, you'll need to ensure it meets the latest requirements for VHF communication radios once you get to Europe.

Avionics requirements for international operations can be broken down into three broad categories: communications, navigation and surveillance. Generally, ICAO, the International Civil Aviation Organization, or Europe's ATC provider, Eurocontrol, are the organizations whose rules and regulations you'll need to comply with when operating across the Atlantic to Europe. Their requirements for each of these three categories differ somewhat from U.S. rules and, just like with the FAA, can depend on the type of aircraft you plan to operate in their airspace and your preferred altitudes.

When flying to other parts of the world, including South America and Asia, ICAO standards are generally the ones implemented. In other words, if your aircraft is ICAO-compliant for en route operations, you shouldn't have too many avionics issues until you get to Europe.

But, what makes your aircraft ICAO-compliant? The quick answer is that what's perfectly acceptable equipment for U.S. operations may not be enough for flying internationally.

Communications

In normal domestic operations, civil U.S.-registered aircraft use very-high frequency (VHF)

radios operating in the range 118.0 MHz to 136.0 MHz to communicate with ATC. These radios will normally allow you to tune 760 channels within that range, spaced 25 kHz apart (i.e., 120.825 MHz and 120.850 MHz are 25 kHz apart in the frequency spectrum). And this scheme of frequency allocation and spacing works well in U.S. airspace, where the federal government sets the standards and minimizes interference by preventing two nearby parcels of airspace from being assigned the same frequency.

In Europe, however, many more nations are involved in allocating frequencies, and the potential for interference between them is much greater. As one result, more frequencies within the VHF aviation band have been allocated. How? By decreasing the spacing from 25 kHz to 8.33 kHz. In other words, by using 8.33 kHz spacing, European airspace regulated by Eurocontrol requires many operators to be able to use the two additional frequencies added between 120.825 MHz and 120.850 MHz: 120.833 and 120.842. Presently, 8.33 spacing is required in Eurocontrol airspace for flights above Flight Level (FL) 245; it will be required above FL195 on March 15, 2007. And, in all instances, two radios capable of 8.33 spacing are required.

But before you decide you don't want to replace any communications radios and give up on your plans to fly to Europe, you may already have the avionics necessary to meet this requirement. In fact, many newer avionics have this capability built into them. For example, GARMIN International's GNS530 can be configured to enable 8.33 spacing without any physical changes. Many other current-technology communications avionics will have this capability, also. To be certain of your existing equipment's capabilities, pay a visit to your favorite avionics shop.

Even if you have two communications radios featuring 8.33 spacing, you may still need to add a new piece of avionics: a high-frequency (HF) radio. In this instance, the problem to be resolved stems from the inherent line-of-sight limitations of VHF radio equipment. For the same reason you can't receive a distant VORTAC's signals when it's still over the horizon, you won't be able to communicate with ATC beyond certain distances from land, no matter how high you are. In international oceanic airspace, aircraft operating under IFR or controlled VFR and beyond VHF range are required to use an assigned HF frequency. Again, check with your avionics shop to verify requirements for the routes and airspace you plan to use. Depending on how often you plan to fly overseas, a portable HF radio with an external antenna may be just the ticket for your planned flight.

Depending on what kind of aircraft you operate and how often you plan to fly it to international destinations, three optional pieces of equipment also may be worth considering: SELCAL, SATCOM and ACARS.

The former, an abbreviation for "selective calling," allows a ground radio operator like ATC to alert the aircraft that the operator wishes to communicate with that aircraft. This is useful since the background noise on HF radio frequencies prompts pilots to turn down the volume of their HF receiver—and that can mean missed messages. Using the SELCAL standard, a ground-based operator uses a four-letter code for your aircraft to alert the crew of an incoming HF transmission.

Meanwhile, satellite communications, or SATCOM, can be an alternative to HF radios. The ARINC network, which is the actual conduit en route aircraft use to communicate with ATC when out of range for normal VHF, can use SATCOM for voice communications. This equipment can also be used as an alternative when other methods fail or when over remote terrain.

Finally, ACARS, or Aircraft Communications Addressing and Reporting System, might be worth considering for high-end bizjets that spend a lot of time shuffling back and forth between the United States and other countries. This system provides a digital, text-only service to exchange messages between aircraft and ATC, again through the ARINC network. Clearances are the primary ATC-related function for which ACARS is used, although airlines make substantial use of the technology for their own, internal operational message traffic.

Navigation

The navigation portion of your avionics-equipment decisions is probably a bit less complicated. That's especially true for piston-powered aircraft with at least one current-technology GPS navigator installed in the panel. For high-end aircraft and those planning to operate in the flight levels, the picture becomes a

Continued on following page…

INTERNATIONAL OPERATIONS

Continued from page 61

bit murkier, however, but is still navigable.

You'll need to become familiar with ICAO's Minimum Navigation Performance Specification, MNPS, and its cousin MASPS, or Minimum Aircraft System Performance Specification. These acronyms should not be confused with RVSM, or the Reduced Vertical Separation Minimum standard, which was implemented over North America in January 2005. Of course, if you're operating a later-model turboprop or bizjet in the United States, Canada, Mexico and the Caribbean, it's probably already RVSM-compliant, and you know all about the regulatory and operational requirements for RVSM. The RVSM standard has been implemented in just about every high-altitude airspace segment in the world, including Europe, the North Atlantic, the Pacific and Asia and North America.

The MNPS was adopted on a worldwide basis to ensure navigation accuracy. Over the North Atlantic (NAT), MNPS is implemented between FL285 and FL420, between latitudes 27°N and the North Pole and, at least partially, in the controlled areas (CTAs) of Santa Maria Oceanic, Shanwick Oceanic, Reykjavik, Gander Oceanic, and New York Oceanic. Within this airspace, the standard deviation of lateral track errors should be less than 6.3 nm. According to the FAA, aircraft unable to meet this standard will receive "special consideration" only in a very limited number of cases and will require advanced coordination to determine a final routing and/or any special arrangements that must be made.

Generally, a modern panel-mounted GPS navigator should be able to maintain the required MNPS performance over regular routes. The problems arise with other long-range navigation systems, including older INS/IRS units and, over some geographic areas, Loran C. Newer, multi-sensor navigation systems installed in high-end bizjets and some turboprops should not have a problem meeting these standards along these routes. For N-registered aircraft, the FAA is the agency responsible for determining whether an aircraft meets the MNPS. For this purpose, the FAA has published several documents for operators needing guidance on meeting the standard. Still, and especially if you have doubts or questions about your aircraft's navigation equipment, it's a good idea to sit down with your avionics shop and discuss what else you might need.

Other standards and requirements may greet you once you arrive at your destination. For example, Eurocontrol presently requires basic RNAV (B-RNAV) capability with 5 nm accuracy in its en route airspace. However, many terminal areas subject to Eurocontrol require precision RNAV (P-RNAV) equipment capable of accuracies of within 1 nm. The Eurocontrol P-RNAV requirement in terminal areas was implemented for certain airspace in November 2004 and is expected to be the norm by April 2005.

In Eurocontrol airspace, you may need to obtain advanced approval for P-RNAV operations. If so, approval will be based on the requirements detailed by the Joint Aviation Authority (JAA) and, for N-registered aircraft, is to be accomplished by the FAA. Fortunately, according to Eurocontrol, "a considerable percentage of airframes are already P-RNAV capable," but some may need modifications to comply. Again, based on your aircraft, its equipment and where you intend to operate, using your favorite avionics shop to ensure compliance with these standards and to secure FAA approval, if needed, is the way to go. Also, and as Eurocontrol suggests, "operators are encouraged to contact original equipment manufacturers where there is doubt regarding available equipment or solutions for the types in question."

Surveillance/ELTs

Addressing the surveillance portion of your avionics requirements can best be accomplished by ensuring a Mode S transponder is aboard. Although in European airspace, requirements implemented by individual nations vary, as do timetables, the safest bet is to go ahead and presume that you'll need a Mode S transponder to access all the airspace you might need. And, to further complicate matters, there are two "flavors" of Mode S of which you need to be aware.

The requirement for a basic Mode S "elementary surveillance" transponder went into effect for IFR aircraft in March 2005, with some nations also implementing them for VFR aircraft at the same time. Other nations have established a transition period for VFR operations until March 2008. Meanwhile, France, Germany and the United Kingdom are mandating Mode S "enhanced surveillance" (EHS) capability for all IFR aircraft beginning March 2005. A two-year transition period will be implemented until March 2007, during which Eurocontrol

will be the coordinating authority.

The Mode S EHS standard includes the ability to transmit data including selected altitude, roll angle, track angle rate and magnetic heading, in addition to groundspeed. Fortunately, Eurocontrol has also implemented a "Mode S Enhanced Surveillance Exemption Coordination Cell" (ECC). Among this office's responsibilities is processing requests for exemption. Eurocontrol wants operators of aircraft with maximum gross takeoff weights in excess of 5,700 kg, (12,566.2 pounds) or a maximum cruising true airspeed in excess of 250 knots to register with the office. To facilitate the process, Eurocontrol's Mode S EHS website is available online at www.eurocontrol.int/mode_s/>.

That's the transponder side of the surveillance equation. On another side, U.S. operators have long had to comply with requirements for an emergency locator transmitter (ELT). The first-generation ELTs were troublesome, but more recent products are much more reliable. Most ELTs aboard U.S.-registered aircraft transmit their warbling tone on two frequencies: 121.5 MHz and 243.0 MHz. However, advances in both the devices themselves and in the orbiting satellites that listen for and plot the position of a transmitting ELT will soon require all U.S. operators to transition to a new frequency, 406 MHz.

The new-generation ELTs transmitting on 406 MHz are much more trouble-free than even their recent predecessors. And that's a good thing because the existing satellite-based system that monitors ELT and other distress beacon signals (COSPAS-SARSAT) will discontinue monitoring 121.5/243.0 MHz as of February 1, 2009. While there's no existing U.S. requirement to replace 121.5/243.0 MHz ELTs, after COSPAS-SARSAT stops monitoring those frequencies, only terrestrial receivers—such as local airport and ATC facilities or other aircraft—will be listening.

When considering international operations, however, compliance with ICAO Standards and Recommended Practices requires an ELT transmitting on 121.5 and 406 MHz when operating in oceanic airspace and any designated remote areas. This requirement went into effect on January 1, 2005. The new-technology ELTs using 406 MHz—and which comply with FAA Technical Standard Order C126—are a vast improvement over older technology units, and you'll eventually want to upgrade your ELT to the 406 MHz standard, anyway.

Conclusion

You may already have the avionics required for safe, efficient operations to overseas destinations, depending on where you want to go and the aircraft you intend to use. And, of course, this overview doesn't begin to address other things you should consider and plan for, like handling, routings, operational requirements and the like. But every successful flight begins with a well-conceived plan, and making sure your aircraft has the right equipment for the proposed operation is the place to start.

And don't forget, when all else fails, turn to your favorite avionics shop for expert advice on what your aircraft needs and how it can be used. ■