

Avionics: Enhancing Situational Awareness Via Integration

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In this information age we have been falsely led to believe that more data is good, but it's not necessarily so. Often more is not better, just more. Bits and pieces of data are meaningless unless the data is integrated into information, and that's the key, integration.

Modern avionics, as capable as they are, do not guarantee that your situational awareness is improved; it may just lead to an information overload situation, which is worse than no avionics at all. In order to benefit from their advanced design and increased situational awareness, two things must take place—the myriad of data must be integrated into true information, and you must be proficient enough to know exactly where to look for the information.

The avionics manufacturers compete for the most features in

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the smallest amount of space, which is a benefit to the pilot/owner of a small single engine aircraft, but an over-informed pilot is just as problematic as an under-informed pilot. Such is the case in an overly equipped aircraft. Having multiple units that perform the same function could easily overload the pilot, and waste precious time “tuning” the redundant system.

With this in mind, you may be at the point of seriously considering how to best equip your panel. Complex avionics have undoubtedly increased the capability of our aircraft, but a lot of time is spent looking down at the avionics either learning their operation, or manipulating their controls to finally get what you want. This reduces heads-up time looking for other aircraft or absorbing the whole flight situation. In other words, it's all about situational awareness. Selecting the right avionics is not an easy task, especially when trying to add capability in increments to an older panel with original equipment.

We live in an information age, the more information that we have the happier we are. Pilots,

even more so, like to have as much information as possible. The avionics market is full of devices that present a great amount of information to the pilot. We can be told how we were, how we are, and how we will be with the turn of a knob or push of a button. But sometimes too much of a good thing can be counterproductive.

It used to be that redundant avionics needed to cover each other in case of a failure. There were two Comms, two Navs, alternate navigation sources and the like. But with the modern avionics and their high-level of reliability, redundancy is not as big an issue any more. Many pilots that started flying in the days of higher failure rates saw first hand the need for dual everything. With the growth of computer technology, the engineers have been hard at work designing avionics that are highly reliable and total failures are actually quite rare these days. Therefore, spending the money on dual systems running continuously, or hot spares, may not be the way to go anymore. Your money is better spent on increased capability, instead of dual units that

accomplish the same task. For instance, instead of purchasing that second Nav/Comm/GPS/Map unit, consider increasing your capability by purchasing an autopilot, traffic alert or weather detection device, therefore, increasing safety and comfort instead of redundancy.

Because an airplane just can't pull over to the side of the airway when something does fail, reliability is still a concern. Instead of dual capability, the focus should be on separate source back-ups—namely, handheld GPS and Comm radios. These incredibly capable units provide the ultimate back-up when all else fails. Their battery operation provides instant communication and navigation totally isolated from the rest of the aircraft; but only when two conditions are met, spare battery packs and familiarity.

Since the handheld GPS and Comms operate on batteries, it's commonplace to use rechargeable batteries (Ni-Cad or Ni-MH). These are fine when the units are used on a daily basis, but the shelf-life of a rechargeable battery is pretty dismal. Discharge rates may vary a little, but they generally lose about 1 percent of their charge per day. A typical back-up Comm radio is usually stuffed in a side pocket for months at a time until needed. Three months in that side pocket renders the rechargeable batteries pretty well dead. A better choice would be to use alkaline batteries that have a shelf life of many years. Even then, a second battery pack should still be kept with the handheld radio. Not just a store-bought package of fresh

batteries, the second set of batteries should already be installed in a second battery holder for the unit. It's no fun trying to load a battery pack when you need the handheld the most, so keep a second battery pack at the ready to quickly replace the old one.

The second important requirement for a back-up set of handheld radios is that you become intimately familiar with their operation. No fair just buying the handheld GPS and stuffing it in a side pocket. Just like the panel mounted units, these handhelds require many hours of training. Remember, these are in the side pocket for a reason, to quickly provide navigation and communication when the panel goes dead. If you don't know how to confidently operate them, their worth as a back-up is wasted. So, get to know their quirks and practice with them on those long trips.

Selecting the right suite of avionics is increasingly difficult. A sound strategy to improving your situational awareness is to select and install avionics that integrate and turn a myriad of data into useful pilot information.

For example, the GPS gives you distance, but that distance is not information, just data. It is only useful when it is referenced to a ground position, for ATC position reports only. When that distance data is integrated with speed it turns into information, specifically, time. Our brains use time as predictors and organizers. Why not let our avionics do the conversions instead of our brains.

We need to look at the big picture, and not get caught up in

the details. With so much information available to the pilot, the important stuff must have priority. Sifting through the information, the important stuff is not so clear.

The five burning questions are:

- ✓ Where am I now?
- ✓ Where am I going?
- ✓ How am I going to get there?
- ✓ Keep me out of danger.
- ✓ Do I have enough fuel?

The proper combination of integrated avionics will improve your flying and improve safety. The first three burning questions are answered by the GPS.

Where am I now—The GPS always has position information available, with either bearing and distance to VORs/airports, or Lat/Lon coordinates. Sometimes this information doesn't give you the big picture, so enter another popular piece of avionics, the integrated moving map. This is the ultimate source for instant "Where am I?" information. At a glance the pilot knows where the aircraft is in relation to airports, terrain, nav aids and airspace. This reduces the time folding maps and increases the time for looking outside. Remember, we want information, not data. Lat/Lon is just data, but that position on a moving map is information.

Where am I going—This burning question has been answered with every new generation of avionics. First it was radio navigation (ADF), then A-N ranges, then VORs, then ARNAV, then Loran and now currently GPS. No more changing frequencies or turning course knobs, just

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Direct-to. What could be simpler? Although, much of the information given to the pilot is not useful in the big picture. A GPS provides a lot of raw data in the form of numbers: track, bearing, desired track, distance, etc. Only when that course data is placed onto a moving map does it turn into usable information.

How am I going to get there—The GPS comes to the rescue again. To quote captain Kirk when asked “Where to now captain?” he responded and pointed “Thataway” which is just what the GPS does with its bearing, distance and cross track error (CDI). Luckily those engineers who designed the GPS units conveniently placed that information on the main navigation page of their multi-function displays.

To further improve situational awareness and make better use of the savings from not having to buy redundancy, add a good autopilot and more time can be spent looking outside avoiding other airplanes. A two axis autopilot (roll and pitch) can free you from the mundane task of hand flying a long cross country and let you concentrate on more important issues, such as monitoring systems and keeping that high level of situational awareness.

Keep me out of danger—The three dangers to be avoided are, weather, terrain and traffic. Weather, heavy rain or lightning, can be displayed on independent indicators but it's still data waiting to be integrated into the big picture. Terrain and traffic avoidance systems are capable of just supplying audio warnings, but when the position of these hazards are

placed on a moving map display with the navigation course, true information results. It may get a little crowded on that moving map with all the navigation, weather, terrain, traffic and airspace, but hopefully all those hazards don't appear at the same time. It's always a good idea to keep the map decluttered to avoid information overload.

The last burning question is, “**Do I have enough fuel?**” There are two ways avionics have come to our rescue, and set us free from calculations and inaccurate fuel gauges, digital fuel flow computers and GPS interfaces. Separate panel mounted fuel flow computers derive flow information from an engine flow transducer and distance-to-way-point information from a GPS to give us the fuel remaining, real information. The second method is where the GPS taps into the fuel flow transducer (via an adapter) and displays fuel remaining information as requested by the pilot. Additionally, an Air-Data-Computer (ADC) may be installed that collects fuel flow, heading, airspeed, altitude and temperature. The GPS then computes all this data into useful information, such as fuel (or time) remaining for each leg, winds and many other E6B functions.

The proper “combination” of avionics involve a GPS for navigation, a coupled autopilot to relieve fatigue, a moving map for instant position awareness and a fuel flow computer for fuel planning. This will give you more time to do the important things—keep a high-level of situational awareness and eliminate those distractions that may jeopardize your command of the aircraft.

When deciding on any new piece of avionics, consider the

interface capability between all the components, talk to your avionics shop and equipment manufacturers about integration and turning data into useful pilot information.

Improve your situational awareness by avoiding information overload, eliminating unnecessary redundancies and focusing on useful information delivered via integrated avionics. ■