AVIONICS: The Next Generation

BY DALE SMITH

I'm going to really date myself here, but I was one of the very first people to fly an EFIS–equipped business airplane. The early system was installed in the Beech Queen Air that was our engineering test bed. I can still remember how amazed I was to see that tiny TV screen come alive with all kinds of information that just wasn't possible with even the best flight directors. Add to that, the ability to have weather and a course line displayed on the HSI was, to say the least, incredible. "It can't get much better than this," I thought. Boy, was I wrong.

That was 20-plus-years ago. Fast forward to today, and you'll find piston singles sporting avionics suites that would blow-away the top end "integrated" systems we had on the drawing boards for G-IIIs. So what will the next five-, 10- or 20-years bring? Nobody knows. But we curious types at *Avionics News* thought it would be fun to peek into the crystal displays of some industry innovators to get their thoughts. Hang on. It's going to be one heck-of-a-ride.

We've come a long way, baby

"Over the past 10 years the major trend has been to integrate the avionics and grow the display size," said David Wu, director of flight deck systems marketing for Rockwell Collins. "Large size CRTs have transitioned to the larger and lighter LCD displays. This trend is going to continue."

"It's the 'bigger is better' type of thing," he continued. "Of course, there's going to be a limit to how big the displays can become because they have to fit in the available panel space."

But what if we had a way of creating one display that was the entire panel? "With a new projection-type display you could have any shape you want without worrying about running out of room for anything," explained Tom Simon, Rockwell's manager of aftermarket marketing for corporate aircraft. "Instead of a single LCD, you will have a number of different 'projectors' creating the display. And because you have multiple projectors, it's always operating in a reversionary mode—if you lose one, you don't lose the display."

Honeywell's APEX integrated avionics suite

While few can disagree that pilots want the biggest, most informative displays they can cram in the panel, even if it means making the entire panel into one big active display, Wu cautions that there may need to be a line between what is technically feasible and what is marketable. "At some point we may see a reaction from the market that there is too much information displayed. How will pilots cut through it all?" he said. "We're already seeing some aircraft manufacturers using a 'dark cockpit' philosophy—most displays don't even light up unless there is something you really want the pilot to pay attention to."

"So perhaps we will soon see more use of aural indications of required pilot intervention," Wu continued. "We can envision speech recognition as a valuable tool in future avionics systems."

HELLO DAVE...

If you remember Stanley Kubrick's groundbreaking sci-fi movie, "2001: A Space Odyssey," you're familiar with the smooth talking HAL9000 computer. Crew interaction with systems and control of the ship was as simple as talking to the computer—well, it looks like cockpits in 2009 may actually resemble the world of "2001."

"Manipulating large amounts of visual data is cumbersome for pilots, so I think the next big revolution is going to be a much larger use of voice interactive interfaces between man and his complete machine," explained Glenn Connor, president, Discover Technology International. "If you buy a Lexus, they do a lot of that now. And every high school kid has a cell phone programmed for voice commands.

"The capability for active voice control is certainly there today," he continued. "There's no reason why it won't work in the cockpit—a pilot knows what he wants, it's just a matter of getting the machinery to deliver it the right way." So instead, of fumbling to manually tune a frequency, the pilot just tells the radio what to switch to—pretty cool.

Another scenario has the frequency transfer handled 'invisibly'to the pilot by an advanced controller/aircraft interface. "We're on the verge of some advanced airspace automation kind of stuff that will not be display-oriented," said Dan Barks, marketing director, Honeywell's General Aviation Business Unit. "It's part of the National Airspace System. That will be the case for a whole bunch of avionics upgrades. There are all sorts of ideas about how to get more capacity from the airspace system and a lot of them will rely on the electronics."

To help ease the transition and implementation of evolving system performance requirements, the current and future-generation avionics system architecture will become much more software based. "All the radios won't be in the panel like they used to be," Barks continued. "They'll manifest themselves some other way and be controlled via a large screen display and a central processor."

For example, the GPS in Honeywell's new APEX integrated avionics suite, isn't a separate box that can slide out of the panel. "The GPS function is fully integrated in the system, so when you need to upgrade its performance, you just upgrade its software," Barks explained. "The future of avionics aren't as 'things' anymore, they are becoming more like applications."

LITTLE JETS. BIG OPPORTUNITIES.

Mini-Jets, Micro Jets or Barbie Jets, no matter what you call them, the seemingly endless parade of new personal jet aircraft are going to provide an opportunity for avionics manufacturers to introduce systems that will help owners get the most out of their new aircraft.

"We'll soon see a change in the cockpit procedures and how the pilot will interact with the sensors and controls," Simon said. "Certainly in the 'micro jets' area there's a philosophy to operation that is more akin to a game-based type of graphical user interface rather than the traditional knobs-and-dials panel."

"How that will work out in the end remains to be seen," he continued. "We are beginning to see it in the air transport industry already. The Airbus A380 incorporates elements of this thinking in its new graphical user interface system."

"We (Rockwell Collins) are providing the displays for the new Boeing 7E7 program," Wu added. "What we're seeing are more very large format displays that will possibly be controlled by a track-ball type controller." Oh, I can see it now: "Please insert two more tokens before you begin your approach…"

CO-PILOT IN A BOX

Another area, driven by the popularity of personal jet transportation, that is ripe for innovation, is autopilots. In particular, a new generation of units that will bring full auto flight and auto land capabilities into the cockpits of legions of little jets.

"Developing the electronics that will really allow all-weather operation of light aircraft by pilots who don't necessarily have the advanced skill and experience levels—kind of an auto flight, auto land system—will be a major breakthrough," Barks said. "I'm thinking a little George Jetson here. If we could develop a sophisticated auto-control system that could routinely take you down real low, that would be what you need to significantly improve the safety of operations for these low-time pilots."

"If you look at the marketing hype, the people flying these new aircraft in

Continued on following page

Continued from page 27

single-pilot IFR conditions will be relatively low-time," Connors said. "They won't have the benefit of a gray bearded copilot sitting in the right seat. But it would be interesting if technology could create some sort of 'copilot-in-a-box.'"

Connors' concept would essentially be a system that would integrate input from all of the aircraft's instrumentation and sensors, along with uplinked information from the ground, to create a "forward-looking" picture of where the aircraft will be if nothing is altered. "The system would automatically deliver just the information the pilot will need to safely fly in that situation," he explained. "The 'copilot' would handle clearances, approach plates and so forth, and spoon-feed the pilot along. The pilot just keeps the needles centered."

Using the unfortunate JFK Jr. accident as an example of an inexperienced pilot paying the ultimate price for getting in over his proverbial head, Connor said, "If he had had his instructor with him, even if only to predict what could happen when he flew from VFR into IFR, he would have had help in accessing the situation based on experience and information. This accident, and others like it, may never happen again."

THE INFORMATION "SUPER SKYWAY"

Whether it's creating a copilot in a box or some other predictive pilot information system, Connors says the key to making it all happen will be having the ability to deliver, seamless, real-time information that is collected from a variety of sources both on and off the aircraft and then delivered for display in the cockpit.

"It won't be too long before the basic avionics data base will change to something that is much faster," Connors said. "Now you have ARINC 429/629 architectures—those standards are very old and they can't accommodate sub-level systems integration.

"The next-generation of data bus architecture will be able to grow so processors will be able to dynamically respond to the condition of the moment," he continued. "It (the database) will be able to find sources for the information it needs, even if that means looking outside the aircraft."

Connors said that a lot of valuable information lies on the Internet, and accessing it is where the next-generation of broadband wireless datalinks will come in. "These systems will be able to search every available source for the information it needs to complete a task," Connors said. "And as it finds a particular piece, it will automatically analyze it to see how it impacts the other parts of the flight, then go back out and find the new information it requires."

Connors gave the example of an aircraft enroute finding out that the intended destination airport is socked-in due to weather. The aircraft's onboard system would automatically search for an alternate airport with suitable weather, coordinate traffic flow information from ATC and then present the alternative along with all the necessary navigational information to the pilot in a logical, graphical format.

It's not as far-fetched as you might think. "When UAVs (Unmanned Aerial Vehicles) begin operating in the traffic network, they will need this type of associate technology to help them dodge traffic," Connors said. "They will have the ability to tap into the Internet, ATC network, and other sources to look ahead for traffic, plan an alternate route around weather or whatever it needs to safely fly in the system."

THE FUN IS JUST BEGINNING

Before we get too far into avionics "la-la land" let's take a minute to remember that the technology you see tomorrow will be firmly grounded in what we're installing in the cockpits today. "When we look back five years ago, there were such obvious things to do—build integrated cockpits for 'little airplanes,' put traffic alerts and ground prox in little airplanes, put datalink weather in 'little airplanes,'" Barks said. "It was more straightforward to move forward. But once we've done all that over the next five or 10 years, what will we do next? That's the interesting question.

"More aircraft builders are putting turbine engines on more aircraft types, which means more pilots who may not have been able to fly them before will be able to now, and that's kind of cool," he continued. "And with those new aircraft, pilots will be able to get their hands on some real integrated cockpits and enjoy the excitement, capabilities, fun and safety that they bring. I know pilots are excited about it—having some really genuinely new stuff. It's an exciting time and it will be good for the entire industry." ❑