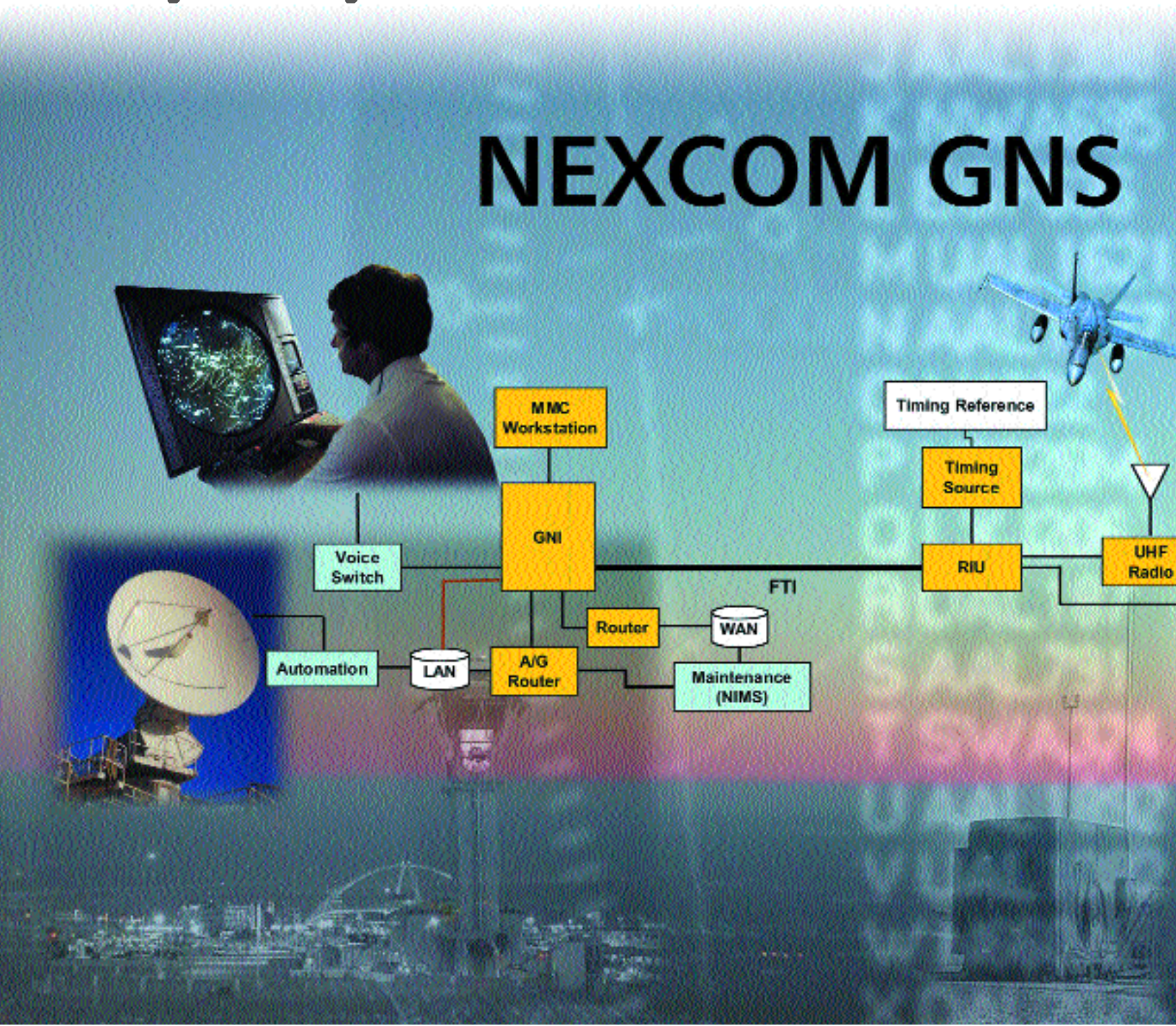
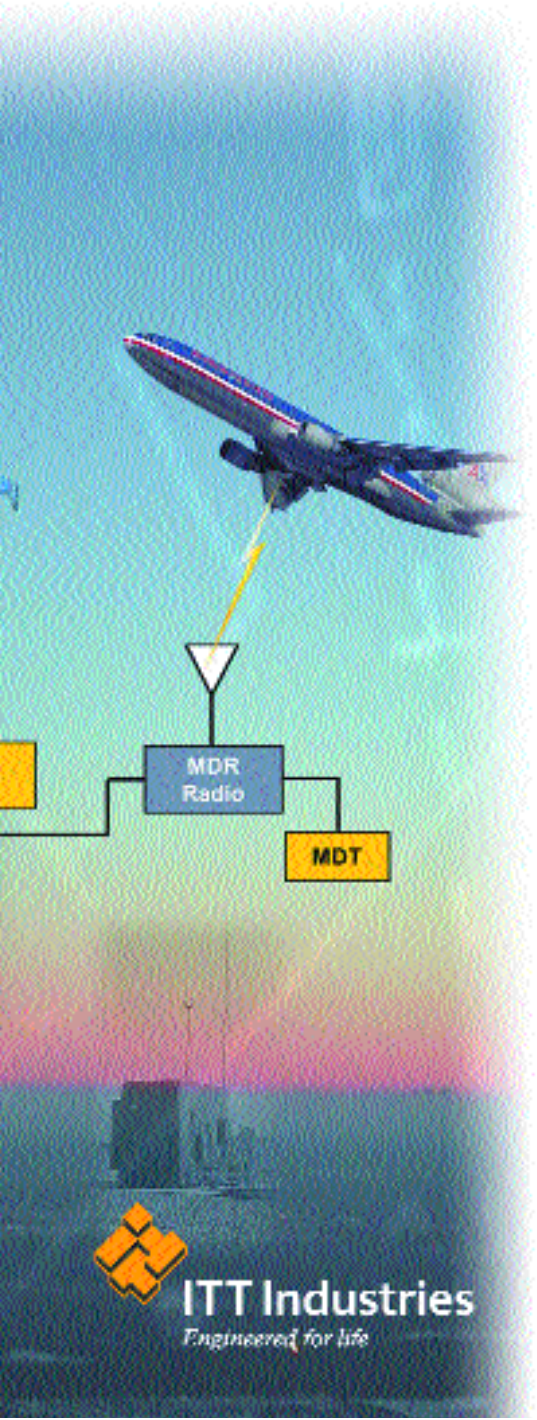
NEXCOM: The Next Step

BY DALE SMITH

Avionics News takes you on an insiders look at the FAA's program to develop the next generation air/ground communications network.





Anyone who has tried to contact a controller during flights in-to or out-of Class B airspace has experienced first-hand just how crowded our air traffic control communications system is getting. And easing that "communications system overload" is the exact reason why the FAAis investing millions of dollars to develop their Next Generation Air/Ground Communications program: a.k.a. NEXCOM.

"Back in 1990, the FAA, along with members of the international aviation community, saw the problem with the current analog air-to-ground communication system," explained Daniel Salvano, director of the FAA's Office of Communication, Navigation and Surveillance Systems. "They determined that if the system continued to grow at its historical 3 percent per-year rate, the network would effectively run out of frequency spectrum.

"The goal of NEXCOM is to provide digital voice and datalink growth capabilities through the year 2030," he continued. "Although trying to reach out and predict what we'll need in 27 years is pretty tough."

Salvano went on to say that the guidelines for NEXCOM's development were created through a combination of inputs from both the RTCAand ICAO. "Because aircraft communications are a global system, we need ICAO's full support if we are going to create a 'seamless' air transportation system around the world," he said. "It all sort of jelled in about 1995, when the groups issued a report that's become the 'roadmap'for the future of air/ground communications."

What the report basically said was that VDL Mode 3 (VDL-3) was an ideal choice to become the standard for digital communications worldwide. It also recognized that certain countries had an immediate problem and using 8.33 KHz frequency spacing on their analog VHF radios would be an interim solution until the time when VDL-3 could be fully implemented.

So you ask: Why not just have everyone switch to using 8.33 KHz spacing and continue to use the "current" communications system? "Historically, we have always approached solving our frequency needs by continually dividing up the analog frequencies," Salvano explained. "We started with 100 KHz radios. In the '60s we went to 50 KHz. Then to 25 KHz in the '70s and it's down to 8.33 KHz, which is splitting that even further."

"But what that really does," he continued, "is to take us to the very cutting-edge of analog technology where you begin to have co-location and antenna problems. And you're not getting any new capabilities. It's just slicing the bologna a little thinner. It's an OK solution for a period of time, but you can't go back—like flying into a box canyon."

"VDL-3 is a better long-term option than the 8.33 spacing," added Randy Kenagy, director, Advanced Technology, Government and Technology Affairs Division for the Aircraft Owners and Pilots Association. "The 8.33 option has emerged simply because the Europeans decided to go that route instead of with digital. A lot of international air carriers are saying they're already equipped with 8.33 radios so why should the FAA require different equipment to fly domestically in the United States?

"Even though they believe it's the right solution, the FAA hasn't decided for sure on VDL-3," he continued. "Right now they're in the beginnings of their demonstration trials where they will ensure that it can be matured to the point of certification. If it works out and they can prove it works with

Continued on following page

NEXCOM: THE NEXT STEP

Continued from page 47

real-live avionics and a ground infrastructure they will pursue it. If not, they'll have to go with 8.33 until they run out of spectrum." After that, who knows…

Testing 1-2-3.

According to Salvano, the FAA completed the first of three scheduled operational evaluations just this past November. "Basically, the purpose was to demonstrate the viability and some of the features of VDL-3 technology in a real ATC environment," he explained. "We had three aircraft in the test. Our 727 was in the air over Atlantic City and we had a Convair 580 and a Learjet on the ground simulating ground control operations. We also had two controllers representing two different sectors.

"The system worked in the lab just fine," Salvano added. "But we really needed to string an end-to-end system in a situation that was as close as we could get to a simulation of two sectors in an active ATC environment with actual aircraft."

To complete the first test, the FAA had to use a combination of prototype ground and airborne avionics because the first-generation of "certifiable" equipment isn't scheduled to be ready for use until the next test later this year. "Even with the lab equipment the tests came off really well," he continued. "We had 17 scenarios showing seven different features, plus two sectors in voice mode. We wanted to show that we can actually do voice and data on one frequency simultaneously. That was one of the really big events."

The ability to transmit both voice and data over a single frequency is one of the biggest benefits of VDL-3 technology. VDL-3 utilizes Time Division Multiple Access (TDMA)—the same technology used by a lot of cellular phone networks—to divide a single digital channel into four equal parts. These four independent channels now allow simultaneous voice and data communications between pilots and controllers.

"Because aircraft communications are a global system, we need ICAO's full support if we are going to create a 'seamless' air transportation system around the world. It all sort of jelled in about 1995, when the groups issued a report that's become the 'roadmap' for the future of air/ground communications."

— Daniel Salvano, director of the FAA's Office of Communication, Navigation and Surveillance Systems

This increased quantity of available communications channels will enable additional ATC sectors to be added and additional communications channels to be deployed throughout the national air traffic system. The FAA also says that the digital technology will also provide the highest levels of security. Users will be required to provide a digital form of authentication, thus preventing the possibility of "phantom controllers" gaining access to the communications system.

While simultaneous voice and data transmissions and increased security are certainly considerable benefits to the VDL-3 digital network, they aren't the only benefits pilots will enjoy. "From the immediate response we found it to be a lot clearer than today's systems," Salvano said. "There's no analog background 'hiss'with the digital transmissions." Aside from clearer communications, the digital network will also provide other operational benefits including the elimination of "stepped-on" transmissions and "stuck-mic" problems.

Ground control to Major Tom…

While the airborne avionics are getting the majority of the attention from the end-users, the switch to an all-digital network will mean that the FAA will need to change out all of their existing ground-based equipment.

The first step of that infrastructure update program was recently taken when the FAA awarded contracts to ITT Industries Inc., and Harris Corp. valued at $16 million and $21 million respectively. The contracts run over a 20-month period and cover the initial development phase of NEXCOM's ground-based transmission equipment.

"Right now the Multimode Digital Radios (MDRs) that will be installed in the field in the June/July time frame this year will be operating at 25 kilohertz like all the other radios in use today," explained Dick Eckerd, marketing manager, ATC Businesses, Aerospace Communications Division of ITT Industries. "What they'll need then is the Ground Network System (GNS) infrastructure, which is part of the development contract that was recently awarded to ITT and Harris. It allows the voice signal to be digitized and then sent over to a remote site where it is either left as a digital signal or converted back to analog before being transmitted."

Currently ITT and Harris are in the early stages of creating what they call the Engineering Development Model (EDM) phase of the overall infrastructure development process. "What this

initial contract will allow us to do is prove to the FAA that this technology will actually work," he said.

"Once the final program contract is issued, the entire network can be installed," Eckerd added. "In the meantime, we'll still be operating all-analog. There will not be a mish-mash of capabilities. There are a lot of logistics in a program like this from an equipage standpoint, airspace standpoint and channel/frequency assignment standpoint. A lot has to be done between now and the time the FAA can flip a switch and go from analog to digital."

One thing Eckerd also explained was the need to develop the ground network interface that works with the voice switch on the controller's headset. "There are some simple signals like 'push-to-talk' and those types of things that have to get sent along with a digital voice signal. Analog systems don't need those types of commands."

Being able to send those hidden "controls" from ATC to the aircraft's avionics is a key feature of the new digital system. "For example," he continued, "we can have 'controller override,' which means the controller now has the ability to override the pilot's transmission in a stuck mic type of situation. The 'management burst' from the controller's set can literally shut the aircraft's transmitter off. You get a lot of additional safety issues in there."

So what's in it for me?

While the FAA and ICAO believe the future of air-to-ground communications will be found in VDL-3 digital technology, the people who will end up using the system may not be quite so easy to win over. The air carriers, although relatively limited in number of actual users, will theoretically get the most "bang for their buck" when they switch over to VDL-3 because they will benefit most from digital technology's features like Controller/Pilot Datalink Capabilities (CPDLC) and next-channel uplink capabilities. And even with all that, the airlines aren't lining-up to upgrade their current avionics to VDL-3 digital boxes.

"The decision may be 'final' to the FAA and the people making the money, but it's far from final with the airlines," Kenagy said.

Another concern is that individual pilot/owners may not see the benefits of the new digital technology quite so readily. "As a representative of general aviation and its users, we're (AOPA) kind of setting back and watching all of this," he continued. "Basically the general aviation end-users, our AOPA members, are going to ask; 'Except for the Unicom frequency environment on the east coast, we really don't have a frequency problem.' So why do we really have to switch at all?'"

To answer that question, Kenagy said his No. 1 concern right now is keeping AOPA members, and their needs, at the forefront of what the future equipage mandated may be. "Understanding and maximizing the benefits of VDL-3 equipage for general aviation pilots is very important," he explained. "We look at the average pilot flying a 172. If we can ensure that the technology will provide benefits for that type of user, then there will be substantial benefits for everyone else. We want to make sure there's a good reason to reequip and not just to satisfy some mandate. Our member will simply not allow us to accept that."

Another potential problem Kenagy brought up is the potential need for pilot/owners to reequip their aircraft to up to three-times to meet a variety of evolving requirements. "Think about it," he added. "You've got WAAS coming along and ADS-B, coming—probably before this NEXCOM stuff because it has a lot more substantial benefits—so we're looking at NEXCOM being the third of possible three major avionics upgrades an owner would have to endure. By the time an owner finishes all three upgrades, if he had to do them individually, he would be both emotionally and financially exhausted. And he wouldn't be very happy."

"Those are the types of challenges that are just now starting to identify themselves," Kenagy said. "And the sooner some real decisions are made, the faster the avionics manufacturers can begin to design equipment that meets all these needs without having to be continually replaced."

Kenagy also pointed out the fact that there are about 135,000 single-engine, general aviation airplanes and they fly the majority of their hours VFR, and most of those hardly, if ever, operate in Class B airspace. "Most pilots just fly under the Class B airspace instead of having to deal with the additional communications workload," he explained. "That's why we're going to make sure they ring everything out of the current VHF analog spectrum before we accept this digital solution as a 'sliced bread' implementation." q

"The decision may be 'final' to the FAA and the people making the money, but it's far from final with the airlines."

— Randy Kenagy, director, Advanced Technology, Government and Technology Affairs Division, for AOPA