

Going Solo

BY R. KURT BARNHART

Single-pilot air carrier operations, boosted by technology, could have wider application in the future.

Being involved in the relatively novel unmanned aerial systems (UAS) industry and in the flight training industry, I'm often faced with the question: "Do you think that passenger aircraft will ever fly without a pilot?" To all but the youngest inquirers, I often reply, "Probably not in your lifetime," based on my 25 years of experience as a pilot, although I can be a bit pessimistic when it comes to the pace of change in air transportation — and, to a great extent, we all benefit from a system that is allowed to become more efficient as technology permits.

That question, however, is intriguing and has caused me to look back over the history of commercial air transportation and consider the future possibilities in light of our work with small, but fully autonomous, UAS that now fly in the U.S. national airspace system.

Looking at the history of commercial air travel, it is easy to see several trends. The most obvious change to the flight deck over 60 to 70 years has been the reduction in the number of required flight crewmembers. Most long-range

passenger aircraft of yesteryear, such as the Boeing Stratocruiser, required five flight crewmembers.

In addition to the captain and first officer, there was the second officer or "flight engineer," whose job was to monitor from a sideways-facing seat the complex aircraft systems as displayed on an array of analog gauges. There also was a navigator adept at using charts, manual flight computers, sextants and practical mathematics to keep the captain informed of the aircraft's position. Finally, the radio operator, working closely with the navigator, tuned the bulky communications equipment and made periodic position reports. All of this was necessary because the technology of the day made flying long distances a highly labor-intensive operation.

In the late 1950s and 1960s, as electronics technology improved from large vacuum tubes to miniature vacuum tubes, then to solid state transistors with the accompanying improvement in reliability, the radio operator gradually became unnecessary on longer flights as communications improved and the systems became more



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automated. For over-land flights, the advent of very high frequency (VHF) navigational aids such as the VHF omnidirectional radio gradually eliminated the need for a navigator.

Later, with the advent of the on-board inertial navigation system (INS), long-range navigators began to suffer the same fate. Thus, the three-flight-crew aircraft remained the norm for longer-range aircraft until the availability of the microprocessor in the late 1970s, which further reduced the size and improved the reliability of the on-board systems to the point where manufacturers such as Boeing were ready to move to the two-person flight crew for their 767 and 757 aircraft.

It helped greatly that shorter-range transport aircraft such as the Boeing 737 and the McDonnell Douglas DC-9 had already crossed this threshold in spite of strong labor union opposition, but only after long and detailed study revealed that there was no adverse impact on air safety. In fact, early versions of both the 737 and 767 were configured for three flight crewmembers, as both industry and the government grappled with the issue. At the time, many of those in the system seemed to promote the principle of “more is better” when it came to the number of flight crewmembers. However, though crew resource management was a little-understood concept at the time, we can now see that the more people in the front of an aircraft, the more time and energy needs to be devoted to managing the working relationships created by those people. This created enormous potential to detract from flying duties and erode aviation safety. Indeed, some high-profile air carrier accidents in the 1970s seemed to prove this point.

Needless to say, the two-crewmember flight deck has emerged as the winner even for the longest-range aircraft, but will it ever be possible to move from two to one, or even zero in passenger-carrying transports? Certainly in our current air transportation system, this is far from possible and is a *long way* from being accepted; however, the evolution of technology is radically changing air transportation as most of us have known it, and smaller UAS now operate in the national airspace system, fully automated from takeoff to touchdown.

Designers of modern aircraft have transformed the job of a pilot into largely that of an automation manager, even for smaller, shorter-range aircraft. FedEx has already expressed interest in long-range unmanned cargo aircraft for some of its overwater routes. Demonstrating that capability would go a long way to proving the safety and reliability of the technology and, as digital-savvy generations age, public acceptance of unmanned passenger operations would be almost certain to follow, given enough time.

While I do not foresee unmanned passenger airline operations in my lifetime (I'm 40), I do think it's feasible to get down to one flight crewmember, and I think there will be economic pressure on airlines to pursue this as technology matures and pilots become more scarce. For this to happen, many major hurdles will obviously need to be overcome. For instance, automation will need to become the norm for all operations, with hand flying reserved for emergencies, and neither air traffic control nor flight deck technology is there yet. Also, it will need to be possible to monitor the health of the flight crewmember with the capability to intervene through flight control from the ground. In a conversation with Chad Cundiff, vice president of crew interface for Honeywell International, I learned that efforts are under way to improve ground awareness of flight crew health status. Finally, it should be noted that single-pilot jet aircraft carry passengers every day in all weather and traffic conditions under the general operating and flight rules of U.S. Federal Aviation Regulations Part 91, so would it be such a large leap of faith to add a few more passengers with better, more reliable technology? Would it be detrimental to safety? As we have seen as we have moved from five flight crewmembers to two, technology has a way of answering questions like that for us. 🚀

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