

**Jets With Byte Stuff Hovering on Horizon For Airline Industry.....2**

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**HD** **Jets With Byte Stuff Hovering on Horizon For Airline Industry**

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**LP** The pilot types in the Seattle coordinates, taxis his jetliner from gate A-20 to the runway at Hartsfield International Airport and throttles up for takeoff.

Once airborne, however, he can stow his flying skills. The computers will plot the course, fly and land the plane, look for mechanical problems and make adjustments. In the off chance that human input is needed, the computers will buzz the pilot.

**TD** Today, having the right stuff means handling the byte stuff. This is the age of the "glass cockpit," when aviator becomes computer monitor.

In the Boeing 747s, 757s and 767s, McDonnell Douglas MD-88s and Airbus 320s, the old gauges, switches and lights are being replaced by video displays linked to sophisticated instruments and computers.

The new 747-400, debuting this month, has five computer systems with 170 microprocessors doing a variety of menial and significant tasks. The old 747 had 971 lights, gauges and switches and a three-man crew. The new model has a third of the lights, switches and gauges and a two-man crew.

New systems put an incredible array of information, from map displays to color weather radar, at a pilot's instant beckoning. They also are prompting deeper questions about how well man and machine can interact in the unforgiving environment of a cockpit where slight miscalculations can instantly kill scores of people.

There is no question that **automated cockpits** can perform amazing feats. Boeing planes are equipped with laser-gyros that constantly monitor the aircraft's location with near-perfect precision. "As you back out of the gate, the system constantly computes your location," says Shand Gause, a Delta assistant chief pilot. "The airplane knows exactly where it is going and will tell you if there is a deviation."

The new MD 88s are equipped with a woman's voice to warn pilots of imminent dangers, such as improperly set flaps. "Flaps, Flaps, Flaps," she will say if a pilot attempts to take off with the wrong configuration.

In the 767 and 757 cockpits, which are virtually identical, there are six video screens upon which the pilot can call for a variety of displays and input a tremendous amount of information. In the MD 88, there are five.

The systems also troubleshoot mechanical malfunctions, and will send reports to the maintenance stations detailing needed repairs. "This way if we have a radio out, there will be a guy waiting on the ground with a replacement when we get there," says Richard E. Colby, another assistant chief pilot at Delta.

Because pilots like to be involved in flying their airplanes, they often take the controls - but for pleasure rather than necessity. It's analagous to cruise controls on cars, one pilot said. "It would take all the fun out of it if we let the computer do everything," Mr. Gause said.

While no one believes gadgets can replace pilots, the new technology has made one crew member, the flight engineer, obsolete.

"There's a joke," Mr. Colby says. "The next technology will only need a pilot and a dog. The pilot will be there to feed the dog, and the dog will be there to bite the pilot's hand if he touches the instruments."

Not so far-fetched. Technology will be available soon that could make pilots little more than redundant equipment. Air traffic control computers are in development that can track aircraft and beam up course and speed changes to planes between cities.

Lockheed's Georgia unit is developing a system for the U.S. Department of Defense called "pilot's associate," an electronic aide that uses models of human behavior to figure out what a pilot needs to know and in some cases actually performs tasks such as lowering flaps or landing gear. The associate would act as an "expert executive secretary," thinking of the boss's needs and responding to them, said Norman D. Geddes, the senior staff scientist at Search Technology, a subcontractor for Lockheed on the project.

The associate would also watch for pilot errors and respond with corrective actions when needed, Mr. Geddes said. If the pilot is busy, the system may act on its own without necessarily telling the pilot. This technology is being refined and is targeted to be on the market in 1995.

Although technology marches on, humans remain the single most difficult system to improve upon. Examples abound of the frailties of pilots and their tenuous control over high-tech aircraft.

**Automated cockpits** have bred new kinds of human performance problems - complacency and boredom.

The most graphic example of this is the 1985 incident involving a China Airlines 747 that went out of control over the Pacific Ocean and fell 30,000 feet in less than two minutes, upside down much of the time.

The crew had spent much of the all-night flight gazing at their instruments and watching the autopilot navigate the plane. The captain fell into what aviation psychologists call "the system monitor mode." He had become a passive observer rather than active pilot and was unable to shift modes when an emergency arose.

The problem is that "none of the designs work well with human beings," said Richard B. Stone, a 767 pilot for Delta and safety expert with the Air Line Pilots Association.

The systems are designed to be monitored by human beings "and everyone knows human beings make poor monitors," Mr. Stone said. "Instead of the small errors a pilot might make flying the plane, you end up with gross errors they make by entering data improperly."

Last year, a Delta Lockheed L-1011 drifted 60 miles off course over the Atlantic and nearly collided with another passenger plane, probably because a crew member entered the wrong information in the plane's autopilot.

In addition to the passivity the systems can instill, they can also distract a crew's attention from flying. Having to deal with the computer while performing some of the duties of the extinct third crew member can be taxing during critical phases of flight.

"A 767 makes the busy times more busy," Mr. Stone said. "When you're flying, you have almost nothing to do but watch the airplane fly the magenta line." Magenta is the shade the computer colors the flight course on the monitor.

The difficulties of getting man and machine to mesh have given rise to a new aviation discipline: cockpit resource management. It blends mechanical engineering and psychology with an emphasis on communication and coordination among crew members.

However, this concept has caught on slowly in aviation, a conservative business, run by engineers and business executives with a certain suspicion of psychologists.

Pilots, who are fascinated by new gadgets, like the idea of Lockheed's pilot's associate because it would relieve them of the mundane computer management tasks while leaving the humans free to fly.

Pilots believe they know when to switch off the computers, and reject the notion that their importance is somehow diminished by the automation. They consider themselves the ultimate safety systems.

Scientists agree. "Automation will never replace the human. But it can make him a very good helper," Mr. Geddes said.

"Humans perform some functions very well."

**ART** Notes: Color Photo: Ray Hudson, a Delta captain, looks over the 'glass cockpit' of his Boeing 767

that includes six video screens offering a variety of displays and information. Such computerized equipment has turned many pilots into cockpit monitors/John Spink Photo: Punching in a destination, a pilot of this Boeing 767 (left) can receive such data as flight plans or characteristics of individual airports/John Spink

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