FactSheet

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Langley Research Center
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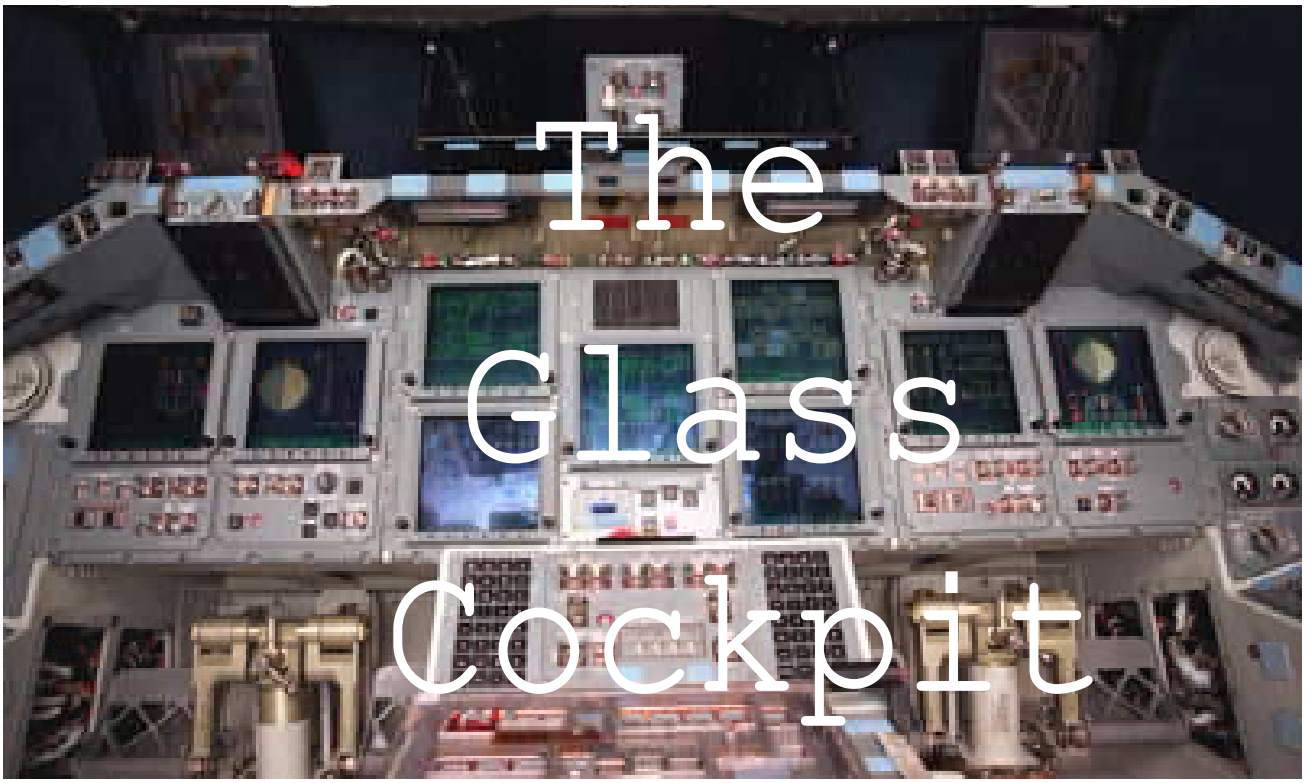

The new full-color, flat panel Multifunction Electronic Display Subsystem (MEDS) is shown in the cockpit of Atlantis. The "glass cockpit" offers easy-to-read graphical views of key flight indicators such as attitude display and mach speed.

Technology first used in military, commercial aircraft

When NASA astronaut Fred Gregory learned that the cockpit in Shuttle Atlantis was slated for a total technology update, he advised Shuttle managers to talk with the agency's aeronautics experts. So it should be no surprise that Atlantis' new cockpit looks a lot like a future airliner cockpit, with colorful multi-function computer displays stretched from one side to the other. The radical new look is an accurate reflection of the cockpit's radical new capabilities.

Gregory, originally from NASA Langley and now NASA Associate Administrator for Safety and Mission Assurance, knew that Langley had pioneered the "glass cockpit" concept in ground simulators and demonstration flights in the NASA 737 flying laboratory. Based on that work and a favorable response from industry customers, Boeing had developed the first glass cockpits for production airliners. It was an aviation success story.

And, now, what is good for modern airliners will also be good for modern spaceships. The technology will make Shuttle Atlantis much easier and safer to fly, according to Shuttle officials. Scores of outdated electromechanical cockpit instruments and gauges have given way to 11 full-color flat panel screens.

Not only does the new system improve crew/orbiter interaction with easy-to-read, graphic portrayals of key flight indicators like attitude, altitude and speed, but it also reduces the high cost of maintaining obsolete systems. The system also provides greater backup capability, weighs less and uses less power than the original design.

For these reasons, the people who fly and maintain the Shuttle fleet eagerly awaited the first flight of Atlantis since it was equipped with the new Multifunc-

tion Electronic Display System (MEDS). That first flight — to deliver supplies to the International Space Station — took place in May 2000.

Honeywell Space Systems, Phoenix, was instrumental in designing and producing MEDS.

Astronauts will use the displays to navigate and land Atlantis. The displays operate with the convenience and control of the most advanced commercial and military flat-panel display technology available today. In addition, the liquid crystal displays provide unique performance capabilities that enhance mission safety. Astronauts can easily read important flight data because light sources, including the sun, produce no glare on the screen and the display allows for clear viewing from positions at a wide range of angles from the screen.

The $9 million MEDS, including design and development costs, is perhaps the most visible of several system-wide improvements made to Atlantis during a 10-month major overhaul. Other upgrades were in areas of Shuttle main engines, the new Super Lightweight Tank, Integrated Vehicle Health Management System, and the Checkout and Launch Control System.

Honeywell is under contract to Boeing North American to provide the new displays for all four Shuttle orbiters.

What is a "Glass Cockpit?"

Why all future aircraft will have one

Modern "glass cockpits" like those in the Boeing 777, the F-117 stealth fighter and Shuttle Atlantis represent a revolution in the way cockpits for aircraft and spacecraft are designed and built today. The first hints of this revolution appeared in the 1970s when flight-worthy cathode ray tube (CRT) screens began to replace a few of the electromechanical displays, gauges and instruments that had served so well for so long. These new "glass" instruments, as few and as primitive as they were, gave the cockpit a distinctly different look and suggested the name, "glass cockpit."

The revolution in cockpit design was born of both opportunity and necessity. Those working to advance commercial airline passenger service felt it first.

Writing in "Airborne Trailblazer: Two Decades with NASA Langley's 737 Flying Laboratory," Lane Wallace said:

"Prior to the 1970s, air transport operations were not considered sufficiently demanding to require advanced equipment like electronic flight displays. The increasing complexity of transport aircraft, the advent of digital systems and the growing air traffic congestion around airports began to change that, however."

She added that the average transport aircraft in the mid-1970s had more than 100 cockpit instruments and controls, and the primary flight instruments were already crowded with indicators, crossbars, and symbols. In other words, the growing number of cockpit elements were competing for cockpit space and pilot attention.

What was needed, she explained, were displays that could process the raw aircraft system and flight data into an integrated, easily understood picture of the aircraft situation, position and progress, not only in horizontal and vertical dimensions, but with regard to time and speed, as well.

In response, engineers at NASA Langley Research Center worked with key industry partners to develop and test electronic flight display concepts, culminating in an all-important series of flights to demonstrate a full glass cockpit system. Boeing loaned some of its most promising engineers to the project. Rockwell Collins turned the team's concepts into hardware.

The challenges were many and varied. In designing the experimental system, the research team looked at what information pilots needed to have and how it should be presented to them. One unexpected challenge: Finding the right balance between what the computerized system should manage and what the pilot should manage. The result: A glass cockpit system with an autopilot that increased safety by reducing pilot workload at peak times, yet kept the pilot "in the loop" at all times to maintain situational awareness.

Realistic terminal area flights with the NASA Boeing 737 flying laboratory generated a great deal of interest from airline pilots and other key elements of the aviation industry, and helped state the case for Federal Aviation Administration certification.

The success of the NASA-led glass cockpit work is reflected in the total acceptance of electronic flight displays beginning with the introduction of the Boeing 767 in 1982. Airlines and their passengers, alike, have benefitted. Safety and efficiency of flight have been increased with improved pilot understanding of the airplane's situation relative to its environment. The cost of air travel is less than it would be with the old technology and more flights arrive on time.

The Department of Defense has adopted glass cockpit technology to increase performance of its newest aircraft, from fighter-interceptors to long-range bombers.

(For more information, call the NASA Langley Office of Public Affairs at (757) 864-6124.)