SCIENCE NEWS of the week

Stray Jets: The Human Factor

Electronic navigation systems have become so reliable that when airliners stray off course, most of the time the problem involves human error and not equipment failure, according to testimony presented this week at a Congressional hearing.

The hearing was prompted by the shooting down on Sept. 1 of a Korean Air Lines Boeing 747 aircraft that had inexplicably strayed into Soviet airspace about 310 miles away from its intended route. Rep. Dan Glickman (D-Kans.), chairman of the House transportation, aviation and materials subcommittee, called the hearing to examine the nature and frequency of navigation errors. The fate of the Korean airliner, traveling from Anchorage, Alaska, to Seoul, South Korea, "illustrates graphically the absolute dependence the modern airplanes have on highly sophisticated navigation systems," he said.

William D. Reynard, who heads a voluntary, confidential aviation safety reporting system for the National Aeronautics and Space Administration, testified that during the last five years pilots have reported almost 1,000 incidents of "navigational abnormalities." Two-thirds clearly involved human error and many of the rest involved equipment problems linked to human error. At least 21 navigation errors occurred with equipment similar to the inertial navigation system on board the Korean airliner. Errors in programming the system's computers were almost always the cause, said Reynard.

Aircraft, particularly those flying long distances over water, are usually equipped with two or three independent inertial navigation systems. Before takeoff, the flight crew feeds into the systems' computers the starting point's longitude and latitude and the coordinates of nine positions along the route. The computers keep track of the plane's position by interpreting what each navigational system senses of the plane's motion. The computers then tell the automatic pilot how to steer the plane to its next "way point."

Henry A. Duffy of the Air Line Pilots Association, said that although pilots are confident in available systems, a better means of independently verifying a plane's position is needed. He said, "One good cross-check on human factors is to have somebody on the ground looking at you."

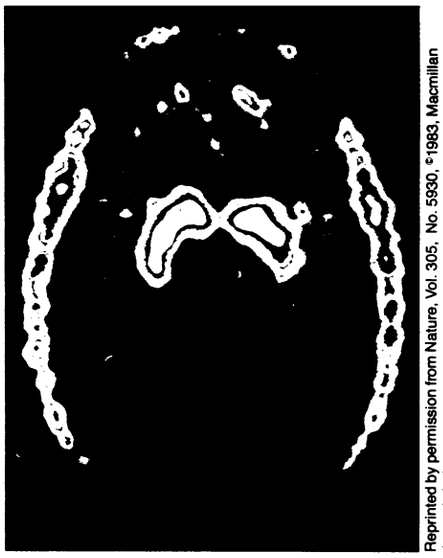
In addition to improved ground radar tracking, Duffy suggested that a satellite-based "global positioning system," now being developed by the Department of Defense, may be the answer. This system, which will have 18 satellites in operation by 1988, will then be able to pinpoint an aircraft's position anywhere in the world in three dimensions to within tens of meters. However, a dispute over how much civilian aviation should pay for the service is slowing development.

William Frisbie, a Pan American World Airways pilot who has often flown north Pacific routes, described procedures pilots are required to use to avoid errors such as transposing numbers when plugging in positions. He noted that by using its on-board weather radar system, the Korean airliner should have been able to delineate landmasses and "to know easily where it should not have been."

Referring to the Korean pilot, Duffy added, "Every time we come up with a theory, we find maybe two cross-checks that should have told him he was wrong."

Why the Korean airliner was so far off course remains a mystery. Whether the intrusion was caused by a string of instrument failures, however implausible, or because of pilot carelessness or a deliberate violation of Soviet airspace may never be known. However, the attention being paid to human factors involved in navigation errors is highlighting potential problems in highly automated cockpits.

"The problem is that the system works too well," Reynard said. "You have to become somewhat creative to overcome the complacency problem because everything seems to work so well."—*I. Peterson*



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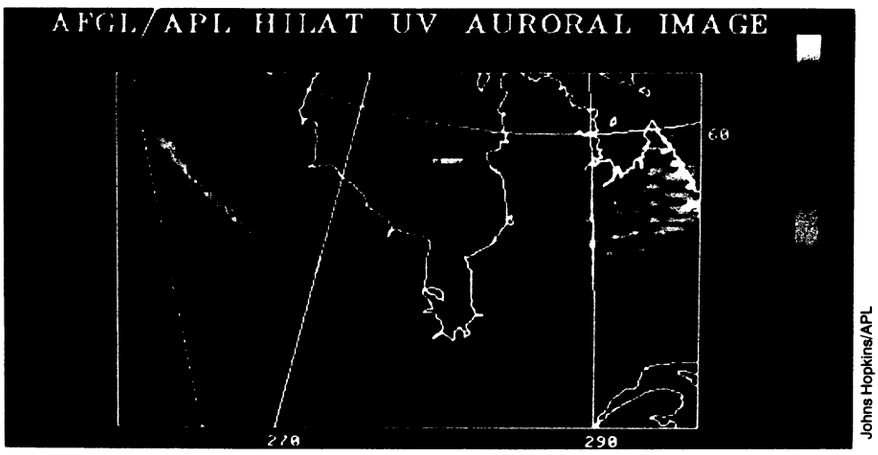
PET scans brain pathways

Three hours after injecting a radioactively labeled dopamine precursor into a live human, E. Stephen Garnett and colleagues at McMaster University in Hamilton, Ontario, took this positron emission tomography (PET) scan of the subject's brain, forehead up. As reported in the Sept. 8 NATURE, *the tracer (which appears light) accumulated mainly in the basal ganglia, the major dopamine pathway. While researchers at Johns Hopkins University in Baltimore recently used PET to visualize dopamine receptors (SN: 6/25/83, p. 406), the McMaster group is the first to view the neurotransmitter itself. Using these complementary imaging techniques, scientists should be able to study chemicals at work in the human brain.*

The Northern Lights—in the daytime



Johns Hopkins/APL

The Aurora Borealis or Northern Lights, stretched across the sky over Hudson's Bay (superimposed map), is shown in this image from an instrument aboard the Defense Nuclear Agency's HILAT satellite, said to be the first ever to picture the aurora in full daylight. The far-ultraviolet image records the 1,356-angstrom emissions produced where charged particles from the sun collide with oxygen atoms about 100 kilometers up in earth's atmosphere. Unlike visible wavelengths, the far-UV wavelengths are readily absorbed by the atmosphere, so they do not reflect from the earth's surface or atmosphere to wash out the aurora, but the absorption also means that the emissions cannot be observed from the ground. HILAT was launched by the Air Force Space Division June 27, and the imaging device activated July 5, though the instrument stopped functioning on July 23, after taking about 45 images. Scientists in charge of the device are R. E. Huffman of the Air Force Geophysics Laboratory, Hanscomb A.F.B., Mass., and Ching Meng of Johns Hopkins Applied Physics Laboratory in Laurel, Md.

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