Airline
Crew
Training

"Until the late 1970s, airline crew training was focused on stick-and-rudder skills, the physical skills needed to fly an airplane," says United Airlines training coordinator Cliff Lawson. "Training in crew coordination or teamwork skills was almost unheard of. By the late seventies, however, the airline industry and United in particular began to realize that the vast majority of accidents and incidents were taking place in airplanes that were flyable. In many cases, there was absolutely nothing wrong with the airplane."

What was wrong was human error, surveys showed; statistics indicated that mistakes were causing far more accidents/incidents than mechanical malfunctions. Among the most common human errors, researchers found, was failure on the part of crew members to communicate properly and failure to use resources readily available to them. These and many other breakdowns of cockpit management and teamwork sparked a major change in airline flight and simulator training wherein the focus shifted to programs intended to improve teamwork and coordination in the cockpit.

Ames Research Center, a pioneer and world leader in human factors research aimed at greater understanding of aircrew capabilities and limitations, played a principal role in developing two interdependent training programs that concentrate on more effective aircrew operations.

The first is Cockpit Resource Management, or CRM, which by one definition is "the effective utilization of all available resources — hardware, software and liveware — to achieve safe, efficient flight operations." Hardware includes the aircraft's on-board systems; software embraces operating manuals, bulletins, charts and other information; liveware is people, including air traffic controllers and other "resources" not on board. CRM defines a number of areas for focus in lectures and simulation
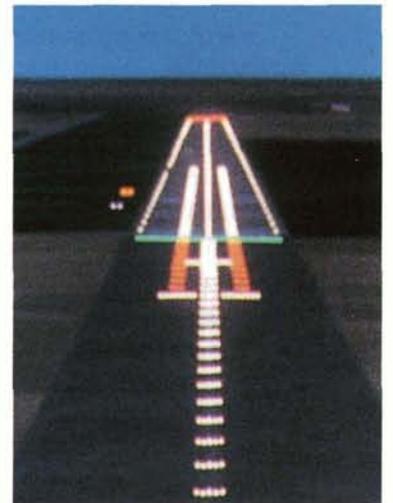
training, such as decision making, establishment of priorities for cockpit attention, cockpit workload distribution, making most effective use of available information, avoiding distractions, developing intracockpit communication skills and, for the pilot in command, establishing firm leadership that nonetheless encourages participation and critique by subordinates.

Ames' Aerospace Human Factors Research Division began CRM development in the latter 1970s and — in 1979 — sponsored the first CRM workshop, which brought together airline and government aviation interests to address the problems of human error.

A major result of that workshop was United Airlines' initiation, with NASA help, of a multi-faceted CRM training program. Many other carriers adopted the United program and still others developed their own approaches, again with NASA assistance. A typical comment, from Captain Reuben Black, chairman of Delta Airlines' CRM Steering Committee: "NASA has been a tremendous help to us...The staff of Ames Research Center have been very influential in the development of our CRM program." In top left photo is a Delta CRM session.

Ames also played a leadership role in the development and airline adoption of a CRM-related program known as LOFT, for Line Oriented Flight Training, in which crews fly complete missions in high fidelity simulators that simulate "real world" conditions as closely as possible. In photo far left is United Airlines' LOFT simulator; at left is a view from the simulator cockpit of a realistic final approach.

In LOFT training, instructors induce emergency situations whose successful handling demands coordinated actions of all crew members. The entire simulated flight, conducted in real time, is video-taped for later review; at right, a United captain and first officer (seated) go over their tape with their simulator check

pilot. "This self critique is one of the most valuable facets of CRM training," says United Airlines' Lawson. "It allows an individual pilot to see himself as others see him and consequently to observe how his individual operating style affects other crew members."

"LOFT is a learning experience in which errors are usually made," according to two of the leading CRM researchers, Dr. H. Clayton Foushee, formerly of NASA-Ames, and NASA consultant Dr. Robert L. Helmreich of The University of Texas at Austin, in their chapter of the book Human Factors in Aviation.[©] "However, since effective group function in this environment is by definition the management of human error, LOFT provides highly effective crew coordination training."

NASA continues to conduct or support research to improve CRM/LOFT training. In 1986, Ames — jointly with the USAF Military Airlift Command — sponsored a second CRM workshop. Under a NASA grant, The University of Texas at Austin, with participation by several airlines and some military units, is collecting data on CRM/LOFT; the intent is to help users measure the before-and-after effects of resource management training as an aid to enhancing their CRM programs.