AUTOMATION

A study is seeking answers to continuing and evolving questions about the optimal human/machine interface.

BY MARK LACAGNINA

Acknowledging that improvements have been made during the past 10 years in the design of flight deck automation systems and in training pilots to use them, the U.S. Federal Aviation Administration (FAA) Performance-based Operations Aviation Rulemaking Committee and the Commercial Aviation Safety Team (CAST) have launched a study to identify how far we have come and where we need to go, not only to solve persistent problems but also to ensure that modern aircraft are flown safely and efficiently as new operating and navigational procedures are introduced.

The study specifically will update a 1996 report by the FAA Human Factors Team. The report, "The Interfaces Between Flightcrews and Modern Flight Deck Systems," was reprinted by Flight Safety Foundation in the September–October 1996 issue of *Flight Safety Digest*.

We have made significant improvements since the 1996 study," Nicholas Sabatini, FAA associate administrator for aviation safety, told *Aviation Safety World*. "But we need to get even

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better as we expand new operations like RNAV [area navigation] and RNP [required navigation performance]. Human factors will be critical for the success of these and other future operations."

Co-chairs of the working group performing the study are Kathy Abbott, Ph.D., of FAA — who was a co-author of the 1996 report — David McKenney of the Air Line Pilots Association and Paul Railsback of the Air Transport Association.

Abbott told *ASW* that among improvements made since the 1996 study are new regulations governing the design of flight guidance systems in transport category airplanes. Replacing design standards adopted in 1964 for autopilots, U.S. Federal Aviation Regulations Part 25.1329, effective April 2006, states, in part, that flight guidance systems cannot cause an unsafe reduction in airspeed or create a potential hazard when pilots attempt to override them. The new regulation also states, "The flight guidance system functions, controls, indications and alerts must be designed to minimize flight crew errors and confusion concerning the behavior and operation of the flight guidance system."

Error and Confusion

Flight crew error and confusion were involved in a fatal accident that prompted the 1996 study: the April 26, 1994, China Airlines Airbus A300 accident at Nagoya, Japan. The first officer was hand-flying an ILS approach with the autothrottles engaged. The approach was stabilized until the airplane reached about 1,070 ft and the first officer inadvertently selected the TOGA (takeoff/go-around) mode, resulting in an increase in thrust. The first officer disengaged the autothrottles and manually reduced thrust. The airplane rose slightly above the glideslope, and one of the pilots, apparently seeking to regain the glideslope, engaged the autopilot — with the TOGA mode still selected. The crew apparently did not realize that the autopilot was trimming the horizontal stabilizer nose-up. The first officer applied forward pressure to the control column to counter the nose-up pitch commanded by the autopilot, but the autopilot, opposing the first officer's control input, trimmed the horizontal stabilizer to its full nose-up position. The captain took control and, deciding that landing the airplane would be difficult, initiated a go-around. The airplane began to climb with a high nose-up pitch attitude that reached 52 degrees. Although the throttles were advanced, airspeed decreased to 78 kt; the airplane stalled and descended to the ground, killing 264 occupants and seriously injuring seven others.

Among the findings of the 1996 study were that pilots often misunderstood the capabilities, limitations and operation of automation equipment, and when — and when not — to use the various levels of automation. The Human Factors Team found that pilots frequently were surprised by the behavior of their equipment and asked questions such as "Why did it do that?" and "What is it doing now?" The team also found that pilots frequently were unaware of the mode in which their equipment was operating, their projected flight path and the aircraft's energy state.

In the terms of reference for the new study, FAA and CAST said that "incident reports suggest that flight crews continue to have problems interfacing with the automation and have difficulty using these systems." The working group will review actions that have been made to address the more than 50 recommendations generated by the 1996 study.

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Training Aid?

Abbott said that improvements have been made in pilot-training programs but that current training programs vary. "Training is not consistent," she said. Thus, among the tasks that the working group may pursue is the development of an automation training aid. The decision to pursue this task has not yet been made. The study currently is envisioned as requiring about 30 months to complete; at press time, the working group was conducting its third meeting.

"It's too early to discuss the training aid," Abbott said. "But if we do something, we would use the result of our analyses to see what areas of training are not getting sufficient emphasis now." ●