BY LINDA WERFELMAN

Pilots need specific guidelines for deciding how much to rely on automation, an EASA official says.

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Smoothing automation's path

Modern aircraft are increasingly reliant on automation, but flight crews need more guidance to determine exactly how much automation they should use for various tasks, Michel Masson, safety action coordinator for the European Aviation Safety Agency (EASA), says.

Masson told Flight Safety Foundation's 24th European Aviation Safety Seminar — held Feb. 29–March 1 in Dublin, Ireland (see "Simple Clues," p. 45) — that EASA's automation policy is being developed as part of the European Aviation Safety Plan, a coordinated multi-year plan addressing major aviation safety concerns throughout Europe. The automation policy is based on "mapping crew-automation interaction issues, design-and-certification and training principles, and respective regulatory provisions to identify top issues and paths for improvement," said Masson, who, along with Charles Denis of EASA, authored the policy on behalf of the EASA Internal Group of Personnel Training (IGPT).

Development of the policy has been considered crucial because of pilots' reactions to the increasing role of automation, Masson said, noting that "senior pilots … may be less comfortable with automation, while the new generation of pilots may lack basic flying skills when the automation disconnects or fails or when there is a need to revert to a lower automation level, including hand flying the aircraft. …

"It is worth noticing that [EASA] is not against automation, [which is] inevitable, especially with the evolutions foreseen in SESAR and NextGen [EASA's Single European Sky Air Traffic Management Research and the U.S. Federal Aviation Administration's Next Generation Air Transportation System], but [wants to ensure] that proper mitigation measures, including regarding design and training, are encouraged to maximize benefits and minimize drawbacks."

The first step in EASA's development of an automation policy was the identification of more than 100 flight crew–automation interaction issues, which subsequently were grouped into 17 categories, including "managing the automation versus flying the aircraft," crew coordination, lack of standardization, and "complacency, over-reliance on automation [and] decision making."

The IGPT panel evaluated each of the 100 issues to determine how it might be further mitigated by design and training.

Masson noted that aircraft manufacturers' guidelines on the use of automation discuss competences that pilots must possess to make the best use of automation.

For example, a manufacturer's statement that a pilot should "select the appropriate automation level for the task and situation at hand" can be rephrased as a training objective — "pilots must be able to select the appropriate level of automation." The corresponding design objective, Masson said, is "allow/advise on selection of automation level(s) appropriate for the task and situation at hand."

In this instance, the system should provide adequate information about the selected automation level, and the flight crew should "check/monitor" the selected level, he said.

He added, "Performance of a man-machine system basically depends on design, procedures and competences, which result from education, training and experience. … Good — simple, intuitive, user-friendly — design requires fewer competences and/or procedural guidance (instructions) to be operated, and conversely … poor design requires more guidance and/or competences from the user. …

"Pointing the finger at only one element of the system in case of performance breakdown (e.g., 'pilots don't know how to fly the aircraft when the automation disconnects') is reductive and … overall system performance can be enhanced by improving any of these three basic components, individually or in combination."

Priorities

The IGPT panel then conducted risk assessments and determined the priority of each issue. The highest priority was assigned to 12 issues, including that "basic manual and cognitive flying skills tend to decline because of lack of practice and deterioration of feel for the aircraft" and "difficulties in understanding the situation and gaining/regaining control when automation reaches the limit of its operation domain and disconnects, or in case of automation failure."

Other top-priority issues included "when automation fails or disconnects, the tasks allocated to the pilots may fall beyond their capabilities," "for highly automated aircraft, problems may occur when transitioning to degraded modes (e.g., multiple failures requiring manual flight)" and "flight crew is not

sufficiently informed of automation failures or malfunctions."

Also on the list were the following:

- "Pilots interacting with automation can be distracted from flying the aircraft. Selection of modes … may be given more importance than value of pitch, power, roll and yaw and so distract the flight crew … from flying the aircraft.
- "Unanticipated situations requiring pilots to manually override automation are difficult to understand and manage, create a surprise effect and induce a workload peak.
- "Diagnostic systems are limited with regard to dealing with multiple failures, with the unexpected and with situations requiring deviations from [standard operating procedures].
- "Flight crews may spend too much time trying to understand the origin/conditions/causes of an alarm, which may distract them from other priority tasks.
- "Although the situation is safety critical and the action that the flight crew must take is known, the alarm only indicates the condition met (e.g., stall) but not the action to take (e.g., push stick).
- "Data entry errors, either mistakes or typing errors committed when using electronic flight bags (EFBs), may have critical consequences. Errors may be more difficult to prevent and to detect — no system check of the consistency of the computed or entered values — as EFBs are out of the scope of type certification and there is no guarantee that they are designed in accordance with human factors standards."

'Well Defended'

Masson said that the issue-analysis process led the IGTP panel to conclude that the aviation system in Europe is "well defended against flight crew automation issues," as long as regulations and best practices are implemented. Planned regulatory changes in design certification specifications, flight crew licensing and operations will provide additional protection, he said.

Nevertheless, he added, the aviation industry should devote special attention to the top-priority issues and to IGTP proposals for improvement.

Those proposals call for revising requirements involving basic airmanship and manual flying skills, multi-crew pilot license/computer-based training (MPL/CBT) requirements, the multi-crew cooperation concept and instruction requirements concerning management of automation, and recurrent training and testing requirements regarding automation management.

Other proposals call for improving operator automation policies, encouraging manufacturers and operators to develop and publish specific automation policies for individual aircraft types rather than general guidelines for all, and reviewing regulations concerning automation management and assumptions involving a flight crew's ability to take appropriate action.

Masson cited the automated cockpit guidelines discussed in the *Operators Guide to Human Factors in Aviation (OGHFA)*, developed by the Flight Safety Foundation European Advisory Committee, which characterizes a pilot's understanding of automation as "an essential personal quality that can influence safety."

OGHFA emphasizes the "integrated and coordinated use" of the autopilot/flight director, autothrottle/autothrust and flight management system.

"Higher levels of automation provide flight crews with an increasing number of options and strategies to choose for the task to be accomplished — for example, complying with air traffic control (ATC) requirements," the *OGHFA* guidelines say.

Masson also cited EASA Safety Information Bulletin (SIB) 2010-33, *Flight Deck Automation Policy — Mode Awareness and Energy State Management*, which was "prepared in a context in which air operators are requested to provide an operations manual which should contain flight procedures, one of them being related to the policy on the use of autopilot and auto-throttle in accordance with [European Commission regulations]."

The SIB recommends that operators and manufacturers work together to prepare an automation policy that addresses "philosophy, levels of automation, situational awareness, communication and coordination, verification, system and crew monitoring, and workload and system use."

The document also says that "a core philosophy of 'fly the airplane' should permeate the automation policy prepared by air operators," and that the policy should be reviewed regularly, featured in training and reinforced in all operating procedures and training programs.

Masson said the panel also recommended that authorities consider introducing requirements regarding the customization of flight deck software for electronic checklists, flight warning systems and other related items.

He said that EASA officials were planning an online survey, and possibly a workshop, to gather further suggestions for improving the agency's current policy on automation.