



**WORKING PAPER**

**ASSEMBLY — 40TH SESSION**

**TECHNICAL COMMISSION**

**Agenda Item 30: Other issues to be considered by the Technical Commission**

**PILOT TRAINING IMPROVEMENTS TO ADDRESS AUTOMATION DEPENDENCY**

(Presented by the United States, Canada, Peru, and Trinidad and Tobago)

**EXECUTIVE SUMMARY**

Concerns over flight deck human factors have created additional pressure to increase reliance on automation in commercial aviation. Although increased use of automation has enhanced safety, this trend is also likely contributing to a lack of practice and therefore potentially a degradation of pilot skills in flight path management using manual flight control. These skills are essential for pilot confidence and competence, and they are necessary to take control of the aircraft when automated systems do not function as intended. This issue may be further complicated by the variation in pilot training, skills, and experience entering air carrier service worldwide. This paper outlines recommendations for the Assembly to mitigate the consequences of automation dependency, and how it may be addressed at the global, regional, and national levels.

**Action:** The Assembly is invited to:

- a) direct ICAO to accomplish the following:
  - 1) identify the scope of automation dependency globally and the methods to ensure air carrier pilots maintain their ability to manage the flight path manually, by examining pilot training systems and operational policies of a representative sample of Member States;
  - 2) identify competency requirements for flight path management using manual flight control and assess the need for new or amended Standards and/or guidance material;
  - 3) assess existing commercial air operator training programs and pilot operational preparedness at the commercial air transport level to determine if licensing requirements adequately prepare a pilot to serve as a co-pilot, and, if requirements are determined to be inadequate, develop recommendations for licensing or commercial air operator training programs, as appropriate;
  - 4) develop recommendations to maintain pilot skills in flight path management using manual flight control;
  - 5) establish a Personnel Training and Licensing Panel, as recommended by the ICAO Personnel Training and Licensing Exploratory Meeting in July 2019, and have this body address the aforementioned items; and
  - 6) conduct outreach to Member States to promote the results of items i) through v) above;
- b) recommend that States identify and take steps to mitigate automation dependency;
- c) recommend that States work bilaterally and multilaterally to assist in implementation of recommended practices in flight path management using manual flight control; and
- d) recommend that States of Design work with manufacturers of transport category aircraft to promote

	training programs and operational policies that focus on greater understanding of aircraft automation capabilities and awareness of competencies, including flight path management using manual flight control, needed for intervention when necessary, including when automation does not function as intended.
<i>Strategic Objectives:</i>	This working paper relates to the Safety Strategic Objective.
<i>Financial implications:</i>	The activities referred to in this paper should be undertaken subject to the resources available in the 2020-2022 Regular Programme Budget and/or from extra budgetary contributions. Other financial implications will vary across Member States.
<i>References:</i>	<p>FAA Safety Alert for Operators (SAFO) 13002, Manual Flight Operations          FAA SAFO 17007, Manual Flight Operations Proficiency          FAA 14 CFR Part 121, Subparts N and O regarding Pilot Training and Qualification          FAA Advisory Circular (AC) 120-109A, Stall Prevention and Recovery Training          FAA AC 120-111, Upset Prevention and Recovery Training          FAA AC 120-114, Pilot Training and Checking          Operational Use of Flight Path Management Systems: Final Report of the Performance-based Aviation Rulemaking Committee/Commercial Aviation Safety Team Flight Deck Automation Working Group, September 5, 2013</p>

## 1. INTRODUCTION

1.1 The United States recognizes safety enhancements gained through the use of automation in the flight deck. Although there are numerous safety benefits provided by automation, and use of automation often helps to prevent errors, an over-reliance on automation can introduce new hazards and risks. When automation systems do not work as intended or do not work well in the operational situation, pilots without sufficient manual flight control experience and proper training may be reluctant or may not be adequately skilled to take control of the aircraft. It is important to seek a balance in training of automation and maintaining manual flight control skills.

1.2 It is acknowledged that pilot competency in this context is a multi-dimensional topic encompassing knowledge of the aircraft automation systems and aspects such as situational awareness to recognize abnormal aircraft performance, and there are likewise a variety of safety enhancements, such as effective crew resource management, that may play a role in preventing loss of control in-flight (LOC-I) occurrences. It is also important to develop pilot resilience when reacting to startle effects and consider human reaction, physiologic, and psychologic aspects as key elements when taking over control manually. This paper highlights a continuing critical need for pilots to maintain and be confident in their manual flight skills when the operational circumstances justify it, e.g. automation confusion, error, failure, or not operating as intended.

1.3 ICAO Standards and guidance material regarding pilot training serve a critical purpose in promoting system-wide interoperability and global confidence. As the use of automation increases in aircraft design, it is important to consider how ICAO Standards and guidance should evolve to ensure that pilot training programs align with technological advancements. Further study of the issues surrounding automation in the flight deck could enhance the safety of flight operations worldwide. This further study should include assessing the degree to which over-reliance on automation may be occurring globally and reviewing the methodologies currently employed by States and industry to ensure pilots maintain necessary skills.

1.4 In addition, as States are responsible for approving pilot training programs for national air operators, it is critical that each State has the ability to identify whether an over-reliance on automation is a risk factor within its system, and determine how to mitigate this risk in a robust pilot training program and through other safety oversight means.

## 2. DISCUSSION

### *Current Efforts to Address Automation Dependency in the Cockpit*

2.1 In the case of the United States, the Federal Aviation Administration's (FAA) approach to ensuring that U.S. air carrier pilots, regardless of previous experience, are proficient in both manual flight and the use of automation, includes regulations with training requirements for manual flight operations.

2.2 The United States and Canada have researched manual flight operations and related topics because early human factors studies pointed to the potential for skill degradation when manual flying skills were not practiced regularly. Between 1996 and 2013, the FAA Human Factors Team and the Performance-based Aviation Rulemaking Committee/Commercial Aviation Safety Team Flight Deck Automation Working Group (FltDAWG) noted that flight crews may have vulnerabilities related to flight path management, one of which was their manual handling skills. A recent update to the 2013 FltDAWG report found that from 2009-2016, 92% of the flight path management related accidents worldwide had a manual flight operations error that was contributory or causal in the accident. Additionally, it was found that manual flight operations errors co-occur as a result of inadequate training.

2.3 The FAA requires all air carrier pilots to satisfactorily complete initial and recurrent training, which includes an additional six manual flying manoeuvres that must be performed in a specifically qualified full flight simulator. These manoeuvres include manually flown arrivals and departures, manually flown slow flight, recovery from a bounced landing, upset prevention and recovery, and recovery from full stall. Further, the pilots must also satisfactorily perform loss of reliable airspeed, which reinforces the need for pilots to ignore erroneous indications and manually fly the aircraft with sole reference to pitch and power displays.

2.4 The FAA has also published several advisory circulars (AC) related to this topic, including: AC 120-109A, Stall Prevention and Recovery Training; AC 120-111, Upset Prevention and Recovery Training; and AC 120-114, Pilot Training and Checking (14 CFR Part 121, Subparts N and O, including Appendices E and F).

### *Future Considerations for the International Community on Addressing Automation Dependency in the Cockpit*

2.5 In 2012, ICAO brought many of the groups involved with efforts to reduce the number of LOC-I events into discussions under what became known as the loss of control avoidance and recovery training (LOCART) initiative. Improvements have since been introduced to existing Standards and Recommended Practices and guidance material.<sup>1</sup> However, while many civil aviation authorities are adapting the provisions for upset prevention and recovery training outlined by ICAO, many of the

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<sup>1</sup> Both on-airplane training at the commercial pilot and multi-crew pilot level and training in a flight simulation training device at the airline transport pilot and type rating level are now promulgated in Annexes 1 — Personnel Licensing and 6 — Operation of Aircraft, Part I — International Commercial Air Transport — Aeroplanes, as well as in the Procedures for Air Navigation Services – Training (PANS-TRG, Doc 9868,), with an applicability date of 13 November 2014.

beneficial skill building manoeuvres identified by the FAA to be performed in simulation in transport category aircraft were not included in the ICAO Standard(s).

2.6 At a global level, if the potential for automation dependency and degradation of manual flight operations skills is not satisfactorily addressed in existing Standards, there may be a high level of variation in the approach utilized by individual States regarding how associated risks may be addressed in regulation or guidance. This variation adds an additional layer of complexity to addressing automation dependency to include maintaining and enhancing proficient manual flight operations skills worldwide. Further study of these issues, led by ICAO, could leverage experiences and expertise from across Member States and the industry to identify recommended practices with the potential to enhance safety if adopted globally.

2.7 Another consideration to facilitate pilot skill is through addressing the potential gap between satisfying licensing requirements, and additional enhancements that may be necessary to adequately prepare pilots for air transport operations. In July 2019, ICAO convened the Personnel Training and Licensing Exploratory Meeting, which included discussions on this issue. In line with the above, recommendations resulting from this meeting addressing pilot training should be considered as high priorities for the upcoming triennium.

2.8 At the national and regional levels, States may benefit from bilateral or multilateral cooperation, to identify automation dependency hazards and mitigate related operational safety risks. States may be able to leverage the experience of partner States to build upon recommended practices that would serve to enhance the approaches to pilot training and operational use of automation.

2.9 Finally, States that are responsible for certification of transport aircraft that incorporate new and novel uses of automation in aircraft design are uniquely suited to promote training programs and operational policies that highlight automation capabilities and accompanying manual flight operations skillsets. These States of Design should identify means to work with manufacturers to promote the inclusion of pilot training programs by States of the Registry/Operator that are commensurate with the skills and experiences of the pilots that will be operating the aircraft.

### 3. CONCLUSION

3.1 Member States and industry are encouraged to support the proposals outlined in this paper, and to engage in the further study of potential pilot training improvements to address automation dependency.

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