



Advisory Circular

Subject: Flight Deck Automation Policy and Manual Flying in Operations and Training

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1.0 INTRODUCTION

- (1) This Advisory Circular (AC) is provided for information and guidance purposes. It describes an example of an acceptable means, but not the only means, of demonstrating compliance with regulations and standards. This AC on its own does not change, create, amend or permit deviations from regulatory requirements, nor does it establish minimum standards.

1.1 Purpose

- (1) This Advisory Circular (AC) is to remind pilots and operators on the appropriate use of automation and the importance of maintaining manual flying skills.
- (2) This Advisory Circular (AC) was developed for fixed wing aircraft although some portions may be useful for rotorcraft pilots and operators.

1.2 Applicability

- (1) This document is applicable to all Transport Canada Civil Aviation (TCCA) employees, operators, manufacturers, training providers, pilots, flight crews, and to individuals or organizations exercising privileges granted to them under an External Ministerial Delegation of Authority.

1.3 Description of Changes

- (1) Not applicable.

2.0 REFERENCES AND REQUIREMENTS

2.1 Reference Documents

- (1) It is intended that the following reference materials be used in conjunction with this document:
 - (a) Advisory Circular (AC) 700-031, Issue 01, 2013-11-08—Prevention and Recovery From Aeroplane Stalls;
 - (b) Federal Aviation Administration (FAA), SAFO 13002 – Manual Flight Operations, dated 4 Jan 2013;
 - (c) Federal Aviation Administration Advisory Circular (FAA AC) 120-111, 2015-04-14 – Upset Prevention and Recovery Training;
 - (d) European Aviation Safety Agency (EASA) SIB 2010-33 : Flight Deck Automation Policy - Mode Awareness and Energy State Management;
 - (e) European Aviation Safety Agency (EASA) SIB 2013-05 : Manual Flight Training and Operations;
 - (f) Commercial Aviation Safety Team - Safety Enhancement 30, Revision-5, Final Report. “Mode Awareness and Energy State Management Aspects of Flight Deck Automation”, August, 2008.

2.2 Cancelled Documents

- (1) Not applicable.
- (2) By default, it is understood that the publication of a new issue of a document automatically renders any earlier issues of the same document null and void.

2.3 Definitions and Abbreviations

- (1) The following **abbreviations** are used in this document:
 - (a) **AC:** Advisory Circular
 - (b) **CRM:** Crew Resource Management
 - (c) **RVSM:** Reduced Vertical Separation Minima
 - (d) **SOP:** Standard Operating Procedures
 - (a) **TCCA:** Transport Canada Civil Aviation

3.0 BACKGROUND

3.1 General

- (1) In the vast majority of situations automatic flight control (autoflight) systems provide excellent results. When deviations from expected performance do occur, they are often due to the flight crew having an incomplete understanding of the autoflight system's operations and limitations.
- (2) It should also be understood that in some situations, it will be more appropriate to reduce the level of automation or control the aircraft manually. Maintaining a high degree of proficiency in manual and automated flight operations is therefore necessary for safe flight operations.
- (3) Recent studies and publications have concluded that the continuous use of autoflight systems could potentially lead to the degradation of a pilot's manual flying skills.

3.2 Appropriate Use of Automation

- (1) Some air operators have established automation policies which specify the appropriate use of automation; these policies may also include provisions related to manual flying. Automation policies vary among operators. These range from mandating the use of full automation at all times, except take-off and landing, to encouraging the disconnection of automation whenever possible, under certain conditions.
- (2) Varied levels of automation are available. The pilot should decide what level of automation (e.g., autopilot or autothrottle / autothrust) to use that is consistent with the operator's automation policy. The selected level of automation should provide the best increase in safety and reduce workload appropriate to the corresponding phase of flight.

3.3 Manual Flying Skills

- (1) Pilots need to maintain manual flying skills to a high degree of proficiency and must develop confidence in their ability to do so. The maintenance of manual flying skills will ensure that pilots are able to safely and accurately control the aircraft in all phases of flight and will be capable of responding to unforeseen events and circumstances.
- (2) A pilot is expected to reduce the level of automation or revert to manual flight operation when the automation does not produce the expected results. A pilot is also expected to promptly intervene and/or may need to assume manual control of the aircraft in certain situations such as stall, upset, terrain avoidance or windshear events.

4.0 RECOMMENDATIONS

4.1 Automation Policy

- (1) Operators are urged, in cooperation with the aircraft manufacturers of their fleets, to prepare an Automation Policy which should in particular address the seven (7) following topics:
 - (a) Philosophy;
 - (b) Levels of automation;
 - (c) Situational awareness;
 - (d) Communication and coordination;
 - (e) Verification;
 - (f) System and Crew Monitoring;
 - (g) Workload and System Use.
- (2) A core philosophy of “**FLY THE AIRCRAFT**” should permeate the operator’s automation policy.
- (3) If an automation policy already exists, it should be assessed against the above topics to identify any needed changes. Operators should ensure that each topic is regularly reinforced in operating procedures and training programs.
- (4) Operators should regularly train staff on the automation policy and related operating procedures, including aircraft flight manual (AFM) non-normal and emergency procedures. The automation policy and related operating procedures should be reviewed at periodic intervals to ensure accuracy and continuous safety improvement.
- (5) Operators should carefully consider whether their automation policies provide for sufficient manual operation of the aircraft during routine operations to ensure that their pilots maintain a high level of proficiency in manual flying skills.
- (6) Operators are encouraged to incorporate manual flight operations into both line operations and training (initial, line indoctrination, upgrade and recurrent) as a means of maintaining basic flying skills.
- (7) Operational policies should be developed or reviewed to ensure that there are appropriate opportunities for pilots to exercise manual flying skills such as in non-RVSM airspace and during low workload conditions.

4.2 Manual flight Operations

- (1) Operators are encouraged to emphasize manual flight operations as a means of maintaining basic flying skills into initial and recurrent training and when feasible during line operations.
- (2) Operational principles should be developed by operators and should be included in their automation policy. The operator should identify appropriate opportunities for pilots to practice their manual flying skills, taking into account factors such as:
 - (a) Phase of flight;
 - (b) Workload conditions;
 - (c) Altitude/Flight Level (RVSM);
 - (d) Meteorological conditions;
 - (e) Traffic density;

- (f) Air Traffic Control (ATC) and Air Traffic Management (ATM) procedures;
- (g) Pilot and crew experience;
- (h) Operator experience.

Note: *this is not an exhaustive list of potential factors.*

- (3) It is important that pilots clearly understand the circumstances under which automated systems should be used; typical circumstances include high workload conditions, operations in traffic congested airspaces, or when specific airspace procedures (RVSM) or approach procedures (CAT II/III) require the use of the autopilot for precise operations.
- (4) The conditions and procedures for manual flying should be clearly described in the operator's operations and training manuals. Operators should continuously review data derived from Flight Data Monitoring (FDM), Advanced Qualification Programs (AQP), and Safety Management Systems (SMS), and other sources, as applicable, to effectively monitor the benefits and the drawbacks of manual flying and adjust policies accordingly.
- (5) Augmented crew operations may also limit the ability of some pilots to obtain practice in manual flight operations. Airline operational policies should ensure that all pilots have the appropriate opportunities to exercise the aforementioned knowledge and skills in flight operations.

4.3 Training Emphasis

- (1) An operator's theoretical, practical and line indoctrination training content, should address the considerations used to determine the appropriate level of automation or manual flight.
- (2) During initial type training, pilots should have ample opportunity to fly the aircraft manually (without automation), in all phases of flight. This will allow pilots to develop the necessary skills and confidence. Manual flying during recurrent training is equally important; especially if minimal opportunities are provided during line operations.
- (3) The following are training elements that should receive emphasis with respect to the use of automation:
 - (a) Pilots should thoroughly understand the function and limitations of vertical and lateral automation modes. They should understand which modes are appropriate (and inappropriate) for various conditions, and how these modes are selected.
 - (b) In circumstances where the flight director commands are not to be followed, such as while conducting a visual approach, appropriate flight director selections should be made to avoid conflicting guidance. (Remove flight director guidance or select modes that synchronize with the desired flight path.)
 - (c) The necessity of the flight crew to monitor the sometimes-subtle mode changes that can occur with regard to flight path management and the auto-throttle system. (The interaction of flight director, autopilot and auto-throttle may not be intuitive under some situations.)
 - (d) Pilots must be aware of the low speed/high angle of attack protections and high speed protections that are provided by the automation; they must also understand the modes in which these protections function, as well as their limitations. Automation mode reversions in some phases of flight do not provide speed protection. (For example, on some aircraft types, selecting a high vertical speed during descent may result in overspeeding the flaps.)
 - (e) Special challenges in aircraft handling and flight deck coordination are encountered when capturing a glideslope (or glidepath) from above. Approaches can rapidly become destabilized and flight crews must understand how they can achieve and maintain the

desired flight profile (in terms of airspeed and energy management). Thrust levels, especially if controlled by auto-throttles must be carefully monitored.

- (f) A go-around with all engines operating can present a significant challenge. This is because of the high performance capability of modern two-engine aeroplanes and the automation mode changes associated with a go-around. Loss-of-Control accidents and incidents have occurred because of inappropriately conducted missed approaches.
- (g) During all operations, especially while managing the aircraft's automation, it is essential that pilots adhere to standard operating procedures (SOPs) and practice effective crew resource management (CRM). SOPs and CRM help to optimize the flight crew's awareness of automation modes as well as the aircraft's flight path and energy state.

Notes:

1. *The above list is not exhaustive; operators should consider additional areas of emphasis as applicable to their particular operation.*
2. *The manufacturer's procedures take precedence over the recommendations of this AC.*

5.0 INFORMATION MANAGEMENT

- (1) Not applicable.

6.0 DOCUMENT HISTORY

- (1) Not applicable.

7.0 CONTACT OFFICE

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