RSA-10

RASG-PA SAFETY ADVISORY – 10

September 2023

Regional Aviation Safety Group-Pan America (RASG-PA)

Manual Flight Operations

1. Purpose

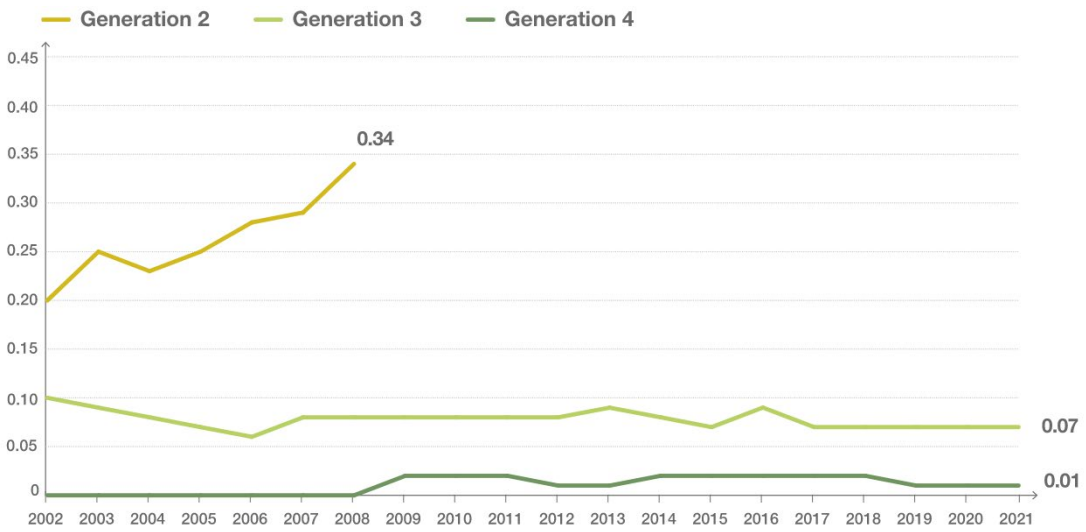
1.1 This RASG-PA Safety Advisory (RSA) provides States, air operators and flight crews with guidance and recommended practices to foster Manual Flight Operations (MFO) with the proper operational policies, procedures, and criteria, in addition to addressing the subject in theoretical training and simulator sessions, similarly to what was recently done in Brazil through its Commercial Aviation Safety Team (BCAST).

1.2 Manual Flight Operations are those operations where the pilot is performing flight path management while physically controlling pitch, roll, yaw, and/or thrust. Manual flight is the foundation upon which other technical flying skills are built. It applies to a broad range of situations, including situations where some automated systems are engaged or operating. Manual flight knowledge and skills are required in all situations, not only when all automated systems are off.

2. Background

2.1 It is undeniable that the implementation of new technologies in aircraft cockpits has reduced the number of accidents. This fact is presented by Airbus in its annual statistical analysis of accidents (image below). However, the same technologies that mitigate events of Loss of Control In-flight (LOC-I) by reducing the workload of the flight crews, may end up generating residual risks, such as the loss of proficiency in manual flight caused by poor practice. To quantify the previous statement, a validation of the FOQA/FDM indicators of the 3 largest Brazilian airlines

indicated that the manual flight represents on average less than 5 minutes of the total flight time, in line with the data found by the FAA.



10-year moving average of LOC-I fatal accident rate (per million flights) per aircraft generation (Airbus)

2.2 This loss of proficiency due to lack of practice is related to some factors in the functioning of the human brain. An analysis carried out by Puentes in 2011 gathered some studies that indicate that this condition is directly linked to the motor and cognitive processes of the brain, susceptible to decay during periods of disuse.

2.3 "Wright (1973) found that flight by reference to instruments placed significant cognitive demands on pilot participants, and revealed that this type of flying was most affected after nonpractice intervals. Recent research has also revealed that cognitive skills, in addition to physical skills, decrease over time without proper practice, especially those skills that were learned early in training but not used for extended periods (Arthur, Bennet, Stanush, & McNelly, 1998)." (PUENTES, 2011)

2.4 This conclusion denotes the importance of practicing manual flight, mainly due to the fact demonstrated by Puentes in his analysis, that proficiency in manual flight skills returns quickly with practice. "Flight skill quickly returned to proficiency, up to 75 percent, in as little as five minutes of practice after the hiatus" (PUENTES, 2011).

3. The Impact of Manual Flight Operations on Safety

3.1 Two accidents in particular show the impact of the lack of manual flight practice on safety: The Air France 447 and the Asiana 214 (HASLBECK; HOERMANN, 2016). Both final reports mention the lack of proficiency in manual flight several times, including it as one of the contributing factors to the final state of the aircraft.

3.2 However, those two accidents are examples of extreme events within a big global air operation where, despite the investigation and qualitative analysis of the French BEA and the US NTSB being of high level, in the statistical scope, they possibly do not indicate a correlation. Thus, aiming to validate this hypothesis, Haslbeck and Hoermann proposed another approach to this issue in their research, where they randomly selected 126 airline pilots and put them in a simulator to perform a precision approach in raw data. The pilots were both Captains and First Officers from single-aisle and widebody types of aircraft. The results showed that the level of daily practice of pilots directly influences their manual flying skills, where single-aisle pilots, which are more exposed to landings and take-offs in their daily activities, performed approaches with lower margins of error than the widebodies pilots.

"When looking at the long-haul data, it seems that the total flight time and the time on type beyond 2,000 or 3,000 hours are less important factors for the level of manual skills than the daily practice and the time period since flight school. Therefore, the A340 FOs generally had more difficulties than the A320 FOs." (HASLBECK; HOERMANN, 2016).

3.3 The FAA adds that skills related to performing MFO include cognitive skills, psychomotor skills, and communication skills, and pilot proficiency for performing all MFO skills provides a foundation for pilots to handle any operational situation, whether expected or unexpected.

4. Manual Flight Operations Scenario

4.1 To better understand the issues and why many pilots are reluctant or unable to practice manual flight, a survey was conducted by the International Air Transport Association (IATA) on Aircraft Handling and Manual Flying Skills to capture the pilots' subjective feedback about their airline automation policies, manual flying practices during everyday line operations and during operator training.

4.2 The overall results of the survey from 5,650 respondents were:

- Good manual flying skills remain essential to achieve safe line operations.
- Manual flying skills need to be trained and maintained, irrespective of the aircraft generation.
- Manual flying skills can be lost if they are not practiced on a regular basis.
- Pilots should have the possibility to revert to basic hand flying when situation permits.
- Pilots should be trained to revert to manual flying when automation fails or during an emergency.
- Pilots need to maintain manual flying skills to a high degree of proficiency and must develop confidence in their ability to do so.

4.3 In addition, in the Latin America and Caribbean region, when asked if the airline policy allows and support manual flying without any limitations, 62% of the respondents answered "No". However, 70% answered that their airline policy allows and support manual flying within specific limitations. Some limitations mentioned were adverse weather, poor visibility, gusty conditions, traffic, fatigue, aircraft malfunction, among others.

4.4 The respondents from Latin America and Caribbean also answered having recent experience of manual flying in line operations during:

- Take-off and landing only: 28%
- Approach: 22%
- Good weather conditions only: 16%
- Climb and descent: 14%
- VMC only: 12%
- Daytime only: 7%
- Cruise at high altitude: 1%

5. Countermeasures for Unsafe Conditions Associated with LOC-I

5.1 In the IATA 2021 Safety Report, the analysis of LOC-I events brought up several interesting points. LOC-I remained the category with the highest number of fatalities in 2021, totalling 75 fatalities in three accidents. The association also analysed errors and their contribution percentages to LOC-I events. In this category, both manual handling/flight controls and adherence/cross verification to Standard Operating Procedures (SOP) represented 50% of the analysed events. The same was done for the undesired aircraft states in the LOC-I events where the vertical, lateral and speed deviations represented 43%, followed by the operation outside the aircraft limitations with 36% contribution and abrupt aircraft control with 21% contribution.

5.2 In order to understand which measures are implemented by the crews that can prevent LOC-I events, the association also lists the contribution percentage of so-called countermeasures. Overall crew performance had a contribution of 50% while workload management, defined as correctly prioritizing tasks in order to keep the flight safe, had 21% of contribution. Automation management, defined as the right balance between workload management and situational awareness, also had a 21% of contribution.

	Percentage Contribution
Overall Crew Performance	50%
Leadership	43%
Captain Should Show Leadership	36%
In-flight Decision-making/Contingency Management	36%
Monitor/Cross-check	36%
Workload Management	21%
Automation Management	21%
FO Is Assertive When Necessary	14%
Communication Environment	7%
Reactive – Contingency Management	7%
Evaluation of Plans	7%
SOP Briefing/Planning	7%
Proactive – In-flight Decision-making	7%
Taxiway/Runway Management	7%

Crew countermeasures for LOC-I events (IATA)

6. Recommendations for Air Operators

a) Develop and publish an operational policy for performing manual flight, considering the possibilities of combining aircraft automation levels with manual flight. Many aspects of operator policies and procedures can affect the readiness of pilots to perform Manual Flight Operations effectively. For example, operator policies on flight path management that excessively require the use of automated systems may negatively affect the retention of manual flight skills. Therefore, policy should not be overly prescriptive on requiring the use of automated systems at all times but instead encourage a culture that promotes joint responsibility of operator and individual pilots for maintaining pilot proficiency in manual flight operations.

b) Guide the development of this policy through a specific risk analysis.

c) Indicate to the flight crews the conditions and recommended scenarios or criteria for the practice of manual flight.

d) Specifically address in the policy the practice of manual flight for pilots who are away from their duties for extended periods.

e) Encourage and promote the practice of manual flying within the established policy, also focusing on the crews of widebody fleets.

f) Implement specific SOPs to support the Manual Flight Operations portion of their flight path management policy. These policies and procedures should protect the pilot flying's ability to maintain focus on flight path management.

g) In line with the published policy, adjust or include scenarios in the simulator sessions that encourage the practice of manual flight, considering the company's operational scenario and also the possibilities of combining the levels of automation of the aircraft with manual flight.

h) Adapt or include scenarios in the simulator sessions that encourage manual flight in degraded controllability conditions, such as the trim runaway event, for example.

i) In line with the published policy, the learning objectives of all hands-on training must consider knowledge and skills in manual flight.

j) Approach, in theoretical training, the fundamentals of manual flight such as concepts of energy management, aircraft characteristics, visual scanning, etc.

k) Promote actions with the flight operations team in order to demystify the fear that manual flying will result in punishment.

l) Promote, within each FOQA/FDM policy, a greater acceptability of the variation of flight parameters by the crews that were practicing manual flight, until they mature and increase the learning curve.

7. Recommendations for Flight Crews

a) Familiarize yourself with the manual flight policy of the company and fleet you fly.

b) Always remember to follow SOP and Flight Operations Manual standards. Don't let the fear of FOQA/FDM events stop you from practicing manual flying.

c) Fully understand the automation modes of the fleet you operate.

d) Before deciding to practice manual flight, perform a Threat and Error Management (TEM) of the respective flight to ensure that all members of the technical crew are fully aware of the risks involved when flying manually.

e) In this Threat and Error Management (previous item), consider factors associated with:

- Human performance such as fatigue, workload, crew experience and knowledge of the operating environment.
- Meteorological conditions, such as the current weather, intensity and variation of wind direction, gusts, etc.
- Operational aspects, such as MEL items, in-flight failures or malfunctions, other contingencies, etc.
- Airport infrastructure, such as works and maintenance services, obstacles, terrain, etc.
- Air traffic, such as type and availability of Air Traffic Control, type and density of local air traffic, etc.
- The practice itself, which level of automation will be used (Auto-Pilot, Flight Director and/or Auto-Throttle/Thrust).

f) Conduct a thorough briefing that ensures all pilots are aware of when and how automation will be managed, including when automation should be turned off, when it should be

turned on, how the workload will be managed under abnormal conditions, and other factors understood as relevant by the crew during the flight.

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