EASA Safety Information Bulletin

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Subject: **Safety Management of Flight Operations in Adverse Convective Weather and the Inter-Tropical Convergence Zone**

Ref. Publications:

American Institute of Aeronautics and Astronautics (AIAA) Paper No 2014-0612, NF1676L-16719 “Preliminary Analysis of Aircraft Loss of Control Accidents: Worst Case Precursor Combinations and Temporal Sequencing”.

National Aeronautics and Space Administration (NASA) Paper No NF1676L-11047 “Aircraft Loss-of-Control Accident Analysis” and Paper No 00299, NF1676L-11771 “Aircraft Loss-of-Control: Analysis and Requirements for Future Safety-Critical Systems and their Validation”.

European Aviation Safety Plan 2014-2017.

European Commission Regulation (EU) No 965/2012 on Air Operations, Part-ORO – see European Flight Standards Implementing Rules.

International Civil Aviation Organization (ICAO) Annex 19 ”Safety Management”; ICAO Doc 9859 “Safety Management Manual”; ICAO 2014 Safety Report; ICAO Doc 10011 ”Manual on Aeroplane Upset Prevention”; ICAO Doc 8335 “Manual of Procedures for Operations Inspection, Certification and Continued Surveillance”; ICAO Doc 7192 “Training Manual - Part F1 - Meteorology for Air Traffic Controllers and Pilots”; ICAO Doc 7192 “Training Manual - Part D3 - Flight Operations Officers/Flight Dispatchers”.

Federal Aviation Administration (FAA) Advisory Circular No AC 00-24C ”Thunderstorms” and No AC 91-70A “Oceanic and International Operations”.

European Authorities Coordination Group on Flight Data Monitoring (EAFDM) – “Developing standardised FDM-based indicators (Dec. 2013)”.

United Kingdom Civil Aviation Authority Aeronautical Information Circular AIC No. P 056/2010 “The Effect of Thunderstorms and Associated Turbulence on Aircraft”.

International Air Transport Association (IATA) Safety Report 2014, 51st Edition (April 2015).

This is information only. Recommendations are not mandatory.

Applicability: National Aviation Authorities (NAAs), Commercial Air Transport (CAT) operators of multi-pilot operations.

Background: Loss of control in flight (LOC-I) is a predominant cause of aviation accidents[1,2,3]. Many initiatives have been taken to address this major aviation safety risk from the pilot training perspective[4].

Analyses of recent aircraft accidents reveal that LOC-I results from a wide spectrum of contributing factors, often occurring in combination[5,6], of which inclement weather is part. This requires the implementation of a comprehensive set of LOC-I prevention schemes addressing all potential LOC-I causes, based on accident and incident data as well as known and emerging risks.

In this respect, it is of particular strategic importance to ensure that proactive accident prevention is achieved through adequate and efficient safety management of flight operations in adverse convective weather and large-scale areas of concentrated inclement weather such as the Inter-Tropical Convergence Zone, or ITCZ (including various hazards such as thunderstorms, turbulence, ice crystals, icing, hail, windshear, lightning, etc.).

Description: The ITCZ is characterised by powerful convective activity which generates often vigorous thunderstorms over large areas.

The position of the ITCZ varies with the seasons. In July and August, over the Atlantic and Pacific, the ITCZ is between 5 and 15 degrees north of the Equator, but over the land masses of Africa and Asia it is located further north. In eastern Asia, the ITCZ may propagate up to 30 degrees north of the Equator. In January, over the Atlantic, the ITCZ is generally located no further south than the Equator, but it extends much further south over the land masses of South America, Southern Africa, and Australia.

Where the trade winds are weak, the ITCZ is characterised by isolated Cumulus (Cu) and Cumulonimbus (Cb) cells.

However, where the trade winds are stronger, the ITCZ can generate a solid line of active Cb cells embedded with other cloud types, developing as a result of instability at higher levels. Cb tops can reach and sometimes exceed an altitude of 55 000 feet, and the ITCZ can be as wide as 300 nautical

[1] Annual Safety Review 2013, Executive Summary, page 6

[2] European Aviation Safety Plan 2014-2017, Pages 8, 9, 22, 24 and 26

[3] ICAO 2014 Safety Report, Appendix 1

[4] See in particular ICAO Doc 10011 ”Manual on Aeroplane Upset Prevention”

[5] AIAA Paper No 2014-0612, NF1676L-16719

[6] NASA Paper No 00299, NF1676L-11771 “Aircraft Loss-of-Control: Analysis and Requirements for Future Safety-Critical Systems and their Validation”

miles in places, thus presenting a formidable obstacle to aircraft transit.

Aircraft flying through an “active” ITCZ (strong trade winds) will most probably encounter the hazards associated with thunderstorms and adverse convective weather. All thunderstorms have conditions that are a hazard to aviation. These hazards occur separately or in various combinations. While not every thunderstorm contains all hazards, it is not possible to visually determine which hazards a thunderstorm contains.

Inclement weather and atmospheric disturbances are potential contributory factors to loss of control in flight (LOC-I). Hence the need for effective safety management adapted to the specific risks related to flight operations in the ITCZ.

In this regard, it is reminded that strategic (planning) and tactical (in-flight) weather avoidance is best practice.

Risk mitigation should be achieved through the operator’s Safety Management System (SMS) based on hazard identification and data monitoring.

Recommendation(s): When operating in adverse convective weather and the ITCZ area, operators should thoroughly determine their exposure to ITCZ risks and ensure that efficient mitigating actions are continually and consistently taken, based on data-driven strategies, thereby actively preventing accidents resulting from LOC-I.

Safety management principles should apply to all aspects of flight operations in adverse convective weather and the ITCZ with a view to implementing risk mitigation strategies and proactively taking preventive actions. Particular attention should be paid to precursors of LOC-I.

In addressing the specific risks related to adverse convective weather and operations in the ITCZ, it is therefore recommended that, as a minimum, the following aspects and/or contributing factors are considered:

Operators

- Safety risk management[7]:
  - Predictive, proactive and reactive identification processes for ITCZ-related hazards;
  - Safety data collection which is consistent with aircraft operations in adverse convective weather;

[7] In the sense of APPENDIX 2 (SMS Component 2) of ICAO Annex 19 and chapter 5 of ICAO Doc 9859 “Safety Management Manual”.

- FDM-based indicators[8] targeting the risks related to adverse convective weather and ITCZ (for example: number of events associated with excessive roll, stall protection trigger, excessive speed / vertical speed / accelerations and/or insufficient energy at high altitude);
- Safety data analysis to adequately identify existing or emerging risks associated with aircraft operations in the ITCZ;
- Trend analysis to properly identify in a timely manner existing or emerging (isolated or combined) contributing factors to LOC-I, such as, but not limited to:
  - » Increased rate of turbulence / icing encounter for the flights in the vicinity of the ITCZ compared to flights in other geographical areas of operation;
  - » Poor strategic or operational decision making related to weather avoidance;
  - » Inaccurate or outdated meteorological data, products, reports or forecasts used for flight planning or in flight;
  - » Scarce adherence to Standard Operating Procedures;
  - » Erosion of skills, risk-taking attitudes or lack of awareness of the potential of LOC-I in adverse convective weather and the ITCZ.
- Defensive strategy and risk mitigation appropriately addressing each identified contributing factors to LOC-I.

- Flight planning and dispatch:
  - Adequacy of flight preparation and dispatch with particular regard to anticipated weather conditions;
  - Fuel policy and guidance that is consistent with anticipated operational constraints and weather contingency planning, providing an appropriate range of possible strategic avoidance routes and the ability to conduct unplanned in-flight deviations from intended route;
  - Dispatch with Minimum Equipment List / Configuration Deviation List that preserves the ability of the aircrew to avoid weather and to mitigate the effects of inadvertent inclement weather encounter, such as requiring appropriate reliability of weather radar, de-icing / anti-icing systems, navigation systems, air data.

[8] European Authorities Coordination Group on Flight Data Monitoring: EAFDM – Developing standardised FDM-based indicators (Dec. 2013).

- In-flight procedures:
  - Avoidance manoeuvres should be performed as early as possible, as weather radar information on nearby cells becomes partial, and possibly misleading, when the aeroplane gets closer to convective areas;
  - No attempts to climb over the convective area should be undertaken when buffet and performance margins are dangerously reduced.
- Competency of personnel:
  - Effective detection and resolution of lack of knowledge, deficient skills and inappropriate attitudes of pilots, dispatchers, maintenance personnel and safety officers as regards their proficiency to ensure safe flight operations in adverse convective weather and the ITCZ;
  - Adequate initial, recurrent, route-specific or seasonal refresher training with regard to the specific geographical areas of operation associated with the ITCZ.

National Aviation Authorities

When approving an “area of operation” or overseeing existing operations in the ITCZ, competent authorities should:

- Evaluate the operators’ risk assessment to ensure that it is appropriate for the operations conducted, considering as a minimum the above mentioned aspects;
- Assess the adequacy and the correct implementation of the resulting mitigating measures.

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