IFALPA
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Position

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Tailwind Operations

INTRODUCTION

Wind and all associated characteristics such as cross- and tailwind, shear, turbulence, vortices, and gusts are significant to the execution of daily flight operations. Wind influences not only the aircraft's performance but also the aircraft handling characteristics and the piloting task. This position paper focuses on the specific operational risks of flight operations in tailwind.

Variations in wind speed and direction are a fairly common phenomenon whose potential safety hazard must be recognized and subject to appropriate risk mitigations.

To conduct flight safety in tailwind conditions, one should assess the related risks very thoroughly and a robust safety study should be the basis of any tailwind procedure. Potential shortcomings in regulations, wind measurement, and training must be clearly identified to establish and implement the relevant mitigating measures. A conservative approach must be taken because of all variations and uncertainties in the tailwind operation.

DEFINITION

Tailwind operations in fixed wing aircraft are considered to be take-offs, approaches, and landings in actual tailwind conditions. Aircraft manufacturers publish tailwind limitations in the Aircraft Flying Manual and are, in most cases of modern airline aircraft, in the order of 10 to 15 kts. The actual wind is a random phenomenon and varies in time and location. It cannot be described, measured, reported, or dealt with in an exact manner. Wind reports may vary considerably from actual wind values (see section on Shortcomings of Wind Measurement).

BACKGROUND ON SAFETY STATISTICS

Adverse wind conditions (strong crosswind and tailwind) are involved in a significant portion of approach and landing accidents (ref. 4, 5, 6). Ref. 4 shows that in many analysed tailwind related accidents, the actual tailwind exceeded the approved limitations.

Tailwind-related overrun accident data shows that in 70% of the cases, the runway was wet or contaminated. Clearly, the combination of tailwind and a slippery runway is hazardous and should be avoided (ref 4,6).

History tells us that in more than half of tailwind related overrun accidents, floating and/or long or bounced landings took place (ref. 6). A high tailwind on approach may also result in unwanted excessive rates of descent and higher ground speeds and result in unstabilized or rushed approaches (ref 13).

HAZARDS IN TAILWIND CONDITIONS

- Tailwind affects the required take-off and landing field lengths, especially on contaminated runways.
- The touchdown speed and required brake energy and brake temperature is increased.
- Wake vortex separation may be reduced in the presence of a light quartering tailwind.

- Tailwind during approach:
  - increases the rate of descent to stay on the descent path (may exceed 1000-1200ft/min) and may trigger the GPWS “Sink Rate” warning;
  - may cause engine thrust to become as low as flight idle, which increases the engine spool up time for jet engines;
  - makes it difficult to reduce the approach speed and configure the aircraft without exceeding the placard speeds;
  - increases the probability of floating during landing.

SHORTCOMINGS AND IFALPA POSITION

In many tailwind-related accident reports, several contributing factors have been identified: piloting techniques, poor decision making, runway assignment, wind changes, and runway conditions. In all of these contributing factors shortcomings in training, procedures and legislation can be identified, which create a typical risk in the tailwind operation and require a closer look and a mitigating strategy or a conservative approach. These shortcomings are listed in combination with proposed IFALPA solutions.

a) Wind measurement of tailwind

ICAO Annex 3 provides wind measurement and reporting recommendations. Wind measurement and its presentation to the pilot inherently create inaccuracies and uncertainties. Wind measurement is neither done at the right place (the touchdown zone, final approach path), nor at the right time (time lag). Wind data are filtered, and the high frequency content of the wind disturbances is not represented. Not all wind changes in direction or speed are measured and communicated as reporting thresholds are in place.

Accurate and reliable (tail)wind information should be measured and reported to the cockpit, based on anemometers for each runway.

Wind information should not only include the touchdown zone but also be representative for the final approach.

In particular, variations in wind direction can rapidly increase the maximum tailwind component. These variations should be closely monitored.

ICAO Annex 3 states that wind must be measured and may not be mathematically derived or augmented, although this could produce more accurate and consistent wind data for the approach path and touchdown zone.

IFALPA supports the research and development of a mathematically-derived wind value to incorporate the approach path and augment landing zone winds and to improve the anemometer siting. If derived and actual wind values are available in future, usage should be assessed.

IFALPA opposes close-by construction developments that obstruct airflow around the approach path and near the anemometer.

FMS-derived wind information can be of value to the pilot, but current Flight Management Systems do not provide a reliable and accurate wind indication to pilots in gusty and crosswind conditions. Due to flight physics as well as the position of the sensors and the inertial reference system in the aircraft, the wind direction and speed is not always calculated correctly. This is especially true when the aircraft moves around the longitudinal, lateral, or pitch axis and in a side-slip condition. Different wind values might also be presented to pilots when derived from separate data sources or when the inertial reference system positions have become less accurate after long flights.

Pilots should be trained to recognize these limitations to be able to judge the provided indication accordingly.

b) Operations

Approach procedures should be designed in a way that allows pilots to execute safe flights according to stabilized approach criteria. A stable approach reduces the likelihood of a long flare, a long landing and runway excursions, especially during tailwind conditions and in adverse weather and runway conditions.

The touchdown aiming point should be defined as target. Pilots should be trained in following a consistent go/no-go decision-making process based on clear operational criteria for tailwind and long landings, possibly assisted by technological aids.

Operators should be encouraged to refuse land and hold short operations (LAHSO) with tailwinds.

Operators should support not conducting tailwind approaches on Steep Approaches, or GP greater than 3.0 degrees.

Operators should ensure that SOPs include adequate monitoring and cross-checking by all cockpit crew members to support crew co-ordination during approach and landing.

Operators should develop a method to identify unstable approaches from integrated data of flight tracks, wind conditions, navigation procedures, and aircraft parameters. FDM can indicate precursors of unstable approaches with high tailwind and can be used to monitor general SOP compliance, identify critical approaches, runways and airports, and train flight crew in general.

c) Wake vortices and tailwind

Separation criteria for Final Approach are based on Runway Occupancy Time (ROT) on the ground and safe wake vortex separation during approach (see ref. 4). The wake generated by an aircraft will normally descend below its flight path. In a tailwind situation, the wake may be blown back onto the glide slope and a wake encounter is more likely than under normal headwind conditions. This phenomenon may be observed especially when the wind is not strong enough to decay the wake.

In the landing phase, this tailwind condition can move the vortices of an aircraft forward into the touchdown zone and cause a hazard to following landing traffic.

Separation minima on final approach should take wind conditions into account and prevent a hazardous wake encounter for actual wind and tailwind conditions.

d) Simulator training and wind modelling

It is generally recognised that the quality of wind modelling of aircraft simulator software is deficient to simulate accurate wind and aircraft behaviour near the ground. According to NLR research, the quality of the mathematical ground model in combination with the motion and visual ques of a simulator is usually not high enough to allow sufficient confidence in the crosswind or tailwind evaluation results.

Wind models used on training simulators are simplified. Simulators lack sufficiently high response times, proper ground and aerodynamical models, high frequency turbulence, and terrain induced wind effects.

Two-dimensional wind modelling (empirical, wind tunnel, or mathematical) has limited validity for predicting unsafe wind situations. A given complex surface situation requires 3-dimensional modelling and advanced fluid dynamics.

3D-windmodelling may be needed to identify the specific wind conditions at a specific aerodrome and the related hazardous wind phenomena.

The lack of realistic tailwind and gusty wind conditions in simulator training should be further evaluated and may require further consolidation of the pilot's experience during actual flights. Extra attention should be given to the impact of tailwind when landing on slippery runways.

IFALPA supports confirmation of training during exposure flights under supervision for every type or variant.

IFALPA supports training in bounced landing recovery techniques.

e) Landing Performance

Landing distance increases with tailwind. As a rule-of-thumb, the landing distance increases by 21 percent for the first 10 kts tailwind. The runway length may become limiting and other hazards (such as runways other than dry, wind disturbances, no RESA) may become more relevant. The combination of these hazards should be assessed (ref. 12).

A correct landing performance assessment before landing in tailwind conditions is of paramount importance with the following considerations:

- The latest weather data and Runway Condition Report should be assessed before landing.
- Conservative weather and runway data should be used to calculate actual landing distances.
- Margins should be included to account for variations and uncertainties.
- Deteriorating circumstances during approach should be noted.
- Other options with increased safety margins should be considered.
- Select the correct level of automation for the approach and landing.
- Select the proper flap setting, approach speed, autobrake setting, and intended use thrust of reverse.
- Use landing techniques that resemble the assumptions on which the landing performance calculations are based: at the intended touchdown point, firmly to ensure weight on wheels and derotation without delay.
- The correct deceleration technique should be used with all available means, including reverse thrust until one can ensure that the airplane will stop in time.
- Runway end safety areas and any EMAS should be identified.

Pilots should be trained to assess the runway excursion risk due to tailwind, to apply correct landing performance calculations, and to perform correct landing and deceleration techniques in tailwind operations.

Operators should develop and apply procedures for flight crew to assess landing performance during flight before landing based on actual conditions.

Additional safety margins should be added – IFALPA considers that at least a 15 percent margin should be added to the runway length required to allow for uncertainties and variations from assumed conditions.

IFALPA opposes any restrictions on the use of reverse thrust.

f) Take Off Performance

Specific risks are identified for take-off in tailwind conditions.

For Take-Off-Performance calculations, the highest tailwind should be taken into account (and by regulation factored by 150%) and crosschecked with actual wind reading upon take-off. The actual take-off wind should be provided by ATC at the moment of the take-off.

Intersection take-offs are not recommended.

Tail clearance may be an issue and this risk should be addressed during training and in a crew briefing during actual operation.

g) Runway orientation and allocation

Runway orientation and runway allocation have a direct impact on the encountered tailwind.

According to the ICAO Annex 14 recommendation, the primary runway should be directed in the prevailing wind direction. This must be the basic rule in the siting and orientation of all runways, that are needed to allow for the expected number of aircraft movements at a specific aerodrome.

The ICAO defined runway usability factor (Ref. 14) should be as high as reasonably possible and be at least 95 percent. This factor is, among others, determined by the prescribed prevailing crosswind limits.

For runway usability assessment, IFALPA supports the addition of a 5 kts tailwind limitation to the existing 20 kts crosswind limitation (Annex 14 Chapter 3.1.3). These are maximum wind values and should be reduced if safety is compromised due to environmental factors, or topography. See Ref 2, appendix A.

ICAO PANS-OPS I-7-2-1 clearly states that "Noise abatement should not be the determining factor in runway nomination when the tailwind component, including gusts exceeds 5 kts (and crosswind exceeds 15 kts)."

Some States deviate from this ICAO recommendation.

IFALPA supports the current runway assignment criteria (5 and 15 kts) for noise abatement and stresses that gusts should be included.

IFALPA believes that these criteria should equally apply for capacity enhancement or other non-operational considerations.

IFALPA believes that noise abatement runway assignment criteria apply for all landing and take-off runways in case of simultaneous runway use.

IFALPA stresses that the Pilot in Command has the final authority to accept or request a runway for safety reasons and that this request should be granted.

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