GACA Safety Bulletin

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Controlled Flight Into Terrain (CFIT) – Risk Awareness, Mitigation, and Prevention

Applicability:

Flight Operations:	Air Operators

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General:

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Subject:

Controlled Flight Into Terrain (CFIT) – Risk Awareness, Mitigation, and Prevention

Version: 1.0

References:

- Kingdom of Saudi Arabia National Aviation Safety Plan (NASP)
- ICAO Doc 10004 Global Aviation Safety Plan (GASP) 2023-2025

Purpose:

This bulletin supports national safety objectives under the Kingdom's State Safety Programme (SSP) and National Aviation Safety Plan (NASP), which identify CFIT as a top-priority risk. It provides updated guidance for integrating CFIT hazard identification, training, and controls into operator SMS.

Background:

CFIT is an in-flight collision with terrain, water, or obstacle without indication of loss of control. Accidents categorized as CFIT involve all instances where an aircraft is flown into terrain in a controlled manner, regardless of the crew's situational awareness. CFIT is a more significant risk to helicopter operations in KSA due to the nature of the operational environment. CFIT accidents involve multiple contributing factors, including procedural design and documentation, pilot disorientation, and adverse weather conditions.

A study of CFIT accidents involving commercial aircraft showed that nearly half occurred during approach and landing, with the majority resulting in hull loss and fatalities. Contributing factors typically include loss of situational awareness, deviations from established standard operating procedures (SOPs), reliance on outdated or inadequate terrain data, continuation of non-precision

approaches below the minimum descent altitude without adequate visual reference and delayed or incorrect responses to ground proximity alerts.

The requirement for aircraft to be equipped with ground proximity warning systems has significantly reduced the number of CFIT accidents. Despite the absence of CFIT accidents involving transport-category aircraft over the past few years, CFIT accidents often have catastrophic results when they occur, with very few, if any, survivors. Therefore, there is a high risk of fatality associated with these events.

Recognized by ICAO's Global Aviation Safety Plan and Saudi National Aviation Safety Plane as a High-Risk Category of Occurrence, CFIT prevention hinges on comprehensive flight crew training, strict adherence to procedures, effective deployment of technology such as Terrain Awareness and Warning Systems (TAWS), and proactive integration of CFIT hazards into SMS risk assessments and safety performance monitoring.

Recommended Actions:

Operational Controls:

- Stabilized Approach Criteria & Go-Around Policies: Define and enforce clear stabilized approach parameters (e.g., correct glidepath, airspeed within target, landing configuration) and mandate immediate go-around if these criteria are not met. This ensures crews do not continue into unstable approaches that can compromise terrain clearance and situational awareness.
- Comprehensive Approach Briefings: Prior to descent, crews must conduct detailed briefings covering topography, obstacle locations, minimum safe altitudes, and environmental factors (e.g., wind shear, visibility). Incorporate visual aids such as terrain profiles and electronic charts to reinforce terrain threats and escape routes.
- Obstacle & Terrain Data Management: Maintain up-to-date obstacle databases on EFBs and flight planning systems. Establish procedures for periodic validation of terrain data against official sources and NOTAMs. This reduces the risk of outdated or inaccurate terrain information leading to CFIT events.
- Use of Terrain display in order to enhance full situational awareness and ensure a timely and appropriate pilot response.
- Report instantly to the relevant ATC Units and authorities all incidents related to GPS interference that would trigger inaccurate terrain warnings.

Technical Measures

- TAWS/GPWS Integrity & Usage: Implement regular functional checks of TAWS/GPWS equipment, verify terrain database currency before dispatch, and prohibit any inhibition of terrain alerts during critical phases. Encourage crews to practice CRM-driven responses to system warnings to ensure timely terrain avoidance maneuvers.
- Altimetry Cross-Checks: Require cross-verification between radio and barometric altimeter readings, especially in mountainous or coastal environments where elevation changes rapidly. Any discrepancy greater than manufacturer tolerance must be resolved before continuing approach.
- Flight Data Monitoring & Reporting: Leverage FDM platforms to detect terrain proximity alerts, excessive descent rates, and unstable approaches. Establish automated alerts to SMS teams when preset thresholds are exceeded. Use trend data to guide targeted training and procedural updates.

Training & Human Factors

- CFIT-Focused Scenario Training: Integrate realistic CFIT scenarios into both initial and recurrent simulator sessions, including black-hole illusions, mountainous approaches, and low-level operations. Emphasize recovery techniques such as immediate climb-to-safe altitude procedures when terrain warnings occur.
- Checklist Discipline & CRM Principles: Reinforce strict adherence to challenge–response checklist protocols during descent and approach. Train crews to assertively call deviations and engage in an ongoing terrain awareness cross-checks. Use debriefs to highlight instances where CRM prevented potential CFIT occurrences.

SMS Integration

- Hazard Identification & Risk Assessment: Ensure CFIT hazards are explicitly listed in SMS hazard logs, with risk controls documented and regularly reviewed. Use bow-tie analysis to map CFIT threat–control–recovery pathways.
- Safety Performance Indicators (SPIs): Define SPIs for unstable approach frequency, go-around rates, and terrain proximity alert occurrences. Monitor these metrics and trend regularly and develop apropriote risk controls to further reduce safety risks.
- Reporting Culture: Promote a non-punitive reporting environment for CFIT precursors, including SOP deviations, unplanned terrain alerts, and visual reconnaissance failures. Ensure reported events trigger thorough investigations and feedback loops for continuous improvement.

Contact:

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