



**FLIGHT SAFETY FOUNDATION CFIT TASK FORCE
FLIGHT CREW TRAINING & PROCEDURES WORKING GROUP**

- A REPORT -

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by

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OVERVIEW

The Flight Crew Training & Procedures Working Group was established in 1993, as one aspect of the Flight Safety Foundation (FSF) CFIT (Controlled Flight into Terrain) Task Force. The Working Group's mission was to "*develop and present guidelines and recommendations for flight crew operating policies, procedures and associated training and evaluation to reduce the risk of having CFIT encounter*" (London, May 1993).

Composed of a broad spectrum of international experts in aviation safety and training, the Working Group encompasses knowledge and experience pertaining to the CFIT phenomenon. Regional and technical diversity was a specific objective in composing the Working Group team. This is reflected in its broad regional representation, with active participation from Africa, Asia, Europe, North America and South America. Technical diversity of the Working Group is also reflected in the range of companies and organizations represented, including airline companies, aircraft manufacturers, training centers, pilot associations (U.S. Air Line Pilots Association [ALPA], International Federation of Air Line Pilots Associations [IFALPA]) and international organizations (FSF, International Civil Aviation Organization [ICAO], IATA).

The Working Group identified three products to deliver to the industry, through Flight Safety Foundation. Each product was developed by a small task team that reported to the full Working Group. Each of the three products was considered an important element of a coordinated strategy to achieve the Working Group's objectives. The products are:

- A CFIT awareness package;
- A set of recommended policies and procedures related to CFIT risks encountered by flight crews; and,
- A model CFIT training program.

This paper describes the status of each of these products.

CFIT AWARENESS PACKAGE

The objectives of the CFIT awareness package are to:

Increase awareness among decision makers about CFIT risks;
and,

Promote support for appropriate CFIT safety and prevention strategies.

The awareness package target audience includes:

Airlines;
Government regulators;
Industry groups and associations;
ATC authorities;
Insurers;
Aircraft operators of all kinds;
Lessors;
Financial institutions; and,
Other related groups.

The Awareness Package Task Team has completed its work. Their accomplishments include several important achievements:

A *Safety Alert* issued worldwide by Flight Safety Foundation in late 1993 (Appendix A). This alert warns of the CFIT accident risk and contains recommendations for flight crew response to ground-proximity warning system (GPWS) warnings:

“When a GPWS warning occurs, pilots should immediately, and without hesitating to evaluate the warning, execute the pull-up action recommended in the company procedure manual. ... This ... procedure should be followed except in clear daylight visual meteorological conditions when the flight crew can immediately and unequivocally confirm a false GPWS warning”;

A recommendation to outfit all aircraft with state-of-the-art GPWS systems;

[In 1995, the CFIT Task Force’s recommendation for broadening the use of GPWS was adopted by ICAO. New standards,

effective Dec. 31, 1998, require GPWS in all aircraft used in “international commercial and general aviation operations, where the MCTM (maximum certified takeoff mass) is in excess of 5,700 kilograms (12,500 pounds) ... or (that) are authorized to carry more than nine passengers,” the ICAO ruling said. ICAO said that the new standards also “specify the minimum modes in which GPWS is required to operate.”]; and,

A CFIT awareness video, specifically targeting regional airlines and corporate flight operations.

[The FSF CFIT checklist, distributed worldwide by Flight Safety Foundation, enables a flight crew to calculate the CFIT risk for any route or destination. The checklist assigns positive or negative values to a series of factors to be encountered in the flight or approach.]

CFIT POLICY & PROCEDURES RECOMMENDATIONS

The team was tasked to provide a set of baseline flight crew operating policies and procedures to support reduction of CFIT accident risk. This work of the Policy & Procedures Task Team is complete.

The recommendations that were produced target:

Airlines;
Government regulators;
Pilot associations; and,
Individual flight crew members.

This spectrum of end-users provides a safety net intended to ensure the benefit of the recommendations. Placing a consistent set of procedures in the hands of multiple levels of decision makers provides the redundancy to do this. Each level of authority has the capacity to embrace and implement the recommended CFIT avoidance strategies and achieve productive advantage independently of the others. When all levels do so in coordination with one another, maximum effect is achieved.

The task team produced 15 policy and procedure recommendations. Two are recommendations to corporate management, which have been referred to the CFIT Task Force Implementation Committee for action. The other 13 recommendations relate to flight operations and training.

The policy recommendations to management are contained in Appendix B. The operations and training recommendations are contained in Appendix C. Each is described in terms of a problem statement and associated policy or procedure recommendations. Recommendations address the following topics:

Policy Recommendations to Management (Appendix B)

- A policy statement for establishing a safety-oriented corporate culture; and,
- A recommendation to implement systemic safety performance measurements.

Flight Operations & Training Recommendations (Appendix C)

Altitude awareness, adherence to altitude clearances and procedures to confirm adequate terrain clearance;
Use of autopilots during approaches and missed approaches;
Acceptance of ATC clearances;
Approach and departure briefings;
Chart supply for flight crews;
Use of checklists;
Allocation of flight crew duties/use of monitored approach procedures;
GPWS warning response;
Nonprecision approach procedures;
Rate-of-descent policy;
Route and destination familiarization;
Stabilized approaches; and,
Ground briefing materials.

MODEL CFIT TRAINING PROGRAM

The CFIT Training Program Task Team was charged with producing a model CFIT training program curriculum. This model was completed in early 1995 and forms the basis of the CFIT Education & Training Aid. This aid will be the most visible product of the Working Group's activity and is patterned after similar training aids previously produced on topics such as wind shear, rejected takeoffs and takeoff performance. It is intended for use by all providers and users of flight crew training.

Resources for development and production of the CFIT Education & Training Aid, along with associated materials and an instructional video, have been provided by the Boeing Commercial Airplane Group. The development group was headed by Capt. Dave Carbough, assisted by Capt. Skip Cooper and Steve Morman. The Training & Procedures Working Group is grateful to these dedicated professionals for their support, effort and persistence.

The Training Aid is composed of two parts:

- An instructional video; and,
- A detailed written document.

The instructional video contains a history of CFIT accidents, a review of worldwide CFIT accident statistics and trends, an analysis of the "traps" with CFIT accident potential that flight crews might encounter, and CFIT avoidance and recovery strategies. Interviews with aviation industry leaders from throughout the world highlight the importance of the Task Force initiative and call on industry executives at the highest level of organizations to support this effort. The video also includes sample training situations that illustrate how the aid can be used by an operator.

The written document is composed of five sections:

Management Overview

An executive level briefing package to educate senior level executive management about the CFIT phenomenon and the role of management in CFIT reduction strategies;

Decision Maker Guide

Important considerations to help operations managers implement CFIT training and associated policies and procedures;

Operators Guide

CFIT policy and procedures recommendations;

CFIT Training Program

A flight crew training program containing associated instructor documentation, support materials and participant manuals. The program includes specific ground school and simulator training lessons and recognition, avoidance and recovery strategies. Aircraft-specific CFIT recovery procedures are given for aircraft for which appropriate technical data were available; and,

Background Data

Supporting reference material containing engineering and testing data developed and used to support Training Aid recommendations.

ACKNOWLEDGMENTS

The Flight Crew Training & Procedures Working Group would like to express appreciation to the following companies, organizations and individuals, without whose support this effort would not have been possible.

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British Airways
Delta Air Lines
Flight Safety Foundation
FlightSafety International
Gulfstream Aerospace
International Air Transport Association (IATA)
International Civil Aviation Organization (ICAO)
International Federation of Air Line Pilots' Associations
(IFALPA)
Japan Airlines
Lockheed Martin
McDonnell Douglas Corporation
SAS
United Airlines
Varig Brazilian Airlines

- APPENDIX A -

**FLIGHT SAFETY FOUNDATION
CFIT SAFETY ALERT**

-APPENDIX B -

**POLICY RECOMMENDATIONS
TO MANAGEMENT TEAM**

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COMMITMENT TO SAFETY

Problem Statement

Consistent levels of safety cannot be achieved without a genuine commitment from management to support reasonable initiatives and the dedication of employees to contribute to a safe operating environment.

Recommendation to Steering Committee

Companies should support and adopt a mission statement along the following lines:

All employees, at all levels, share responsibility for safety and for the enhancement of the overall corporate safety culture. Safety priorities are considered in decision making within all departments. To this end, there should be a structure in place, supported at the highest level, to manage and support safety-related issues, as well as to ensure that safety is measured as an integral part of operational efficiency.

The company shall foster confidence that the decisions of all departments with regard to rational safety decisions will be supported and not subject to adverse reaction.

Scrutiny of safety-related decisions will be dedicated exclusively to developing improvements in the operational integrity of support systems.

Refer to Implementation Committee for action.

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MEASUREMENT & EVALUATION OF SYSTEM PERFORMANCE

Problem Statement

Companies have insufficient systems and infrastructure for monitoring and evaluating the operational performance of management, crew and equipment.

Recommendation to Steering Committee

All companies should provide systems and infrastructure for monitoring and evaluating the operational performance of management, crew and equipment with the objective of enhancing operational integrity. This can be accomplished by means of some, or preferably all, of the following:

- Flight data recorder analysis;
- Quick access recorder analysis;
- Flight operations quality assurance (FOQA) programs;
- Data bases for safety analysis;
- Defined criteria for safety reporting;
- Establishment and encouragement of a “no blame” reporting culture;
- Management process/culture to apply accumulated data effectively; and,
- An independent quality audit function to achieve operational integrity.

Recommendations & Notes

Operational Integrity describes a set of interrelated performance measures that might be employed to measure safety in relation to other key indicators. It presents a set of indices to measure performance of the infrastructures within a system that support safety. The performance measures described are:

- Safety;
- Cost efficiency;

Schedule performance;
Customer satisfaction;
Regulatory compliance; and,
Adherence to operating policies and procedures.

Refer to Steering Committee for further action.

- APPENDIX C -

**POLICY AND PROCEDURE RECOMMENDATIONS
FOR FLIGHT OPERATIONS & TRAINING**

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ALTITUDE AWARENESS

Problem Statement

Many incidents/accidents have occurred as a result of crews not having sufficient awareness of altitude and proximity to terrain.

Policy/Procedure Statement

It is essential that flight crews always appreciate the altitude of their aircraft relative to terrain, and assigned or desired flight path. Methods by which flight crews will monitor and cross-check assigned altitudes, as well as verify and confirm altitude changes, should be established and followed.

As a minimum, procedures should encompass the following items:

The crew must be responsible for ascertaining the applicable minimum safe altitude (MSA) reference point. Crews are cautioned that the MSA reference point for an airport may vary considerably according to the specific approach in use;

The crew must be aware of the applicable transition altitude or transition level;

There should be a checklist item to ensure that all altimeters are correctly set in relation to transition altitude/level;

Any crew member(s) should call out any significant deviation or trend away from assigned clearances;

Minimum operating altitudes should be adjusted in conditions of low temperatures, low pressures and/or excessive winds. It is suggested that the following corrections be applied:

For low temperature add 4 percent per 10 degreesC below ISA;
For low pressure (if flying on standard pressure setting of

1013 hPa or 29.92 inches), add 30 feet (9.2 meters) per hPa below standard setting; and,
For winds in excess of 30 knots add 500 feet (153 meters) per 10 knots above 30, up to a maximum correction of 2,000 feet (610 meters).

In all cases, air traffic control will be notified when altitude corrections are applied;

A call-out should be made at the following times:

Upon initial indication of radio height, at which point altitude vs. height above terrain should be assessed and confirmed to be reasonable, and radio height will be added to the standard instrument scan of pilots;

Above or below approaching assigned altitude (adjusted as required to reflect specific aircraft performance);

Approaching relevant approach minimums (specific height to be determined by operator); and,

Passing transition altitude/level;

Consideration should be given to incorporating a 500-foot (153-meter) radio height call-out on final approach (strongly recommended for all nonprecision approaches). At this point, altitude vs. height above terrain should be assessed and confirmed to be reasonable or an immediate missed approach initiated;

The pilot flying should announce, and the pilot not flying confirm, any changes to aircraft altitude or heading (excluding minor corrections);

Flight crew members should confirm altimeter-setting units. It is recommended that this be done by repeating all digits and altimeter units in clearance readbacks and by cockpit call-outs between crew members; and,

On crossing the final approach fix, outer marker or equivalent position, the pilot not flying will cross-check actual crossing altitude/height, against altitude/height as depicted on the approach chart.

Notes

Reference item 7 above: the Working Group feels that automated call-outs are preferable to manual call-outs.

Refer to ATC Working Group to advise item #5.

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USE OF AUTOPILOTS

Problem Statement

Crews do not take full advantage of automatics as a means to manage the progress of a flight and reduce workload.

Policy/Procedure Statement

The use of autopilots is encouraged during all approaches and missed approaches, in instrument meteorological conditions, when suitable equipment is installed. It is incumbent on operators to develop specific procedures for the use of autopilots and autothrottles during precision approaches, nonprecision approaches and missed approaches, and to provide simulator-based training in the use of said procedures to all flight crews.

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ACCEPTANCE OF ATC CLEARANCES

Problem Statement

From time to time, air traffic control (ATC) issues flawed instructions that do not ensure adequate terrain clearance. Such clearances are too often accepted by pilots without considering consequences and/or questioning instructions.

Policy/Procedure Recommendation

Flight crews should *not* assume that ATC clearances will ensure terrain clearance. If an ATC clearance is given that conflicts with the pilot's assessment of terrain criteria relative to known position, the clearance should be questioned and, if necessary, refused and suitable action taken.

Refer to ATC Working Group (Bob Vandel) for information purposes and perhaps to include in air traffic controller training/orientation.

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APPROACH AND DEPARTURE BRIEFINGS

Problem Statement

The failure of flight crews to conduct thorough briefings causes uncertainty about intentions, hazards and other special conditions relevant to terrain clearance during approach and departure.

Policy/Procedure Recommendation

Flight crews will conduct predeparture and preapproach briefings. Flight crew briefings will include discussions of hazardous terrain features and avoidance strategies with appropriate consideration for aircraft performance capabilities. Briefings should include use of applicable charts with specific attention to departure routings, departure procedures, arrival routings, approach procedures, missed-approach procedures and altitude changes that ensure terrain clearance relative to planned approach or departure paths.

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CHART SUPPLY

Problem Statement

The failure of companies to provide crew members with adequate supplies of current navigation and approach charts is a significant barrier to safety of flight. Furthermore, in some instances, current charting standards do not provide adequate information to flight crew members about terrain hazards, or are so complex as to make clear interpretation difficult.

Recommendation to Airborne Equipment Working Group and Steering Committee

Each pilot will be provided with accurate, current charts with clear depiction of hazardous terrain. Charts provided should depict hazardous terrain in a manner that is easy to recognize and understand. Electronic displays should resemble printed chart displays to the maximum extent feasible.

Refer to Airborne Equipment Working Group (David Walker) for further action.

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USE OF CHECKLISTS

Problem Statement

Poorly conceived procedures for checklist use can result in task saturation of crew members during critical phases of flight. Incidents/accidents have occurred because of noncompletion of relevant checklist(s).

Policy/Procedure Recommendation

It is recommended that a detailed policy on checklist use be formulated by each operator and a strict discipline regarding their use be maintained. Such policies should require that checklists be completed early in the approach phase so as to minimize distraction while maneuvering close to the ground. In all cases, checklists should be completed no later than 1,000 feet (305 meters) above ground level (AGL).

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ALLOCATION OF FLIGHT CREW DUTIES
USE OF MONITORED APPROACH PROCEDURES

Problem Statement

The majority of CFIT incidents/accidents are known to occur in instrument meteorological conditions (IMC) and night conditions when the pilot flying the approach also lands the aircraft.

Policy/Procedure Statement

Proper management of crew workload during night and IMC requires that precise and unambiguous procedures be established. It is recommended that operators adopt a monitored approach procedure during approaches and missed approaches conducted in these conditions. In this case, the first officer will fly approaches and missed approaches. The captain will monitor approach progress and subsequently land the aircraft after obtaining sufficient visual reference.

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GPWS WARNING RESPONSE

Problem Statement

Incidents/accidents have occurred because flight crews have failed to make timely response to ground-proximity warning system (GPWS) alerts.

Policy/Procedure Recommendation

When a GPWS warning occurs, pilots should immediately, and without hesitating to evaluate the warning, execute the pull-up action recommended in the company procedure manual. This procedure should be followed in all but clear daylight visual meteorological conditions when the flight crew can immediately and unequivocally confirm a false GPWS warning.

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NONPRECISION APPROACH PROCEDURES

Problem Statement

Most CFIT incidents/accidents occur during nonprecision approaches. Nonprecision approach procedures are different from precision approach procedures. Furthermore, stepdown nonprecision approach procedures can increase the risk of unstabilized approaches.

Policy/Procedure Statement

Approaches should be constructed and managed so that nonprecision approaches are as similar to precision approaches as possible, incorporating a stabilized approach concept. From a point prior to the final approach fix, pilots will establish an approximate three-degree approach path to touch down, in a stabilized condition for landing.

At the briefing stage, on nonprecision approaches, particular attention should be made regarding locations at which configuration changes will take place, as well as crossing altitudes. Rates of descent on final approach and relevant timings from the final approach fix that can be expected, as well as criteria for continuing the approach visually, should be confirmed. Special attention should be paid to relevant call-outs and monitoring.

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RATE-OF-DESCENT POLICY

Problem Statement

High rates of descent in close proximity to terrain are dangerous. They result in increased risk of CFIT, high crew workload and reduced margins for safety.

Policy/Procedure Recommendation

A policy should be established that restricts the rate of descent allowed within a prescribed vertical distance of (1) the applicable minimum safe en route altitude, and (2) the minimum sector altitude as defined by ICAO PANS-OPS/TERPS.

For example, the restriction could be 2,000 feet (610 meters) per minute maximum rate of descent at or below 2,000 feet above either of these altitudes.

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ROUTE & DESTINATION FAMILIARIZATION

Problem Statement

Crews may be inadequately prepared for CFIT-critical conditions, both en route and at destination.

Policy/Procedure Recommendation

Flight crews shall be provided with adequate means to become familiar with en route and destination conditions for routes deemed CFIT-critical. One or more of the following methods are considered acceptable for this purpose:

- When making first flights along routes, or to destinations, deemed CFIT-critical, captains should be accompanied by another pilot familiar with the conditions; or,
- Suitable simulators can be used to familiarize crew members with airport critical conditions when those simulators can realistically depict the procedural requirements expected of crew members; or,
- Written guidance, dispatch briefing material and video familiarization using actual or simulated representations of destination and alternates can be provided.

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STABILIZED APPROACHES

Problem Statement

Unstable approaches contribute to many incidents/accidents.

Policy/Procedure Statement

Pilots will establish a stabilized approach profile for all instrument and visual approaches. A stabilized approach has the following characteristics:

- A constant rate of descent along an approximate three-degree approach path that intersects the landing runway approximately 1,000 feet (305 meters) beyond the approach end and begins not later than the final approach fix or equivalent position;
- Flight from an established height above touchdown should be in a landing configuration with appropriate and stable airspeed, power setting, trim and constant rate of descent; and,
- Normally, a stabilized approach configuration should be achieved no later than 1,000 feet above ground level (AGL). However, in all cases if a stabilized approach is not achieved by 500 feet (153 meters) AGL, an immediate missed approach shall be initiated.

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GROUND BRIEFING MATERIAL

Problem Statement

The absence of information to adequately assess routings, terrain and hazards relevant to destination and possible alternates contributes to poor planning and decision making on the part of flight crews.

Policy/Procedure Recommendation

Crew members will be provided with and review suitable materials to conduct thorough briefings for the route to be flown. This must include departure, en route, destination and potential alternates.

As a minimum this should include these materials:

- Current NOTAMs;
- Current weather conditions and forecasts;
- Seasonal weather analysis; and,
- Specific procedures critical to terrain avoidance.

Desirable materials that might also be used are:

- Video route briefings;
- Video destination and alternate airport briefings; and,
- A data base of materials describing unique features/conditions specific to route, destination and alternate airports.