International Civil Aviation Organization

FIRST MEETING OF THE ASIA PACIFIC REGIONAL AVIATION SAFETY TEAM (APRAST/1)

(Bangkok, Thailand, 20-24 February 2012)

Agenda Item 16: Controlled Flight into Terrain (CFIT)

CONTROLLED FLIGHT INTO TERRAIN (CFIT)

(Presented by the Secretariat)

SUMMARY

Controlled flight into terrain (CFIT) - accidents, where a properly functioning aircraft under the control of a fully qualified and certificated crew is flown into terrain with no apparent awareness on the part of crew. This paper provides detailed information on the initiatives undertaken by ICAO, COSCAPs and other organizations related to reducing the risk of a CFIT occurrence.

1. INTRODUCTION

1.1 Accident Data indicates that controlled flight into terrain (CFIT) accounts for just over 20% of all fatal accidents, a disproportionately high percentage given the low proportion of all accidents attributed to this category. While ICAO and other organizations have undertaken a number of initiatives over the past 15 years which have met with considerable success, the data would suggest that additional efforts should be considered.

2. DISCUSSION

ICAO CFIT Initiatives

2.1 ICAO Assembly Resolution A31-9 urges States to implement the ICAO program for the prevention of CFIT. ICAO introduced a number of amendments to SARPs and related guidance material to reduce the risk of CFIT accidents. ICAO was also an active participant of the Flight Safety Foundation Approach and Landing Accident Reduction (ALAR) Task Force.

ICAO Universal Safety Oversight Programme

2.2 Over the past six years, ICAO has conducted audits of Member States implementation of ICAO SARPs and related guidance material under the Universal Safety Oversight Audit Programme (USOAP). The data from these audits related to CFIT initiatives could be utilized by the APRAST to determine the priorities on the development and implementation of safety enhancement initiatives. Attachment I outlines the Lack of Effective Implementation of these ICAO SARPs for consideration of the APRAST.

Flight Safety Foundation Initiatives

2.3 The Flight Safety Foundation (FSF) has led an initiative to reduce CFIT accidents and produce an Approach and Landing Accident Reduction (ALAR) Toolkit. Over the past number of years, FSF with other stakeholders have conducted numerous ALAR workshops to encourage States, air operators, and air traffic management to implement many of the safety interventions that are contained in the ALAR Toolkit.

2.4 The task force's work, and the subsequent safety products and international workshops on the subject, have helped reduce the risk of ALAs — but the accidents still occur. In 2009, of 17 major accidents, nine were ALAs, compared with 19 and eight the previous year.

2.5 A major update of the FSF *ALAR Tool Kit* — featuring the findings of analyses of recent accident data, as well as the data-driven findings of the FSF Runway Safety Initiative — was developed in 2010.

Note: SEs that follow refers to Safety Enhancements of the FAA Commercial Aviation Safety Team (CAST)

Safety Enhancement Initiative CFIT 1 (SE1, SE120) - Ground Proximity Warning Systems (GPWS) With Forward Looking Terrain Avoidance Function (Safety Impact High)

2.6 This safety enhancement substantially reduces or eliminates CFIT accidents by improving pilot situational awareness through the installation and use of GPWS with a forward looking feature (also known as TAWS). It is also important that procedures are developed and used to ensure proper flight crew reaction to TAWS aural and visual warnings.

2.7 Amendments 21 and 27 to ICAO Annex 6 Part I; and Amendment 22 to Annex 6 Part II strengthened the requirements for carriage of GPWS and introduced the requirements for aircraft to be equipped with GPWS with forward looking terrain avoidance function.

2.8 As of 1 January 2007, all turbine-engined aeroplanes of a maximum certificated take-off mass in excess of 5,700 kg or authorized to carry more than nine passengers shall be equipped with a ground proximity warning system which has a forward looking terrain avoidance function.

COSCAP RAST Outputs

2.9 COSCAP ARASTs promoted timely implementation of these SARPs through issuance of an Advisory Bulletin (AB). In addition, COSCAPs prepared an Advisory Circular (AC) to highlight the training requirements for air operators related to TAWS.

2.10 More recently, technical issues were identified that could reduce the effectiveness of this safety enhancement. The accuracy of the TAWs equipment is greatly reduced in aircraft that are not equipped with GPS, especially in areas with limited navaid coverage. COSCAP RAST developed an AC to highlight the difficulties related to reduce capabilities of TAWS equipment where position accuracy is not adequate. The AC encouraged the modification of TAWS equipment to include GPS input or the development of SOPs to deal with map shifts. In addition, information was provided to ensure that databases are maintained current. An AB was issued to States to highlight the need to ensure that the serviceability of TAWS equipment, including status of software and data base, was examined when conducting inspections of air operators.

Safety Enhancement Initiative CFIT 2 (SE2) – Standard Operating Procedures (Safety Impact High)

2.11 All air operators should have standard operating procedures (SOPs) and training which should address all projected normal situations which crews and company personnel will encounter. SOPs address: use of checklists, what each person's responsibilities are, use of available equipment, and expected procedures to be used during preflight, taxi, take-off, climb, cruise, descent, approach, missed approach, landing, taxi and parking.

2.12 ICAO Annex 6 requires an Operations Manual which must contain SOPs for each phase of flight. Further, ICAO *Procedures for Air Navigation Services — Aircraft Operations* (PANS – OPS) Volume 1 (Doc 8168) contains additional guidance material on the requirements for SOPs to include checklists and crew briefings as an integral part of SOPs.

COSCAP RAST Outputs

2.13 COSCAP issued an AB and an AC to States designed to provide advice and recommendations about development, implementation, and updating of SOPs as a means to implement these ICAO requirements. The AC presents the background, basic concepts, and philosophy of SOPs. Many important topics that should be addressed in SOPs are provided in a Standard Operating Procedures Template.

Safety Enhancement Initiative CFIT 3 (SE3,4,5,6,7,8) – Precision-Like Approach Standard Operating Procedures (Safety Impact High)

2.14 Analysis of accident data indicates that the accident rate is five times greater during non-precision approaches than when aircraft are conducting precision approaches. In the interest of safety, air operators should discontinue the use of step-down or "dive-and-drive" non-precision approach procedures as soon as, and wherever possible. Air operators who have yet to do so should, at the earliest possible date, develop procedures and train pilots to fly continuous descent final approaches (CDFA) when flying non-precision approach procedures. All types of aircraft can fly procedures utilizing a constant rate descent, even those with just basic navigation capabilities.

2.15 ICAO PANS-OPS (Doc 8168), Volume I, Part I, Section 4, Chapter 1, promotes the use of Constant Decent Final Approach through utilization of a number of techniques.

COSCAP RAST Outputs

2.16 COSCAP issued an AC - Guidance for Operators conducting Continuous Decent Final Approach for Non-Precision Approaches, which is a technique that requires a continuous descent, flown either with VNAV guidance calculated by onboard equipment or based on manual calculation of the required rate of descent, without level-offs. In addition the AC promoted the development of "APV/baro-VNAV procedures" as outlined in PANS OPS, Volume I, Part II.

Note: ICAO PBN developments have overtaken some of the information contained in the AC.

Safety Enhancement Initiative CFIT 4 (SE10) – Flight Data Analysis (Safety Impact High)

2.17 A Flight Data Analysis programme (FDA) is a predictive and non-punitive use of information derived from aircraft flight data recorders to improve aviation safety. The use of FDA as an important safety tool has grown as emerging technology expands the capabilities of gathering and analyzing such data. Daily collection and analysis of data provides valuable information to correct undesirable trends, improve safety and ultimately reduce the number of accidents.

2.18 From 1 January 2005 Annex 6, Part 1 requires operators of aeroplanes of a maximum certificated take-off mass in excess of 27,000 kg. to establish and maintain a flight data analysis programme as part of its accident prevention and flight safety programme. A flight data analysis programme shall be non-punitive and contain adequate safeguards to protect the source(s) of the data.

COSCAP RAST Outputs

2.19 COSCAP RAST issued an AB and and AC – Information to States on Flight Data Analysis (FDA) Programme. The AB was intended to draw the attention of States to the new ICAO SARPs requiring Flight Data Analysis and to provide a model regulation States may wish to utilize to implement this ICAO requirement. It also provides guidance material to States that can be utilized to ensure air operators have implemented an effective Flight Data Analysis programme. The AC was to provide guidance to CAA and air operator staff for the implementation of an effective Flight Data Analysis programme.

Safety Enhancement Initiative CFIT 5 (SE11) – Crew Resource Management Training (Safety Impact Low)

2.20 Annex 6 requires air operators to provide training to flight crew on Human Factors principles. The ICAO Human Factors Training Manual (Doc 9683), Part 2 Chapter 2, contains information on Crew Resource Management (CRM) Training.

COSCAP RAST Outputs

2.21 COSCAP developed an AC which provides guidelines for developing, implementing, reinforcing, and assessing Crew Resource Management (CRM) training programs for flight crew members and other personnel essential to flight safety. These programs are designed to become an integral part of training and operations.

2.22 Annex 6 has for many years required flight crew training related to human performance, and it was amended in 2006 to include threat and error management.

Safety Enhancement Initiative CFIT 6 (SE12/23) – CFIT/ALAR Training (Safety Impact Moderate)

2.23 CFIT accidents could be substantially reduced if all air operators and training centers developed CFIT prevention training and procedures to be added to their approved training curriculums, stressing position awareness and escape maneuvers in the event of a terrain warning indication.

2.24 Approach and Landing Accidents could also be reduced if flight crews were properly trained on topics related to stabilized approaches. This training should include: crew resource management, go around criteria, approaches with system malfunctions, non-normal conditions, and emphasis on basic airmanship, approach briefings, approach and missed approach procedures.

COSCAP RAST Outputs

2.25 COSCAP RAST issued an AB to assist States in developing appropriate legislation, regulations and/or standards to require air operators to ensure flight crew receive initial and recurrent Approach and Landing Accidents (ALA) and CFIT prevention training.

Safety Enhancement Initiative CFIT 7 (SE-14/15/16) ALAR - Policies for ALAR (Safety Impact Moderate)

2.26 ICAO SARPs in *Annex 6, Operations of Aircraft, Part I,* require that an operator establish a flight safety documents system for the use and guidance of operational personnel as part of its accident prevention and flight safety programme.

2.27 Previously, Annex 6 required air operators to establish an Accident Prevention programme which was effectively implemented through the establishment of a Flight Safety Department under the direction of a Director of Flight Safety. *Note: This ICAO requirement was replaced at Amendment 30 by Safety Management System (SMS).*

COSCAP RAST Outputs

2.28 COSCAP developed an AC which would be issued by States to provide air operators with guidance on the establishment of an effective flight safety document system for the use and guidance of operational personnel.

2.29 COSCAP issued ABs to States highlighting safety promotion by the CEO and on establishing a Flight Safety Department.

2.30 COSCAP issued an AB to States with information on how to access essential safety information data from the airplane manufacturer's website.

2.31 Accident prevention and the requirements related to establishing a flight safety department have been replaced by ICAO SARPs for SMS.

Safety Enhancement Initiative CFIT 8 (SE-9) Minimum Safe Altitude Warning (MSAW) (Safety Impact High)

2.32 Recognizing that installation of radars and associated MSAW capability provides the necessary levels of terrain avoidance protection to aircraft operations, States are to consider this aspect when determining the justification for installation of new radar equipment. Justification would be strengthened for installation of radar where the CFIT risk is high. ICAO Recommended Practice is that an MSAW feature should be included with radar and ADB equipment. ICAO *Procedures for Air Navigation Services — Air Traffic Management* (PANS-ATM) (Doc 4444) provides some guidance on MSAW procedures.

2.33 Where the MSAW equipment is being utilized it is important that all controllers are aware of the need to issue 'Safety Alert / Warning' when circumstances so warrant and that procedures have been clearly established in this regard.

COSCAP RAST Output

2.34 COSCAP letter to States highlighting the aspect of 2.32 above.

2.35 The FAA provided a series of MSAW Workshops to review the aspects of MSAW certification and inspection, nuisance warnings as well as Air Traffic Controller MSAW procedures and training. In addition, the FAA workshop included a module on Human Factors for ATM.

2.36 COSCAP issued an AB – Issuance of Safety Alert/Warning which provides procedures on action to be taken by ATC staff when an MSAW warning is received.

3. ACTION BY THE MEETING

3.1 The Meeting is invited to:

a) Note the initiatives undertaken by ICAO and other organizations.

b) Determine other initiatives that could reduce the safety risks for CFIT accidents.

c) Determine which initiatives should be examined by APRAST to reduce the risk of CFIT accidents.

d) For each Safety Enhancement Initiative, utilize the ICAO Regional Performance Framework for Safety and related processes (Tool) to develop, implement and measure the effectiveness of the SEI.

— — — — — — — —

Attachment I

USOAP Results Related to CFIT

Note: The following USOAP protocol questions have some linkages to CFIT Safety Enhancement Initiatives and indicate the Lack of Effective Implementation (LEI) in %. The first number represents LEI based on the audit results of 170 States. The second number represents LEI based on the audit results of 34 APAC States.

Flight Operations

4.12 Does the aircraft operations organization ensure that an applicant for an AOC has established and maintains a flight safety documents system? OPS STD A6, Part I, 3.3 & Att. H - LEI 48/60.

4.153 Does the aircraft operations organization ensure that the air operator has established in its operations manual instructions and training requirements for the avoidance of controlled flight into terrain (CFIT) and policy for the use of the ground proximity warning system (GPWS)? OPS STD A6, Part I, 3.3, 4.2.2 & App. 2, 2.1.30 - LEI 38/35

4.157 Does the aircraft operations organization ensure that the air operator has established a safety management system? OPS STD A6, Part I, 3.3, 4.2.2 & App. 2, 2.1.34 - LEI 49/57

4.203 Does the aircraft operations organization ensure that the air operator has established and maintained a flight data analysis programme as part of its safety management system? OPS STD A6, Part I, 3.2.3 - LEI 52/57

4.305 Does the aircraft operations organization ensure that the air operator has established standard operating procedures (SOPs) which provide guidance to flight operational personnel? OPS PANS Doc 8168, OPS/611, Vol. I, Part XIII, C1 - LEI 25/13

— END —