



ICAO

INTERNATIONAL CIVIL AVIATION ORGANIZATION

A UN SPECIALIZED AGENCY

RASG-AFI CFIT Workshop

Yaounde, Cameroon,

17 - 9 October 2024

By Mr. Kebba Lamin Jammeh
Regional Officer, Flight Safety
ICAO WACAF



ICAO Regulatory Provisions on Controlled Flight Into Terrain (CFIT) and Safety Enhancement Initiatives (SEIs) to mitigate its related occurrences

2

CFIT Workshop

Outline

- **ICAO regulatory provisions on CFIT.**
- **RASG-AFI Occurrence Data, 2013-2023.**
- **Focus on CFIT - Safety Enhancement Initiatives (SEIs) for Mitigating risks associated with CFIT (GPWS; SOPs; CDFA; FDAP; CRM; ALAR; MSAW; PBN).**
- **References.**
- **Conclusion.**
- **Take-Away.**

ICAO regulatory provisions on CFIT.

What is Controlled flight into terrain (CFIT) ?

- A situation where a properly functioning aircraft under the control of a fully qualified and certificated crew is flown into terrain (mountain, ground, water mass, trees, etc.) with no apparent awareness on the part of the crew.
- 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.

ICAO regulatory provisions on CFIT (Cont'd.).

- While ICAO and other organizations (FSF, CAST, JSAT, JSSI, etc.) have undertaken a number of initiatives over the past 20 years which have met with considerable success, the data would suggest that additional efforts should be considered.
- ICAO Assembly Resolution A31-9 urges States to implement the ICAO programme 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 regulatory provisions on CFIT (Cont'd.).

- Over the years, ICAO and aviation partners have taken initiatives to reduce the risk of CFIT accidents such as the production of an Approach and Landing Accident Reduction (ALAR) Toolkit; and the conduct of several workshops to encourage States, air operators, and air traffic management to implement many of the safety interventions that are contained in the Toolkit.
- Each time you approach a runway, the risks associated with approach and landing accidents are present. It is this phase of flight operations where the greatest number of accidents occur. The risks include the non-stabilised approach, landing short, landing off the side of the end of the runway and controlled flight into terrain.

ICAO regulatory provisions on CFIT (Cont'd.).

- During the 1990s extensive industry attention was focused on CFIT because it was the single biggest risk to aircraft, crew and passengers.

RASG-AFI Occurrence Data, 2013-2023

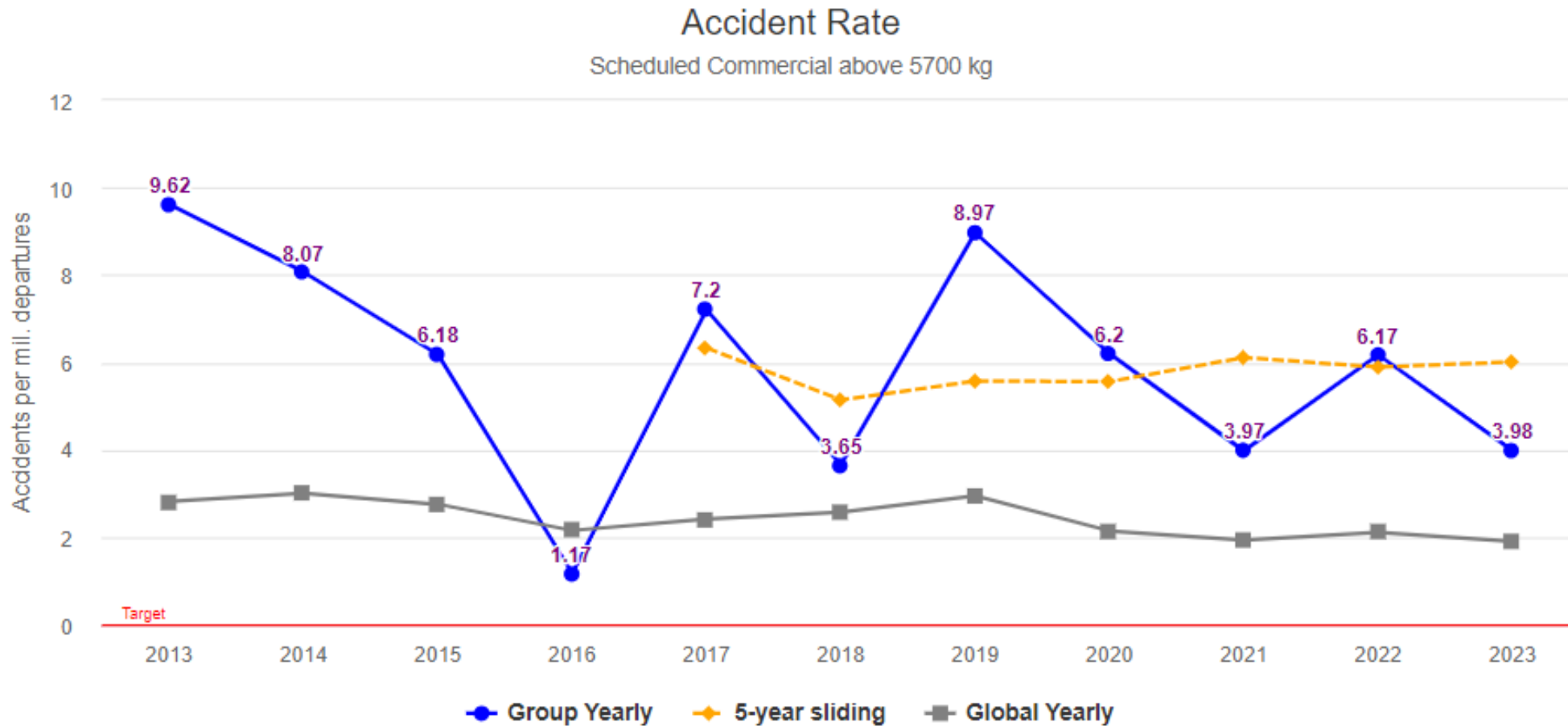
- RASG-AFI Fatal Accident Rate;
- RASG-AFI Accident Rate;
- RASG-AFI Accidents and Fatalities by Year;
- RASG-AFI Accidents by Regional Office;
- RASG-AFI Accidents by Occurrence Category;
- RASG-AFI Accidents by Flight Phase;
- RASG-AFI List of Occurrences.

RASG-AFI Fatal Accident Rate

- The vision of both the Global Aviation Safety Plan (GASP) and the Regional Aviation Safety Plan (AFI-RASP) is to achieve and maintain the aspirational safety goal of zero fatalities in commercial operations by 2030 and beyond, which is consistent with the United Nations' *2030 Agenda for Sustainable Development*. The plan's mission is to continually enhance the global aviation safety performance (and in consequence the regional aviation safety performance) and resilience by providing a collaborative framework for States and industry.

RASG-AFI Accident Rate

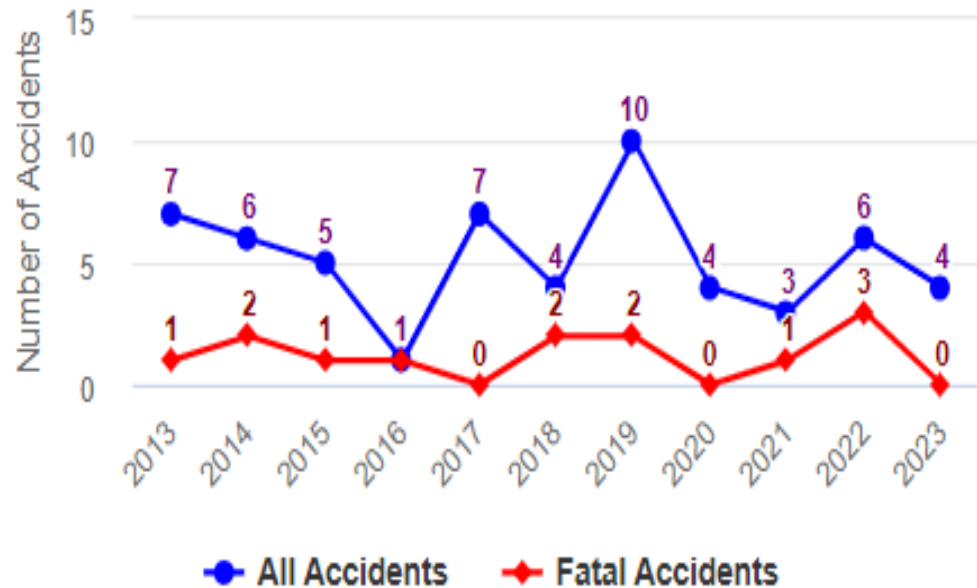
RASG-AFI Accident Rate involving scheduled commercial flights on aeroplanes above 5,700 Kg Maximum Certificated Take-off Mass.



RASG-AFI Accidents and Fatalities by Year

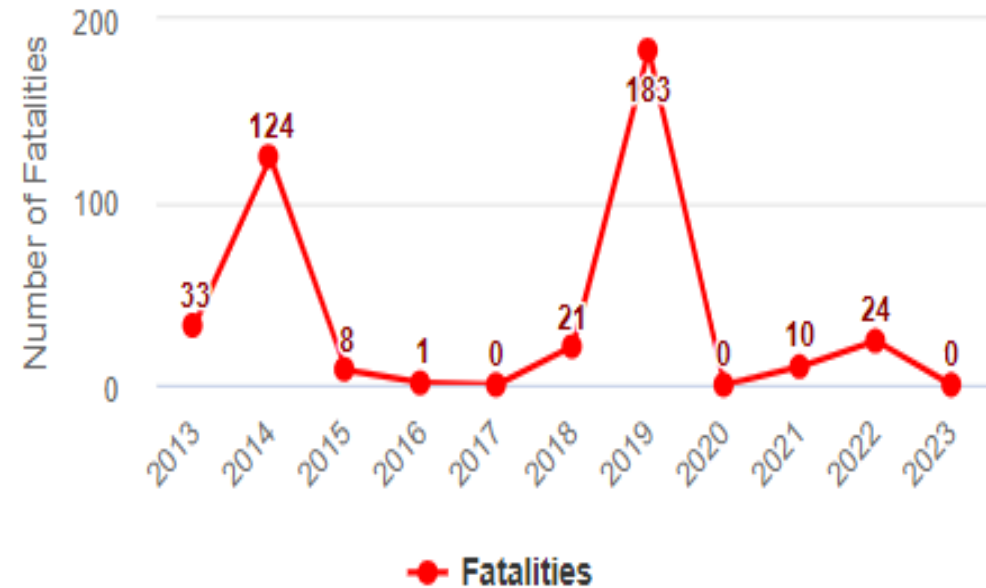
Accidents

Scheduled Commercial above 5700 kg

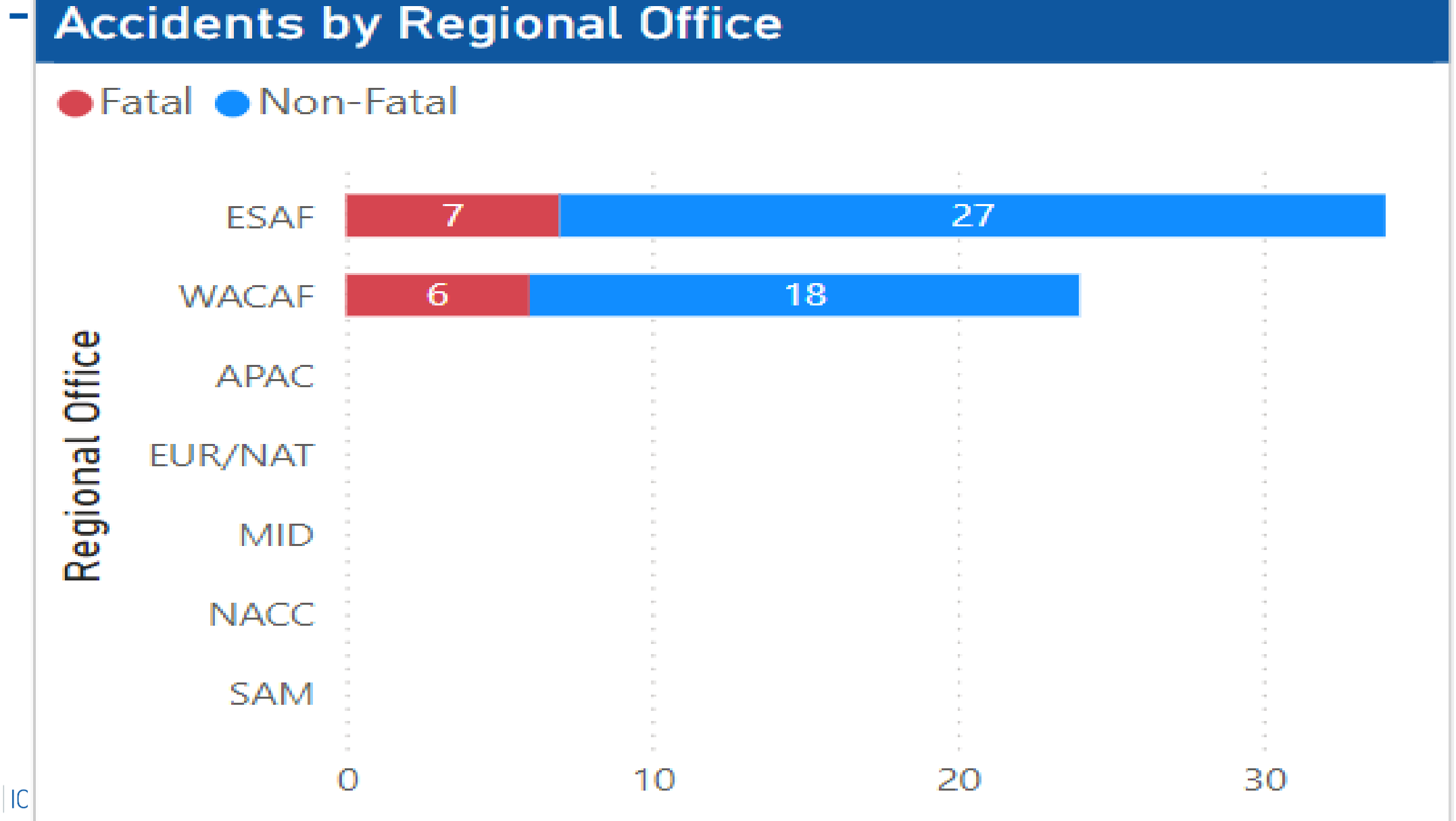


Fatalities

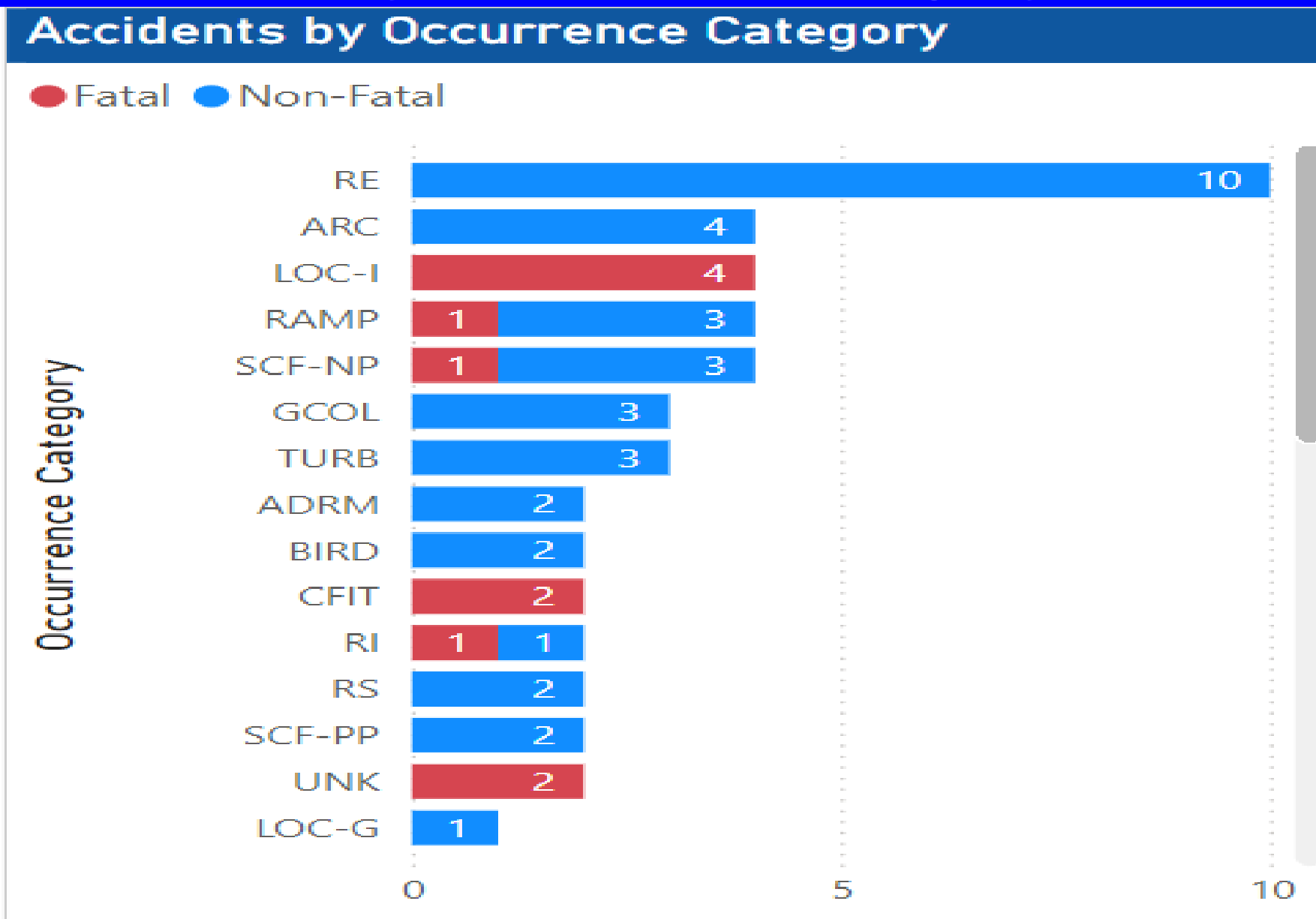
Scheduled Commercial above 5700 kg



RASG-AFI Accidents by Regional Office



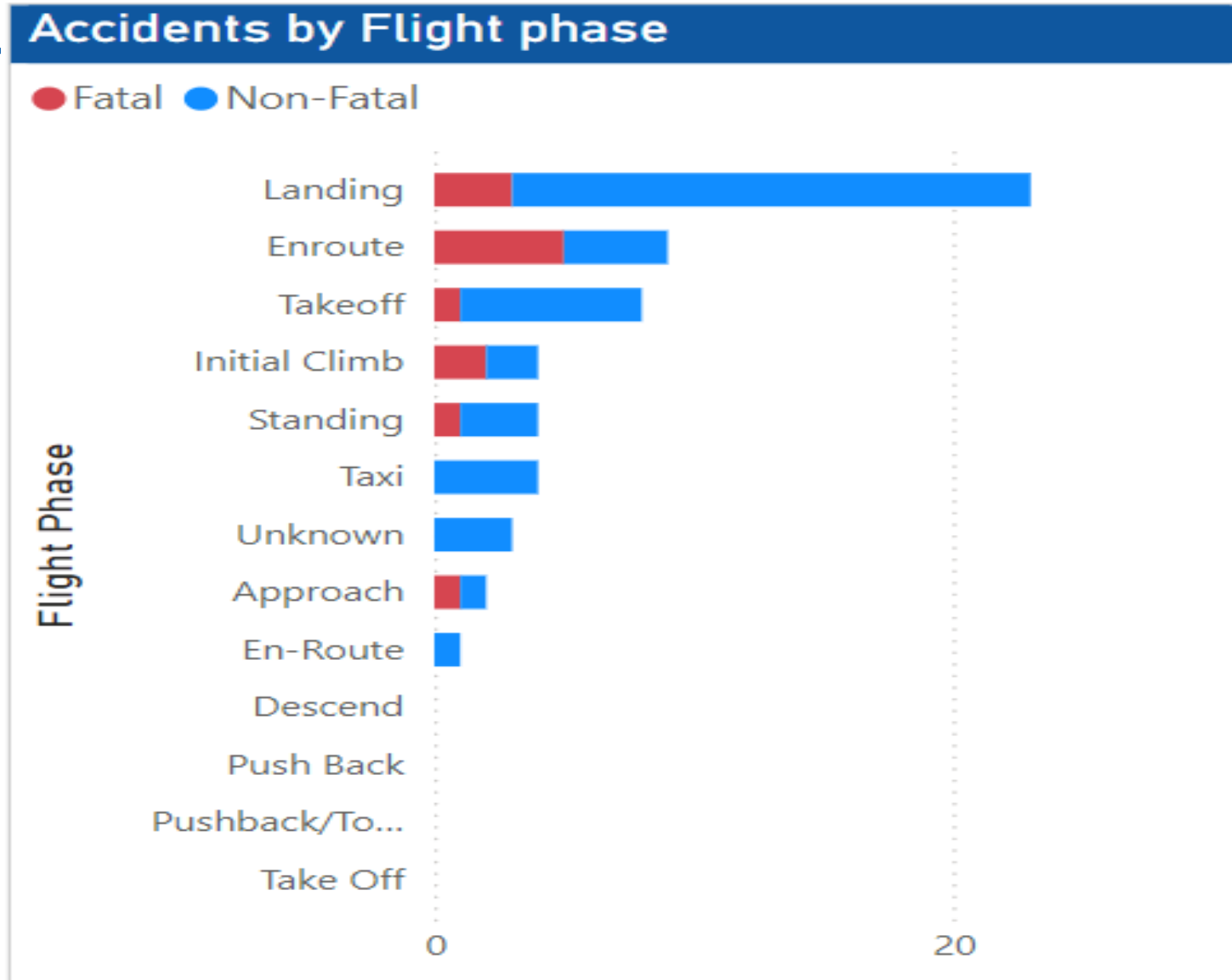
RASG-AFI Accidents by Occurrence Category, 2013 - 2023



Two CFIT Occurrences in the RASG-AFI Region, 2013 - 2023

Local Date	State of Occurrence	Manufacturer	Model	Aircraft registration	Operator	Flight phase	Occurrence Category	Aircraft damage	Injury level	Fatalities	Region
28-Dec-2014	Democratic Republic of the Congo	ANTONOV	AN26	4L-AFS	AG Air	Enroute	CFIT	Destroyed	Fatal	6	Africa
06-Nov-2022	United Republic of Tanzania	ATR	ATR42	5H-PWF	Precision Air	Approach	CFIT	Destroyed	Fatal	19	ESAF

RASG-AFI Accidents by Flight Phase, 2013 - 2023



RASG-AFI List of Occurrences in 2013 - 2023

Local Date	State of Occurrence	Manufacturer	Model	Aircraft registration	Operator	Flight phase	Occurrence Category	Aircraft damage	Injury level	Fatalities	Region
20-Mar-2013	Zambia	BOEING	777-300	A6-ECP	Fly Emirates	Standing	RAMP	Minor	None	0	Africa
26-Jun-2013	South Africa	BOMBARDIER	CRJ-200			Unknown	SCF	Unknown	Unknown	0	Africa
29-Jul-2013	Democratic Republic of the Congo	SAAB	SAAB 340	UR-ARO	Air Urga	Takeoff	SCF-PP	Substantial	None	0	Africa
21-Sep-2013	Uganda	BOMBARDIER	CRJ-200			Unknown	RS	Unknown	Unknown	0	Africa
27-Sep-2013	Kenya	LET KUNOVICE	L410			Unknown	OTH	Unknown	Unknown	0	Africa
22-Dec-2013	South Africa	BOEING	747-400	G-BNLL	British Airways	Taxi	GCOL	Substantial	Minor	0	Africa
24-Jan-2014	United Republic of Tanzania	LET KUNOVICE	L410	5H-ZAP	ZanAir	Landing	RE	Substantial	None	0	Africa
11-Apr-2014	United Republic of Tanzania	EMBRAER	ERJ190	5Y-FFC	Kenya Airways	Landing	RE	Substantial	Serious	0	Africa
10-Jul-2014	United Republic of Tanzania	ATR	ATR72-212A	5H-PWA	PrecisionAir	Landing	SCF-PP	Substantial	None	0	Africa
24-Jul-2014	Mali	MCDONNELL DOUGLAS	DC9-80-83	EC-LTV	Air Algerie	Enroute	LOC-I	Destroyed	Fatal	118	Africa

RASG-AFI List of Occurrences in 2013 – 2023 (Cont'd)

Local Date	State of Occurrence	Manufacturer	Model	Aircraft registration	Operator	Flight phase	Occurrence Category	Aircraft damage	Injury level	Fatalities	Region
24-Nov-2014	Gabon	BOEING	B 747-8R7F	LX-VCC	Cargolux	Landing	RS	Substantial	None	0	Africa
28-Dec-2014	Democratic Republic of the Congo	ANTONOV	AN26	4L-AFS	AG Air	Enroute	CFIT	Destroyed	Fatal	6	Africa
10-Jan-2015	Ghana	BOEING	737-400	ET-AQV	Ethiopian Airlines	Landing	ARC	Substantial	Serious	0	Africa
31-Aug-2015	Botswana	BOMBARDIER	CL600 2B19	ZS-CME	CemAir	Landing	SCF-NP	Substantial	Serious	0	Africa
06-Oct-2015	Ghana	BAE	AVRO146RJ 300	9G-SBB	Starbow	Landing	RE	Substantial	None	0	Africa
26-Oct-2015	South Africa	BOEING	737-400	ZS-OAA	Comair Ltd	Landing	SCF-NP	Substantial	None	0	Africa
01-Nov-2015	Democratic Republic of the Congo	GRUMMAN	G159	9Q-CND	Malu Aviation	Landing	SCF-NP	Substantial	Fatal	8	Africa

RASG-AFI List of Occurrences in 2013 – 2023 (Cont'd)

17

Local Date	State of Occurrence	Manufacturer	Model	Aircraft registration	Operator	Flight phase	Occurrence Category	Aircraft damage	Injury level	Fatalities	Region
02-Feb-2016	Somalia	AIRBUS	A321	SX-BHS	Daallo Airlines	Initial Climb	SEC	Substantial	Fatal	1	Africa
01-Apr-2017	Nigeria	LET KUNOVICE	L410	5X-EIV	Eagle Air Iceland	Takeoff	RE	Substantial	None	0	Africa
09-Apr-2017	South Africa	BOEING	737-800	ZS-SJD	Mango	Enroute	BIRD	Minor	None	0	Africa
30-Apr-2017	Angola	BOEING	737-700	D2-TBF	TAAG Angola Airlines	Landing	SCF-NP	Substantial	None	0	Africa
29-Jul-2017	Sao Tome and Principe	ANTONOV	AN74	UR-CKC	Cavok air	Takeoff	RE	Destroyed	Serious	0	Africa
22-Aug-2017	Ethiopia	AIRBUS / BOEING	A350 / 777-	ET-ATR /	Ethiopian Airlines	Taxi	GCOL	None	None	0	Africa
10-Sep-2017	Democratic Republic of the Congo	ANTONOV	AN26	9S-AFL	Serve Air Cargo	Takeoff	RE	Substantial	None	0	Africa
25-Nov-2017	Ghana	ATR	ATR72-212A	9G-SBF	Starbow Airlines	Takeoff	RE	Substantial	Serious	0	Africa

RASG-AFI List of Occurrences in 2013 – 2023 (Cont'd)

Local Date	State of Occurrence	Manufacturer	Model	Aircraft registration	Operator	Flight phase	Occurrence Category	Aircraft damage	Injury level	Fatalities	Region
13-Feb-2018	Nigeria	AIRBUS	A330-200	N858NW	Delta Air Lines	Initial Climb	SCF-PP; F-NI; EVAC	Minor	Serious	0	Africa
20-Feb-2018	Nigeria	MCDONNELL DOUGLAS (DC)	DC9-80-83	5N-SRI	DANA Airlines	Landing	ARC; RE	Destroyed	None	0	Africa
10-Mar-2019	Ethiopia	BOEING	737-800	ET-AVJ	Ethiopian Airlines	Initial Climb	SCF-NP; LOC-I	Destroyed	Fatal	157	Africa
21-Mar-2019	Sao Tome and Principe	ATR	ATR72-200	TR-ABS	Afrijet	Standing	RAMP	Substantial	None	0	Africa
23-Jul-2019	Nigeria	BOEING	737-300	5N-BQQ	Air Peace	Landing	ARC	Substantial	None	0	Africa
16-Aug-2019	Kenya	DE HAVILLAND	DHC8-200	5Y-SLM	Safarilink	Landing	WILD	Substantial	None	0	Africa
11-Oct-2019	Kenya	FOKKER	F27-50	5Y-IZO	Silverstone Air Service	Takeoff	RE	Substantial	Serious	0	Africa
24-Nov-2019	Democratic Republic of the Congo	DORNIER	228	9S-GNH	BusyBee	Takeoff	LOC-I	Destroyed	Fatal	26	Africa

RASG-AFI List of Occurrences in 2013 – 2023 (Cont'd)

Local Date	State of Occurrence	Manufacturer	Model	Aircraft registration	Operator	Flight phase	Occurrence Category	Aircraft damage	Injury level	Fatalities	Region
25-Nov-2019	Zambia	DE HAVILLAND	DHC8-300	9J-PZB	Proflight Zambia	Enroute	WSTRW	Substantial	None	0	Africa
27-Nov-2019	Democratic Republic of the Congo	AIRBUS	A350-900	ET-AWO / TK-JOV	Ethiopian Airlines / Turkish Airlines	Taxi	GCOL	Substantial	None	0	Africa
10-Dec-2019	South Sudan	DE HAVILLAND	DHC8-400	ET-AQC	Ethiopian Airlines	Takeoff	RE	Substantial	None	0	Africa
28-Dec-2019	Democratic Republic of the Congo	LET KUNOVICE	L410	9S-GDX	Air Fast Congo	Landing	RE	Substantial	None	0	Africa
16-Jan-2020	Mozambique	AIRBUS	A380-800	A6-EEN	Fly Emirates	Enroute	TURB	None	Serious	0	Africa
14-Jul-2020	South Africa	BOEING	737-800	ZS-SJB	Mango Airlines	Enroute	TURB	None	Serious	0	Africa
18-Aug-2020	Senegal	ATR	ATR72-212A	6V-ASN	Air Senegal	Landing	ARC	Substantial	None	0	Africa

RASG-AFI List of Occurrences in 2013 – 2023 (Cont'd)

Local Date	State of Occurrence	Manufacturer	Model	Aircraft registration	Operator	Flight phase	Occurrence Category	Aircraft damage	Injury level	Fatalities	Region
02-Dec-2020	Somalia	BOEING	737-500	EY-560	Air Djibouti	Landing	LOC-I; WSTRW; USOS	Substantial	None	0	Africa
02-Mar-2021	South Sudan	LET KUNOVICE	L410	HK-4274	South Sudan Supreme Airlines	Enroute	LOC-I	Destroyed	Fatal	10	Africa
14-Aug-2021	Democratic Republic of the Congo	DE HAVILLAND	DHC8	9S-AAN	Congo Air lines	Landing	RI	Minor	None	0	Africa
27-Sep-2021	Sao Tome and Principe	SAAB	SAAB 340	UR-ALG	Aerojet Airlines	Standing	RAMP	Substantial	None	0	Africa
03-Jan-2022	South Africa	BAE	Jetstream 41	ZS-NRJ	SA Airlink	Approach	BIRD	Substantial	None	0	ESAF
18-Jul-2022	Somalia	FOKKER	50	5Y-JXN	Jubba Airways	Landing	ARC; WSTRW; LOC-I; F-POST; RE	Destroyed	Minor	0	ESAF
02-Sep-2022	Guinea	AIRBUS	A320	CS-TVI	Transportes Aereos Portugueses, SA	Landing	RI	Minor	Fatal	2	WACAF

RASG-AFI List of Occurrences in 2013 – 2023 (Cont'd)

Local Date	State of Occurrence	Manufacturer	Model	Aircraft registration	Operator	Flight phase	Occurrence Category	Aircraft damage	Injury level	Fatalities	Region
25-Sep-2022	Somalia	FOKKER	50	5Y-FAI	Freedom Airline	Taxi	RAMP; GCOL	Substantial	None	0	ESAF
03-Nov-2022	Congo	LET	L410	9S-GPK	Goma Express	Enroute	LOC-I	Destroyed	Fatal	3	WACAF
06-Nov-2022	United Republic of Tanzania	ATR	ATR42	5H-PWF	Precision Air	Approach	CFIT	Destroyed	Fatal	19	ESAF
29-Jan-2023	Democratic Republic of the Congo	AIRBUS A320-200	A320-200	9S-ABM	FlyCAA	Initial Climb	ADRM	Substantial	None	0	WACAF
02-Mar-2023	Seychelles	AIRBUS A330-900	A330-900	D-ANRA	Condor	En-Route	TURB	None	Serious	0	ESAF
11-Jul-2023	Somalia	EMBRAER 120RT	120RT	6O-AAD	Halla Airline	Landing	LOC-G	Destroyed	Minor	0	ESAF
28-Nov-2023	U.R. of Tanzania	Embraer	EMB-120ER	5H-MUH	Unity Air Zanzibar	Landing	ADRM	Substantial	None	0	ESAF

➤ The Regional Aviation Safety Plan for Africa-Indian Ocean (AFI-RASP) which was approved by the Ninth Meeting of the RASG-AFI in November 2023, has identified the following nine occurrences, in no particular order of priority, as the RASG-AFI high-risk categories of occurrences (**R-HRCs**) under the context of the number of fatalities and risk of fatalities associated with such events:

- Controlled Flight into Terrain (CFIT);
- Loss of Control In-Flight (LOC-I);
- Mid-Air Collision (MAC);
- Runway Excursion (RE);
- Runway Incursion (RI);

(These five HRCs are also G-HRCs)

Regional Operational Safety Risks (Cont'd.)

- System/Component Failure/Malfunction – Non-Powerplant (SCF-NP);
- Bird Strikes and Wildlife Hazard;
- Dust Haze; and
- Large Height Deviation (LHD).

(These four HRCs are specific to the RASG-AFI Region)

Focus on CFIT Occurrences

- Although two (2) CFIT-related accidents have been reported during the period 2013-2023 for the RASG-AFI Region, CFIT continues to be a High Risk Category of occurrence both globally (GASP, G-HRC) and regionally (AFI-RASP, R-HRC) thus, no room for complacency.

CFIT Avoidance: What can we do?

Controlled Flight Into Terrain (CFIT) accidents continue to occur in both general and commercial aviation despite enhanced technologies available in the cockpit.

Pilots and Operators: What can we do to help prevent these types of accidents?

CFIT Avoidance: What can we do?



CFIT Statistics

What are the top 10 leading causes of fatal general aviation (GA) accidents (2001-2013)?

1. Loss of Control Inflight
- 2. Controlled Flight Into Terrain**
3. System Component Failure – Powerplant
4. Fuel Related
5. Unknown or Undetermined
6. System Component Failure – Non-Powerplant
7. Unintended Flight in IMC
8. Midair Collisions
9. Low Altitude Operations
10. No Code

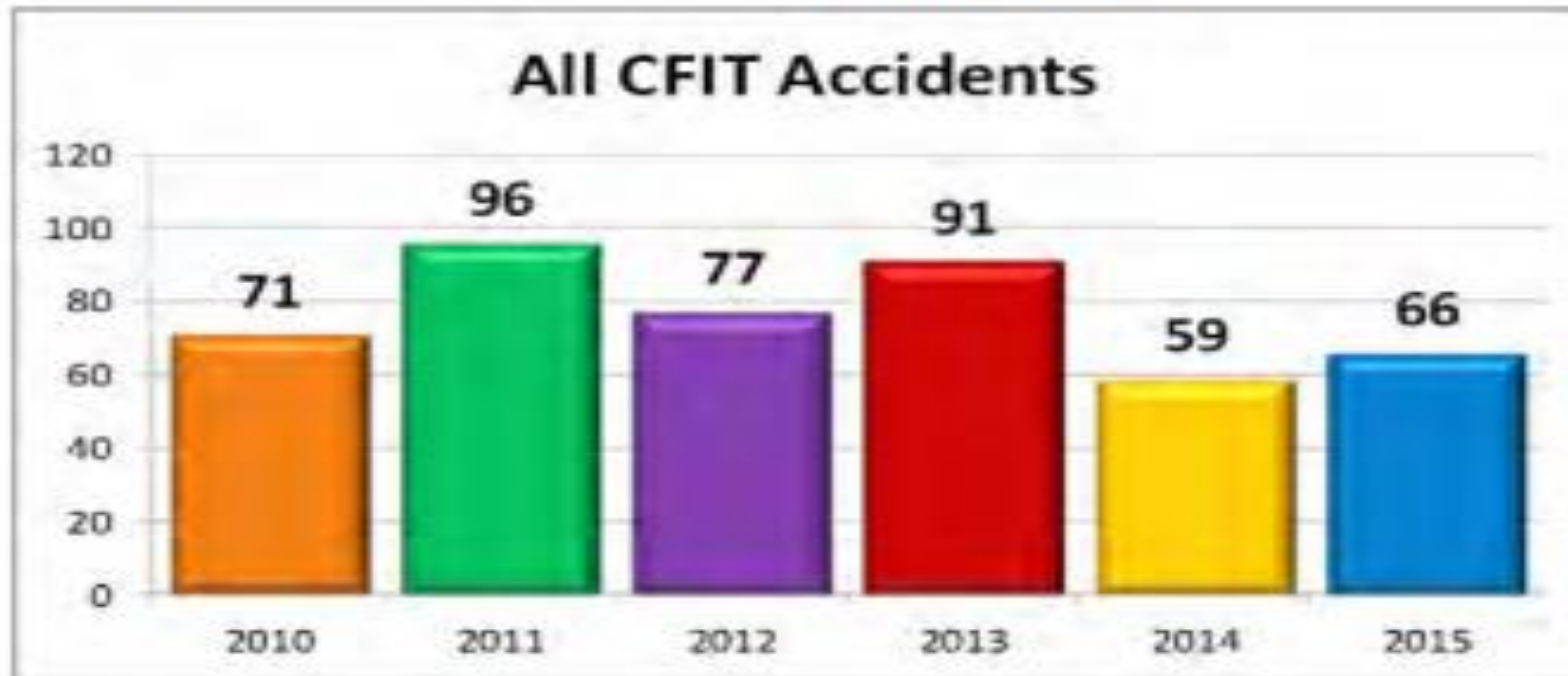


CFIT Avoidance: What can we do?

CFIT Accidents: How frequent are they?

Over 460 CFIT accidents have occurred since 2010 (see chart below), with the greatest number taking place in 2011. Of those, 94 happened outside of the United States. Below are the states which had the great number of accidents during the period from 2010 to 2015:

- | | |
|--------------------|----------------------|
| 1. California (33) | 5. Colorado (14) |
| 2. Alaska (26) | 6. Florida (14) |
| 3. Arizona (18) | 7. New York (13) |
| 4. Texas (17) | 8. Pennsylvania (13) |



What strategies can help prevent CFIT?

Safety is paramount. There are several strategies both before, during and after flight that can help to increase safety and prevent a CFIT event.

Before flight:

- Utilize available sources of training and simulators and continue flying to maintain proficiency with equipment and in decision-making.
- Obtain a complete and accurate weather briefing.

During flight:

- Know your equipment and honestly assess proper use.
- Recognize when to turn around and do so before you feel uneasy.
- Do not let fear of FAA enforcement override making safe decisions in an emergency.

After flight:

- Reflect on the experience -- is there something you wish you had done or could do now?
- Obtain training to maintain proficiency or improve skill with using the equipment.
- Provide feedback to the FAA if you have feedback.

CFIT Avoidance: What can we do?



— In what phase of flight do CFIT accidents usually occur?

According to the FAA's CFIT, Education and Training Aid, about 25 percent of all accidents occur during the takeoff and initial climb segment of flight.

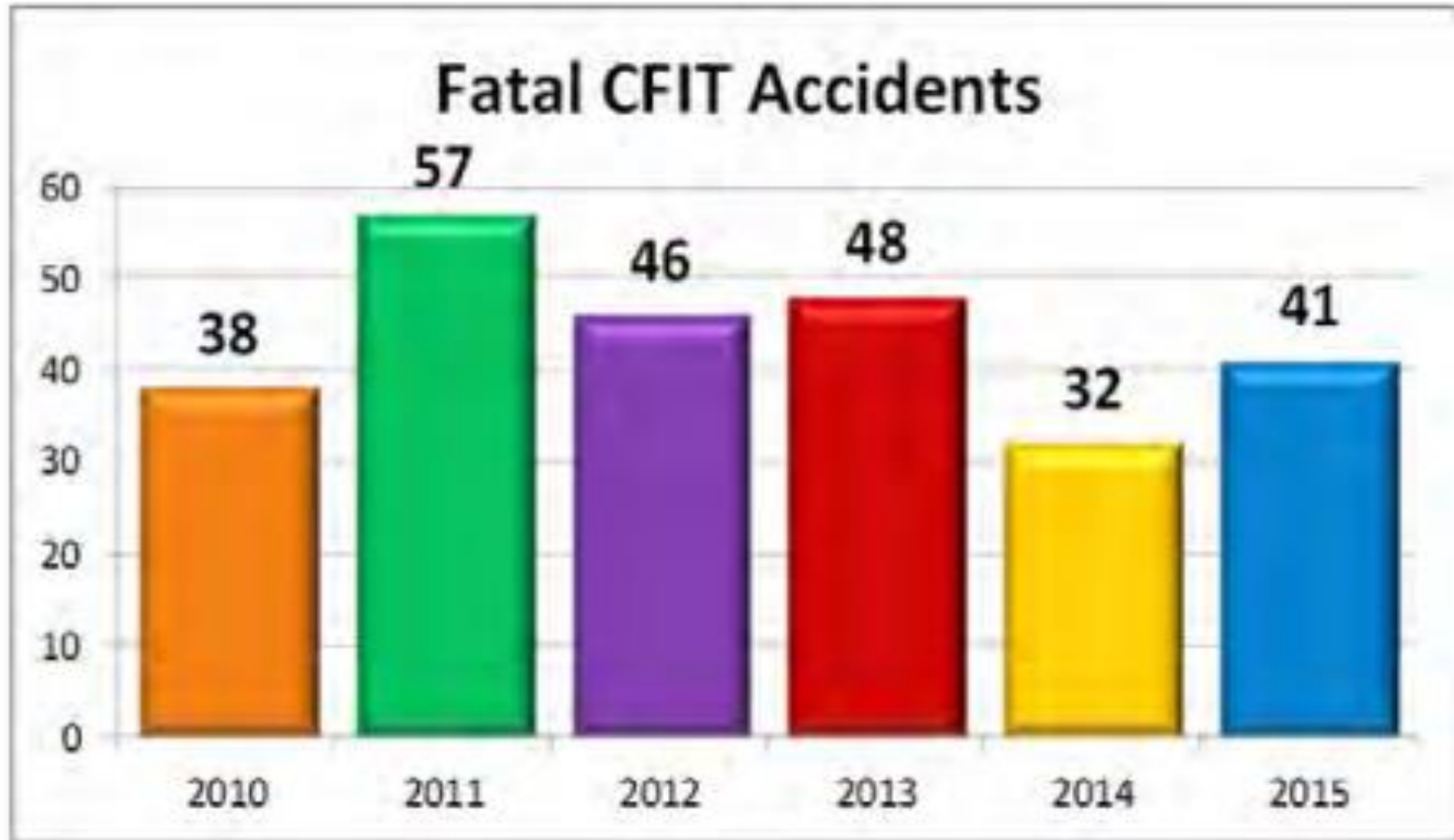
Approximately 7 percent of the accidents occur during the climb portion, while only about 4.5 percent happen during cruise. **Approximately 19.5 percent occur during descent and initial approach, and 41.4 occur during final approach and landing.**

In other words, although takeoff, initial climb, final approach, and landing represent only about 6 percent of the total flight time of a given flight, that 6 percent can be deadly.

How many CFIT accidents are fatal?

CFIT normally occurs at cruise or maneuvering speed, with the result that many such accidents are fatal. Of the 460 CFIT accidents during the period from 2010 to 2015, over 57% of them (262 accidents) were fatal (see chart below). Fatalities peaked in 2011, with 57 deaths reported. Ten or more fatalities occurred in three states: California, Alaska, and Arizona.

CFIT Avoidance: What can we do?



What equipment can help prevent CFIT?

Ground proximity warning systems and the newer terrain awareness and warning systems using GPS have the potential to reduce CFIT accidents on takeoffs and landings. These systems provide one more tool for pilots to use to increase their safety margin when operating close to terrain and obstacles. However, every pilot must know the limitations of his or her database and what objects are included in the database.

CFIT Avoidance: What can we do?

It might be difficult to believe, but, the Controlled Flight Into Terrain has been, for many years around the 90s, the leading cause of aircraft crashes. How is it possible that a fully certified pilot flies a serviceable plane into the ground? The main reason is the loss of situational awareness. Most of the CFIT accidents has been caused by pilots that didn't know where they were, so it is imperative that you know where you are at all time especially when you are below the top of the mountains and you cannot see outside. In the 1970s the Terrain Avoidance Warning System was introduced, followed by the Enhance Ground Proximity Warning System.

CFIT Avoidance: What can we do?

These systems combined with the improved Pilots and Air Traffic Control procedure reduced drastically the CFIT accidents. The EGPWS terrain warning gives you 20 to 30 seconds of protection before the impact, so you need to react quickly. If you hear the EGPWS warning "terrain terrain pull up" there is no discussion, apply full thrust pitch up and get out of the terrain, climb to the Minimum Sector Altitude and then figure out where you are. **The CFIT threat can be easily managed if you keep your situational awareness high.**

Safety Enhancement Initiatives (SEIs) for Mitigating risks associated with CFIT

- *Safety Enhancement Initiative CFIT 1 (SEI-1): Ground Proximity Warning Systems (GPWS) With Forward Looking Terrain Avoidance Function.*

This safety enhancement substantially reduces or eliminates CFIT accidents by improving pilot situational awareness through the installation and use of Ground Proximity Warning Systems (GPWS) with a forward-looking feature (also known as TAWS or EGPWS).

- 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.
- 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.

SEI-1: GPWS (Cont'd.)

- However, the accuracy of the TAWs equipment is greatly reduced in aircraft that are not equipped with Global Positioning System (GPS), especially in areas with limited Navaid coverage. In order to mitigate this situation, Advisory Circular was issued on modification of TAWS equipment to include GPS input or the development of Standard Operating procedures (SOPs) to deal with map shifts. In addition, information was provided to ensure that databases are maintained current.
- States were urged 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.

- **87%** of the accidents showed the flight crew did not execute a go-around when that could be more appropriate. Crew were not aggressive in responding to Ground Proximity Warning System (GPWS) warnings in low altitude go-around situation (**Whoop! Whoop! Pull-up!**).
- Standard Operating Procedures (SOPs) should contain appropriate information regarding these situations and those procedures should be followed.

Recommendation on SEI-1:

Modification of TAWS equipment to include GPS input or the development of SOPs to deal with map shifts. In addition, information should be provided to ensure that databases are maintained current. An Advisory Bulletin should be issued by States to highlight the need to ensure that the serviceability of TAWS equipment, including status of software and data base, is examined when conducting inspections of air operators.

Safety Enhancement Initiative CFIT 2 (SEI-2): Standard Operating Procedures (SOPs).

- All air operators should have Standard Operating Procedures (SOPs) and training which should address all projected normal situations which crew 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.

- **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.

Safety Enhancement Initiative CFIT 3 (SEI-3): Precision-Like Approach Standard Operating Procedures

- 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 that are 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.

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

Recommendation:

➤ *Guidance should be issued 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.*

Safety Enhancement Initiative CFIT 4 (SEI-4): Flight Data Analysis (FDA).

- A Flight Data Analysis Programme (FDAP) 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.

SEI-4: FDAP (Cont'd.)

- 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 (FDAP) 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.

Recommendations:

- *States should establish regulations to be utilized to implement the ICAO requirement on FDAP.*
- *Guidance material should be developed to be utilized to ensure that air operators have implemented an effective Flight Data Analysis programme.*
- *Guidance should be provided to CAA and air operator staff for the implementation of an effective Flight Data Analysis programme.*

Safety Enhancement Initiative CFIT 5 (SEI-5): Crew Resource Management Training.

- 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.

Recommendation:

- *Guidelines should be provided for developing, implementing, reinforcing, and assessing Crew Resource Management (CRM) training programmes for flight crew members and other personnel essential to flight safety. These programmes are designed to become an integral part of training and operations.*

Safety Enhancement Initiative CFIT 6 (SEI-6): CFIT/ALAR Training.

- 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 curricula, stressing position awareness and escape maneuvers in the event of a terrain warning indication.

SEI-6: ALA (Cont'd.)

- Approach and Landing Accidents could also be reduced if flight crew 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.

SEI-6: ALA (Cont'd.)

- Situational awareness is important, as crew can recognize many of the risk factors before an event threatening safety – crew action can be taken to avoid potential approach and landing accidents (ALA).

ALA causal factors include:

- Not being stabilized on approach;
- Not following established procedures;
- Lack of vertical position awareness; and most critically,
- Failure to go around.

SEI-6: ALA (Cont'd.)

- The following parameters constitute a stabilized approach and should be met at 1000ft above touchdown in IMC condition:
 - Aircraft is on the correct flight path;
 - Speed not more than $V_{REF} + 20\text{KIAS}$, and not less than V_{REF} ;
 - Sink rate not more than 1000 feet per minute;
 - Aircraft in proper approach and landing configuration;
 - Power setting is no lower than minimum specified for aircraft type;
 - All briefings and checklists have been performed.

- All these parameters must be met by 500ft including visual approach. The SOPs should include these parameters for a stabilized approach.

- Weather and runway conditions are two areas which can compound the risk during landing. For example, increased risk of short runway, wet and icy runway, wind and obscuration of runway. Make preparations and decisions early!
- Vertical situational awareness is your responsibility as a pilot. GPWS “**PULL-UP! PULL-UP!**” Warning you must be prepared to execute an immediate pull-up.

Recommendation on SEI-6: ALA :

- *States should develop 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 (SEI-7): Minimum Safe Altitude Warning (MSAW).

- 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.

Safety Enhancement Initiative CFIT 8 (SEI-8): Performance-Based Navigation (PBN) Procedures.

- PBN is an international harmonization of navigation requirements and specifications based on the **accuracy/integrity** of the aircraft position. It is based on two main sets of specifications:
 - **RNAV = aRea NAVigation:** Capability to fly any desired flight path – especially on longrange flights – defined by waypoints such as geographic fixes (LAT/LONG) and not necessarily by ground nav aids.

- **RNP = Required Navigation Performance**, which is GNSS based.
- PBN approach procedures is a **key factor for safety enhancement**:
 - Automation of approaches;
 - Lateral navigation;
 - Vertical navigation.

SEI-8: PBN (Cont'd.)

- ICAO controlled flight into terrain (CFIT) studies have shown that runway-aligned approaches (LNAV only) are **25 times safer** than circling approaches, and that once some form of vertical guidance is added to approaches the **safety margin is increased again by a factor of 8**.
- The benefits of PBN include:
 - Enhance Safety;
 - Improve Accessibility;
 - Reduce Fuel Burn Increase Payload;
 - Increase Capacity;
 - Avoid Sensitive Areas.

Recommendation on SEI-8:

- *All RASG-AFI States should implement PBN procedures for all instrument runways by end of 2025.*
- *PBN Implementation – Runways: As at December 2023, **90.37%** of instrument runways were with PBN approaches.*
- *PBN Implementation - State Levels: As at December 2023, **78.72%** of States had PBN approaches on all instrument runways*

ICAO References

- STD A6, Part I, 3.3 & Att. H:
Flight Safety Documents System;
- STD A6, Part I, 3.3, 4.2.2 & App. 2, 2.1.30:
Policy for the use of the ground proximity
warning system (GPWS) ;
- STD A6, Part I, 3.3, 4.2.2 & App. 2, 2.1.34:
Safety Management System (SMS);
- STD A6, Part I, 3.2.3: FDAP.



ICAO References (Cont'd.)

- PANS-OPS Doc 8168, VOL I: SOPs.



CONCLUSIONS:

- Approach and Landing Safety
- Pull up when warned;
- Use SOPs;
- Use the approach briefing plan;
- It's okay to go-around.

CONCLUSIONS (Cont'd.):

Good practices to avoid CFIT accidents are:

- A. Manage Distractions
- B. Seek proficiency training
- C. Give yourself some room
- D. Use Flight Risk Assessment Tools
- E. Fly at least 500 AGL to avoid wires
- F. All of the above



The correct answer is F. All of the above.

Take Away!

- **Safety Enhancement Initiative (SEI):** Mitigate contributing factors to CFIT accidents and incidents.
 1. Implement the following CFIT global safety enhancements:
 - a) Ensure aircraft are equipped with TAWS in accordance with Annex 6;
 - b) Promote the wider use of TAWS beyond the requirements of Annex 6;
 - c) Issue Safety Advisory to increase adherence to TAWS warning procedures;

Take Away!(Cont'd.)

- d) Promote greater awareness of approach risks;
- e) Consider the implementation of Continuous Descent Final Approaches (CDFA);
- f) Consider the implementation of Minimum Safe Altitude Warning (MSAW) systems;
- g) Ensure the timeliness of updates and accuracy of Electronic Terrain and Obstacle Data (eTOD);
- h) Promote the use of GPS-derived position data to feed TAWS;
- i) Implement PBN procedures for all instrument runways by 2025.

Take Away! (Cont'd.)

2. Validate the effectiveness of the global safety enhancements through the analysis of MORs and VORs and accident/incident investigations (apply safety management methodologies).

3. Identify additional contributing factors for example:

- a) Flight in adverse environmental conditions
- b) Approach Design and documentation
- c) Phraseology used (standard vs non-standard)
- d) Pilot fatigue and disorientation.

Take Away! (Cont'd.)

4. Develop and Implement further safety enhancements to mitigate the risk of the identified contributing factors, if any, for CFIT.

5. Conduct continuous evaluation of the performance of the safety enhancements.

6. **Video:** <https://youtu.be/JBxg6hgbAr8>.

7. **GPWS and EGPWS video:** <https://studio.youtube.com/video/peJf>



Thank You!