

# **Belize Department of Civil Aviation**

## **Short Description**

This safety assessment is intended to determine the required RESA lenght at both runway ends for Philip Goldson International Airport (MZBZ) in accordance with BCAR regulation 14.209

BDCA AGA UNIT/ACSA. NOVEMBER 2023

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## SAFETY ASSESSMENT

## DISTANCE REQUIRED FOR RUNWAY END SAFETY AREAS PHILIP GOLDSON INTERNATIONAL AIRPORT (MZBZ)

### 1. ORIGIN OF THIS ANALYSIS

In a review of the regulation BAR 14.109 Runway end safety areas, it is possible to identify a contradiction in the dimensions of the RESA, since in the article BCAR 14.209 (b) it is established that the minimum required dimension is 90 m after the strip. However, BCAR 14.209(c) states that for new aerodromes constructed prior to the enactment of the regulation it must be at least 240 m after the strip for aerodromes with code number 3 or 4.

Through an interview with the personnel who developed the regulation, it has been identified that this discrepancy responds to an error in the wording, since the intended spirit of article BCAR 14.209 (c) was to establish that any new key aerodrome 3 or 4 that was built in the future would adopt the 240 of RESA as a standard.

Regardless of the causes, the truth is that the regulation produces a double requirement for the same matter that makes the minimum required distance unclear. Good regulatory practice requires that in a case like this, the most restrictive regulation be taken as applicable, i.e. 240 m, however, due to the fact that the area and quality of the land beyond the current RESA of 90 m do not allow compliance with 240 m requirement. This safety assessment is prepared to identify if the current distances are sufficient to maintain the level of risk in levels as low as reasonably practicable as indicated at the end of BCAR 14.209(c), which also provides that distances may be less if a safety assessment demonstrates that the distances set forth in item (b) are sufficient.

For clarity, the above-quoted article is transcribed below:

#### BCAR 14.209 Runway end safety areas

(See IEM 14.209(a))

#### General

(a) A runway end safety area shall be provided at each end of a runway strip where:

- (1) the code number is 3 or 4; and
- (2) The code number is 1 or 2 and the runway is an instrument one.

A runway end safety area should be provided at each end of a runway strip where the code number is 1 or 2 and the runway is a non-instrument one.

Appendix 1 to BCAR 14.253 provides guidance on the areas of runway end safety.

#### Dimensions of runway end safety areas

(b) A runway end safety area shall extend from the end of a runway strip to a distance of at least 90 m. If an arresting system is installed, the above length may be reduced, based on the design specification of the system, subject to acceptance by the BDCA.

- (c) For new aerodromes constructed before this regulation is in force a runway end safety area shall, extend from the end of a runway strip to a distance of at least:
  - (1) 240 m where the code number is 3 or 4; Or a reduced length when an arresting system is installed, based on the design specification of the system, subject to acceptance by the BDCA.;
  - (2) 120 m where the code number is 1 or 2 and the runway is an instrument one. Or a reduced length when an arresting system is installed based on the design specification of the system, subject to acceptance by the BDCA.

Unless an operational safety assessment accepted by the BDCA demonstrates that it is safe to use the distances indicated in BCAR 14.209.(a)

(d) The width of a runway end safety area shall be at least twice that of the associated runway.

## 2. CHARACTERIZATION OF THE ANALYSIS

#### 2.1. Runway physical characteristics

Designador RWY NR Designations RWY NR	<b>BRG GEO</b> True BRG	Dimensiones de RWY (M) Dimensions of RWY (M)	Resistencia (PCN) y superficie de RWY y SWY Strength (PCN) and surface of RWY and SWY	Coordenadas THR RWY y coordenadas THR de ondulación geoidal THR coordinates RWY end coordinates THR geoid undulation	Elevación THR y elevación máxima de TDZ de precisión APP RWY THR elevation and highest elevation of TDZ of precision APP RWY
1	2	3	4	5	6
07	077.05º GEO 077.48º MAG	2950 x 45	PCN 61/F/C/W/U Hormigón/ Concrete	173212.8422N 0881905.2488W 	THR 4.51M / 15FT TDZ 4.57M / 15FT
25	257.06º GEO 257.49º MAG	2950 x 45	PCN 61/F/C/W/U Hormigón/ Concrete	173234.3386N 0881727.7567W 	THR 4.16M / 14FT

#### MZBZ AD 2.12 CARACTERÍSTICAS FÍSICAS DE LAS PISTAS RUNWAY PHYSICAL CHARACTERISTICS

Designador RWY NR Designations RWY NR	Pendiente de RWY-SWY Slope of RWY- SWY	Dimensiones SWY SWY dimensions (M)	Dimensiones CWY CWY dimensions (M)	Dimensiones de franja Strip dimensions (M)	Dimensiones RESA RESA dimensions (M)
	7	8	9	10	11
07	+0.01%	NIL	212	3070 x 280	90 x 90
25	+0.01%	NIL	350	3070 x 280	90 x 90

# 2.2. Types and number of operations in the MZBZ 2022-2023

P.S.W.GOLDSON INTERNATIONAL	CIVIL AVIATION
AIRPORT	STATISTICS

### AIRCRAFT MOVEMENT

2022

	JA			APRI						00			ACCRUED
MONTH	Ν	FEB	MARCH	L	MAY	JUNE	JULY	AUG	SEPT	Т	NOV	DEC	TOTAL
1. INTL													
SCHEDULED	855	752	870	839	733	656	742	668	426	456	577	696	8270
2. INTL													
UNSCHEDULED													
INTL TOTAL	855	752	870	839	733	656	742	668	426	456	577	696	8270
3. DOMESTIC	230									144			
MVMT	2	2431	3130	2745	2319	2405	2493	1899	1238	7	2005	2582	26996
	315									190			
TOTAL MVMT	7	3183	4000	3584	3052	3061	3235	2567	1664	3	2582	3278	35266
PRIVATE A/C	60	76	87	79	66	48	51	47	50	44	60	55	723
MILITARY A/C	23	10	15	14	26	9	7	8	8	1	6	4	131
TOTAL P&M A/C													
MVMT	83	86	102	93	92	57	58	55	58	45	66	59	854
											Total		

Movements

36120

2023		P.S.W.GOLDSON INTERNATIONAL CIVIL AVIATION AIRPORT STATISTICS											
AIRCRAFT MOVEMENT													
MONTH	JA N	FEB	MARC H	APRIL	MAY	JUNE	JULY	AUG	SEPT	OC T	NOV	DE C	ACCRUE D TOTAL
1. INTL SCHEDULED	771	732	872	751	632	683							4441
2. INTL UNSCHEDUL ED													
INTL TOTAL	771	732	872	751	632	683	0	0	0	0	0	0	4441
3. DOMESTIC MVMT	319 5	3051	2892	2574	2071	1952							15735
	396												
TOTAL MVMT	6	3783	3764	3325	2703	2635	0	0	0	0	0	0	20176
PRIVATE A/C	75	72	95	82	49	53							35911
MILITARY A/C	7	15	7	7	6	4							56087
TOTAL A/C MVMT	853	819	974	840	687	740	0	0	0	0	0	0	96439
											Total Movements		116615

### 2.3. International Operations MZBZ

Philip S W Goldson Intl served 21 international destinations in 2023. The most flow international destination is LA AURORA in Belize with 730 flights per year.

14 airlines operate regularly out of Philip S W Goldson Intl. The first airline is MAYA ISLAND from Belize with 17530 departures per year.





### International Destinations MZBZ

#### 2.4. Runway and PBN approach procedures

Philip S W Goldson Intl has 1 runway with a total of 2 runway ends with instrument approach procedures.



100% of the instrument runway ends have performance based navigation (PBN) approach procedures published.



# PBN Implementation

100% of the instrument runway ends have performance-based navigation (PBN) approach procedures published.

	Landing	Conventior	al	Conventional					SIDs		STARs	
Runway	Distance Available (m)	Non- Precision	Precision	LNAV	LNAV/VNAV	LPV	RNP/AR	UNK	Conv.	RNAV	Conv.	RNAV
25	2950	x		x	x				x			x
7	2950		x	x	x				x			x

The approach, arrival and departure procedures available on each runway end are listed below. Non-instrument runways are marked in italic, if any.

## 2.5. Capacity and Usage

Philip S W Goldson Intl has an average of 315 daily movements. The peak period is between 10:00 and 13:00 local time and counts in average 101 +- 38 movements in 3 hours. Based on the runway layout of Philip S W Goldson Intl, the total estimated maximum throughput capacity (MTC) in every 3-hour period is approximately 120, based on a theoretical hourly MTC per parallel runway of 40 movements per hour.

At peak period, Philip S W Goldson Intl is running approximately at 83.91% of its capacity. The on-time departure performance drops to 98.71% between 10:00 and 13:00.



### 2.6. Terrain Challenge

Philip S W Goldson Intl is located at 4m ASL (above sea level). 0% of the terrain surrounding the airport in 20NM is higher than 300 m above the airport height.





# 2.7. Meteorological conditions 2.7.1. Average

Philip S W Goldson Intl is 96.23% of the time per year in visual meteorological conditions (VMC) and 3.77% in instrument meteorological conditions (IMC). IMC conditions exist when the outside view from an aircraft is restricted in such a way that aircraft control and navigation can only be carried out using special flight instruments. The airport has a new primary and secondary radar system that allows surveillance-based air traffic control procedures which are implemented by the ATS service provider.



Average Meterological Conditions

#### 2.7.2. Wind Conditions

The diagram shows the frequency of prevailing winds at Philip S W Goldson Intl airport from each directions per month in relation to instrument landing runways. Wind directions are in True North and the magnetic runway direction are compensated for -1.17126 magnetic declination at Philip S W Goldson Intl airport to be true in reference to wind directions. Philip S W Goldson Intl airport has a 90.7% chance for prevailing wind conditions.

The lines indicate approach paths to the airport in the center.Only instrument approaches are shown.The colors inducate the level of service provided(see runways and PBN section for more details).



#### 2.7.3. Tailwind landings





#### 3. ACCIDENTS AND INCIDENTS

#### 3.1. Overruns and undershoots occurred

- 1- According to the AIG unit of Belize there are no records of overruns or undershoots at the MZBZ
- 2- According to the Aviation Safety Network there are no occurrences of accidents or incidents at the MZBZ since 1962
- 3- No accidents or mayor incidents has been reported at MZBZ in the las 10 years records in the ICAO accidents portal.

# AVIATION **SAFETY** NETWORK

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Belize City-Philip S.W. Goldson International Airport profile

#### General data

Belize City-Philip S.W. Goldson International Airport
Belize
IATA code: BZE
ICAO code:MZBZ
Elevation: 15 feet / 5 m

Aircraft accidents at or near Belize City-Philip S.W. Goldson International Airport (BZE)

no occurrences in the database

Aircraft that departed Belize City-Philip S.W. Goldson International Airport

date	type	registration	operator	fat.	location		pic	<u>cat</u>
18-NOV-2005	BN-2A-21 Islander	V3-HFO	Blancaneaux Lodge	3	near Privacion Airstrip	0	Ō	A1
27-DEC-2002	Cessna 208B Grand Caravan	V3-HGH	Tropic Air	0	near San Pedro Airpor	0		A2
24-MAY-1988	Boeing 737-3T0	N75356	TACA	0	near New Orleans Inte		Ō	12
<u>06-JAN-1962</u>	Curtiss C-46A	HR-TNB	TAN	1	Belize City-Phil	0		A1



## 4. AIRPORT BRIEFING SUMMARY

### PHYSICAL CHARACTERISTICS

Subject	Characteristics
RWY 07 TORA	2,950m
RWY 25 TORA	2,950m
RWY 07 LDA	2,950m
RWY 25 LDA	2,950m
RWY 07 ASDA	2,950m
RWY 25 ASDA	2,950m
RESA 07	90 x 90 m
RESA 25	90 x 90 m

### Departures

Туре	Quantity	A/C Reference code
International 2022	8,270	4C
Domestic 2022	26,996	1A
International 2023	7,960	4C
Domestic 2023	25,123	1A

#### **Meteorological conditions**

The analysis of the data shows that 96.23% of the operations can be carried out with VFR procedures and that 3.77% of the operations can be carried out with IFR procedures. Likewise, the MZBZ does not present significant crosswind conditions during any month of the year and only 6.25% of the operations were carried out with tailwinds of less than 3 knots.

### Terrain challenge

Negligible. There are no obstacles within a 20 NM radius of more than 300 feet. There are no obstacles on any of the approaches and clearways are declared on both sides of the runway.

#### Overruns or undershoots.

There are no reports of these occurrences in the last 40 years.

### 5. THEATS

According to the information obtained for the MZBZ, this airport has optimal location conditions, it does not have traffic congestion conditions and its meteorological conditions can be considered optimal in terms of wind direction, runway drainage and visibility.

## 6. SAFETY ASSESSMENT

Three safety assessments were carried out related to landing and takeoff operations in both directions.

Two safety events are identified as possible main causes of specific top events with overruns beyond 90 m of the LDA and the ASDA, depending on whether the operation is landing or takeoff.

- Contaminated Runway; or
- Aircraft failure

The proactive defenses to avoid the inability to brake in the LDA in case of landing or in the ASDA in case of aborted takeoff are many, all of which are strong defenses since they are fully implemented.

These proactive defenses involve different areas of air navigation: Operations, Airworthiness, Air Navigation Services, NAVAIDS electronic equipment, primary and secondary radar control that allows surveillance approach control procedures, redundant braking systems, permanent meteorological information, conditions of adequate macrotexture and microtexture runway and friction coefficient measurements on a continuous basis and good runway drainage conditions.

On the other hand, even if any of the top events occurred, there are reactive barriers implemented that could recover control of the top event or mitigate the probability of the consequences of the aircraft exceeding the 90 m length of the RESA on an overrun or suffering excessive damage.

### 6.1. Other mitigating factors

### 6.1.1. Runway length.

As can be seen in the traffic statistics, only 23% of traffic requires runway T-O lengths (TOR) of more than 2,200 m. The rest of the traffic is conformed of aircraft, mostly Cessna 208, which in standard atmosphere conditions at 15 m above sea level and 32° C temperature, standard flaps, does not exceed 800 m TOR Therefore this traffic does not require RESA to avoid an overrun.

### 6.1.2. Terrain Challenge.

Philip S W Goldson Intl is located at 4m ASL (above sea level). 0% of the terrain surrounding the airport in 20NM is higher than 300 m above the airport height.

### 6.1.3. Visibility

Philip S W Goldson Intl is 96.23% of the time per year in visual meteorological conditions (VMC) and 3.77% in instrument meteorological conditions (IMC).

#### 6.1.4. Wind Direction

Philip S W Goldson Intl airport to be true in reference to wind directions. Philip S W Goldson Intl airport has a 90.7% chance for prevailing wind conditions.

## 6.1.5. Tailwinds landings

Only 6.25% of operations with tailwind between 0-3 Kts

### 6.1.6. Overrun Statistics

Any Overrun occurrence where found in the PGIA in the last 60 years. As matter of fact the likelihood in terms of probability is negligible.

## 7. RISK LEVELS

#### Landing operation 07 and 25

- For the event of inability to brake in the LDA in both runways considering the strength and quantity of redundances and the likelihood of occurrence: both Inherent and residual risk: B1
- For the consequence Overrrun beyond 150 m from de LDA: B1
- For the consequence Damage to Aircraft C1

#### Take-off operation 07 and 25

- For the event of inability to brake in the ASDA in both runways considering the strength quantity of redundances and the likelihood of occurrence: both Inherent and residual risk: B1
- For the consequence Overrrun beyond 150 m from de LDA: B1
- For the consequence Damage to Aircraft C1

### 8. Conclusion

Taking into account what is indicated in article BCAR 14,209 in relation to the Dimensions of the Runway end safety area point (c), last paragraph, after analyzing the threats, mitigating factors, and risk levels found in a safety assessment, this report concludes that 90x90 m RESAS at both ends of the runway are sufficient and that it is not necessary to implement 240 m RESAS at the MZBZ.

# **ANNEX 1**

# BOW TIE RISK ASSESSMENT REPORT

# BowTie Report

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Actions overview	
All actions	
Open actions	iError! Marcador no definido.
Completed actions	iError! Marcador no definido.
Activity overview	iError! Marcador no definido.
Activity list	iError! Marcador no definido.
Activity summaries	iError! Marcador no definido.
Job titles	47
Document links	
Systems	iError! Marcador no definido.
Hazard register	iError! Marcador no definido.

# Barrier register

Barrier	Barrier type	Effective ness	Criticalit y	Account able	Description
OPS SOP					
(Haz.) Landing operation RWY 07 PGIA / Inhability to stop de aircratf in the Landing Distance Available / (S.E) Contaminated Runway / (Br.) OPS SOP	ST Socio technica I	++ Very Good	High Critical	AOC7 Pilot	Standard operation procedures in place
(Haz.) Landing operation RWY 07 PGIA / Inhability to stop de aircratf in the Landing Distance Available / (S.E) Equipment failure / (Br.) OPS SOP	ST Socio technica I	++ Very Good	High Critical	AOC7 Pilot	Standard operation procedures in place
(Haz.) Landing operation RWY 25 PGIA / Inhability to stop de aircratf in the Landing Distance Available / (S.E) Contaminated Runway / (Br.) OPS SOP	ST Socio technica I	++ Very Good	High Critical	AOC7 Pilot	Standard operation procedures in place
(Haz.) Landing operation RWY 25 PGIA / Inhability to stop de aircratf in the Landing Distance Available / (S.E) Equipment failure / (Br.) OPS SOP	ST Socio technica I	++ Very Good	High Critical	AOC7 Pilot	Standard operation procedures in place
(Haz.) Take off Operations at PGIA 07 and 25 / Inhability to stop an aborted takeoff in the	ST Socio technica I	++ Very Good	High Critical	AOC7 Pilot	Emergency operation procedures in place

Barrier	Barrier type	Effective ness	Criticalit y	Account able	Description
ASDA / (S.E) Contaminated Runway / (Br.) OPS SOP					
(Haz.) Take off Operations at	ST Socio	++ Very	High	AOC7	Emergency operation
PGIA 07 and 25 / Inhability to	technica	Good	Critical	Pilot	procedures in place
stop an aborted takeoff in the	1				
ASDA / (S.E) Equipment failure					
/ (Br.) OPS SOP					
BRAKING Antiskid System					
(Haz.) Landing operation RWY	A-HW	++ Very	Std	ADR2	A system to mitigate skid
07 PGIA / Inhability to stop de	Active	Good	Standar	Mainten	improoving rolling resistance
aircratf in the Landing	hardwar		d	ance	
Distance Available / (S.E)	е			staff	
Contaminated Runway / (Br.)					
BRAKING Antiskid System					
(Haz.) Landing operation RWY	A-HW	++ Very	Std	ADR2	A system to mitigate skid
25 PGIA / Inhability to stop de	Active	Good	Standar	Mainten	improoving rolling resistance
aircratf in the Landing	hardwar		d	ance	
Distance Available / (S.E)	е			staff	
Contaminated Runway / (Br.)					
BRAKING Antiskid System					
(Haz.) Take off Operations at	A-HW	++ Very	Std	ADR2	A system to mitigate skid
PGIA 07 and 25 / Inhability to	Active	Good	Standar	Mainten	improoving rolling resistance
stop an aborted takeoff in the	hardwar		d	ance	
ASDA / (S.E) Contaminated	е			staff	
Runway / (Br.) BRAKING					
Antiskid System					
(Haz.) Take off Operations at	A-HW	++ Very	Std	ADR2	A system to mitigate skid
PGIA 07 and 25 / Inhability to	Active	Good	Standar	Mainten	improoving rolling resistance
stop an aborted takeoff in the	hardwar		d	ance	
ASDA / (S.E) Equipment failure	е			staff	

Barrier	Barrier type	Effective ness	Criticalit y	Account able	Description
/ (Br.) BRAKING Antiskid System					
(Haz.) Landing operation RWY 25 PGIA / Inhability to stop de aircratf in the Landing Distance Available / (S.E) Equipment failure / (Br.) BRAKING Antiskid System	A-HW Active hardwar e	++ Very Good	Std Standar d	ADR2 Mainten ance staff	A system to mitigate skid improoving rolling resistance
<ul> <li>(Haz.) Landing operation RWY</li> <li>07 PGIA / Inhability to stop de aircratf in the Landing</li> <li>Distance Available / (S.E)</li> <li>Equipment failure / (Br.)</li> <li>BRAKING Antiskid System</li> <li>Braking systems: 2 main, 1 eme</li> </ul>	A-HW Active hardwar e	++ Very Good	Std Standar d	ADR2 Mainten ance staff	A system to mitigate skid improoving rolling resistance
(Haz.) Landing operation RWY 07 PGIA / Inhability to stop de aircratf in the Landing Distance Available / (S.E) Contaminated Runway / (Br.) Braking systems: 2 main, 1 emergency	A-HW Active hardwar e	++ Very Good	High Critical	ADR2 Mainten ance staff	
(Haz.) Landing operation RWY 25 PGIA / Inhability to stop de aircratf in the Landing Distance Available / (S.E) Contaminated Runway / (Br.) Braking systems: 2 main, 1 emergency	A-HW Active hardwar e	++ Very Good	High Critical	ADR2 Mainten ance staff	
(Haz.) Take off Operations at PGIA 07 and 25 / Inhability to	A-HW Active	++ Very Good	High Critical	ADR2 Mainten	

Barrier	Barrier type	Effective ness	Criticalit y	Account able	Description
stop an aborted takeoff in the ASDA / (S.E) Contaminated	hardwar e			ance staff	
Runway / (Br.) Braking systems: 2 main, 1 emergency					
(Haz.) Take off Operations at PGIA 07 and 25 / Inhability to	A-HW Active	++ Very Good	High Critical	ADR2 Mainten	
stop an aborted takeoff in the ASDA / (S.E) Equipment failure / (Br.) Braking systems: 2 main, 1 emergency	hardwar	Cood	ontical	ance staff	
(Haz.) Landing operation RWY 25 PGIA / Inhability to stop de aircratf in the Landing	A-HW Active hardwar	++ Very Good	High Critical	ADR2 Mainten ance	
Distance Available / (S.E) Equipment failure / (Br.) Braking systems: 2 main, 1 emergency	e			staff	
(Haz.) Landing operation RWY 07 PGIA / Inhability to stop de aircratf in the Landing Distance Available / (S.E) Equipment failure / (Br.) Braking systems: 2 main, 1 emergency	A-HW Active hardwar e	++ Very Good	High Critical	ADR2 Mainten ance staff	
BRAKING Spoilers speed brake	S				
(Haz.) Landing operation RWY 07 PGIA / Inhability to stop de aircratf in the Landing Distance Available / (S.E) Contaminated Runway / (Br.)	A-HW Active hardwar e	++ Very Good	Std Standar d	AOC7 Pilot	

Barrier	Barrier type	Effective ness	Criticalit y	Account able	Description
BRAKING Spoilers speed brakes					
(Haz.) Landing operation RWY 25 PGIA / Inhability to stop de aircratf in the Landing Distance Available / (S.E) Contaminated Runway / (Br.) BRAKING Spoilers speed brakes	A-HW Active hardwar e	++ Very Good	Std Standar d	AOC7 Pilot	
(Haz.) Take off Operations at PGIA 07 and 25 / Inhability to stop an aborted takeoff in the ASDA / (S.E) Contaminated Runway / (Br.) BRAKING Spoilers speed brakes	A-HW Active hardwar e	++ Very Good	Std Standar d	AOC7 Pilot	
(Haz.) Take off Operations at PGIA 07 and 25 / Inhability to stop an aborted takeoff in the ASDA / (S.E) Equipment failure / (Br.) BRAKING Spoilers speed brakes	A-HW Active hardwar e	++ Very Good	Std Standar d	AOC7 Pilot	
(Haz.) Landing operation RWY 25 PGIA / Inhability to stop de aircratf in the Landing Distance Available / (S.E) Equipment failure / (Br.) BRAKING Spoilers speed brakes	A-HW Active hardwar e	++ Very Good	Std Standar d	AOC7 Pilot	
(Haz.) Landing operation RWY 07 PGIA / Inhability to stop de aircratf in the Landing	A-HW Active	++ Very Good	Std Standar d	AOC7 Pilot	

Barrier	Barrier type	Effective ness	Criticalit y	Account able	Description
Distance Available / (S.E)	hardwar				
Equipment failure / (Br.)	е				
BRAKING Spoilers speed					
brakes					
BRAKING Engine reverse					
(Haz.) Landing operation RWY	A-HW	++ Very	High	AOC7	
07 PGIA / Inhability to stop de	Active	Good	Critical	Pilot	
aircratf in the Landing	hardwar				
Distance Available / (S.E)	е				
Contaminated Runway / (Br.)					
BRAKING Engine reverse					
(Haz.) Landing operation RWY	A-HW	++ Very	High	AOC7	
25 PGIA / Inhability to stop de	Active	Good	Critical	Pilot	
aircratf in the Landing	hardwar				
Distance Available / (S.E)	е				
Contaminated Runway / (Br.)					
BRAKING Engine reverse					
(Haz.) Take off Operations at	A-HW	++ Very	High	AOC7	
PGIA 07 and 25 / Inhability to	Active	Good	Critical	Pilot	
stop an aborted takeoff in the	hardwar				
ASDA / (S.E) Contaminated	е				
Runway / (Br.) BRAKING					
Engine reverse					
(Haz.) Take off Operations at	A-HW	++ Very	High	AOC7	
PGIA 07 and 25 / Inhability to	Active	Good	Critical	Pilot	
stop an aborted takeoff in the	hardwar				
ASDA / (S.E) Equipment failure	е				
/ (Br.) BRAKING Engine					
reverse					
(Haz.) Landing operation RWY	A-HW	++ Very	High	AOC7	
25 PGIA / Inhability to stop de	Active	Good	Critical	Pilot	

Barrier	Barrier type	Effective ness	Criticalit y	Account able	Description
aircratf in the Landing Distance Available / (S.E) Equipment failure / (Br.) BRAKING Engine reverse	hardwar e				
(Haz.) Landing operation RWY 07 PGIA / Inhability to stop de aircratf in the Landing Distance Available / (S.E) Equipment failure / (Br.) BRAKING Engine reverse	A-HW Active hardwar e	++ Very Good	High Critical	AOC7 Pilot	
Visual Aids. (Haz.) Landing operation RWY 07 PGIA / Inhability to stop de aircratf in the Landing Distance Available / (S.E) Contaminated Runway / (Br.)	C-HW Continu ous hardwar e	+ Good	Std Standar d	ADR2 Mainten ance staff	Runway Markings (THR, TDZ, RWYcentreline, RWY edge stripes, PAPI lights,RWY edge lights, RWY end lights)
Visual Aids. (Haz.) Landing operation RWY 07 PGIA / Inhability to stop de aircratf in the Landing Distance Available / (S.E) Equipment failure / (Br.) Visual Aids.	C-HW Continu ous hardwar e	+ Good	Std Standar d	ADR2 Mainten ance staff	Runway Markings (THR, TDZ, RWYcentreline, RWY edge stripes, PAPI lights, RWY edge lights, RWY end lights)
(Haz.) Landing operation RWY 25 PGIA / Inhability to stop de aircratf in the Landing Distance Available / (S.E) Contaminated Runway / (Br.) Visual Aids.	C-HW Continu ous hardwar e	+ Good	Std Standar d	ADR2 Mainten ance staff	Runway Markings (THR, TDZ, RWYcentreline, RWY edge stripes, PAPI lights, RWY edge lights, RWY end lights)

Barrier	Barrier type	Effective ness	Criticalit y	Account able	Description
(Haz.) Landing operation RWY 25 PGIA / Inhability to stop de aircratf in the Landing Distance Available / (S.E) Equipment failure / (Br.) Visual Aids.	C-HW Continu ous hardwar	+ Good	Std Standar d	ADR2 Mainten ance staff	Runway Markings (THR, TDZ, RWYcentreline, RWY edge stripes, PAPI lights, RWY edge lights, RWY end lights)
(Haz.) Take off Operations at PGIA 07 and 25 / Inhability to stop an aborted takeoff in the ASDA / (S.E) Contaminated Runway / (Br.) Visual Aids.	C-HW Continu ous hardwar e	+ Good	Std Standar d	ADR2 Mainten ance staff	Runway Markings ( RWY edge lights, RWY end lights)
(Haz.) Take off Operations at PGIA 07 and 25 / Inhability to stop an aborted takeoff in the ASDA / (S.E) Equipment failure / (Br.) Visual Aids.	C-HW Continu ous hardwar e	+ Good	Std Standar d	ADR2 Mainten ance staff	Runway Markings (RWY edge lights, RWY end lights)
Pilot monitoring an resolution					
(Haz.) Landing operation RWY 07 PGIA / Inhability to stop de aircratf in the Landing Distance Available / (Cons.) Overrrun beyond 150 m from the LDA / (Br.) Pilot monitoring an resolution	BEH Behavio ural	? Unasses sed	Std Standar d	AOC7 Pilot	
(Haz.) Landing operation RWY 07 PGIA / Inhability to stop de aircratf in the Landing Distance Available / (Cons.) Damage to the aircraft / (Br.) Pilot monitoring an resolution	BEH Behavio ural	? Unasses sed	Std Standar d	AOC7 Pilot	

Barrier	Barrier type	Effective ness	Criticalit y	Account able	Description
<ul> <li>(Haz.) Landing operation RWY</li> <li>25 PGIA / Inhability to stop de aircratf in the Landing</li> <li>Distance Available / (Cons.)</li> <li>Overrrun beyond 150 m from the LDA / (Br.) Pilot monitoring an resolution</li> </ul>	BEH Behavio ural	? Unasses sed	Std Standar d	AOC7 Pilot	
(Haz.) Landing operation RWY 25 PGIA / Inhability to stop de aircratf in the Landing Distance Available / (Cons.) Damage to the aircraft / (Br.) Pilot monitoring an resolution	BEH Behavio ural	? Unasses sed	Std Standar d	AOC7 Pilot	
(Haz.) Take off Operations at PGIA 07 and 25 / Inhability to stop an aborted takeoff in the ASDA / (Cons.) Overrrun beyond 150 m from the LDA / (Br.) Pilot monitoring an resolution	BEH Behavio ural	? Unasses sed	Std Standar d	AOC7 Pilot	
(Haz.) Take off Operations at PGIA 07 and 25 / Inhability to stop an aborted takeoff in the ASDA / (Cons.) Damage to the aircraft / (Br.) Pilot monitoring an resolution	BEH Behavio ural	? Unasses sed	Std Standar d	AOC7 Pilot	
Runway Strip (Haz.) Landing operation RWY 07 PGIA / Inhability to stop de aircratf in the Landing Distance Available / (Cons.)	C-HW Continu ous	+ Good	High Critical	AOC1 Operator	

Barrier	Barrier type	Effective ness	Criticalit y	Account able	Description
Overrrun beyond 150 m from	hardwar				
the LDA / (Br.) Runway Strip	е				
(Haz.) Landing operation RWY	C-HW	+ Good	High	AOC1	
07 PGIA / Inhability to stop de	Continu		Critical	Operator	
aircratf in the Landing	ous				
Distance Available / (Cons.)	hardwar				
Damage to the aircraft / (Br.)	е				
Runway Strip					
(Haz.) Landing operation RWY	C-HW	+ Good	High	AOC1	
25 PGIA / Inhability to stop de	Continu		Critical	Operator	
aircratf in the Landing	ous				
Distance Available / (Cons.)	hardwar				
Overrrun beyond 150 m from	е				
the LDA / (Br.) Runway Strip					
(Haz.) Landing operation RWY	C-HW	+ Good	High	AOC1	
25 PGIA / Inhability to stop de	Continu		Critical	Operator	
aircratf in the Landing	ous				
Distance Available / (Cons.)	hardwar				
Damage to the aircraft / (Br.)	е				
Runway Strip					
(Haz.) Take off Operations at	C-HW	+ Good	High	AOC1	
PGIA 07 and 25 / Inhability to	Continu		Critical	Operator	
stop an aborted takeoff in the	ous			-	
ASDA / (Cons.) Overrrun	hardwar				
beyond 150 m from the LDA /	е				
(Br.) Runway Strip					
(Haz.) Take off Operations at	C-HW	+ Good	High	AOC1	
PGIA 07 and 25 / Inhability to	Continu		Critical	Operator	
stop an aborted takeoff in the	ous			-	
ASDA / (Cons.) Damage to the	hardwar				
aircraft / (Br.) Runway Strip	е				

Barrier	Barrier type	Effective ness	Criticalit y	Account able	Description
RESA 90x90 m		_			
(Haz.) Landing operation RWY 07 PGIA / Inhability to stop de aircratf in the Landing	C-HW Continu ous	++ Very Good	High Critical	AOC1 Operator	
Distance Available / (Cons.) Overrrun beyond 150 m from the LDA / (Br.) RESA 90x90 m	hardwar e				
(Haz.) Landing operation RWY 07 PGIA / Inhability to stop de	C-HW Continu	++ Very Good	High Critical	AOC1 Operator	
aircratf in the Landing Distance Available / (Cons.) Damage to the aircraft / (Br.)	ous hardwar e				
RESA 90x90 m	C				
(Haz.) Landing operation RWY 25 PGIA / Inhability to stop de	C-HW Continu	++ Very Good	High Critical	AOC1 Operator	
aircratf in the Landing Distance Available / (Cons.)	ous hardwar				
Overrrun beyond 150 m from the LDA / (Br.) RESA 90x90 m	е				
(Haz.) Landing operation RWY 25 PGIA / Inhability to stop de	C-HW Continu	++ Very Good	High Critical	AOC1 Operator	
aircratf in the Landing Distance Available / (Cons.)	ous hardwar				
Damage to the aircraft / (Br.) RESA 90x90 m	е				
(Haz.) Take off Operations at PGIA 07 and 25 / Inhability to	C-HW Continu	++ Very Good	High Critical	AOC1 Operator	
stop an aborted takeoff in the ASDA / (Cons.) Overrrun	ous hardwar				
beyond 150 m from the LDA / (Br.) RESA 90x90 m	e				

Barrier	Barrier type	Effective ness	Criticalit y	Account able	Description
(Haz.) Take off Operations at	C-HW	++ Very	High	AOC1	
PGIA 07 and 25 / Inhability to	Continu	Good	Critical	Operator	
stop an aborted takeoff in the	ous				
ASDA / (Cons.) Damage to the	hardwar				
aircraft / (Br.) RESA 90x90 m	е				
RFF Service					
(Haz.) Landing operation RWY	ST Socio	?	High	ERP1	
07 PGIA / Inhability to stop de	technica	Unasses	Critical	Emergen	
aircratf in the Landing	1	sed		су	
Distance Available / (Cons.)				service	
Overrrun beyond 150 m from				organiza	
the LDA / (Br.) RFF Service				tion	
(Haz.) Landing operation RWY	ST Socio	?	High	ERP1	
07 PGIA / Inhability to stop de	technica	Unasses	Critical	Emergen	
aircratf in the Landing		sed		су	
Distance Available / (Cons.)				service	
Damage to the aircraft / (Br.)				organiza	
RFF Service				tion	
(Haz.) Landing operation RWY	ST Socio	?	High	ERP1	
25 PGIA / Inhability to stop de	technica	Unasses	Critical	Emergen	
aircratf in the Landing		sed		су	
Distance Available / (Cons.)				service	
Overrrun beyond 150 m from				organiza	
the LDA / (Br.) RFF Service				tion	
(Haz.) Landing operation RWY	ST Socio	?	High	ERP1	
25 PGIA / Inhability to stop de	technica	Unasses	Critical	Emergen	
aircratf in the Landing		sed		cy	
Distance Available / (Cons.)				service	
Damage to the aircraft / (Br.)				organiza	
RFF Service				tion	

Barrier	Barrier type	Effective ness	Criticalit y	Account able	Description
(Haz.) Take off Operations at PGIA 07 and 25 / Inhability to	ST Socio technica	? Unasses	High Critical	ERP1 Emergen	
stop an aborted takeoff in the	I	sed		cy	
ASDA / (Cons.) Overrrun				service	
beyond 150 m from the LDA / (Br.) RFF Service				organiza tion	
(Haz.) Take off Operations at	ST Socio	?	High	ERP1	
PGIA 07 and 25 / Inhability to	technica	Unasses	Critical	Emergen	
stop an aborted takeoff in the ASDA / (Cons.) Damage to the		sed		cy service	
aircraft / (Br.) RFF Service				organiza	
				tion	
OPS On flight landing distance					
(Haz.) Landing operation RWY	C-HW	++ Very	Std	AOC7	
07 PGIA / Inhability to stop de	Continu	Good	Standar	Pilot	
aircratf in the Landing	ous		d		
Distance Available / (S.E)	hardwar				
Contaminated Runway / (Br.)	е				
OPS On flight landing distance					
required calculation (Haz.) Landing operation RWY	C-HW	++ Very	Std	AOC7	
07 PGIA / Inhability to stop de	C-nw Continu	Good	Standar	Pilot	
aircratf in the Landing	ous	0000	d	1 1101	
Distance Available / (S.E)	hardwar		ч Ч		
Equipment failure / (Br.) OPS	e				
On flight landing distance					
required calculation					
(Haz.) Landing operation RWY	C-HW	++ Very	Std	AOC7	
25 PGIA / Inhability to stop de	Continu	Good	Standar	Pilot	
aircratf in the Landing	ous		d		
Distance Available / (S.E)					

Barrier	Barrier type	Effective ness	Criticalit y	Account able	Description
Contaminated Runway / (Br.)	hardwar				
OPS On flight landing distance required calculation	е				
(Haz.) Landing operation RWY	C-HW	++ Very	Std	AOC7	
25 PGIA / Inhability to stop de aircratf in the Landing	Continu	Good	Standar d	Pilot	
Distance Available / (S.E)	ous hardwar		a		
Equipment failure / (Br.) OPS	e				
On flight landing distance	Ŭ				
required calculation					
<b>ANS-MET METAR information</b>					
(Haz.) Landing operation RWY	ST Socio	++ Very	Std	ANS1	Continous METARS, ATIS, and
07 PGIA / Inhability to stop de	technica	Good	Standar	ATS	SPECI
aircratf in the Landing			d	organiza	
Distance Available / (S.E)				tion	
Contaminated Runway / (Br.) ANS-MET METAR information					
(Haz.) Landing operation RWY	ST Socio	++ Very	Std	ANS1	Continous METARS, ATIS, and
07 PGIA / Inhability to stop de	technica	Good	Standar	ATS	SPECI
aircratf in the Landing	1		d	organiza	
Distance Available / (S.E)				tion	
Equipment failure / (Br.) ANS-					
MET METAR information					
(Haz.) Landing operation RWY	ST Socio	++ Very	Std	ANS1	Continous METARS, ATIS, and
25 PGIA / Inhability to stop de	technica	Good	Standar	ATS	SPECI
aircratf in the Landing			d	organiza	
Distance Available / (S.E) Contaminated Runway / (Br.)				tion	
ANS-MET METAR information					

Barrier	Barrier type	Effective ness	Criticalit y	Account able	Description
(Haz.) Landing operation RWY 25 PGIA / Inhability to stop de aircratf in the Landing Distance Available / (S.E) Equipment failure / (Br.) ANS- MET METAR information	ST Socio technica I	++ Very Good	Std Standar d	ANS1 ATS organiza tion	Continous METARS, ATIS, and SPECI
Grooved ridgid pavement.					
(Haz.) Landing operation RWY 07 PGIA / Inhability to stop de aircratf in the Landing Distance Available / (S.E) Contaminated Runway / (Br.) Grooved ridgid pavement.	C-HW Continu ous hardwar e	+ Good	Std Standar d	ADR2 Mainten ance staff	
(Haz.) Landing operation RWY 25 PGIA / Inhability to stop de aircratf in the Landing Distance Available / (S.E) Contaminated Runway / (Br.) Grooved ridgid pavement.	C-HW Continu ous hardwar e	+ Good	Std Standar d	ADR2 Mainten ance staff	
(Haz.) Take off Operations at PGIA 07 and 25 / Inhability to stop an aborted takeoff in the ASDA / (S.E) Contaminated Runway / (Br.) Grooved ridgid pavement.	C-HW Continu ous hardwar e	+ Good	Std Standar d	ADR2 Mainten ance staff	
(Haz.) Take off Operations at PGIA 07 and 25 / Inhability to stop an aborted takeoff in the ASDA / (S.E) Equipment failure / (Br.) Grooved ridgid pavement.	C-HW Continu ous hardwar e	+ Good	Std Standar d	ADR2 Mainten ance staff	

Barrier	Barrier type	Effective ness	Criticalit y	Account able	Description			
Glideslope and overspeed warn	Glideslope and overspeed warning systems							
(Haz.) Landing operation RWY	C-HW	+ Good	Std	ANS7				
07 PGIA / Inhability to stop de	Continu		Standar	Other				
aircratf in the Landing	ous		d					
Distance Available / (S.E)	hardwar							
Contaminated Runway / (Br.)	е							
Glideslope and overspeed								
warning systems								
(Haz.) Landing operation RWY	C-HW	+ Good	Std	ANS7				
07 PGIA / Inhability to stop de	Continu		Standar	Other				
aircratf in the Landing	ous		d					
Distance Available / (S.E)	hardwar							
Equipment failure / (Br.)	е							
Glideslope and overspeed								
warning systems								
(Haz.) Landing operation RWY	C-HW	+ Good	Std	ANS7				
25 PGIA / Inhability to stop de	Continu		Standar	Other				
aircratf in the Landing	ous		d					
Distance Available / (S.E)	hardwar							
Contaminated Runway / (Br.)	е							
Glideslope and overspeed								
warning systems								
(Haz.) Landing operation RWY	C-HW	+ Good	Std	ANS7				
25 PGIA / Inhability to stop de	Continu		Standar	Other				
aircratf in the Landing	ous		d					
Distance Available / (S.E)	hardwar							
Equipment failure / (Br.)	е							
Glideslope and overspeed								
warning systems								
OPS Go arround procedures								

Barrier	Barrier type	Effective ness	Criticalit y	Account able	Description	
(Haz.) Landing operation RWY	BEH	++ Very	Std	AOC7		
07 PGIA / Inhability to stop de	Behavio	Good	Standar	Pilot		
aircratf in the Landing	ural		d			
Distance Available / (S.E)						
Contaminated Runway / (Br.)						
OPS Go arround procedures						
(Haz.) Landing operation RWY	BEH	++ Very	Std	AOC7		
07 PGIA / Inhability to stop de	Behavio	Good	Standar	Pilot		
aircratf in the Landing	ural		d			
Distance Available / (S.E)						
Equipment failure / (Br.) OPS						
Go arround procedures						
(Haz.) Landing operation RWY	BEH	++ Very	Std	AOC7		
25 PGIA / Inhability to stop de	Behavio	Good	Standar	Pilot		
aircratf in the Landing	ural		d			
Distance Available / (S.E)						
Contaminated Runway / (Br.)						
OPS Go arround procedures						
(Haz.) Landing operation RWY	BEH	++ Very	Std	AOC7		
25 PGIA / Inhability to stop de	Behavio	Good	Standar	Pilot		
aircratf in the Landing	ural		d			
Distance Available / (S.E)						
Equipment failure / (Br.) OPS						
Go arround procedures						
ANS ATC RWY conditions information						
(Haz.) Landing operation RWY	ST Socio	+ Good	Std	ANS2	Standard ATC procedures for	
07 PGIA / Inhability to stop de	technica		Standar	ATCOs	RWY condition notification	
aircratf in the Landing			d	and FIS		
Distance Available / (S.E)				staff		
Contaminated Runway / (Br.)						

Barrier	Barrier type	Effective ness	Criticalit y	Account able	Description
ANS ATC RWY conditions information					
(Haz.) Landing operation RWY 25 PGIA / Inhability to stop de aircratf in the Landing Distance Available / (S.E) Contaminated Runway / (Br.) ANS ATC RWY conditions information	ST Socio technica I	+ Good	Std Standar d	ANS2 ATCOs and FIS staff	Standard ATC procedures for RWY condition notification
(Haz.) Take off Operations at PGIA 07 and 25 / Inhability to stop an aborted takeoff in the ASDA / (S.E) Contaminated Runway / (Br.) ANS ATC RWY conditions information	ST Socio technica I	+ Good	Std Standar d	ANS2 ATCOs and FIS staff	Standard ATC procedures for RWY condition notification
Friction measurment procedure	s and rubb	er removal	procedures	5	
(Haz.) Landing operation RWY 07 PGIA / Inhability to stop de aircratf in the Landing Distance Available / (S.E) Contaminated Runway / (Br.) Friction measurment procedures and rubber removal procedures	technica I		Std Standar d	AOC1 Operator	
(Haz.) Landing operation RWY 25 PGIA / Inhability to stop de aircratf in the Landing Distance Available / (S.E) Contaminated Runway / (Br.) Friction measurment	ST Socio technica I	+ Good	Std Standar d	AOC1 Operator	

Barrier	Barrier type	Effective ness	Criticalit y	Account able	Description
procedures and rubber removal procedures					
(Haz.) Take off Operations at PGIA 07 and 25 / Inhability to stop an aborted takeoff in the ASDA / (S.E) Contaminated Runway / (Br.) Friction measurment procedures and rubber removal procedures	ST Socio technica I	+ Good	Std Standar d	AOC1 Operator	
Insurance					
(Haz.) Landing operation RWY 07 PGIA / Inhability to stop de aircratf in the Landing Distance Available / (Cons.) Damage to the aircraft / (Br.) Insurance	ST Socio technica I	++ Very Good	Std Standar d	ATO5 Other	
(Haz.) Landing operation RWY 25 PGIA / Inhability to stop de aircratf in the Landing Distance Available / (Cons.) Damage to the aircraft / (Br.) Insurance	ST Socio technica I	++ Very Good	Std Standar d	ATO5 Other	
(Haz.) Take off Operations at PGIA 07 and 25 / Inhability to stop an aborted takeoff in the ASDA / (Cons.) Damage to the aircraft / (Br.) Insurance	ST Socio technica I	++ Very Good	Std Standar d	ATO5 Other	
NAVAIDS Electronic Aids					
(Haz.) Landing operation RWY 07 PGIA / Inhability to stop de aircratf in the Landing	C-HW Continu ous	++ Very Good	High Critical	MET2 Mainten	ILS CAT I, DME, VOR
Barrier	Barrier type	Effective ness	Criticalit y	Account able	Description
---------------------------------	-----------------	----------------	-----------------	-----------------	--------------------------------
Distance Available / (S.E)	hardwar			ance	
Contaminated Runway / (Br.)	е			staff	
NAVAIDS Electronic Aids					
(Haz.) Landing operation RWY	C-HW	++ Very	High	MET2	ILS CAT I, DME, VOR
07 PGIA / Inhability to stop de	Continu	Good	Critical	Mainten	
aircratf in the Landing	ous			ance	
Distance Available / (S.E)	hardwar			staff	
Equipment failure / (Br.)	е				
NAVAIDS Electronic Aids					
ANS ATC surveillance Based Pr					systems
(Haz.) Landing operation RWY	ST Socio	+ Good	Std	ANS2	
07 PGIA / Inhability to stop de	technica		Standar	ATCOs	
aircratf in the Landing	1		d	and FIS	
Distance Available / (S.E)				staff	
Contaminated Runway / (Br.)					
ANS ATC surveillance Based					
Procedures with primary and					
recondari radar systems					
(Haz.) Landing operation RWY	ST Socio	+ Good	Std	ANS2	
25 PGIA / Inhability to stop de	technica		Standar	ATCOs	
aircratf in the Landing	1		d	and FIS	
Distance Available / (S.E)				staff	
Contaminated Runway / (Br.)					
ANS ATC surveillance Based					
Procedures with primary and					
recondari radar systems					
ATC emergency procedures					
(Haz.) Landing operation RWY	ST Socio	?	Std	ANS1	Prioritization of traffic, RFF
07 PGIA / Inhability to stop de	technica	Unasses	Standar	ATS	awareness
aircratf in the Landing		sed	d	organiza	
Distance Available / (S.E)				tion	

Barrier	Barrier type	Effective ness	Criticalit y	Account able	Description
Equipment failure / (Br.) ATC emergency procedures					
(Haz.) Landing operation RWY 25 PGIA / Inhability to stop de aircratf in the Landing Distance Available / (S.E) Equipment failure / (Br.) ATC emergency procedures	ST Socio technica I	Unasses sed	Std Standar d	ANS1 ATS organiza tion	Prioritization of traffic, RFF awareness
<b>OPS Take-off distance required</b>	calculation	1			
(Haz.) Take off Operations at	C-HW	++ Very	Std	AOC7	
PGIA 07 and 25 / Inhability to	Continu	Good	Standar	Pilot	
stop an aborted takeoff in the	ous		d		
ASDA / (S.E) Equipment failure	hardwar				
/ (Br.) OPS Take-off distance	е				
required calculation					
(Haz.) Take off Operations at	C-HW	++ Very	Std	AOC7	
PGIA 07 and 25 / Inhability to	Continu	Good	Standar	Pilot	
stop an aborted takeoff in the	ous		d		
ASDA / (S.E) Contaminated	hardwar				
Runway / (Br.) OPS Take-off	е				
distance required calculation					

# BowTie diagrams

# Landing and T-O operations at PGIA

Hazard	Top event
Landing operation RWY 07 PGIA	Inhability to stop de aircratf in the Landing Distance Available



# Landing at PGIA 25

Hazard	Top event
Landing operation RWY 25 PGIA	Inhability to stop de aircratf in the Landing Distance Available



# Take off operations at PGIA 07 and 25

Hazard	Top event
Take off Operations at PGIA 07 and 25	Inhability to stop an aborted takeoff in the ASDA



# Threats and consequences

Landing and T-O operations at PGIA

BowTie Group	Description
Landing and T-O operations at	
PGIA	

Landing operation RWY 07 PGIA / Inhability to stop de aircratf in the Landing Distance Available		
Safety Events	Contaminated Runway Equipment failure	
Consequen ces	Overrrun beyond 150 m from the LDA	
	Damage to the aircraft	

## Landing at PGIA 25

BowTie Group	Description
Landing at PGIA	
25	

	eration RWY 25 PGIA / Inhability to ance Available	stop de aircratf in the
Safety	Contaminated Runway	
Events	Equipment failure	
Consequen	Overrrun beyond 150 m	
ces	from the LDA	
	Damage to the aircraft	

Take off operations at PGIA 07 and 25

BowTie Group Description
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Take off	
operations at	
PGIA 07 and 25	

Take off Operations at PGIA 07 and 25 / Inhability to stop an aborted takeoffIn the ASDAContaminated RunwaySafetyContaminated RunwayEventsEquipment failureConsequen<br/>cesOverrrun beyond 150 m<br/>from the LDADamage to the aircraftImage to the aircraft

## **Barrier summaries**

#### OPS SOP

Code	Name	Effectiveness
OPS	SOP	++ Very Good

#### ANS ATC RWY conditions information

Code	Name	Effectiveness
ANS	ATC RWY conditions information	+ Good

### OPS On flight landing distance required calculation

Code	Name	Effectiveness
OPS	On flight landing distance required calculation	++ Very Good

#### **ANS-MET METAR information**

Code	Name	Effectiveness
ANS-MET	METAR information	++ Very Good

### BRAKING Antiskid System

Code	Name	Effectiveness
BRAKING	Antiskid System	++ Very Good

### Braking systems: 2 main, 1 emergency

Code	Name	Effectiveness
	Braking systems: 2 main, 1 emergency	++ Very Good

### **BRAKING Spoilers speed brakes**

Code	Name	Effectiveness
BRAKING	Spoilers speed brakes	++ Very Good

#### BRAKING Engine reverse

Code	Name	Effectiveness
BRAKING	Engine reverse	++ Very Good

Friction mea	surment procedures and rubber removal procedures	
Code	Name	Effectiveness
	Friction measurment procedures and rubber removal procedures	+ Good
Grooved rid	gid pavement.	
Code	Name	Effectiveness
	Grooved ridgid pavement.	+ Good

#### Visual Aids.

Code	Name	Effectiveness
	Visual Aids.	+ Good

#### **NAVAIDS Electronic Aids**

Code	Name	Effectiveness
NAVAIDS	Electronic Aids	++ Very Good

### ANS ATC surveillance Based Procedures with primary and recondari radar systems

Code	Name	Effectiveness
ANS	ATC surveillance Based Procedures with primary and recondari radar systems	+ Good

#### Glideslope and overspeed warning systems

Code	Name	Effectiveness
	Glideslope and overspeed warning systems	+ Good

## OPS Go arround procedures

Code	Name	Effectiveness
OPS	Go arround procedures	++ Very Good

#### ATC emergency procedures

Code	Name	Effectiveness
	ATC emergency procedures	? Unassessed

### Pilot monitoring an resolution

Code	Name	Effectiveness
	Pilot monitoring an resolution	? Unassessed

### Runway Strip

Code	Name	Effectiveness
	Runway Strip	+ Good
RESA 90x90 i	n	
Code	Name	Effectiveness
	RESA 90x90 m	++ Very Good
RFF Service		
Code	Name	Effectiveness
	RFF Service	? Unassessed
nsurance		
Code	Name	Effectiveness
	Insurance	++ Very Good

Code	Name	Effectiveness
OPS	Take-off distance required calculation	++ Very Good

# Actions overview

All actions

Code	Name	Action party	Target
DEF	Addtional actions		
	No additional action required		

# Job titles

Maintenance staff

Job Title	# Barriers	# Activities	# Document Links
ADR2 Maintenance staff	22	0	0

rriers	
RAKING Antiskid System	
aking systems: 2 main, 1 emergency	
ooved ridgid pavement.	
sual Aids.	
sual Aids.	
AKING Antiskid System	
aking systems: 2 main, 1 emergency	
ooved ridgid pavement.	
sual Aids.	
sual Aids.	
AKING Antiskid System	
aking systems: 2 main, 1 emergency	
ooved ridgid pavement.	
sual Aids.	
sual Aids.	
ooved ridgid pavement.	
AKING Antiskid System	
aking systems: 2 main, 1 emergency	
AKING Antiskid System	
aking systems: 2 main, 1 emergency	
RAKING Antiskid System	
aking systems: 2 main, 1 emergency	

## ATS organization

Job Title	# Barriers	# Activities	# Document Links
ANS1 ATS organization	6	0	0

Barriers	
ANS-MET METAR information	
ATC emergency procedures	
ATC emergency procedures	

## ATCOs and FIS staff

Job Title	# Barriers	# Activities	# Document Links
ANS2 ATCOs and FIS staff	5	0	0

Barriers	
ANS ATC RWY conditions information	
ANS ATC surveillance Based Procedures with primary and recondari radar systems	
ANS ATC RWY conditions information	
ANS ATC surveillance Based Procedures with primary and recondari radar systems	
ANS ATC RWY conditions information	

# Other

Job Title	# Barriers	# Activities	# Document Links
ANS7 Other	4	0	0
Barriers			
Glideslope and overspeed	warning systems		
Glideslope and overspeed	warning systems		
Glideslope and overspeed	warning systems		
Glideslope and overspeed	warning systems		

## Operator

Job Title	# Barriers	# Activities	# Document Links
AOC1 Operator	15	0	0

Barriers
Friction measurment procedures and rubber removal procedures
Runway Strip
RESA 90x90 m
Runway Strip
RESA 90x90 m
Friction measurment procedures and rubber removal procedures
Runway Strip
RESA 90x90 m
Runway Strip
RESA 90x90 m
Friction measurment procedures and rubber removal procedures
Runway Strip
RESA 90x90 m
Runway Strip
RESA 90x90 m

# Pilot

Job Title	# Barriers	# Activities	# Document Links
AOC7 Pilot	34	0	0

OPS SOP       OPS On flight landing distance required calculation       BRAKING Spoilers speed brakes       BRAKING Engine reverse       OPS Go arround procedures       OPS On flight landing distance required calculation       OPS Go arround procedures       OPS Go arround procedures       OPS Go arround procedures       OPS Go arround procedures       Pilot monitoring an resolution       Pilot monitoring an resolution       OPS SOP       OPS On flight landing distance required calculation       OPS SOP       OPS On flight landing distance required calculation       BRAKING Spoilers speed brakes       BRAKING Engine reverse       OPS Go arround procedures       OPS OP       OPS On flight landing distance required calculation       OPS SOP       OPS Go arround procedures       OPS On flight landing distance required calculation       OPS Go arround procedures       Pilot monitoring an resolution       Pilot monitoring an resolution       OPS SOP       OPS Take-off distance required calculation       BRAKING Spoilers speed brakes       BRAKING Spoilers speed brakes       BRAKING Engine reverse	
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OPS SOP OPS Take-off distance required calculation BRAKING Spoilers speed brakes BRAKING Engine reverse	Pilot monitoring an resolution
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BRAKING Spoilers speed brakes BRAKING Engine reverse	OPS SOP
BRAKING Engine reverse	OPS Take-off distance required calculation
	BRAKING Spoilers speed brakes
OPS SOP	BRAKING Engine reverse
	OPS SOP

Barriers
OPS Take-off distance required calculation
Pilot monitoring an resolution
Pilot monitoring an resolution
BRAKING Spoilers speed brakes
BRAKING Engine reverse
BRAKING Spoilers speed brakes
BRAKING Engine reverse
BRAKING Spoilers speed brakes
BRAKING Engine reverse

## Other

Job Title	# Barriers	# Activities	# Document Links
ATO5 Other	3	0	0

Barriers	
Insurance	
Insurance	
Insurance	

## Emergency service organization

Job Title	# Barriers	# Activities	# Document Links
ERP1 Emergency service organization	6	0	0

Barriers	
RFF Service	

## Maintenance staff

Job Title	# Barriers	# Activities	# Document Links
MET2 Maintenance staff	2	0	0
ME12 Maintenance staff	2	0	0
Barriers			

	Electronic Aids
INAVAIDO	

Document links

# Hazard register

Landing operation RWY 07 PGIA / Inhability to stop de aircratf in the Landing Distance Available

Contaminated R	unway				
Barriers & Escalation Factors	Criticality	Barrier type	Effectiveness	Accountable	Activities
OPS SOP	High Critical	ST Socio technical	++ Very Good	AOC7 Pilot	
ANS ATC RWY conditions information	Std Standard	ST Socio technical	+ Good	ANS2 ATCOs and FIS staff	
OPS On flight landing distance required calculation	Std Standard	C-HW Continuous hardware	++ Very Good	AOC7 Pilot	
ANS-MET METAR information	Std Standard	ST Socio technical	++ Very Good	ANS1 ATS organization	
BRAKING Antiskid System	Std Standard	A-HW Active hardware	++ Very Good	ADR2 Maintenance staff	
Braking systems: 2 main, 1 emergency	High Critical	A-HW Active hardware	++ Very Good	ADR2 Maintenance staff	
BRAKING Spoilers speed brakes	Std Standard	A-HW Active hardware	++ Very Good	AOC7 Pilot	

BRAKING Engine reverse	High Critical	A-HW Active hardware	++ Very Good	AOC7 Pilot
Friction measurment procedures and rubber removal procedures	Std Standard	ST Socio technical	+ Good	AOC1 Operator
Grooved ridgid pavement.	Std Standard	C-HW Continuous hardware	+ Good	ADR2 Maintenance staff
Visual Aids.	Std Standard	C-HW Continuous hardware	+ Good	ADR2 Maintenance staff
NAVAIDS Electronic Aids	High Critical	C-HW Continuous hardware	++ Very Good	MET2 Maintenance staff
ANS ATC surveillance Based Procedures with primary and recondari radar systems	Std Standard	ST Socio technical	+ Good	ANS2 ATCOs and FIS staff
Glideslope and overspeed warning systems	Std Standard	C-HW Continuous hardware	+ Good	ANS7 Other
OPS Go arround procedures	Std Standard	BEH Behavioural	++ Very Good	AOC7 Pilot

Equipment failur	re				
Barriers &	Criticality	Barrier type	Effectiveness	Accountable	Activities
Escalation					
Factors					
OPS SOP	High Critical	ST Socio technical	++ Very Good	AOC7 Pilot	
ATC	Std Standard	ST Socio	? Unassessed	ANS1 ATS	
emergency		technical		organization	
procedures					
OPS On flight	Std Standard	C-HW	++ Very Good	AOC7 Pilot	
landing		Continuous			
distance		hardware			
required					
calculation					
ANS-MET	Std Standard	ST Socio	++ Very Good	ANS1 ATS	
METAR		technical		organization	
information					
Visual Aids.	Std Standard	C-HW	+ Good	ADR2	
		Continuous		Maintenance	
		hardware		staff	
NAVAIDS	High Critical	C-HW	++ Very Good	MET2	
Electronic Aids		Continuous		Maintenance	
		hardware		staff	
Glideslope and	Std Standard	C-HW	+ Good	ANS7 Other	
overspeed		Continuous			
warning		hardware			
systems					
OPS Go	Std Standard	BEH	++ Very Good	AOC7 Pilot	
arround		Behavioural			
procedures					

BRAKING	Std Standard	A-HW Active	++ Very Good	ADR2
Antiskid		hardware		Maintenance
System				staff
Braking	High Critical	A-HW Active	++ Very Good	ADR2
systems: 2		hardware		Maintenance
main, 1				staff
emergency				
BRAKING	Std Standard	A-HW Active	++ Very Good	AOC7 Pilot
Spoilers speed		hardware		
brakes				
BRAKING	High Critical	A-HW Active	++ Very Good	AOC7 Pilot
Engine reverse		hardware		

Landing operation RWY 25 PGIA / Inhability to stop de aircratf in the Landing Distance Available

Contaminated R	Contaminated Runway					
Barriers &	Criticality	Barrier type	Effectiveness	Accountable	Activities	
Escalation						
Factors						
OPS SOP	High Critical	ST Socio	++ Very Good	AOC7 Pilot		
		technical				
ANS ATC RWY	Std Standard	ST Socio	+ Good	ANS2 ATCOs		
conditions		technical		and FIS staff		
information						
OPS On flight	Std Standard	C-HW	++ Very Good	AOC7 Pilot		
landing		Continuous				
distance		hardware				
required						
calculation						
ANS-MET	Std Standard	ST Socio	++ Very Good	ANS1 ATS		
METAR		technical		organization		
information						

BRAKING	Std Standard	A-HW Active	++ Very Good	ADR2	
Antiskid		hardware		Maintenance	
System				staff	
Braking	High Critical	A-HW Active	++ Very Good	ADR2	
systems: 2		hardware		Maintenance	
main, 1				staff	
emergency					
BRAKING	Std Standard	A-HW Active	++ Very Good	AOC7 Pilot	
Spoilers speed		hardware			
brakes					
BRAKING	High Critical	A-HW Active	++ Very Good	AOC7 Pilot	
Engine reverse		hardware			
Friction	Std Standard	ST Socio	+ Good	AOC1 Operator	
measurment		technical			
procedures					
and rubber					
removal					
procedures					
Grooved ridgid	Std Standard	C-HW	+ Good	ADR2	
pavement.		Continuous		Maintenance	
		hardware		staff	
Visual Aids.	Std Standard	C-HW	+ Good	ADR2	
		Continuous		Maintenance	
		hardware		staff	
ANS ATC	Std Standard	ST Socio	+ Good	ANS2 ATCOs	
surveillance		technical		and FIS staff	
Based					
Procedures					
with primary					
and recondari					
radar systems					

Glideslope and overspeed warning systems	Std Standard	C-HW Continuous hardware	+ Good	ANS7 Other	
OPS Go arround procedures	Std Standard	BEH Behavioural	++ Very Good	AOC7 Pilot	
Equipment failur	re				
Barriers & Escalation Factors	Criticality	Barrier type	Effectiveness	Accountable	Activities
OPS SOP	High Critical	ST Socio technical	++ Very Good	AOC7 Pilot	
ATC emergency procedures	Std Standard	ST Socio technical	? Unassessed	ANS1 ATS organization	
ÖPS On flight landing distance required calculation	Std Standard	C-HW Continuous hardware	++ Very Good	AOC7 Pilot	
ANS-MET METAR information	Std Standard	ST Socio technical	++ Very Good	ANS1 ATS organization	
Visual Aids.	Std Standard	C-HW Continuous hardware	+ Good	ADR2 Maintenance staff	
Glideslope and overspeed warning systems	Std Standard	C-HW Continuous hardware	+ Good	ANS7 Other	

OPS Go arround procedures	Std Standard	BEH Behavioural	++ Very Good	AOC7 Pilot	
BRAKING Antiskid System	Std Standard	A-HW Active hardware	++ Very Good	ADR2 Maintenance staff	
Braking systems: 2 main, 1 emergency	High Critical	A-HW Active hardware	++ Very Good	ADR2 Maintenance staff	
BRAKING Spoilers speed brakes	Std Standard	A-HW Active hardware	++ Very Good	AOC7 Pilot	
BRAKING Engine reverse	High Critical	A-HW Active hardware	++ Very Good	AOC7 Pilot	

Take off Operations at PGIA 07 and 25 / Inhability to stop an aborted takeoff in the ASDA

Contaminated R	Contaminated Runway					
Barriers &	Criticality	Barrier type	Effectiveness	Accountable	Activities	
Escalation						
Factors						
OPS SOP	High Critical	ST Socio	++ Very Good	AOC7 Pilot		
		technical				
ANS ATC RWY	Std Standard	ST Socio	+ Good	ANS2 ATCOs		
conditions		technical		and FIS staff		
information						
OPS Take-off	Std Standard	C-HW	++ Very Good	AOC7 Pilot		
distance		Continuous				
required		hardware				
calculation						

BRAKING	Std Standard	A-HW Active	++ Very Good	ADR2		
Antiskid		hardware		Maintenance		
System				staff		
Braking	High Critical	A-HW Active	++ Very Good	ADR2		
systems: 2		hardware		Maintenance		
main, 1				staff		
emergency						
BRAKING	Std Standard	A-HW Active	++ Very Good	AOC7 Pilot		
Spoilers speed		hardware				
brakes						
BRAKING	High Critical	A-HW Active	++ Very Good	AOC7 Pilot		
Engine reverse		hardware				
Friction	Std Standard	ST Socio	+ Good	AOC1 Operator		
measurment		technical				
procedures						
and rubber						
removal						
procedures						
Grooved ridgid	Std Standard	C-HW	+ Good	ADR2		
pavement.		Continuous		Maintenance		
		hardware		staff		
Visual Aids.	Std Standard	C-HW	+ Good	ADR2		
		Continuous		Maintenance		
		hardware		staff		
Equipment failure						
Barriers &	Criticality	Barrier type	Effectiveness	Accountable	Activities	
Escalation						
Factors						
OPS SOP	High Critical	ST Socio	++ Very Good	AOC7 Pilot		
		technical				

OPS Take-off distance required calculation	Std Standard	C-HW Continuous hardware	++ Very Good	AOC7 Pilot
Visual Aids.	Std Standard	C-HW Continuous hardware	+ Good	ADR2 Maintenance staff
Grooved ridgid pavement.	Std Standard	C-HW Continuous hardware	+ Good	ADR2 Maintenance staff
BRAKING Antiskid System	Std Standard	A-HW Active hardware	++ Very Good	ADR2 Maintenance staff
Braking systems: 2 main, 1 emergency	High Critical	A-HW Active hardware	++ Very Good	ADR2 Maintenance staff
BRAKING Spoilers speed brakes	Std Standard	A-HW Active hardware	++ Very Good	AOC7 Pilot
BRAKING Engine reverse	High Critical	A-HW Active hardware	++ Very Good	AOC7 Pilot