AIRCRAFT SERIOUS INCIDENT REPORT AND EXECUTIVE SUMMARY

			Reference:	CA18/3/2/1368	
Aircraft Registration	**ZS-PTV & ZS-JRE**	**Date of Incident**	25 August 2021	**Time of Incident**	0725Z
Type of Aircraft	ZS-PTV – Piper PA-28R-200 ZS-JRE – Boeing 737-400		**Type of Operation**	Training (Part 141) Commercial (Part 121)	
Pilot-in-Command Licence Type	SPL (A) (Integrated) ATPL (A)		**Age**	33 32	**Licence Valid**	Yes
Pilot-in-Command Flying Experience		**Total Flying Hours**	104 6980.6	**Hours on Type**	27.8 2875.8
Last Point of Departure	Port Alfred Aerodrome (FAPA), Eastern Cape Province Cape Town International Aerodrome (FACT), Western Cape Province				
Next Point of Intended Landing	East London Aerodrome (FAEL), Eastern Cape Province				

Number of People On-board	1 + 0 6 + 158	**Number of People Injured**	0	**Number of People Killed**	0	**Other (On Ground)**	0
Damage to Aircraft	None						

Location of the incident site with reference to easily defined geographical points (GPS readings if possible)

On final approach for Runway 11 at FAEL (GPS position: 33°2'13.80" South, 027°48'43.20" East) at an elevation of 435 feet (ft)

Meteorological Information	METAR FAEL 250700Z 03004KT 350V060 CAVOK 19/08 Q1020hPa

Synopsis

On Wednesday morning, 25 August 2021 at 0721Z, a Piper PA-28R-200 aircraft using a Prima 285 (PIU285) call sign with registration ZS-PTV, and a Boeing 737-400 commercial aircraft using Safair 142 (SFR142) call sign with registration ZS-JRE approached East London Aerodrome (FAEL) at about the same time.

The air traffic control officer (ATCO) instructed the student pilot (SP), who was the sole occupant on-board the ZS-PTV aircraft, to route northbound (a right turn) away from ZS-JRE's flight path as it was cleared for instrument landing system (ILS) approach for landing on Runway (RWY) 11. The SP appeared to have misinterpreted the ATCOs instruction and made a left turn instead of a right turn. The ATC did not correct the SP. The ZS-PTV aircraft was later observed by the ATCO crossing overhead the ZS-JRE which was already established on the long final approach. This led to a loss of vertical separation between the two aircraft.

The ZS-JRE continued with the approach and landed safely before it vacated the runway. It was estimated that the aircraft, at their closest, were 200 feet (ft) (61 metres) vertically and 0.2 nautical miles (NM) (370 metres) horizontally apart.

After receiving clearance to perform a touch-and-go landing on RWY 11, the ZS-PTV SP conducted a single touch-and-go and reported "safe" after getting airborne. The SP routed outbound via Keyser's Beach.

No injuries resulted from this serious incident, and neither aircraft sustained damage.

Probable Cause

Loss of minimum separation (AIRPROX) between the two aircraft on final approach after the SP deviated from executing the ATCO's instruction.

Contributing Factors

- Incorrect execution of the ATCO's instructions by the SP.
- Omittance by the ATCO to correct the misinterpreted readback by the SP.

SRP Date		Publication Date	

Occurrence Details

Reference Number	**:** CA18/3/2/1368
Occurrence Category	**:** Serious Incident
Type of Operation	**:** Part 141 (Training)
	: Part 121 (Commercial Transport Operations)
Name of Operator	**:** 43 Air School
	: FlySafair
Aircraft Registration	**:** ZS-PTV
	: ZS-JRE
Aircraft Make and Model	**:** Piper Aircraft Company, PA-28R-200
	: Boeing Aircraft Company, B737-400
Nationality	**:** South African
	: South African
Place	**:** East London Aerodrome (FAEL), Eastern Cape Province
Date and Time	**:** 25 August 2021, 0725Z
Injuries	**:** None
Damage	**:** None

Purpose of the Investigation

In terms of Regulation 12.03.1 of the Civil Aviation Regulations (CAR) 2011, this report was compiled in the interest of the promotion of aviation safety and the reduction of the risk of aviation accidents or incidents and not to apportion blame or liability.

All times given in this report are Co-ordinated Universal Time (UTC) and will be denoted by (Z). South African Standard Time is UTC plus 2 hours.

Investigation Process

The Accident and Incident Investigations Division (AIID) of the South African Civil Aviation Authority (SACAA) was notified of the occurrence on 26 August 2021 at 0904Z. The occurrence was classified or categorised as a serious incident according to the CAR 2011 Part 12 and ICAO STD Annex 13 definitions. The notifications were sent to the States of Registry, Operator, Design and Manufacturer in accordance with the CAR 2011 Part 12 and ICAO Annex 13 Chapter 4. The State of Manufacturer appointed a non-travelling accredited representative. The investigator-in-charge (IIC) did not dispatch for this serious incident site.

Notes:

1. *Whenever the following words are mentioned in this report, they shall mean the following:*
   Serious Incident — this investigated serious incident
   Aircraft — the Piper PA-28R-200 and Boeing 737-400 involved in this serious incident
   Investigation — the investigation into the circumstances of this serious incident
   Pilots — the pilots involved in this serious incident
   Report — this serious incident report

2. *Photos and figures used in this report were taken from different sources and may have been adjusted from the original for the sole purpose of improving clarity of the report. Modifications to images used in this report were limited to cropping, magnification, file compression; or enhancement of colour, brightness, contrast; or addition of text boxes, arrows, or lines.*

Disclaimer

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Abbreviation	Description
°	Degrees
°C	Degrees Celsius
ACAS	Advisory, Conciliation and Arbitration Service
AIID	Accident and Incident Investigations Division
AIRPROX	Near Collision/Aircraft Proximity/Loss of minimum separation
AOC	Air Operating Certificate
ATC	Air Traffic Control
ATCO	Air Traffic Control Officer
ATO	Aviation Training Organisation
ATPL	Airline Transport Pilot Licence
CAR	Civil Aviation Regulations
C of A	Certificate of Airworthiness
C of R	Certificate of Registration
CRS	Certificate of Release to Service
CVR	Cockpit Voice Recorder
DME	Digital Elevation Model
DVOR	Doppler Very High Frequency Omni Range
E	East
FACT	Cape Town International Aerodrome
FAEL	East London Aerodrome
FAPA	Port Alfred Aerodrome
FDR	Flight Data Recorder
FO	First Officer
ft	Feet
GPS	Global Positioning System
hPa	Hectopascal
ICAO	International Civil Aviation Organisation
IFR	Instrument Flight Rules
ILS	Instrument Landing System
kt	Knots
m	Metres
MEL	Minimum Equipment List
METAR	Meteorological Routine Aerodrome Report
MHz	Megahertz
MPI	Mandatory Periodic Inspection
NM	Nautical mile(s)
OpSpec	Operation Specifications
PAPI	Precision Approach Path Indicator
PIC	Pilot-in-command
QNH	Barometric Pressure Adjusted to Sea Level
RTF	Radiotelephony
RWY	Runway
S	South
SACAA	South African Civil Aviation Authority
SAWS	South African Weather Service
SP	Student Pilot
SPL	Student Pilot Licence
TCAS TA	Traffic Collision Avoidance System Traffic Avoidance
UTC	Co-ordinated Universal Time
VFR	Visual Flight Rules
Z	Zulu (Term for Universal Co-ordinated Time - Zero Hours Greenwich)

1. FACTUAL INFORMATION

1.1. History of Flight

1.1.1. On Wednesday morning, 25 August 2021, a Boeing 737-400 commercial aircraft using Safair 142 (SFR142) call sign with registration ZS-JRE was on a scheduled commercial flight from Cape Town International Aerodrome (FACT) to East London Aerodrome (FAEL). The flight was conducted under instrument flight rules (IFR). On-board the aircraft were two flight deck crew members, four cabin crew members and 158 passengers. The flight was operated under the provisions of Part 121 of the Civil Aviation Regulations (CAR) 2011 as amended.

1.1.2. On the same morning, a Piper PA-28R-200 aircraft using Prima 285 (PIU285) call sign with registration ZS-PTV was on a training flight from Port Alfred Aerodrome (FAPA) to FAEL. On-board the aircraft was a student pilot (SP) who was on a solo cross-country flight. The flight was conducted under visual flight rules (VFR). The flight was operated under the provisions of Part 141 of the Civil Aviation Regulations (CAR) 2011 as amended.

1.1.3. The ZS-PTV entered the FAEL airspace inbound from the north at 07:18:36Z. The SP requested to conduct two touch-and-go landings at FAEL. The air traffic control officer (ATCO) at FAEL instructed the SP to report when the field was in sight. When the SP reported that the field was in sight, the ATCO instructed the SP to join and report on left downwind for Runway (RWY) 11. The ZS-PTV was observed turning left downwind for RWY 11, close to the runway centreline.

1.1.4. At 07:21:48Z, the first officer (FO) on-board the ZS-JRE who was charged with radio work, informed the ATCO that they were established on an ILS approach for RWY 11, inbound from the west (of FAEL). The ATCO gave the ZS-JRE crew permission to continue with the approach. Another aircraft, a Cessna 150F, had just taken off from RWY 11 and had not commenced with the turn for right downwind at that time.

1.1.5. At 07:22:10Z, the ZS-PTV SP was instructed by the ATCO to turn right and continue routing north of the aerodrome, and then standby for further instructions; this was to keep the ZS-PTV aircraft clear of the final approach path of the ZS-JRE aircraft.

1.1.6. At 07:23:47Z, the ATCO instructed the ZS-PTV SP to turn or orbit to the right and re-establish on the left downwind for RWY 11. However, the SP did not readback the ATCO's instructions correctly; the ATCO repeated the instructions to the SP, who then readback the instructions correctly. However, the ZS-PTV was seen turning left, crossing the ZS-JRE's final approach path for RWY 11 instead.

1.1.7. At 07:24:28Z, the ATCO cleared the ZS-JRE aircraft to land. At 07:25:12Z, the ZS-JRE crew asked the ATCO if he was aware of the traffic turning base leg for RWY 11 in front of them. As both aircraft converged, the ZS-JRE flight crew received a Traffic Collision Avoidance System (TCAS) Traffic Advisory (TA) alert from their aircraft's Airborne Collision Avoidance System (ACAS). The crew did not carry out any avoidance manoeuvres. The separation between the aircraft was approximately 500 feet (ft) (152 metres (m)) vertically and approximately 4 nautical miles (NM) (7 408 m) horizontally.

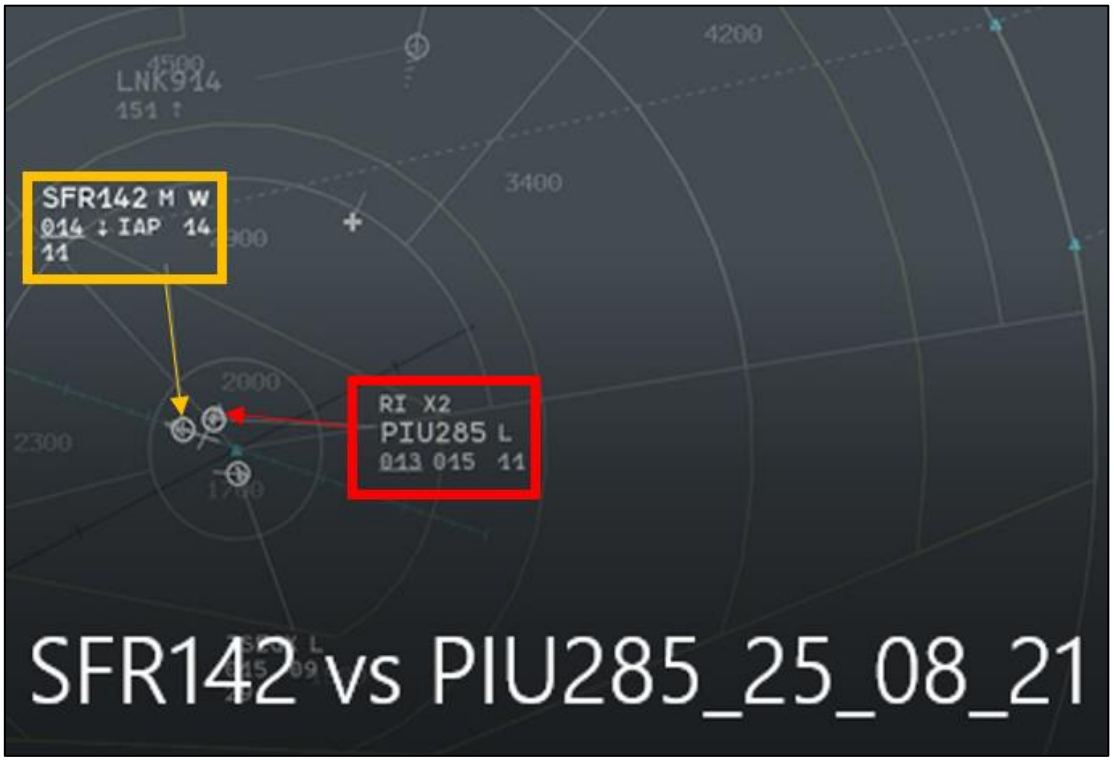

Figure 1: SFR142 (ZS-JRE) and PIU285 (ZS-PTV) at 07:25:08Z, at which time the vertical separation was around 106 ft with the horizontal separation of around 2.3 NM.

1.1.8. At 07:25:27Z, the ATCO instructed the SP to turn right and report final approach for RWY 11. At 07:25:35Z, the ATCO again instructed the SP to turn right immediately, this time with a much more forceful tone. However, the SP continued with the left turn. This reduced the separation between the aircraft to approximately 4ft (1.2 m) vertically and approximately 1.5 NM (2 778 m) horizontally.

Figure 2: At 07:25:39Z, the vertical separation was approximately 100 ft with a horizontal separation of 1.0 NM.

1.1.9. The ZS-JRE crew was advised of the instructions issued to the ZS-PTV SP and to continue to land as both aircraft were being monitored by the ATCO on the radar system, the ZS-PTV aircraft was observed to be above ZS-JRE. The ZS-PTV aircraft crossed overhead the ZS-JRE aircraft path, and the pilot was instructed to orbit and then to report established on final approach for RWY 11. At this time, the ZS-JRE had landed and vacated the runway.

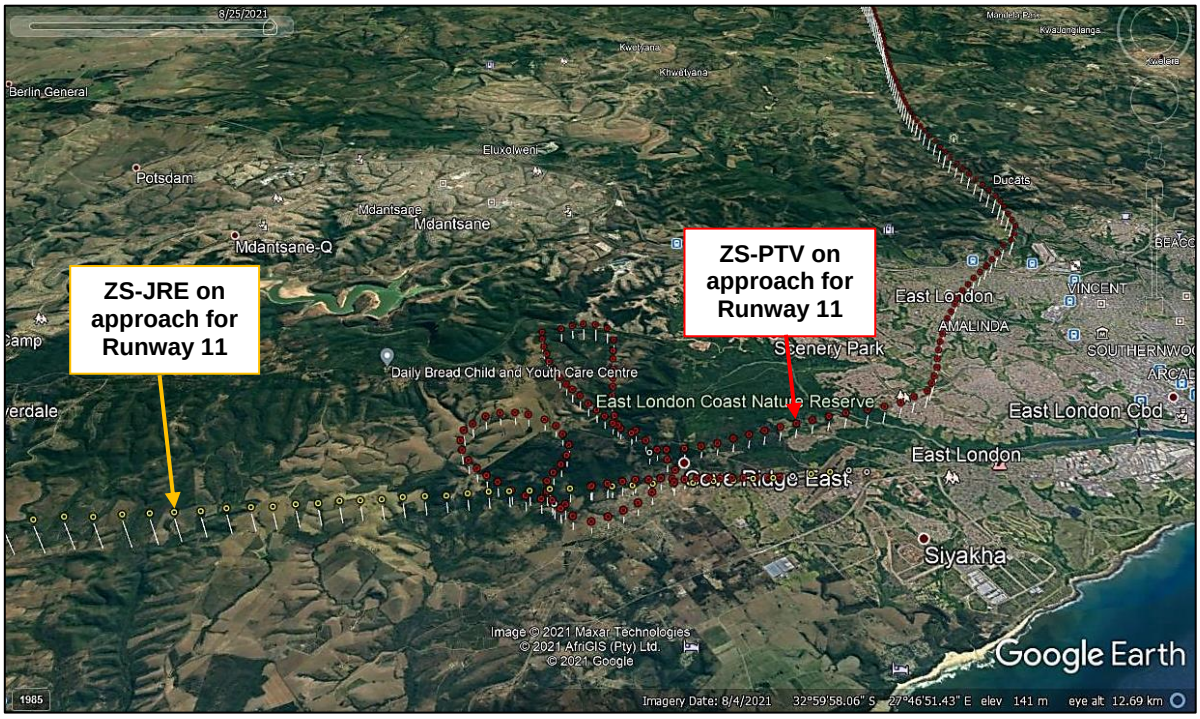

Figure 3: The radar tracks flown by the ZS-PTV and ZS-JRE aircraft, respectively. (Source: Google Earth)

1.1.10. The ZS-PTV aircraft carried out a single touch-and-go landing, reported safely airborne and, thereafter, routed outbound via Keyser's Beach.

1.1.11. No injuries resulted from this serious incident and neither of the two aircraft sustained damage.

1.1.12. Following the flight, the pilot-in-command (PIC) of the ZS-JRE aircraft submitted a near-collision (AIRPROX) report.

1.1.13. The serious incident occurred during day light at FAEL in the Eastern Cape province at Global Positioning System (GPS) co-ordinates determined to be 33°2'16.93" S, 27°47'48.28" E, at an elevation of 435 ft.

1.2. Injuries to Persons

1.2.1. Persons on-board ZS-PTV:

Injuries	Pilot	Crew	Pass.	Total On-board	Other
Fatal	-	-	-	-	-
Serious	-	-	-	-	-
Minor	-	-	-	-	-
None	1	-	-	1	-
Total	**1**	**-**	**-**	**1**	**-**

Note: Other means people on the ground.

1.2.2. Persons on-board ZS-JRE:

Injuries	Pilot	Crew	Pass.	Total On-board	Other
Fatal	-	-	-	-	-
Serious	-	-	-	-	-
Minor	-	-	-	-	-
None	2	4	158	164	-
Total	**2**	**4**	**158**	**164**	**-**

Note: Other means people on the ground.

1.3. Damage to Aircraft

1.3.1. Neither aircraft sustained damage.

1.4. Other Damage

1.4.1. None.

1.5. Personnel Information

1.5.1. **ZS-PTV Student Pilot (SP):**

Nationality	Ghanaian	Gender	Male	Age	33
Licence Type	Student Pilot Licence (Integrated Course)				
Licence Valid	Yes	Type Endorsed	Yes		
Ratings	Night Rating, Language Proficiency 6				
Medical Class & Expiry Date	Class 2; 8 October 2025				
Restrictions	None				
Previous Incidents	None				

Note: Previous serious incidents/accidents refer to past serious incidents/accidents the pilot was involved in, when relevant to this incident.

Flying Experience:

Total Hours	104
Total Past 24 Hours	2.7
Total Past 7 Days	8.0
Total Past 90 Days	18.2
Total on Type Past 90 Days	18.2
Total on Type	27.8

1.5.1.1. According to the logbook, the SP did not log any flight time between 11 October 2019 and 16 July 2021.

1.5.1.2. The SP was familiar with FAEL and had flown in the area previously. He had conducted circuits and touch-and-go exercises on eight occasions prior to the day of the serious incident. The SP had also performed a touch-and-go exercise at FAEL on 23 August 2021, two days before the serious incident.

1.5.1.3. The SP had an English language proficiency Level 6: Expert; as well as sufficient ability to read, speak and understand the English language.

Remedial Training following this serious incident:

1.5.1.4. According to the submitted Training Review Report (TRR) for the SP, he was put under remedial training because he *did not follow ATC routing instructions when joining at FAEL, resulting in a near miss with scheduled traffic*. The report further mentioned that the *SP did not take ownership of his mistakes and blamed other factors for this serious incident*.

1.5.1.5. According to the TRR, the SP underwent the following remedial training *to meet the standard required for safe solo flights in controlled airspaces*:

- *1x dual flight to FAEL focusing on arrival briefings and procedure compliance.*
- *1x Student pilot in command (SPIC) flight to FAPE to observe student following correct arrival and joining procedure before being released solo.*

1.5.1.6. On 10 September 2021 and on 18 September 2021, the SP flew with a Grade 2 flight instructor in which a total of 4.3 hours of flight time was accumulated by the SP. Following the completion of the remedial training, the SP flew a further 13.5 hours as pilot-in-command (PIC) between 22 and 26 September 2021 with no incidents.

1.5.2. **ZS-JRE Crew:**

Pilot-in-command (PIC):

Nationality	South African	Gender	Male	Age	32
Licence Type	Airline Transport Pilot Licence (ATPL) (A)				
Licence Valid	Yes	Type Endorsed	Yes		
Ratings	Instrument Rating, Instructor Grade 2				
Medical Class & Expiry Date	Class 1; 30 June 2022				
Restrictions	None				
Previous Incidents	None				

Note: Previous serious incidents/accidents refer to past serious incidents/accidents the pilot was involved in, when relevant to this incident.

Flying Experience:

Total Hours	6 980.6
Total Past 24 Hours	8.9
Total Past 7 Days	13.1
Total Past 90 Days	101.9
Total on Type Past 90 Days	101.9
Total on Type	2875.8

1.5.2.1. The PIC of the ZS-JRE aircraft had an English language proficiency Level 6: Expert; as well as sufficient ability to read, speak and understand the English language.

First Officer (FO):

Nationality	South African	Gender	Male	Age	37
Licence Type	Airline Transport Pilot Licence (ATPL) (A)				
Licence Valid	Yes	Type Endorsed	Yes		
Ratings	Instrument Rating, Instructor Grade 2				
Medical Class & Expiry Date	Class 1; 30 June 2022				
Restrictions	None				
Previous Incidents	None				

Note: Previous serious incidents/accidents refer to past serious incidents/accidents the pilot was involved in, when relevant to this incident.

Flying Experience:

Total Hours	7 394.6
Total Past 24 Hours	4.2
Total Past 7 Days	19.4
Total Past 90 Days	123.7
Total on Type Past 90 Days	121.2
Total on Type	4135.9

1.5.2.2. The First Officer (FO) of the ZS-JRE aircraft had an English language proficiency Level 6: Expert; as well as sufficient ability to read, speak and understand the English language.

1.5.3. **FAEL Air Traffic Control:**

Nationality	South African	Gender	Male	Age	30
Licence Type	Air Traffic Services				
Licence Issue & Expiry Date	29 November 2017		29 November 2021		
Licence Valid	Yes	Type Endorsed	Yes		
Ratings	Aerodrome/Tower Control				
Medical Class & Expiry Date	Class 3; 30 November 2022				
Restrictions	None				

1.5.3.1. The FAEL ATCO had a valid and current Air Traffic Control (ATC) licence which allowed him to exercise the privileges of an Air Traffic Control Tower Control Service.

1.5.3.2. The ATCO was off duty from 20 August 2021 to 22 August 2021 (three-day rest period) and was allocated an administration shift on 24 August 2021 with minimal duties in the 24 hours prior to the occurrence. His administration shift commenced from 0600Z to 1400Z.

1.5.3.3. The day of the incident was the ATCO's second consecutive day on duty.

1.5.3.4. The ATCO was on duty from 0530Z to 1100Z on 25 August 2021 and was approximately two (2) hours into the shift when the serious incident between the ZS-PTV and ZS-JRE aircraft occurred.

Air Traffic Control Training:

1.5.3.5. According to ICAO Doc 10056 – Manual on Air Traffic Controller Competency-based Training and Assessment:

Air Traffic Controllers (ATCO) with aerodrome control rating are trained to carry out the following tasks:

1. *Separate aircraft and vehicles operating on the manoeuvring area.*
2. *Separate aircraft in the circuit, and from arriving and departing aircraft.*
3. *Select runway in use.*
4. *Issue IFR clearances for departing aircraft and ensure correct readbacks.*
5. *Manage inbound and outbound IFR aircraft.*

Under the subject of Air Traffic Management, ATCOs are trained and assessed on their ability to manage air traffic to ensure safe, orderly, and expeditious services. A sub-topic (TWR ATM 2.1.2) of this subject is Topic ATM 2: Communication; whereby ATCOs are trained and assessed on Effective Communication – Communication techniques, readback/verification of readback.

ATCOs are also trained and assessed on their ability to manage Abnormal and Emergency Situations (ABES) under Topic ABES, whereby ATCOs must have the ability to ensure effective communication in all circumstances including the case where standard phraseology is not applicable – Phraseology, vocabulary, readback, silence instruction is performed satisfactorily.

1.6. Aircraft Information

1.6.1. ZS-PTV Aircraft Information:

1.6.1.1. The ZS-PTV is a *Piper PA-28R-200, which is an all-metal low-wing aircraft, powered by a Lycoming IO-360-C1C piston engine, driving a three-bladed variable-pitch Hartzell propeller. It was designed with mechanical flying controls, retractable tricycle landing gear and a wingspan of 9.81m.* (Source: Piper PA-28R-200: Cherokee Arrow II Owner's Manual).

Figure 4: Piper PA-28R-200, ZS-PTV aircraft. (Source: Owner)

Airframe:

Manufacturer/Model	Piper Aircraft Company, PA-28R-200	
Serial Number	28R-7635363	
Year of Manufacture	1976	
Total Airframe Hours (At Time of Serious Incident)	11 032	
Last MPI (Date & Hours)	10 August 2021	11 023
Airframe Hours Since Last Inspection	9	
CRS Issue Date	10 August 2021	
C of A (Original Issue Date & Expiry Date)	19 December 2008	31 December 2021
C of R (Issue Date) (Present Owner)	7 September 2018	
Operating Category	Part 141	
Type of Fuel Used	Avgas 100 LL	
Previous Serious Incidents/Accidents	None	

Note: Previous serious incidents/accidents refer to past serious incidents/accidents the aircraft was involved in, when relevant to this incident.

Engine:

Manufacturer/Model	Lycoming / IO-360-C1C
Serial Number	L-10420-51A
Hours Since New	2 795
Hours Since Overhaul	788

Propeller:

Manufacturer/Model	HARTZELL / HC-C2YK-1BF
Serial Number	CH39346B
Hours Since New	2 144
Hours Since Overhaul	404

1.6.1.2. The investigation found no technical defects with the airframe or installed systems and components that were recorded in the logbook or defect reports which may have led to the serious incident.

1.6.2. ZS-JRE Aircraft Information:

1.6.2.1. The ZS-JRE aircraft is a *Boeing 737-400, a twin-engine short-to-medium-range narrow body airliner with a capacity of maximum 188 passengers, produced by the American manufacturer Boeing Commercial Airplanes. The Boeing 737-400 is, together with the 737-300 and the 737-500, a member of the Classic-737-Family. It has a wingspan of 29m. (Source: https://www.airlines-inform.com/commercial-aircraft/boeing-737-400.html)*

Figure 5: The Boeing 737-400, ZS-JRE aircraft. (Source: www.jetphotos.com)

Airframe:

Manufacturer/Model	Boeing Aircraft Company, 737-400	
Serial Number	26065	
Year of Manufacture	1992	
Total Airframe Hours (At Time of Incident)	64 113.05	
Last Phased Inspection (Date & Hours)	13 August 2021	64 040.12
Hours Since Last Phased Inspection	72.93	
C of A (Original Date of Issue)	2 October 2014	
C of A Expiry Date	31 October 2021	
C of R (Issue Date) (Present Owner)	12 September 2014	
Type of Fuel Used in the Aircraft	Jet-A1	
Previous Incidents	None	

Note: Previous serious incidents/accidents refer to past serious incidents/accidents the aircraft was involved in, when relevant to this incident.

Engines:

	Engine 1	Engine 2
Manufacturer/Model	CFM International, S.A. – CFM56-3C1	
Serial Number	727435	857703
Hours Since New	55 486.8	53 108.97
Hours Since Overhaul	Modular	Modular

1.6.2.2. The investigation found no technical defects with the airframe or installed systems and components that were recorded in the logbook or defect reports which may have led to the serious incident.

Traffic Alert and Collision Avoidance System (TCAS) II System Details:

Manufacturer & Model	ACSS RT-910
Software Version	7.1 change
Part Number	40660101-914
Serial Number	97043047

1.6.2.3. The Advisory, Conciliation and Arbitration Service (ACAS) II version 7.1 fitted to the ZS-JRE aircraft had the required TCAS II computer, antenna and Mode S Transponder which gives both Traffic Avoidance (TA) as well as Resolution Advisory (RA) alerts. The aircraft systems were functional and serviceable, and operated as designed. At 07:25:44, the ZS-

PTV aircraft was seen crossing overhead the ZS-JRE aircraft's flight path while on final approach and a TCAS TA "*Traffic, Traffic*" alert activated, warning the crew of the ZS-JRE aircraft to be aware of intruding traffic.

4.3.3.2 PROXIMATE TRAFFIC DISPLAY

4.3.3.2.1 **Recommendation.—** *While any RA and/or TA are displayed, proximate traffic within 11 km (6 NM) range and, if altitude reporting, ±370 m (1 200 ft) altitude should be displayed. This proximate traffic should be distinguished (e.g. by colour or symbol type) from threats and potential threats, which should be more prominently displayed.*

4.3.3.2.2 **Recommendation.—** *While any RA and/or TA are displayed, visual acquisition of the threats and/or potential threat should not be adversely affected by the display of proximate traffic or other data (e.g. contents of received ADS-B messages) unrelated to collision avoidance.*

4.3.3.3 *TAs as RA precursors.* The criteria for TAs shall be such that they are satisfied before those for an RA.

4.3.3.3.1 *TA warning time.* For intruders reporting altitude, the nominal TA warning time shall not be greater than (T+20 s) where T is the nominal warning time for the generation of the resolution advisory.

Note.— Ideally, RAs would always be preceded by a TA but this is not always possible, e.g. the RA criteria might be already satisfied when a track is first established, or a sudden and sharp manoeuvre by the intruder could cause the TA lead time to be less than a cycle.

4.3.4.2 *Sensitivity levels.* ACAS shall be capable of operating at any of a number of sensitivity levels. These shall include:

a) *S* = 1, a "standby" mode in which the interrogation of other aircraft and all advisories are inhibited;

b) *S* = 2, a "TA only" mode in which RAs are inhibited; and

c) *S* = 3-7, further levels that enable the issue of RAs that provide the warning times indicated in Table 4-2 as well as TAs.

1.7. Meteorological Information

1.7.1. The weather information below was obtained from the Meteorological Aerodrome Report (METAR) that was issued by the South African Weather Service (SAWS) recorded at FAEL weather station on 25 August 2021 at 0700Z: METAR FAEL *250700Z 03004KT 350V060 CAVOK 19/08 Q1020*=

Wind Direction	030°	Wind Speed	04kts	Visibility	9999m
Temperature	19°C	Cloud Cover	CAVOK	Cloud Base	None
Dew Point	08°C	QNH	1020hPa		

1.8. Aids to Navigation

1.8.1. Both aircraft were equipped with standard factory-fitted navigational equipment approved by the Regulator (SACAA). There were no recorded defects with the equipment prior to the flight, and no defects were reported during the flight. Both aircraft were under the control of the same ATCO.

1.8.2. Air navigation radio aids, ATC radar systems and air-ground radio communication systems relevant to the operations of the ZS-PTV and ZS-JRE aircraft were operating normally at the time of the serious incident.

1.8.3. Figure 6 shows the radar tracks flown by the ZS-PTV (red pins) and the ZS-JRE (yellow pins) aircraft, respectively. The vertical and horizontal distances of the aircraft in relation to their location at different times is given in Table 1. At 07:25:27Z, the aircraft were at the same flight level of 1 100ft AGL, where it was estimated that they were at least 4ft (1.2m) vertically and

1.5NM (2 778m) horizontally.

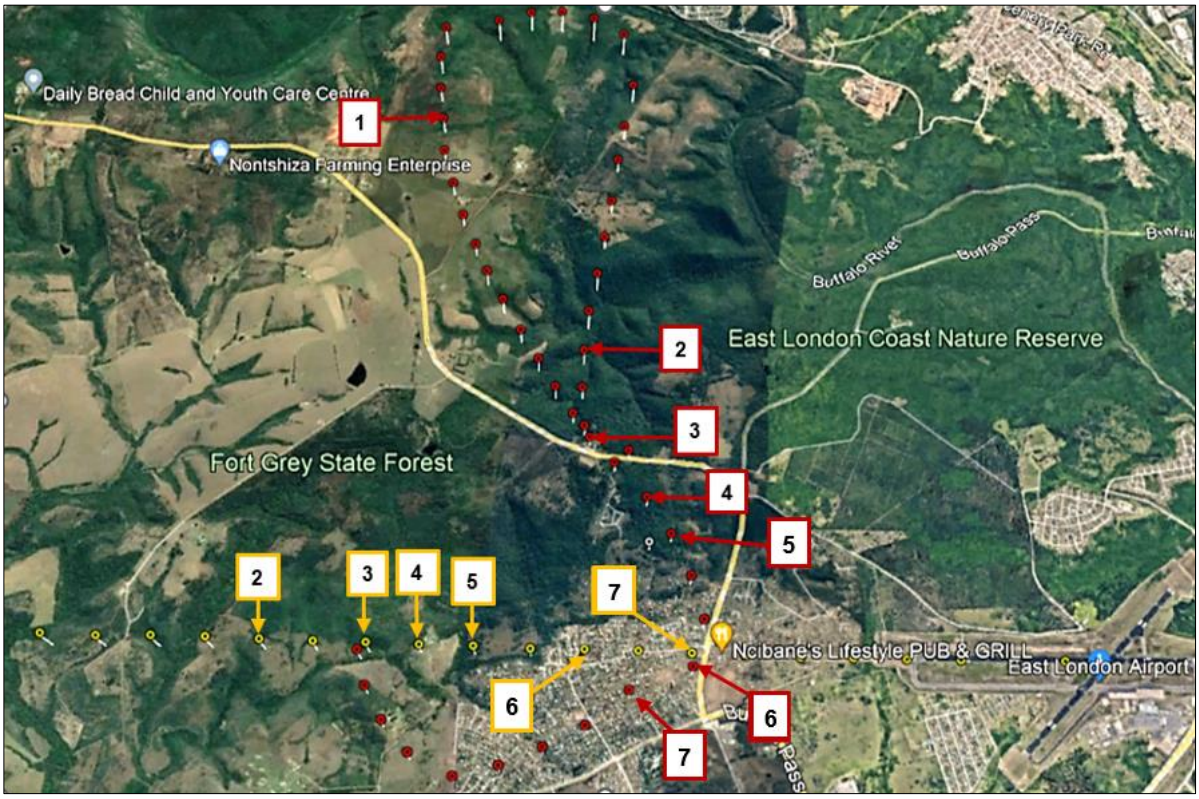

Figure 6: The flight path of the two aircraft showing significant events that led to the serious incident. (Source: Google Earth Map)

Table 1: Vertical and Horizontal Separation

Point	TIME	FLIGHT LEVEL (FL)		SEPARATION		Notes
		SFR142	PIU285	↕ Vertical	↔ Horizontal	
1	07:23:47	FL 22	FL 12	1000 ft	4.9 Nm	ATCO1 instructed PIU285 to turn right but readback was wrong (to left) & was uncorrected by ATCO1
2	07:25:07	FL 12	FL 11	106 ft	2.3 Nm	TA alert, SFR142 to ATCO1 – PIU285 seen turning base in front SFR142
3	07:25:17	FL 11	FL 11	4 ft	2.3 Nm	PIU285 seen turning base in front SFR142, repeat information to ATCO1 SFR142 to ATCO1 – Repeats that they see traffic turning base in front of them
4	07:25:27	FL 11	FL 11	4 ft	1.5 Nm	ATCO1 instructed PIU285 to turn right immediately but PIU285 did not get instruction & ATCO1 had to repeat instruction
5	07:25:32	FL 9	FL 10	100 ft	1.0 Nm	PIU285 crosses SFR142 cleared final approach path while trying to turn right immediately
6	07:25:47	FL 7	FL 10	217 ft	0.5 Nm	Position of PIU285 after crossing paths SFR142
7	07:25:52	FL 7	FL 9	200 ft	0.2 Nm	Position of SFR142 after crossing paths PIU285

Note: FL: NM: Nautical miles, ft: feet. PIU285: Prima 285 (ZS-PTV). SFR142: Safair 142 (ZS-JRE)

1.9. Communication

1.9.1. Both aircraft were equipped with standard communication equipment as per the Minimum Equipment List (MEL), approved by the Regulator. Between 07:18:36Zand 07:32:39Z, the

ZS-PTV and the ZS-JRE aircraft were both communicating with ATC ground on frequency 118.3-Megahertz (MHz).

1.9.2. The ATC recordings and radar files were made available for this investigation. Throughout communication between FAEL ATCO and both aircraft, there were clear instructions from ATCO and correct readback by the FO of the ZS-JRE aircraft.

1.9.3. Both aircraft were fitted with transponders—the ZS-PTV was issued squawk code 1520; and the ZS-JRE was issued squawk code 1541.

1.9.4. Attached to this report as Appendix A is the communication transcript from the air traffic services communications recording of the FAEL ATCO (denoted as ATCO1) and the ZS-JRE (SFR142) and ZS-PTV (PIU285) aircraft.

1.10. Aerodrome Information

1.10.1. The serious incident occurred near East London Aerodrome (FAEL).

Aerodrome Location	Eastern Cape, South Africa	
Aerodrome Status	Licensed	
Aerodrome GPS coordinates	33°2'13.80" South, 27°48'43.20" East	
Aerodrome Elevation	435 ft	
Runway Headings	11/29	06/24
Dimensions of Runway Used	1939 m × 45 m	1585 m × 45 m
Heading of Runway Used	11	
Surface of Runway Used	Asphalt	
Approach Facilities	Runway lights, PAPI, DVOR / DME, ILS	
Tower Radio Frequency	118.3 MHz	
Approach Radio Frequency	120.1 MHz	

1.10.2. Air Traffic Control Information

Separation standards refer to the minimum distance or time apart that aircraft operating in controlled airspace, such as FAEL which is a Class C airport, must be kept. These are outlined in the *CAA Manual of Standards and Procedures* and *ICAO Doc 4444- PANS-ATM*. Air traffic services and ATCO use the same to safely manage air traffic.

ATCO must keep aircraft separated vertically or horizontally. When the separation between two or more aircraft is less than the minimum prescribed, there is a loss of separation.

A surveillance separation standard is used when aircraft position information is derived from air traffic services' surveillance systems (including radar). When aircraft are operating inside terminal area airspace such as FAEL, ATCO must maintain a minimum separation between aircraft of 5 NM (9 260 m) horizontally or 1 000 ft (305 m) vertically. That standard of separation may be reduced by a tower controller when using visual observation.

1.11. Flight Recorders

1.11.1. The ZS-PTV was neither equipped with a flight data recorder (FDR) or a cockpit voice recorder (CVR), nor was it required by regulation to be fitted to the aircraft type.

1.11.2. The ZS-JRE was equipped with a flight data recorder (FDR) and cockpit voice recorder (CVR). Neither of these units was downloaded as the aircraft continued with normal scheduled flights after the serious incident.

1.12. Wreckage and Impact Information

1.12.1. Not applicable to this investigation.

1.13. Medical and Pathological Information

1.13.1. Not applicable to this investigation.

1.14. Fire

1.14.1. Not applicable for this serious incident.

1.15. Survival Aspects

1.15.1. This serious incident was considered survivable as there was no damage to either aircraft which could have caused injury to the occupants.

1.16. Tests and Research

1.16.1. AIRPROX

With reference to ICAO Doc 4444- PANS-ATM, an AIRPROX is defined as "A situation in which, in the opinion of a pilot or air traffic services personnel, the distance between aircraft as well as their relative positions and speed have been such that the safety of the aircraft involved may have been compromised."

ICAO defines a series of classifications for AIRPROX events which have been reported and subsequently investigated by an appropriate body. It is required that this classification should be assigned on the basis only of actual risk, not potential risk. This means that only the residual risk after any avoiding action is considered.

The available classification categories are:

A- Risk of collision. The risk classification of an aircraft proximity in which serious risk of collision has existed. An AIRPROX Classification A may or may not be deemed to be a serious incident as defined by ICAO Annex 13.

B- Safety not assured. The risk classification of an aircraft proximity in which the safety of the aircraft may have been compromised.

*C- **No risk of collision. The risk classification of an aircraft proximity in which no***

risk of collision has existed.

D- Risk not determined. The risk classification of an aircraft proximity in which insufficient information was available to determine the risk involved, or inconclusive or conflicting evidence precluded such determination.

The definition and classification of an AIRPROX given above was agreed prior to the introduction of ground radar and airborne systems (ACAS) capable of measuring accurately the actual separation of the aircraft involved.

An AIRPROX may occur because of a level bust or airspace infringement. Safety nets such as ACAS and STCA mitigate the resultant risk of collision.

1.16.2. According to the UK Airprox Board (AB) Findings on AIRPROX Contributory Factors and Risk Guidelines of June 2019:

The assessment is made purely based on risk of collision, not risk from collision (i.e., what the consequences might have been had the aircraft collided). As a guide:

ICAO 4444 PANS-ATM AIRPROX risk classification	UKAB Collision Risk descriptor and guideline word picture
Category A **Risk of Collision**: aircraft proximity in which serious risk of collision has existed.	**Providence – serious risk of collision**. Situations where separation was reduced to the bare minimum and/or which only stopped short of an actual collision because providence played a major part in events. The pilots were either unaware of the other aircraft or did not/could not make any inputs in time to materially improve matters.
Category B **Safety not assured**: aircraft proximity in which the safety of the aircraft may have been compromised.	**Safety much reduced/safety not assured – risk of collision.** Situations where aircraft proximity resulted in safety margins being much reduced below the norm through either chance, misjudgement or inaction; or where emergency avoiding action that materially increased separation and averted a likely collision was only taken at the last minute.
Category C **No risk of collision**: aircraft proximity in which no risk of collision has existed or risk was averted.	**Safety degraded – no risk of collision**. Situations where safety was degraded but either fortuitous circumstances or early enough sighting, information or action allowed one or both of the pilots to either simply monitor the situation or take timely and effective avoiding action to prevent the aircraft from coming into close proximity.
Category D **Risk not determined**: aircraft proximity in which insufficient information was available to determine the risk involved, or inconclusive or conflicting evidence precluded such determination.	**Non-assessable – insufficient, inconclusive or irresolvable information**. Situations where insufficient information was available to determine the risk involved, or inconclusive/conflicting evidence precluded such determination.
Category E[3] **Non-proximate**: a sighting report of another aircraft where there was no risk of collision and no degradation of safety.	**Normal safety standards and parameters – no risk of collision**. Situations that met the criteria for reporting but where, after analysis, the occurrence was assessed to be benign and where normal procedures, safety standards and parameters were considered to have pertained.

1.16.3. According to ICAO Doc 4444 – Air Traffic Management (16th Edition) & ICAO Annex 11 – Air Traffic Services (15th Edition), pilots shall always readback the following information to the ATCO:

4.5.7.5 READBACK OF CLEARANCES

4.5.7.5.1 The flight crew shall read back to the air traffic controller safety-related parts of ATC

clearances and instructions which are transmitted by voice. The following items shall always be read back:

a) ATC route clearances,

b) clearances and instructions to enter, land on, take off from, hold short of, cross, taxi and backtrack on any runway, and

c) runway-in-use, altimeter settings, SSR codes, level instructions, heading and speed instructions and, whether issued by the controller or contained in automatic terminal information service (ATIS) broadcasts, transition levels.

4.5.7.5.1.1 Other clearances or instructions, including conditional clearances, shall be read back, or acknowledged in a manner to clearly indicate that they have been understood and will be complied with.

4.5.7.5.2 The controller shall listen to the readback to ascertain that the clearance or instruction has been correctly acknowledged by the flight crew and shall take immediate action to correct any discrepancies revealed by the readback.

1.16.4. According to ICAO Doc 9870 – Manual on the Prevention of Runway Incursions (1st Edition), a breakdown in communication between controllers and pilots is caused by the following factors:

2.2 BREAKDOWN IN COMMUNICATIONS

A breakdown in communications between controllers and pilots or airside vehicle drivers is a common factor in runway incursions and often involves:

b) failure of the pilot or the vehicle driver to provide a correct readback of an instruction,

c) failure of the controller to ensure that the readback by the pilot or the vehicle driver conforms with the clearance issued,

d) the pilot and/or vehicle driver misunderstanding the controller's instructions,

2.3 PILOT FACTORS

2.3.1 Pilot factors that may result in a runway incursion include inadvertent non-compliance with ATC clearances. Often these cases result from a breakdown in communications or a loss of situational awareness in which pilots think that they are at one location on the aerodrome (such as a specific taxiway or intersection) when they are elsewhere, or they believe that the clearance issued was to enter the runway, when in fact it was not.

2.4 AIR TRAFFIC CONTROL FACTORS

2.4.1 The most common controller-related actions identified in several studies are:

g) failure of the controller to ensure that the readback by the pilot or the vehicle driver conforms with the clearance issued,

h) communication errors, and

k) reduced reaction time due to on-the-job training.

1.17. Organisational and Management Information

43 Air School Information:

1.17.1. The flight by the ZS-PTV aircraft was conducted under the provisions of Part 141 of the South African CAR 2011 as amended.

1.17.2. The operator had an Approved Training Organisation (ATO) certificate which was issued by the SACAA (Regulator) on 21 November 2019 with an expiry date of 30 November 2024. The ZS-PTV aircraft was authorised to operate under the ATO and was included in the ATO's Operation Specifications (OpSpec) by the SACAA.

Safair Information:

1.17.3. The flight by the ZS-JRE aircraft was conducted under the provisions of Part 121 of the South African CAR 2011 as amended.

1.17.4. The Department of Transport issued the operator a Class I Air Service Licence with an effective date of 26 March 2014 and a Class II Air Service Licence with an effective date of 17 August 2011 without any alteration or erasure.

1.17.5. The operator was in possession of a CAA-issued Air Operating Certificate (AOC), valid from 21 April 2021 to 30 April 2022. The ZS-JRE was authorised to operate under the AOC and was included in the AOC's OpSpec by the SACAA.

1.18. Additional Information

1.18.1. CAA Standards & Procedures (ATCIs) Manual - Section 6 – Separation Methods and Minima:

4 Reduced Separation

4.1 Standard separation may be reduced when authorised by the Civil Aviation Authority and published in the station standing instruction manual.

4.2 In the vicinity of aerodromes, the standard separation minima may be reduced if:

a) Adequate separation can be provided by the aerodrome controller when each aircraft is continuously visible to this controller,

b) Each aircraft is continuously visible to flight crews of the other aircraft concerned and the pilots thereof report that they can maintain their own separation,

c) In the case of one aircraft following another, the flight crew of the succeeding aircraft reports that the other aircraft is in sight and separation can be maintained.

5 Loss of Separation

5.2 Whenever, because of failure or degradation of navigation, communications, altimetry, flight control or other systems, aircraft performance is degraded below the level required for the airspace in which it is operating, the flight crew shall advise the controller without delay. Where the failure or degradation affects the separation minimum currently being employed, the controller shall take action to establish another appropriate type of separation or separation minimum.

6 Essential Traffic Information

6.1 Essential traffic is traffic which is separated for any period by less than the specified standard separation.

a) Direction of flight of conflicting aircraft,
b) Type and wake turbulence category of conflicting aircraft,
c) Cruising level of conflicting aircraft and ETA for the reporting point, or for aircraft passing through the level of another with less than the normal separation; the

ETA for the nearest or next reporting point nearest to where the aircraft will cross levels,

d) Relative bearing of the aircraft concerned in terms of the 12-hour clock as well as the distance from the conflicting traffic,

e) Any alternative clearance.

1.18.2. According to the CAA Standards & Procedures (ATCIs) Manual - Section 6 – Separation Methods and Minima, Separation of aircraft is divided into the following types:

7 Types of Separation

7.1 Separation is divided into the following types:

a) Vertical.

b) Horizontal:

I. Lateral.

II. Longitudinal.

III. ATS Surveillance System.

Chapter 2 Vertical Separation

1 Vertical Separation

1.2 Vertical Separation Minima

Vertical separation exists when the vertical distance between aircraft is never less than the prescribed minimum. The vertical separation minima are:

a) ***1 000 ft up to FL 290 between all aircraft****,*

b) 1 000 ft between FL290 and FL410 between RVSM approved Aircraft only,

c) 2 000 ft between FL 290 and FL410 between non-RVSM approved aircraft and any other aircraft,

d) 2 000 ft between all aircraft above FL410.

4 Horizontal Separation

4.1 An 'exact reporting point' is a position established by a navigational facility which is:

a) Overhead a VOR.

b) Overhead an NDB.

c) A position which has been notified as a reporting point and which is established by the intersection of VOR radials.

d) A position which has been notified as a reporting point and which is established by the intersection of a VOR radial and a bearing from an NDB.

e) A position established by a VOR radial combined with a range from a co-located DME.

f) A recognised and published RNAV reporting point.

1.19. Useful or Effective Investigation Techniques

1.19.1. No new effective investigation techniques were used for this investigation.

2. ANALYSIS

2.1. General

From the available evidence, the following analysis was made with respect to this incident. This shall not be read as apportioning blame or liability to any organisation or individual.

2.2. Analysis

Air Traffic Control Officer

2.2.1. The ATCO was issued an Air Traffic Service Licence on 29 November 2017 with an expiry date of 29 November 2021. The ATCO was issued a Class 3 aviation medical certificate with an expiry date of 31 November 2022.

2.2.2. The ATCO did not apply correct radio communication techniques as he did not listen to the readback from the ZS-PTV aircraft SP to ascertain that the clearance or instructions given (to turn right at 07:25:26Z) were correctly acknowledged. The ATCO did not take immediate action to correct the discrepancy in the readback from the SP who deviated from the given instructions; and thus, causing a loss of separation when the ZS-PTV aircraft crossed overhead the ZS-JRE's final approach path for RWY 11.

2.2.3. After entering the FAEL airspace, the SP made several incorrect and incomplete readbacks during the time of operation; most of these were corrected by the ATCO. However, at times, only certain parts of the incorrect readback were corrected.

Flight Operations ZS-PTV

2.2.4. The flight was conducted in line with the procedures in the operator's operations manual.

2.2.5. The flight was conducted under VFR in daylight with fine weather conditions prevailing. The weather did not play a role in this serious incident.

2.2.6. The SP carried out normal radio communication with the ATCO at FAEL.

2.2.7. The SP misinterpreted the ATCOs instructions when he was instructed to turn right but mistakenly turned left during approach. Instead of correcting the SP, the ATCO discussed the situation with another person in the tower, which led to loss of separation between the aircraft.

2.2.8. Although the SP of the ZS-PTV aircraft requested two touch-and-go landings, the ATCO decided to restrict the aircraft to a single touch-and-go landing and to rather have the SP exit the airspace. After the near miss on final approach, all aircraft continued without further incident.

Flight Operations ZS-JRE

2.2.9. The flight was conducted in line with the procedures in the operator's operations manual.

2.2.10. The FO carried out normal radio communication with the relevant ATCO at FAEL.

2.2.11. The crew had visual reference of the ZS-PTV aircraft after they received a TCAS "*Traffic, Traffic*" alert when the loss of separation occurred, in which both the range and relative elevation of the threat were estimated to have been within 11 km (6 NM) range (horizontally) and at an altitude of approximately 1 200 ft (366 m) (vertically).

2.2.12. The flight was conducted under instrument flight rules (IFR) in daylight with fine weather conditions prevailing. The weather did not play a role in this serious incident.

2.2.13. At 07:24:39Z, a TA warning was issued with no avoidance manoeuvre required. The FO observed an intruder indicating '–02' or '–03' within a 5 NM (9 260 m) range on the TCAS, which indicated that there was a possible intruder flying 200–300 ft (61–91 m) above them. The crew then saw the ZS-PTV aircraft crossing the runway centreline from their left to their right-side slightly above their aircraft. They enquired from the ATCO if he was aware of what was happening. The ATCO responded by saying that the ZS-PTV aircraft was in sight and that instructions were given to the SP to turn left; the ATCO instructed the crew of the ZS-JRE to continue with the landing.

Essential traffic information required to be communicated by the ATCO was not communicated with the flight crew of the ZS-JRE when separation was lost and after the ZS-PTV aircraft was seen crossing the runway centreline, which led to the crew of ZS-JRE aircraft receiving the traffic conflict alert warning.

2.2.14. The ZS-JRE flight crew had made visual contact with the ZS-PTV aircraft and had continued to monitor it well after the TCAS TA was issued.

Probability of a Mid-air Collision

2.2.15. At 07:18:50Z, the ATCO gave the SP the RWY in use and query nautical height (QNH) and instructed him to remain below 1500 ft, east of the mast and to report the field in sight. At 07:19:00Z hours, the SP readback the QNH and RWY in use correctly but did not readback the elevation restriction or the geographical restriction.

2.2.16. At 07:19:09Z, the ATCO instructed the SP again to remain below 1 500 ft and to report the field in sight. At 07:19:16Z, the SP readback that he "*will report the traffic in sight*"; this was the first incorrect readback – stating that "the traffic" will be reported, and then self-corrected to "*the field*". The SP then stated that he will remain below 5 000 ft, which was the second incorrect readback – and then self-corrected to "1 500 ft". The ATCO did not confirm that the SP understood the instructions.

2.2.17. At 07:23:21Z, the ATCO requested the SP to provide information of persons on-board and endurance. The SP requested the ATCO to repeat himself. The ATCO again requested information of the persons on-board and endurance. The SP advised that there was one person on-board and that he had an endurance of 2 hours, this was the third incorrect readback – first by saying, "*2 hours*", and then self-corrected to "*3 hours*".

2.2.18. At 07:23:47Z, the ATCO instructed the SP to turn right, and report re-established on the left downwind for RWY 11. The SP readback the instructions incorrectly, saying "*to turn left and report right downwind for RWY 11*".

2.2.19. At 07:24:10Z, the ATCO repeated the instructions to the SP "to re-establish on the left downwind for RWY 11", who then readback the instructions correctly. The ATCO did not

indicate to the SP that the readback was incorrect, which led to the SP turning left even after the ATCO repeated the instructions.

2.2.20. At 07:24:39Z, the ATCO observed ZS-PTV on radar turning left instead of right, this resulted in the ZS-PTV aircraft crossing overhead the ZS-JRE aircraft's final approach path for RWY 11. It is described in Section 2.2.12 that the crew of the ZS-JRE received a TCAS TA aural advisory with no avoidance manoeuvre required. The TCAS indicated the ZS-PTV aircraft was within the 5 NM range (horizontally), which also indicated that the intruder was flying at 200–300 ft above them (vertically). At this point, the ZS-PTV aircraft was flying at a separation (altitude) of 500 ft above and 4 NM away from the ZS-JRE aircraft.

2.2.21. At 07:25:17Z, the crew of the ZS-JRE aircraft could see the ZS-PTV aircraft directly on the left in the 11 o'clock position, at the same elevation during this transmission, and informed the ATCO of the ZS-PTV aircraft. The ZS-PTV aircraft was flying at a vertical separation of 4 ft (1.2 m) above the ZS-JRE aircraft. The horizontal separation distance between the aircraft was further reduced to 1.5 NM (2 778 m) (see point 3 and 4 of Table 1).

2.2.22. The ATCO advised the crew of the ZS-JRE aircraft to continue with the approach and landing as the trajectory of the ZS-PTV aircraft was observed to cross overhead their flight path. Based on the radar images, the ATCO would have observed the ZS-JRE aircraft to have been at an elevation of 900 ft AGL with the ZS-PTV aircraft at 1500 ft AGL.

2.2.23. At 07:25:52, after ZS-PTV crossed ZS-JRE's path, the aircraft were at a horizontal separation distance of 0.2 NM (370 m), with a vertical separation of 200 ft (61 m) (see point 6 and 7 of Table 1).

2.2.24. In this serious incident, the crew of the ZS-JRE aircraft had visual sight and the TCAS had kept monitoring the movement of the ZS-PTV aircraft. It could not be determined if the SP of the ZS-PTV aircraft had the ZS-JRE aircraft in sight. However, because the crew of ZS-JRE were not prompted to take avoidance action and only had a traffic alert, it is considered that the aircraft did not approach each other to the extent that there was a risk of collision or near mid-air collision.

2.2.25. Based on the proximity of both aircraft described in sections 2.2.20 to 2.2.23, it is estimated that there was no possibility of a risk of collision or near-collision between the aircraft as the crew of ZS-JRE had sight of ZS-PTV and continued to monitor the proximity of the aircraft which would have allowed them to take timely and effective avoiding action to prevent the aircraft from coming into proximity. Aircraft sufficiently monitored the movements of the other. According to the classification of aircraft proximity by the *International Civil Aviation Organization (ICAO) Doc 4444*, this serious incident is classified as "*Class C – No risk of collision - aircraft proximity in which no risk of collision has existed, or risk was averted*. (See section 1.16.1 and 1.16.2).

3. CONCLUSION

3.1. General

From the available evidence, the following findings, causes and contributing factors were made with respect to this incident. These shall not be read as apportioning blame or liability to any organisation or individual.

To serve the objective of this investigation, the following sections are included in the conclusion heading:

- **Findings —** are statements of all significant conditions, events, or circumstances in this incident. The findings are significant steps in this incident sequence, but they are not always causal or indicate deficiencies.
- **Causes —** are actions, omissions, events, conditions, or a combination thereof, which led to this incident.
- **Contributing factors —** are actions, omissions, events, conditions, or a combination thereof, which, if eliminated, avoided or absent, would have reduced the probability of the incident occurring, or would have mitigated the severity of the consequences of the incident. The identification of contributing factors does not imply the assignment of fault or the determination of administrative, civil, or criminal liability.

3.2. Findings

Aircraft

3.2.1. The aircraft were certified, equipped, and maintained in accordance with the existing regulations and approved procedures.

3.2.2. There was no evidence of any defect or malfunction with either aircraft that could have contributed to the serious incident.

Crew of ZS-JRE

3.2.3. The flight crew was properly licensed and medically fit for the flight in accordance with the existing regulations.

3.2.4. The crew's actions indicated that their knowledge and understanding of the aircraft's Traffic Collision Avoidance System (TCAS) was adequate.

Student Pilot (SP) of ZS-PTV

3.2.5. The SP was properly licensed and medically fit for the flight in accordance with the existing regulations.

3.2.6. The SP experienced navigational challenges while on the FAEL approach frequency.

Air Traffic Control

3.2.7. The ATCO was properly licensed, medically fit, and correctly rated to provide the service.

3.2.8. The various incorrect readbacks added to the controller's workload.

Flight Operations

3.2.9. The ZS-PTV aircraft was observed not joining on the downwind, but rather almost overhead the field, crossing the extended centreline whilst the ZS-JRE (SFR142) aircraft was already

established on the long final approach.

3.2.10. The ZS-PTV SP was struggling with correct and fluent readbacks.

3.2.11. The ATCO requested the pilot of the ZS-PTV aircraft to route north bound (turn right) to create space between his aircraft and the ZS-JRE aircraft; however, the pilot misunderstood the instruction and made a sharp left turn routed (south-bound) towards the ZS-JRE aircraft's final approach path, which led to loss of vertical separation.

3.2.12. Even though the ATCO was aware of the ZS-PTV aircraft's position, he did not monitor its flight path and positioning effectively. The ATCO was informed of the ZS-PTV aircraft's position by the crew of the ZS-JRE aircraft on final approach and did not immediately apply avoidance measures, which resulted in the ZS-PTV aircraft routing over ZS-JRE aircraft's flight path. When the ATCO became aware of the proximity of the two aircraft, he did not respond with the required urgency.

3.2.13. From the recordings, it is evident that the ATCO observed the flight path deviation of the ZS-PTV (PIU285) aircraft, however, he did not issue immediate avoidance action. As the ATCO further observed the crossing flight paths which led to the loss of vertical separation, further conflict resolution was not applied as the ATCO deemed it to be a greater risk to issue a go-around instruction to the crew of the ZS-JRE aircraft.

3.2.14. The ATCO did not correct all the incorrect and incomplete readbacks by the ZS-PTV SP.

3.2.15. According to the classification of aircraft proximity by the International Civil Aviation Organization (ICAO) Doc 4444, this serious incident is classified as "*Class C – No risk of collision*".

3.3. **Probable Cause/s**

3.3.1. A loss of minimum separation (AIRPROX) between the two aircraft on final approach after the SP deviated from the ATCO's instruction.

3.4. **Contributory Factor/s**

3.4.1. Incorrect execution of ATCO's instructions by the SP.

3.4.2. Omittance by the ATCO to correct the misinterpreted readbacks by the SP.

4. SAFETY RECOMMENDATIONS

4.1. **General**

The safety recommendations listed in this report are proposed according to paragraph 6.8 of Annex 13 to the Convention on International Civil Aviation and are based on the conclusions listed in heading 3 of this report. The AIID expects that all safety issues identified by the investigation are addressed by the receiving States and organisations.

4.2. **Safety Action taken by Training School**

4.2.1. According to the submitted Training Review Report (TRR) for the SP, he was put under remedial training and underwent the following remedial training to meet the standard required for safe solo flight in controlled airspace:

1x dual flight to FAEL focusing on arrival briefings and procedure compliance.
1x SPIC flight to FAPE to observe students following correct arrival and joining procedure before being released solo.

On 10 September 2021, the SP flew with a Grade 2 flight instructor, as well as on 18 September 2021, with a total of 4.3 hours flight time logged. Following the completion of remedial training, between 22 and 26 September 2021, the SP flew a further 13.5 hours as PIC with no incidents reported to date.

4.3. Safety Action taken by FAEL Air Traffic Control Office

4.3.1. The ATCO was given Critical Incident Stress Management (CISM) support.

4.4. **Safety Recommendation**

4.4.1. Although the ATCO underwent stress management support following the serious incident, the AIID is of the view that the CISM support does not address the technical gaps that prevailed on the day of the serious incident.

To reduce/prevent competence degradation of the air traffic controller (ATCO) involved in this serious incident, AIID recommends that FAEL ATC takes the ATCO through refresher training to reinforce the knowledge, skills, and attitude of the ATCO in Radio Discipline in applying correct radio communication techniques for him to provide safe, orderly, and expeditious flow of air traffic. It is further recommended that the refresher training reinforce the knowledge, skills, and attitude of the ATCO must include but not limited to:

- Enable the ATCO to always insist on complete readbacks of clearances and instructions from pilots.
- Teaches the ATCO to correct any error in readback and insist on further readback until certain that the clearance or instruction has been correctly copied.
- Improves that ATCO's attitude which will lead to the ATCO avoiding distractions when listening to readback.

5. APPENDICES

5.1. Appendix A – Communication transcript
5.2. Appendix B – Doc 10056 Structure of ATC training

This report is issued by:

Accident and Incident Investigations Division
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Appendix A
Communication transcript of the FAEL ATCO with Safair 142 (SFR142) and Prima 285 (PIU285)

Key:
Time: in UTC.
PIU285: Prima 285 (ZS-PTV). SFR142: Safair 142 (ZS-JRE)

TIME	FROM	TO	MESSAGE
07:18:36	PIU285	ATCO1	East London tower good day from 285
07:18:40	ATCO1	PIU285	PRIMA285 good morning, go ahead…
07:18:41	PIU285	ATCO1	PRIMA285 overhead Nahoon Dam requesting for joining and two touch and go's PRIMA285
07:18:50	ATCO1	PIU285	PRIMA285 Runway 11, QNH 1019, cleared inbound not above 1 500 feet. Remain East of the Mast and report field in sight…
07:19:01	PIU285	ATCO1	QNH 1019, Runway 11 is in use PRIMA285
07:19:10	ATCO1	PIU285	PRIMA285, not above 1 500 ft and report field in sight
07:19:14	PIU285	ATCO1	No report traffic, uhhh, will report airport in sight. Will stay below 5 000 ft, uhhh, 1 500 ft. PRIMA285.
07:20:16	ATCO1		(Translated from Sesotho) This is one is trouble, is trouble, is trouble. Another ATCO was heard mimicking ATCO1.
07:20:22	PIU285	ATCO1	PRIMA285, I have airfield in sight
07:20:25	ATCO1	PIU285	PRIMA285 join and report left downwind Runway 11
07:20:28	PIU285	ATCO1	Join and report left downwind for Runaway 11 PRIMA285…
07:20:40	ATCO1		ATCO1 saying "*hmm heish*" responding to another ATCO
07:20:51	ATCO1		ATCO1 saying "I'm watching him' (translated from Sesotho)
07:20:56	ATCO1		ATCO1 saying "He better turn" referring to PIU285 who was on left side of airfield instead of the right side.
07:20:58	ATCO1	ATCO2	That is why he is going to orbit until I schedule his landing
07:21:21	ATCO2	ATCO1	ATCO2 saying something inaudible to ATCO1. ATCO1 responding by saying "heyyy". ATCO2 giggles. You are on the left downwind says ATCO2. ATCO1 responds by saying "heyyy".
07:21:21	ATCO1		(Translated from Sesotho) What is he doing? *(Referring to PIU285)*
07:21:32	SFR142	ATCO1	Tower SAFAIR142 level… (not audible), Runway 11, JRE for Bay 2
07:21:43	ATCO1		Asking himself, "where is this guy going?" *PIU285 flying left downwind instead of right.*
07:21:52	SFR142	ATCO1	SFR142, Juliet Romeo Echo for ***two
07:21:55	ATCO1	SFR142	SURFAIR142 good day continue approach Runway 11 surface wind is 060 degrees ten knots…
07:22:02	SFR142	ATCO1	Continue 11 SAFAIR142
07:22:05	PIU285	ATCO1	PRIMA285 late downwind, Runway 11…
07:22:10	ATCO1	PIU285	Yoh. PRIMA285 right hand turn out head north and standby for further instructions…
07:22:19	ATCO1		ATCO1 comments "Very close to the runway"
07:22:21	PIU285	ATCO1	PRIMA285 please say again…
07:22:24	ATCO1	PIU285	PRIMA285, turn right and head north and standby for further instruction
07:22:30	PIU285	ATCO1	Will turn right and head north and wait for instruction, PRIMA285
07:22:36	ATCO1	ATCO2	Did you see how close he was?
07:22:40	ATCO1	ATCO2	I want him to make a big loop and come back
07:23:12	ATCO1		To himself, "there we go." *Referring to PIU285 after turning and heading right.*
07:23:21	ATCO1	PIU285	PRIMA285 report persons on board and fuel endurance

07:23:25	PIU285	ATCO1	PRIMA285 please say again…
07:23:27	ATCO1	PIU285	PRIMA285 report persons on board and fuel endurance
07:23:31	PIU285	ATCO1	PRIMA285 one on board and I have 2 hours… 3 hours endurance PRIMA285
07:23:47	ATCO1	PIU285	PRIMA285 you can turn right, and report re-established on left downwind Runway 11
07:23:57	PIU285	ATCO1	Turn left, Uhhh, report on, uhhh, right downwind for Runway 11 PRIMA285… (*this readback is incorrect*)
07:24:09	ATCO1	PIU285	PRIMA285 report re-established on left downwind Runway 11…
07:24:17	PIU285	ATCO1	Report left downwind 11 PRIMA285… *(radio signal not good)*
07:24:23	ATCO1	SFR142	SAFAIR142 Runway 11 surface wind 070 degrees 09 knots. Cleared to land…
07:24:29	SFR142	ATCO1	Clear to land 11 SAFAIR142…
07:24:39	ATCO1		Please do not go into that thing (*reference PIU285)*
07:25:07	SFR142	ATCO1	East London tower do you see that traffic?
07:25:13	ATCO1	SFR142	Last call, say again…
07:25:16	SFR142	ATCO1	I am saying, there's traffic turning base in front of us…
07:25:20	ATCO1	SFR142	Traffic will be re-establishing on your left downwind sir; you can continue to land…
07:25:27	ATCO1	PIU285	PRIMA285 turn right immediately and report final approach Runway 11. *Yoh*
07:25:33	PIU285	ATCO1	PRIMA285 turn right immediately…
07:25:37	ATCO1		ATCO1 shouting to himself *"Yoh… Yoh… Yoh… Yoh… Yoh" (PIU285 turning left instead of right.)*
07:25:46	ATCO1		ATCO1 shouting to himself "*Yoh…Yoh… Yoh*"
07:26:09	ATCO1		ATCO1 shouting to himself "*Yoh…Yoh"*
07:26:18	ATCO1		ATCO1 saying to himself "*this guy…"*
07:26:27	ATCO1	PIU285	PRIMA285…
07:26:30	PIU285	ATCO1	PRIMA285 go ahead…
07:26:32	ATCO1	PIU285	PRIMA285, on your current position, commence one more left orbit, sir and report re-established final approach Runway 11…
07:26:43	PIU285	ATCO1	Orbit to the left PRIMA285…
07:26:50	ATCO1		ATCO1 shouting to himself *Yoh*
07:26:54	ATCO1	SFR142	Safair142 vacate left alpha four alpha for the main apron, apologies…
07:26:59	SFR142	ATCO1	Alpha 4 Alpha, that was a near miss on final approach SAFAIR142…
07:27:26	ATCO1	PIU285	PRIMA285 report final approach Runway 11
07:27:28	PIU285	ATCO1	PRIMA285 returning for final approach Runway 11
07:27:32	SFR142	ATCO1	Safair142, requesting details of PIU285 call sign
07:27:41	ATCO1	SFR142	Safair 142, that was PRIMA285
07:27:45	SFR142	ATCO1	What was the registration?
07:27:48	ATCO1	SFR142	Registration… just standby for me. Registration Papa Tango Victor.
07:28:07	ATCO1		ATCO1 saying to himself "*Yoh…"*
07:28:13	SFR142	ATCO1	He nearly crashed into us.
07:28:18	ATCO1		ATCO1 saying to himself "*Yoh…"*
07:28:23	ATCO1	PIU285	PRIMA285 did you copy that sir?
07:29:08	PIU285	ATCO1	PRIMA285 final for Runway 11 (*pilot did not acknowledge near miss*)
07:29:09	ATCO1	PIU285	PRIMA285 Runway 11, cleared for touch and go, surface wind 080 degrees, nine knots, report safely airborne
07:29:22	PIU285	ATCO1	PRIMA285 will report once safely airborne

Appendix A
Doc 10056 Structure of ATC training

The progression of air traffic controller training has been structured into three phases, illustrated in the diagram below.

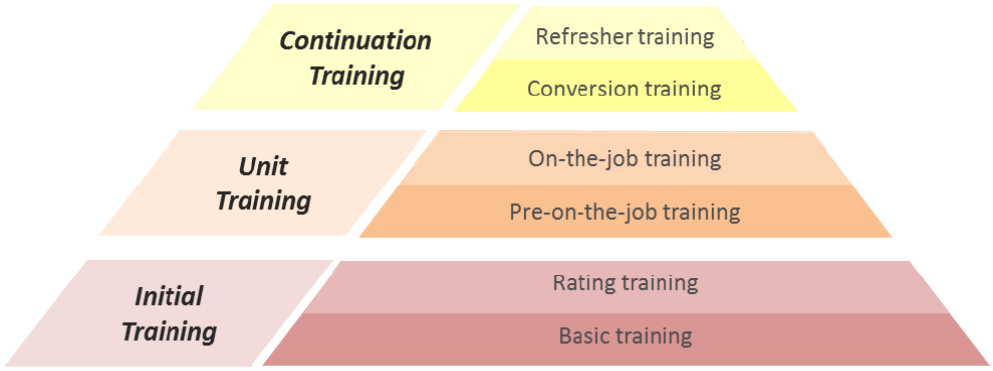

Figure 1: Initial training, unit training and continuation training

1.6.8 **Continuation training**

The objective of continuation training is to enable an operational air traffic controller to maintain the validity of their license and enhance their existing competencies. It consists of two possible phases; refresher training and conversion training, where conversion training only occurs on an "as needed" basis:

Refresher training – which is training designed to review, reinforce and/or enhance the existing competencies of air traffic controllers to provide a safe, orderly, and expeditious flow of air traffic.

2.7.4.5 Refresher training assumes that trainees' have already achieved competence and so it is unlikely that there would be a need to create interim competency standard/s.

Chapter 6 – Refresher Training

6.1 **Introduction**

This chapter provides guidance on the design of ATC refresher training. It explains the purpose of refresher training and then elaborates on the design considerations that are specific to this phase of training. This manual structure's refresher training as one of the phases of continuation training.
Refresher training is designed to review, reinforce, or enhance the existing knowledge, skills, and attitudes of air traffic controllers to provide a safe, orderly, and expeditious flow of air traffic.

Refresher training is typically provided on a routine and scheduled basis. However, it may additionally be provided when an ad-hoc need has been identified, e.g., typically in response to an incident that has highlighted an individual's weakness in the application of a particular emergency procedure, but occasionally it may also be identified that there is a systemic issue affecting all ATCOs in the unit and/or team, that is sufficiently safety critical that it should be addressed early than the scheduled refresher training. Refresher training is not designed to train on elements you do every day that are done in a proficient and correct manner. Refresher training needs to be relevant to the situation so that it is received in a positive and productive way.

Refresher training may address, but is not limited to:
a) standard practices and procedures, using approved phraseology and effective communication,
b) non-routine situations, such as:
   1. unusual and emergency situations related to aircraft operations,
   2. degraded modes of ATS operation, and
c) Human Factors.

Standard practices and procedures could include seldom used procedures, seasonally dependant traffic flows and procedures, working at maximum or slightly above maximum sector capacity, etc. Emergency situations are serious and potentially dangerous situations requiring immediate actions(s), e.g., emergency descents, fire on-board aircraft.

It is important to recognize that not all operational safety issues or risks identified can be mitigated through refresher training. There are some issues for which an alternative mitigation would be more effective.

CHAPTER 6 - Appendix 2 – Example Refresher Training Syllabus

				Relevant competencies from ACM									
Scenarios (sub-topics)	**Training objectives**	**Relevant ATC Licence Ratings**	**Observable behaviours that supplement the Evidence Guide and assessment**	**SITU**	**TRAF**	**SEPC**	**COMM**	**CORD**	**NONR**	**PROB**	**SELF**	**WORK**	**TEAM**
			Takes extra care when language difficulties are apparent				x						
Radio Discipline - any situation where communication is required.	Use appropriate radio telephony phraseology	All	Uses clear and unambiguous phraseology at all times				x	x					
			Use standard RT phraseology, when prescribed				x	x					
	Apply correct radio communication techniques		Insists on complete readbacks of clearances and instructions from pilots at all times				x						
			Corrects any error in read-back and insist on further read-back until certain that the clearance has been correctly copied				x						
			Issues conditional clearances that are correct and complete				x						
			Avoids distractions when listening to readbacks				x						
			Avoids issuing more than two instructions in the same transmission				x						
			Uses standard coordination phraseology, when prescribed				x	x					
			Does not pass RTF frequency changes as part of a multi-part clearance				x						