

COMMAND OF AERONAUTICS
AERONAUTICAL ACCIDENT INVESTIGATION AND
PREVENTION CENTER



FINAL REPORT
A - 033/CENIPA/2013

<u>OCURRENCE:</u>	ACCIDENT
<u>AIRCRAFT:</u>	PT-AVK
<u>MODEL:</u>	D-35
<u>DATE:</u>	29 September 2011



NOTICE

According to the Law n° 7565, dated 19 December 1986, the Aeronautical Accident Investigation and Prevention System – SIPAER – is responsible for the planning, guidance, coordination and execution of the activities of investigation and prevention of aeronautical accidents.

The elaboration of this Final Report was conducted taking into account the contributing factors and hypotheses raised. The report is, therefore, a technical document which reflects the result obtained by SIPAER regarding the circumstances that contributed or may have contributed to triggering this occurrence.

The document does not focus on quantifying the degree of contribution of the different factors, including the individual, psychosocial or organizational variables that conditioned the human performance and interacted to create a scenario favorable to the accident.

The exclusive objective of this work is to recommend the study and the adoption of provisions of preventative nature, and the decision as to whether they should be applied belongs to the President, Director, Chief or the one corresponding to the highest level in the hierarchy of the organization to which they are being forwarded.

This Report does not resort to any proof production procedure for the determination of civil or criminal liability, and is in accordance with item 3.1, Annex 13 of the 1944 Chicago Convention, which was incorporated in the Brazilian legal system by virtue of the Decree n° 21713, dated 27 August 1946.

Thus, it is worth highlighting the importance of protecting the persons who provide information regarding an aeronautical accident. The utilization of this report for punitive purposes maculates the principle of “non-self-incrimination” derived from the “right to remain silent” sheltered by the Federal Constitution.

Consequently, the use of this report for any purpose other than that of preventing future accidents, may induce to erroneous interpretations and conclusions.

N.B.: This English version of the report has been written and published by the CENIPA with the intention of making it easier to be read by English speaking people. Taking into account the nuances of a foreign language, no matter how accurate this translation may be, readers are advised that the original Portuguese version is the work of reference.

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SYNOPSIS

This is the Final Report of the 29 September 2011 accident involving the D35 aircraft, registration PT-AVK. The accident was classified as inflight loss of component.

The control tower lost radio contact with the aircraft, which was on a local flight.

The tower controller managed to reestablish contact with the pilot by means of his cell phone, and received information that there was a problem with the aircraft radio.

45 minutes later, the ATC unit received a phone call with information that the aircraft had crashed.

The occupants of the aircraft (the pilot and a passenger) were killed in the crash.

The aircraft was completely destroyed.

An accredited representative of the NTSB (National Transportation Safety Board) was appointed for participation in the investigation.

GLOSSARY OF TECHNICAL TERMS AND ABBREVIATIONS

AD	Airworthiness Directive
ANAC	(Brazil's) National Civil Aviation Agency
APP-SN	Santarém Approach Control
ATS	Air Traffic Services
CA	Airworthiness Certificate
CCF	Medical Certificate
CENIPA	Aeronautical Accident Investigation and Prevention Center
CHT	Technical Qualification Certificate
DIAM	Annual Maintenance Inspection Declaration.
FAA	Federal Aviation Administration
FCDA	Airworthiness Directive Compliance Sheet
FIAM	Annual Maintenance Inspection Sheet
IAM	Annual Maintenance Inspection
IFR	Instrument Flight Rules
INFRAERO	Brazilian Airports Infrastructure Enterprise
Lat	Latitude
Long	Longitude
MNTE	Airplane, single engine, land certificate
PLA	Airline Transport Pilot – Airplane category
PPR	Private Pilot – Airplane category
RSV	Flight Safety Recommendation
SBSN	ICAO location designator –Santarém Aerodrome, State of Pará, Brazil
SERIPA	Regional Aeronautical Accident Investigation and Prevention Service
SIPAER	Aeronautical Accident Investigation and Prevention System
TWR-SN	Santarém Aerodrome Control Tower
UTC	Coordinated Universal Time
VFR	Visual Flight Rules

AIRCRAFT	Model: D-35 Registration: PT-AVK Manufacturer: <i>Beech Aircraft</i>	Operator: Private
OCCURRENCE	Date/time: 29 SEPT 2011 / 18:15 UTC Location: <i>Comunidade de Lavras</i> Lat. 02°35'51.8"S – Long. 054°44'53"W Municipality – State: Santarém – Pará	Type: Inflight loss of component

1 FACTUAL INFORMATION

1.1 History of the occurrence

The aircraft departed from SBSN at 17:26 UTC on a local flight.

After the aircraft departed, the tower controller ceased to receive communications from the pilot, despite making several calls, which proved unsuccessful.

Sometime later, the approach controller managed to contact the pilot by means of a cell phone, and gave him instructions concerning his return to SBSN.

After about 45 minutes, the ATC unit was informed through a phone call that the aircraft had crashed.

1.2 Injuries to persons

Injuries	Crew	Passengers	Third parties
Fatal	01	01	-
Serious	-	-	-
Minor	-	-	-
Uninjured	-	-	-

1.3 Damage to the aircraft

The aircraft was completely destroyed.

1.4 Other damage

Nil.

1.5 Personnel information

1.5.1 Information on the crew

HOURS FLOWN	
	PILOT
Total	10,520:40
Total in the last 30 days	11:20
Total in the last 24 hours	00:45
In this type of aircraft	01:30
In this type in the last 30 days	00:45
In this type in the last 24 hours	00:45

NB.: Information provided by *Tail Taxi-Aéreo Ltda.*, the company for which the pilot worked as an employee.

1.5.1.1 Professional formation

The pilot did his Private Pilot course (Airplane category) in the *Aeroclube de Itápolis*, State of São Paulo, in 1987.

1.5.1.2 Validity and category of licenses and certificates

The pilot had an ATP license (airplane category), and his ASEL (airplane, single engine, land) technical qualifications were valid.

1.5.1.3 Qualification and flight experience

The pilot was qualified and had enough experience for the type of flight.

1.5.1.4 Validity of medical certificate

The pilot had a valid medical certificate.

1.6 Aircraft information

The aircraft (SN D-3437) was manufactured by Beech Aircraft in 1953.

The aircraft airworthiness certificate was valid.

The airframe, engine, and propeller logbooks were not found, nor the remainder of the aircraft documentation. Information on the inspections was provided by the *Oficina Nacional Manutenção de Aeronaves Ltda* workshop.

The last aircraft inspection (type 100 hours and Annual Maintenance Inspection) was carried out on 10 December 2010 by the *Oficina Nacional Manutenção de Aeronaves Ltda* workshop. The aircraft flew one hour and 30 minutes after the inspection.

It was not possible to determine either the date of the last overhaul of the aircraft or the amount of time flown after the overhaul.

According to the maintenance records located (DIAM and FIAM), and considering the flights performed up to the date of the accident, the aircraft had a total flight time of 7,554:45 hours, and was equipped with a continental engine, model IO-520-BB6, SN573444, which had a total flight time of 1,596:40 hours; and a McCauley propeller (model 2A36C23-PEG, SN 735311), which had a total of 2,103:25 flight hours.

The engine and the propeller were applicable to the accident aircraft model, in accordance with the *Supplemental Type Certificate*, nº SA2200W, issued by the *Federal Aviation Administration* (FAA).

1.7 Meteorological information

Prevailing weather conditions were VMC.

1.8 Navigational aids

Nil.

1.9 Communications

Radio contact with the aircraft was lost just after departure.

The approach controller on duty managed to contact the pilot by means of a cell phone.

At 18:24 UTC, this same controller received a phone call informing that the aircraft had crashed in a locality known as *Comunidade de Lavras*, in the city of Santarém, State of Pará.

At 18:37 UTC, this information was confirmed by another aircraft which was flying over the crash site.

1.10 Aerodrome Information

Not applicable.

1.11 Flight recorders

Neither required nor installed.

1.12 Wreckage and impact information

The accident occurred in an area of forest, and no evidence of earlier impact with obstacles was found.

In the crash site, it was verified that the V-tail empennage had detached from the aircraft in flight.

The stabilizers and ruddervators were found along the trajectory of the aircraft, at a distance of 800 meters short of the concentration of the remainder of the wreckage.

The distribution of the wreckage was of a linear type, as can be seen in the figure below.



Figure 1 - Croquis of the aircraft wreckage distribution.

The aircraft collided with the ground on a pitch-down attitude of approximately 90 degrees.

Due to the large amount of energy of the impact with the ground, the aircraft was completely destroyed, and it was not possible to identify the position of the control surfaces, levers and indicators.

Witnesses reported having sighted the aircraft moments before the accident, and confirmed that they noticed the detachment of some part of the aircraft still in flight, after which a maneuver similar to a spin occurred, culminating with the noise of the impact with

the ground. When they arrived at the crash site, they found the aircraft occupants' bodies and a smell of fuel but without occurrence of fire.



Figure 2- Left stabilizer and ruddervator.



Figure 3 - Right-hand-side stabilizer.



Figure 4 - Right-hand-side ruddervator.



Figure 5 - Wreckage of the PT-AVK.

1.13 Medical and pathological information

1.13.1 Medical aspects

Nil.

1.13.2 Ergonomic information

Nil.

1.13.3 Psychological aspects

Friends, peer pilots, workmates, and family members of the victims were interviewed.

1.13.3.1 Individual information

The pilot had a 25-year professional experience, and was described as a meticulous, competent, professional and responsible person. He was a careful and disciplined pilot, extremely concerned with flight safety.

In 2005, he purchased the PT-AVK aircraft, which had been involved in an aeronautical incident.

He, then, took the aircraft to a certified workshop. Later, he changed to another workshop and would monitor all maintenance services performed in the aircraft.

According to information gathered at the interviews, the pilot waited seven years for the aircraft to become ready, with the repairs being made in accordance with the financial condition.

His intention was to include the aircraft in an air-taxi company, and hire two dependable colleagues to work as pilots. He wanted to make money with the plane, although he did not have the intention to leave the company for which he worked.

When the aircraft was released for a test flight by the ANAC, he set the date of 29 September 2011 for the flight, five days after the release.

The day before, he had finalized the last details regarding the flight.

1.13.3.2 Psychosocial information

Nil.

1.13.3.3 Organizational information

Nil.

1.14 Fire

There was no fire.

1.15 Survival aspects

Nil.

1.16 Tests and research

At the initial action of the investigating team, it was observed that the aircraft had lost the empennage while still in flight.

The empennage of this type of aircraft consists of a V-tail, with right and left stabilizers, and left and right ruddervators.

It was observed that the three fixation points of the left stabilizer to the aircraft tail cone had broken. It was also possible to notice accentuated corrosion in this area of the aircraft.

Since the point of fixation of the stabilizer to the tail cone was weakened on account of the corrosion, it broke due to a torsion effort around the central fixation point in the main longeron of the left stabilizer.

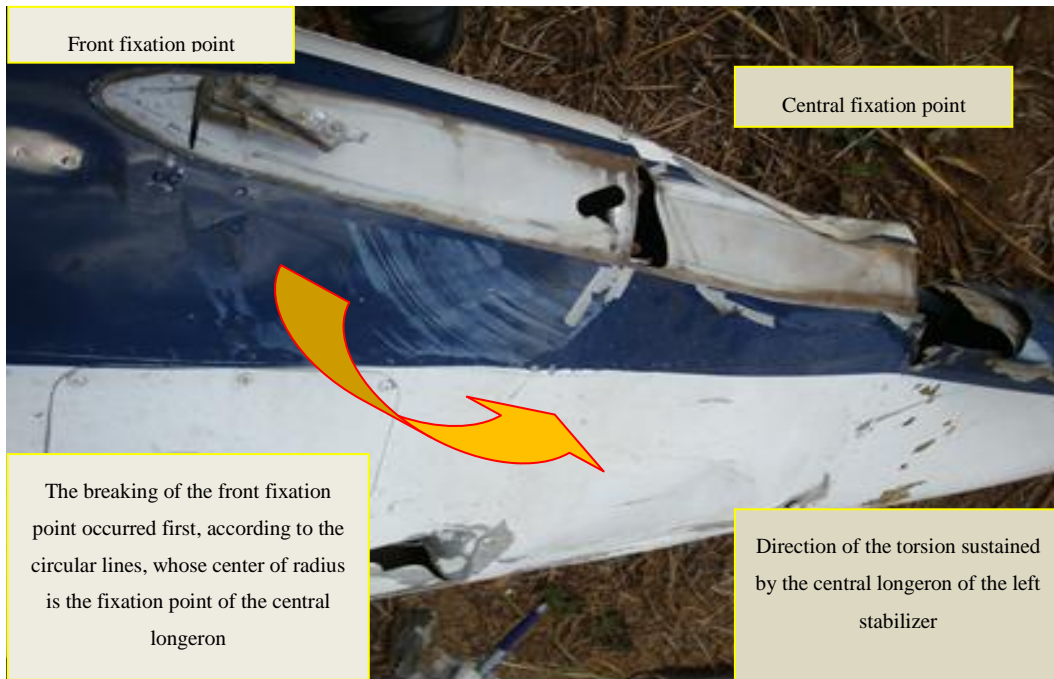


Figure 6 - Fixation points of the left stabilizer to the tail cone of the aircraft.

The aerodynamic forces acting on the aircraft in flight show that the force exerted by the tail stabilizing surface (F) has a downward direction, in the same direction of the weight, and that both of them are balanced by the lift force (L), something that explains the direction of the torsion effort.

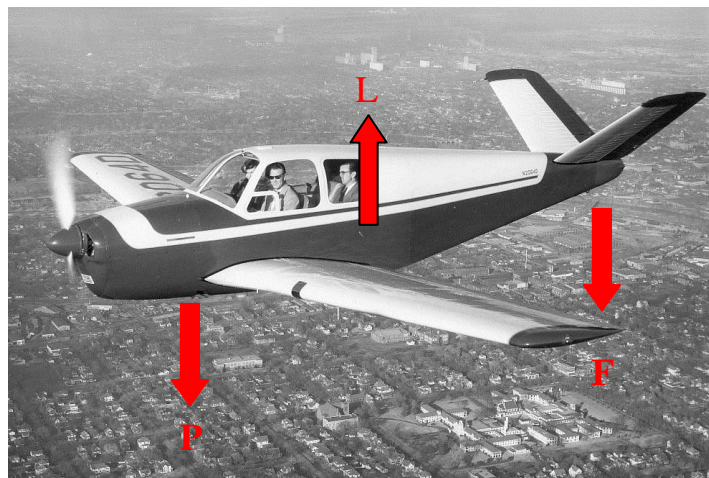


Figure 7 - Forces acting in flight.

The stabilizers and ruddervators were found along the downward trajectory of the aircraft at a distance of approximately 800 meters from the wreckage concentration.

1.17 Organizational and management information

The PT-AVK aircraft had had an aeronautical incident on 13 April 2004.

The maintenance services after this incident were done by the *Águila Manutenção de Aeronaves Ltda* workshop in 2004.

The pilot, who was the owner of the PT-AVK, had purchased the aircraft in 2005, and took it to the *Oficina Nacional Manutenção de Aeronaves Ltda* workshop for the 100 hours inspection/Annual Maintenance Inspection in September 2010.

The aircraft had only flown on two occasions after the 2004 occurrence: a test flight and then the accident flight, both of which conducted by the pilot/owner.

The pilot/owner monitored all the services done to the aircraft, and was advised by the assistant mechanic, who was also aboard the aircraft in the accident flight.

On the day before the accident, they had checked the last details concerning the flight on the following day.

According to witnesses, the pilot was aware that the aircraft needed a tail reinforcement, which had not been installed yet.

1.18 Operational information

The pilot was an employee of the *Tail Taxi-Aéreo Ltda* company, and, according to the records of his flight hours presented by the company, he had not operated any flights in the last twenty days. Nevertheless, he had flown 27 hours and 40 minutes in the last 90 days, most of which on multi-engine aircraft.

In the records kept by the ANAC, there was information of three single engine aircraft flights in the last three months.

The pilot had flown the aircraft on just two occasions, the first of which six months before the day of the accident (30-minute duration). The accident flight was his second on a D35 aircraft model.

According to the flight plan, the flight would be VFR, South of SBSN, at FL045, at a maximum distance of 16 nautical miles from SBSN.

The aircraft had been refueled with 277 liters of AVGAS on 28 September. Just this amount of fuel would guarantee an addition of three hours of flight to the aircraft endurance.

Before departure, the pilot informed SBSN control tower that the aircraft endurance was 4 hours and 30 minutes, implying that the aircraft had some remaining fuel in addition to the 277 liters it had received.

It is supposed that, on the day of the occurrence, during the test flight, the aircraft pilot/owner made maneuvers requiring further efforts from the ruddervators (rudder+elevator, V-tail control surfaces), which work on the same surface of the stabilizer.

The controller on duty at Santarém Approach Control reported that the pilot did not call ATC after departure, but he managed to contact him via cell phone.

Upon answering the phone call, the pilot told the controller that he had lost radio contact on account of problems with the aircraft radio. The controller then passed instructions to him regarding his return to SBSN.

At 18:24 UTC, however, this same controller received another phone call informing that the aircraft had crashed in the district of Lavras.

At 18:37 UTC, this information was confirmed by an aircraft that was flying over the crash site.

The accident aircraft was within the weight and center of gravity limits specified by the manufacturer.

1.19 Additional information

There was an Airworthiness Directive (AD) 94-20-04R2 (Prevent structural failure of the V-tail) with repetitive action compliance every 100 hours, prescribing inspection of the fixation points of the surfaces subjected to loads in flight for verification of corrosion, with repair and/or replacement of these surfaces if necessary.

The objective of the aforementioned AD was to prevent an empennage structural failure, which would result in a loss of control of the aircraft.

AD 94-20-04R2 also contained the mandatory service bulletin MSB 2188, which prescribed reinforcement in the root of the stabilizers in this model of aircraft.

The investigation commission requested the Airworthiness Directive Compliance Sheet (FCDA) related to the AD 94-20-04R2 from the *Oficina Nacional Manutenção de Aeronaves Ltda* workshop, but the aforementioned sheet was not presented.

The workshop presented only a map showing their compliance with the airworthiness directives, but it did not contain information on compliance with the AD 94-20-04R2.

The workshop also presented the Service Order nº 0153/10, which did not mention the execution of the MSB 2188 mandatory service bulletin.

Thus, it was possible to verify that the stabilizer root reinforcement kit prescribed in the service bulletin MSB 2188 had not been installed.

1.20 Utilization of other Investigation techniques

Nil.

2 ANALYSIS

From the distribution of the wreckage on the ground, it was possible to conclude that there was a rupture of the aircraft empennage in flight.

The stabilizers were found along the trajectory of the crashed aircraft at a distance of approximately 800 meters short of the wreckage concentration.

By means of tests, it was possible to determine that there was a rupture of the left stabilizer, with fracture of the three points of fixation to the aircraft tail cone.

The fracture began in the front fixation point, due to a weakening caused by accentuated corrosion and the fact that the stabilizer root reinforcement kit had not been installed.

The aerodynamic forces acting on the aircraft in flight show that the force exerted by the tail stabilizing surface (F) has a downward direction, the same direction of the weight (P), and that these forces are balanced by the lift force (L), explaining the direction of the torsion effort.

So, the initial rupture took place on the left side of the tail stabilizing surface, in the front fixation point, which presented accentuated corrosion, weakening its fastening to the fuselage.

The marks left on the painted surface of the tail cone coating confirm that there was torsion of the central longeron of the stabilizer, up to the point of its full detachment from the aircraft on account of overload.

The AD compliance situation map did not have information concerning compliance with the AD 94-20-04R2 (*Prevent structural failure of the V-tail*).

Among other services, the AD 94-20-04R2 prescribed an inspection for verification of corrosion in the fixation points of surfaces subjected to load demands in flight

The AD 94-20-04R2 also required compliance with the MSB 2188 mandatory service bulletin, which prescribed the installation of a reinforcement in the root of the stabilizer, something that was not done.

The *Oficina Nacional Manutenção de Aeronaves Ltda* workshop did not present any FCDA (Airworthiness Directive Compliance Sheet) relative to the AD 94-20-04R2.

Thus, the commission concluded that the lack of full compliance with the Airworthiness Directive AD 94-20-04R2 (*Prevent structural failure of the V-tail*) and the non-incorporation of the MSB 2188 mandatory service bulletin contributed to the breaking of the front fixation point of the left stabilizer to the tail cone, causing fracture of the central longeron due to overload, resulting in its inflight detachment from the empennage assembly.

Therefore, an inflight loss of control of the aircraft occurred, culminating in the crash.

It was found that the pilot had flown this model of aircraft on only two occasions; the first one in the very PT- AVK more than six months before the occurrence, with duration of 30 minutes. The second one was the accident flight.

In addition, there were records of three flights in single engine aircraft in the last three months, confirming the recent experience of the pilot.

Considering that the accident resulted from the loss of a component in flight, the commission concluded that, independently of the experience of the pilot in the model of aircraft, nothing could have been done to prevent the accident. Therefore, the fact that the pilot had only few hours of flight in the PT-AVK model was not a contributor to this occurrence.

3 CONCLUSIONS

3.1 Facts

- a) The pilot had a valid medical certificate;
- b) The pilot had a valid technical qualification certificate;
- c) The pilot was qualified and had enough experience for the flight;
- d) The aircraft had a valid airworthiness certificate;
- e) The aircraft was within the weight and balance limits;
- f) The aircraft departed from SBSN at 17:26 UTC on a local flight;
- g) The AD 94-20-04R2 was not complied with. It also included compliance with the MSB 2188 mandatory service bulletin;
- h) After departure, radio contact between Santarém control tower and the aircraft pilot was lost;
- i) The Santarém tower controller made several unsuccessful calls to the aircraft;
- j) The Santarém approach controller managed to contact the aircraft pilot by means of a cell phone;

- k) During this phone call, the pilot informed that he was having problems with the aircraft radio equipment;
- l) The controller gave instructions to the pilot regarding the return to SBSN;
- m) At 18:24 UTC, the same controller received another phone call informing that the aircraft at crashed in the region of Lavras (a district of Santarém);
- n) The stabilizer collapsed on account of overload at a fixation point which had signs of corrosion;
- o) The aircraft was completely destroyed; and
- p) Both the pilot and the passenger perished in the crash.

3.2 Contributing factors

3.2.1 Human Factor

3.2.1.1 Medical Aspect

Not a contributor.

3.2.1.2 Psychological Aspect

3.2.1.2.1 Individual information

Not a contributor.

3.2.1.2.2 Psychosocial information

Not a contributor.

3.2.1.2.3 Organizational information

Not a contributor.

3.2.2 Operational Factor

3.2.2.1 Concerning the operation of the aircraft

a) Aircraft maintenance – a contributor

The fact that the stabilizer reinforcement kit had not been installed, contrary to the prescription of the MSB 2188 maintenance service bulletin, and the fact that the AD 94-20-04R2 was not complied with, contributed to the breaking of the left stabilizer of the aircraft in flight.

b) Managerial oversight – a contributor

The managerial oversight deviation at the last inspection of the aircraft did not allow detection of the lack of compliance with the MSB 2188 service bulletin and with the (FAA) AD 94-20-04R2.

3.2.1.3.2 Concerning ATS units

Not a contributor.

3.2.2 Material Factor

3.2.2.1 Concerning the aircraft

Not a contributor.

3.2.2.2 Concerning ATS equipment and technology systems

Not a contributor.

4 SAFETY RECOMMENDATION (RSV)

It is the establishment of an action that the Aviation Authority or the SIPAER-Link issues within its area of responsibility, aiming at eliminating or mitigating the risk of a latent condition or the consequence of an active failure.

From the SIPAER perspective, a safety recommendation is essential to flight safety, refers to a specific hazard, and has to be fulfilled by a certain deadline.

Flight Safety Recommendations made by the CENIPA:

To the National Civil Aviation Agency (ANAC):

A-033/CENIPA/2013 – RSV 001

Issued on 30/12/2013

To make an audit of the *Oficina Nacional Manutenção de Aeronaves Ltda* workshop, with the purpose of analyzing and proposing betterments in the process of execution and control of maintenance of the aircraft models listed in the Addendum to the Company's Homologation Certificate.

A-033/CENIPA/2013 – RSV 002

Issued on 30/12/2013

Promote publicity of this report to maintenance workshops and aircraft owners/operators, with the objective of disseminating the lessons learned.

5 CORRECTIVE/PREVENTATIVE ACTION ALREADY TAKEN

A flight safety inspection of the *Oficina Nacional Manutenção de Aeronaves Ltda*. (an aircraft maintenance workshop) was carried out.

6 DISSEMINATION

- National Civil Aviation Agency (ANAC)
- National Aircraft-Maintenance Workshops Association (ANOMA)
- National Transportation Safety Board
- SERIPA I

7 APPENDICES

Nil.

On 30 / 12 / 2013