

**AAID# A17-000602**



**NASSAU, N. P., BAHAMAS**

# **AIRCRAFT ACCIDENT REPORT**

**GEAR COLLAPSE AND RUNWAY EXCURSION**

**SAAB 340A**

**C6-HBW**

**FREEPORT, GRAND BAHAMA,  
BAHAMAS**

**February 7, 2017**



## The Air Accident Investigation Department (AAID)

The Air Accident Investigation Department (AAID) is the independent accident investigation department under the Bahamas Ministry of Tourism, Aviation & Bahamasair (MOTAB) charged with the responsibility of investigating all aviation accidents and serious incidents in the Bahamas.

The AAID's function is to promote and improve safety and public confidence in the aviation industry through excellence in:

- Independent investigation of aviation accidents and other safety occurrences
- Safety data recording, analysis and research
- Fostering safety awareness, knowledge and action.

**The AAID does not investigate for the purpose of apportioning blame or to provide a means for determining liability.** At the same time, an investigation report must include factual material of sufficient weight to support the analysis and findings. At all times the AAID endeavors to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner.

The AAID performs its functions in accordance with the provisions of the Bahamas Civil Aviation Act 2016, Civil Aviation (Investigations of Air Accidents and Incidents) Regulations and Amendment Regulations 2017, International Civil Aviation Organization (ICAO) Annex 13 (Eleventh edition, July 2016 – latest revision) and, where applicable, relevant international agreements.

The Air Accident Investigation Department is mandated by the Ministry of Tourism, Aviation & Bahamasair to investigate air transportation accidents and incidents, determine probable causes of accidents and incidents, issue safety recommendations, study transportation safety issues and evaluate the safety effectiveness of agencies and stakeholders involved in air transportation. The objective of a safety investigation is to identify and reduce safety-related risk. AAID investigations determine and communicate the safety factors related to the transport safety matter being investigated.

The AAID makes public its findings and recommendations through accident reports, safety studies, special investigation reports, safety recommendations and safety alerts. Unless otherwise indicated, recommendations in this report are addressed to the regulatory authorities of the State having responsibility for the matters with which the recommendation is concerned. It is for those authorities to decide what action is taken. When the AAID issues a safety recommendation, the person, organization or agency is required to provide a written response without delay. The response shall indicate whether the person, organization or agency accepts the recommendation, any reasons for not accepting part or all of the recommendation(s), and details of any proposed safety action(s) resulting from the recommendation(s) issued.

Official Copies of accident reports can be obtained by contacting:

Air Accident Investigation Department  
2<sup>nd</sup> Floor, Manx Corporate Center  
West Bay Street  
P. O. Box CB-11702  
Nassau N. P., Bahamas  
Tel: 1 (242) 397-5513 or (242) 397-5509  
Fax: (242) 327-2192

Additional copies of the reports can be viewed on the AAID's website at: <http://www.baaid.org> or requested by email: [aaid.mota@gmail.com](mailto:aaid.mota@gmail.com) or [baaid@bahamas.gov.bs](mailto:baaid@bahamas.gov.bs).

**AIR ACCIDENT  
INVESTIGATION DEPARTMENT  
MINISTRY OF TOURISM, AVIATION & BAHAMASAIR  
2<sup>ND</sup> FLOOR, MANX CORPORATE CENTER  
WEST BAY STREET  
NASSAU N. P., BAHAMAS**

# **AIRCRAFT ACCIDENT REPORT**



## **SAAB 340A C6-HBW**

### **RUNWAY EXCURSION FREEPORT, GRAND BAHAMA, BAHAMAS February 07, 2017**

**Abstract:**

This report outlines the circumstances involving the accident of a SF-340 aircraft registered to Western Air Limited. The aircraft with registration C6-HBW was involved in a runway excursion at Grand Bahama International Airport, Freeport, Grand Bahama, Bahamas on February 7, 2017.

This investigation was done in accordance with Annex 13 to the Convention on International Civil Aviation. The investigation is intended neither to apportion blame, nor to assess individual or collective liability. Its sole objective is to draw lessons from the occurrence which may help to prevent future accidents.

Consequently, the use of this report for any purpose other than for the prevention of future accidents could lead to erroneous conclusions.

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## EXECUTIVE SUMMARY

On the 7<sup>th</sup> February 2017 at 5:24 pm local (2224 UTC), the Air Accident Investigation Department (AAID) of the Ministry of Tourism, Aviation & Bahamasair was notified of an accident involving a fixed winged, multi-engine Saab 340A aircraft operated by Western Air Ltd. The aircraft with registration C6-HBW was a scheduled commercial flight operating as WST 708 departing from Grand Bahama International Airport (MYGF), enroute to the Lynden Pindling International Airport (MYNN), Nassau N. P., Bahamas. Two minutes and 14 seconds from the start of the takeoff roll, a failure of the electrical DC busses (left main and left essential electrical bus) occurred. The compound electrical system failures prompted a return to the airfield at MYGF.

Prior to the return, the crew attempted to diagnose the failures, however, due to inappropriate and untimely response action to abnormal system failures, the abnormal failures escalated into additional compound dependent failures which eventually resulted in a collapse of the left main landing gear and subsequent runway excursion upon landing on runway 06. There were 34 souls on board, (three crew and 31 passengers). Minor injuries were reported to 3 passengers.

The scheduled flight was under a Visual Flight Rules (VFR) flight plan and visual meteorological conditions (VMC) prevailed at the time. Both pilots were licensed and certified by the Bahamas Civil Aviation Authority and possessed valid first class medicals as required by regulations.

The Air Accident Investigation Department has determined that the probable cause of this accident was ineffective crew resource management and an unstable approach which led to the failure of the left main landing gear upon touchdown. Contributing factors to this accident includes; inadequate systems knowledge, lack of situational awareness and failure to diagnose and remedy multiple system failures in a timely manner resulted in compound failures being escalated to an emergency. The apparent rush to get on the ground without exploring other possible options to identify and verify landing gear security also contributed to the severity of this accident.

Safety issues raised in this report addressed:

- Crew qualification
- Questionable training
- Unapproved Flight Voice and Data Recorder
- Emergency Amended Checklist and
- Inadequate Regulatory Oversight

Recommendations concerning these issues were addressed to the Bahamas Civil Aviation Authority and Western Air Limited, the operator.

This report is submitted pursuant to The Bahamas Civil Aviation Act 2016, Civil Aviation (Investigations of Air Accident and Incident) Regulations and Amendment Regulation, (CA(IAAI)AR), 2017 and Annex 13 to the Convention on International Civil Aviation (ICAO). In accordance with referenced regulations and annex, the fundamental purpose of such investigation is to determine the circumstances and causes of these events, with a view to the preservation of life and the avoidance of similar occurrences in the future. It is not the purpose of such investigations to apportion blame or liability.

This report contains facts, which have been established up to the time of publication. Information is published to inform the aviation industry and the public of the circumstances surrounding this accident.



## AIR ACCIDENT INVESTIGATION DEPARTMENT

### TITLE

**Registered Owner:** Western Air Limited

**Operator:** Western Air Limited

**Manufacturer:** SAAB

**Aircraft Type:** SAAB 340A

**Nationality:** Bahamas

**Registration:** C6-HBW

**Place of Accident:** Runway 06, Grand Bahama International Airport, Freeport, Grand Bahama, Bahamas

**Date and Time:** February 7, 2017 at 5:05pm local (2105 UTC)

**Notification:** BCAA, NTSB, FAA, SAAB, ICAO, Swedish Accident Investigation Authority

**Investigating Authority:** Air Accident Investigation Department,  
Ministry of Tourism, Aviation & Bahamasair

**Investigator in Charge:** Mr. Delvin R. Major

**Accredited Representatives:** Mr. Sakari Havbrandt, Swedish Accident Investigation Authority

**Technical Advisors:** Jan Erik Andersson, SHK Advisor, Chief Coordinator Accident Investigations

**Releasing Authority:** Air Accident Investigation Department

**Date of Final Report Publication:** January 31, 2018

## ABBREVIATIONS & TERMINOLOGY

When the following terms are used in this report, they have the following meanings:

AAID	Air Accident Investigation Department	of flight until such time as all such persons have disembarked, in which: a) a person is fatally or seriously injured as a result of:
ATS	Air Traffic Services	— being in the aircraft, or
BASR	Bahamas Civil Aviation (Safety) Regulations	— direct contact with any part of the aircraft, including parts which have become detached from the aircraft, or
BCAA	Bahamas Civil Aviation Authority	— direct exposure to jet blast, except when the injuries are from natural causes, self-inflicted or inflicted by other persons, or when the injuries are to stowaways hiding outside the areas normally available to the passengers and crew; or
CRM	Crew Resources Management	
CVR	Cockpit Voice Recorder	
EASA	European Aviation Safety Agency	
EST	Eastern Standard Time (-4 hours to convert from UTC)	
FDR	Flight Data Recorder	b) the aircraft sustains damage or structural failure which:
FDAU	Flight Data Acquisition Unit	— adversely affects the structural strength, performance or flight characteristics of the aircraft, and
ICAO	International Civil Aviation Organization	— would normally require major repair or replacement of the affected component, except for engine failure or damage, when the damage is limited to the engine, its cowlings or accessories; or for damage limited to propellers, wing tips, antennas, tires, brakes, fairings, small dents or puncture holes in the aircraft skin; or
ILS	Instrument Landing System	c) the aircraft is missing or is completely inaccessible.
IMC	Instrument Meteorological Condition	Note 1.— For statistical uniformity only, an injury resulting in death within thirty days of the date of the accident is classified as a fatal injury by ICAO.
KIAS	Knots Indicated Airspeed	Note 2.— An aircraft is considered to be missing when the official search has been terminated and the wreckage has not been located.
MET	Meteorological Office / Department	
(M)	Magnetic	
METAR	Weather Report furnished by Meteorological Department	
NM or nm	Nautical Miles	
SOP	Standard Operating Procedures	
STC	Supplemental Type Certificate	
VFR	Visual Flight Rules	
UTC / Z	Universal Coordinated Time / Zulu time	

## DEFINITIONS

When the following terms are used in the Standards and Recommended Practices for Aircraft Accident and Incident Investigation, they have the following meaning:

**Accident.** An occurrence associated with the operation of an aircraft that takes place between the times any person boards the aircraft with the intention

**Accredited representative.** A person designated by a State, on the basis of his or her qualifications, for the purpose of participating in an investigation conducted by another State.

**Adviser.** A person appointed by a State, on the basis of his or her qualifications, for the purpose of assisting its accredited representative in an investigation.

**Aircraft.** Any machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth's surface.

**Causes** - Actions, omissions, events, conditions, or a combination thereof, which led to the accident or incident.

**Flight recorder** - Any type of recorder installed in the aircraft for the purpose of complementing accident/incident investigation.

**Investigation** - A process conducted for the purpose of accident prevention which includes the gathering and analysis of information, the drawing of conclusions, including the determination of causes and, when appropriate, the making of safety recommendations.

**Investigator-in-charge** - A person charged, on the basis of his or her qualifications, with the responsibility for the organization, conduct and control of an investigation.  
Note.— Nothing in the above definition is intended to preclude the functions of an investigator-in-charge being assigned to a commission or other body.

**Maximum mass** - Maximum certificated take-off mass.

**Operator** - A person, organization or enterprise engaged in or offering to engage in an aircraft operation.

**Preliminary Report** - The communication used for the prompt dissemination of data obtained during the early stages of the investigation.

**Safety recommendation** - A proposal of the accident investigation authority of the State conducting the investigation, based on information derived from the investigation, made with the intention of preventing accidents or incidents.

**State of Design** - The State having jurisdiction over the organization responsible for the type design.

**State of Manufacture** - The State having jurisdiction over the organization responsible for the final assembly of the aircraft.

**State of Occurrence** - The State in the territory of which an accident or incident occurs.

**State of the Operator** - The State in which the operator's principal place of business is located or, if there is no such place of business, the operator's permanent residence.

**State of Registry** - The State on whose register the aircraft is entered.

Note. — In the case of the registration of aircraft of an international operating agency on other than a national basis, the States constituting the agency are jointly and severally bound to assume the obligations which, under the Chicago Convention, attach to a State of Registry. See, in this regard, the Council Resolution of 14 December 1967 on Nationality and Registration of Aircraft Operated by International Operating Agencies which can be found in Policy and Guidance Material on the Economic Regulation of International

**“State of Design”** - The State having jurisdiction over the organization responsible for the type design

**“State of Manufacture”** - The State having jurisdiction over the organization responsible for the final assembly of the aircraft.

## 1.0 FACTUAL INFORMATION.

### 1.1 HISTORY OF THE FLIGHT

On the 7<sup>th</sup> February 2017 at 5:24 pm local (2224 UTC), the Air Accident Investigation Department of the Ministry of Tourism, Aviation & Bahamasair received notification of an accident involving a fixed winged, multi-engine Saab 340A aircraft that occurred at Grand Bahama International Airport.

The accident aircraft with registration C6-HBW, serial number 340A067, operated by Western Air Ltd., was a scheduled commercial flight that departed Grand Bahama International Airport (MYGF), with destination, Lynden Pindling International Airport (MYNN), Nassau N. P., Bahamas. Prior to this accident the aircraft operated as WST 902 from Nassau to South Bimini with 15 passengers continuing on to Freeport and then proposed back to Nassau as WST 708 with 31 passengers and 3 crewmembers.

According to the time stamp recorded on the Cockpit Voice Recorder (CVR) at 0 hours 04:39.6 minutes after startup, the crew initiated the start of the takeoff roll with the statement “here we go.” (*Time prior to this take off roll time stamp, conversations involved engine startup, checklist and taxi to the runway*). At timestamp 005:14.2 “rotate” was captured on the CVR. At time stamp 006:53.6, (*2minutes and 14 second from initiation of takeoff roll*) an alarm sound was captured on the CVR. This was followed by crew statement at 007:05.6 of “*we lose all the avionics*”

At timestamp 007:15.7 crew confirmed a failure of the “right bus, left bus,” which actually was a failure of the electrical DC busses, left main and left essential electrical bus, not right bus as stated by crew. The crew eventually diagnosed the failures correctly, however, due to the unusualness of the compound failure of multiple systems simultaneously, crew confusion resulted. Due to their questionable systems knowledge and untimely corrective response to the abnormal system failures, additional compound dependent failures, resulted.

Confusion between crew courses of action followed, state of confusion on the flight deck and lack of situational awareness was evident. One pilot wanted to continue to Nassau, while the other wanted

to return to Freeport. Eventually the decision was made to return to Freeport for a landing.

Despite identifying the initial electrical failures, the wrong QRH reference was consulted. The non-flying pilot unsure of which reference to use to apply to the failure encountered, switched between several QRH references, no evidence was overheard on the CVR transmission of either pilot locating or identifying the correct checklist to effectively deal with the initial abnormal situation they encountered.

Despite all flight instrument indication being lost on the captain’s panel due to the electrical failure, he still elected to command the flight controls from the first officer (*who was the pilot flying and whose flight instrumentations were not affected by the power loss*). The captain requested the first officer to “*feed him*” flight instrument information from his side and carry out QRH instructions, as well as document failure indications for management.

The non-flying pilot’s tasks were increased greatly as he provided the flying pilot, with information such as airport location, distance, speed, altitude and other parameters, including engine and other system indications, while also trying to locate and complete the QRH.

The crew eventually realized that they were having indication problems with the landing gear. Unsure of the position of the landing gear when selected to the down position, the crew requested the assistance from Freeport Air Traffic Control (ATC), to verify the gear was in the down position. The crew was given permission to overfly the airfield and after ATC advised that the gears appeared to be down, the crew decided to prepare for landing.

From CVR recording, the flight deck crew was overheard talking to the cabin attendant and advising her that a return to the field was imminent. No urgency or instructions on preparation for a possible gear up landing was captured on the CVR.

The CVR also captured the crew discussing taking of photographic and video evidence of the abnormal indication “*so that management could see what was occurring so that they won’t blame us.*” This back and forth non-essential dialogue during a critical phase of flight, with system failures occurring without appropriate crew corrective input, continued for quite some time. While attempts were overheard to retrieve and complete the Quick Reference Handbook

(QRH) instructions and pre-landing checklist, the appropriate checklist for the abnormal failures were not captured on the CVR as being located or completed. The pre-landing checklist was called for, but, it also was not captured on the CVR as being completed as per company’s SOPs, where checklist or QRH completion by the non-flying pilot is announced to the pilot flying as having been completed. Ineffective crew resource management led to confusion on the flight deck with locating and completing the appropriate QRH and before landing checklist.

A missed approach procedure was executed on the first attempt at landing because the aircraft was aligned with the runway too late and too high for a safe landing. On the second attempt for a landing the aircraft was aligned with the runway, while still no safe gear indication was noted (*as evidenced from the CVR recording*). The approach was flown with a higher than normal airspeed as the landing flaps were not available due to the electrical failure as stated by the pilot flying.

Confusion continued up until seconds before the aircraft touched down as evidenced from the CVR recording.

Almost immediately upon touch down the left main landing gear collapsed, some 200 to 300 feet beyond the point on the runway where heavy tire marks were noted, which indicated initial touchdown point followed by immediate heavy right brake application. The aircraft touched down at a point almost half the length of the 10,979 foot useable runway at coordinates Latitude 26.557846 N and Longitude 78.698051W.

The CVR captured at touchdown, the non-flying pilot announcing that “*the light came on.*” However, within a second of that announcement, the crew experienced a gear failure on the left side followed by the aircraft propeller and wing making contact with the runway surface. The aircraft started to leave the runway to the left side shortly thereafter, travelling approximately 1,600 feet additionally from the point where the propeller and engine nacelle made contact with the runway.

As a result of the touchdown impact, left gear collapse, and roll-out sequence, substantial damage was sustained by the left wing, left engine nacelle and left hand propeller. Extent of damage sustained by the left engine internally as a result of its propeller contact with the runway while power was still being produced, was not known.

The aircraft came to rest in a marshy area on the northern (left) side of runway 06, approximately 200 feet from the runway edge. When the aircraft came to a stop, the cabin attendant was overheard initiating the evacuation. Due to the high angle of the right wing, it was reported that evacuation occurred through the main entrance door and evacuation using the right side emergency exits was not considered. The investigation team was advised that all emergency exits were opened, however, the additional openings occurred post evacuation.

Failure to adequately diagnose and remedy the landing gear unsafe condition, (*one of the resultant compound dependent failures*), and a rush by the crew to get the aircraft on the ground, resulted in the crew failing to explore and utilize other available alternative methods to ensure the gears were secured in the down and locked position. No reason was given by the crew as to why they did not explore available QRH instructions for abnormal gear position indications and emergency extension prior to attempting to land.

There were 34 souls on board, 3 crew and 31 passengers. Minor injuries were reported to three passengers as a result of the accident and evacuation process.

Visual Meteorological Conditions (IMC) prevailed at the time of the accident.

## 1.2 INJURIES TO PERSONS

Injuries	Crew	Passengers	Total
Fatal			
Serious			
Minor		3	3
None	3	28	31
<b>TOTAL</b>	<b>3</b>	<b>31</b>	<b>34</b>

## 1.3 DAMAGE TO AIRCRAFT

The aircraft was substantially damaged during the impact sequence and subsequent runway excursion through the marshy area.

## 1.4 OTHER DAMAGE

No damages to other aircraft, vehicles, buildings, runway structures or the environment were observed or reported.

## **1.5 PERSONNEL INFORMATION**

### **1.5.1 THE CAPTAIN**

The captain, aged 50, was hired by Western Air Limited during the month of December, 2016 when he received ground training, flight training and received his proficiency check. He was assigned official flight duty on January 3, 2017.

He held a valid (Bahamas) Airline Transport Pilot License, which became effective November 25, 2014. His licenses are inclusive of Airplane Multi Engine Land and Commercial Single Engine Land and Sea Privileges. He is type rated on the CL-600, HS-125 and SF 340 aircraft.

The total hours flying experience as a pilot was 14,239 hours and the hours flying experience on the SF 340 was 1,832 hours up to the time of the assignment to active duty. Since assignment to duty in the month of January, 2017 the pilot completed 128 flights totaling 84.0 hours.

In February 2017 up to the day before the accident he had accumulated an additional 24 flights totaling 13.9 hours. The captain also held a valid (Bahamas) First Class Medical Certificate issued on 24 November 2016, with limitations that he must wear corrective lenses.

The captain conducted initial ground training in Nassau, Bahamas and flight training and proficiency check was conducted at CAE Center Stockholm Sweden using the SF340 aircraft simulator. The simulator used for training was dry-leased from the Swedish training organization and the operator provided the instructor, training program and had the overall responsibility over the training quality.

The captain had no violations or prior aviation accident history recorded by the BCAA.

### **1.5.2 THE FIRST OFFICER**

The first officer was a 54-year-old male who held a valid Airline Transport Pilot License (Bahamas and USA) with airplane ratings on the DHC8, BE1900 and SF340. The first officer also held a valid (Bahamas) First Class Medical Certificate with limitations “must wear corrective lenses” issued on 01 December, 2016.

The total flying hours of the first officer was not known. However, his total flying hours for the month of January 2017 was 40.8 comprising 66 flights. No documented hours for the month of

February 2017 was available. The date of hire of the first officer was also unknown.

The last ground and other required company training for the first officer occurred in March 2016 with his last proficiency check satisfactorily completed on July 16, 2016.

### **1.5.3 CABIN CREWMEMBER**

There was one Cabin Crew Member onboard the aircraft at the time of the accident, which is the minimum required for this type aircraft.

The Cabin Crew Member’s responsibility was to perform cabin safety services while onboard this commercial flight. She held a valid Cabin Crew Member License and was endorsed for this aircraft type. She also held a valid (Bahamas) Second Class Medical Certificate.

### **1.5.4 WESTERN AIR FLIGHT CREW TRAINING**

Western Air flight crew training program as outlined in the Airlines Training Manual had been approved by the Bahamas Civil Aviation Authority previously the Bahamas Civil Aviation Department. The approval was given by the Principal Operations Inspector (POI) assigned to the airline.

The flight and ground training programs contained in the approved Flight Operations Training Manual, Revision 8, consisted of initial, transition, recurrent, upgrade, re-qualification and differences training. A set number of program hours was established for each of the various segments of training. Notwithstanding the programmed hours, pilots are required to receive sufficient training to bring them up to the level of proficiency as required by the Bahamas Civil Aviation Safety Regulations (BASR).

According to approvals issued by the authority, flight and ground training programmed hours may be reduced for a new hire in the event of proficiency and currency in a particular aircraft. However, operator is required to present sufficient documentation to the authority with the requested amount of reduced hours specified and reasons for such reduction. Without such approval, original required programmed hours must occur.

## **1.6 AIRCRAFT INFORMATION**

### **1.6.1 AIRCRAFT HISTORY.**

C6-HBW was a fixed-wing, multi-engine Bahamas registered aircraft. Saab/Fairchild Company manufactured it in 1986. It was model number 340A, and bore serial number 340A067. It was owned by Western Air Limited, San Andros, Andros, Bahamas.

The total time in service of this aircraft could not be determined as from all Aircraft Technical and Journey logs reviewed there were no updates on total hours or cycles as required by regulations.

The aircraft was listed in the normal category, transport classification and was issued an Airworthiness Certificate on 30 May, 2014 by The Flight Standards Inspectorate.

### **1.6.2 AIRCRAFT FUEL**

The aircraft departed Lynden Pindling Int'l Airport (MYNN) for South Bimini as WST 902 with 3000 pounds of fuel. It departed Grand Bahama Int'l Airport (MYGF) for MYNN with approximately 1,800 pounds of fuel on board as recorded on the Load Manifest / Weight & Balance form.

### **1.6.3 AIRCRAFT LOAD**

The aircraft was dispatched from MYGF with a takeoff weight of 24,661 pounds which included a cargo total of 467 pounds and fuel of 1,800 pounds as evidenced on the load manifest / weight & balance form. The maximum allowable takeoff limits for this aircraft was listed as 28,500 pounds, so this aircraft was within its maximum allowable takeoff and landing weight limitations.

## **1.7 METEOROLOGICAL INFORMATION**

Bahamas Area Forecast issued on the day of the accident valid for 12 hours from 1800UTC indicated: **Special Features** high pressure system across the area was weakening through the forecasted period while easterly wave was enhancing light to moderate convection across the south east Bahamas.

Few and scattered clouds at 1,500 to 2,500 feet with towering cumulus clouds with isolated scattered showers in the vicinity. Winds from the surface up to 2,000 feet were reported as 160 degrees

at 15 knots. However, weather was not a factor in this accident.

## **1.8 AIDS TO NAVIGATION**

Navigational Aids were not a factor in this accident.

## **1.9. COMMUNICATIONS**

The ATS communication facility available to the aircraft at MYGF was Freeport Tower which the crew utilized. Communication was not a factor in this accident.

## **1.10 AERODROME INFORMATION**

Grand Bahama International Airport, MYGF, is a privately operated airport. It is located in the Bahamas at coordinates 263331.27N and 0784143.99W. It is elevated seven (7) feet above Mean Sea Level (MSL). It is serviced by one (1) prepared Runway 06/24. The dimension of Runway 06/24 is 10,979 long x 150 feet wide. The runway pavement texture is Asphalt.

MYGF is an airport of entry and operates 1230 to 2200 UTC. It also offers US preclearance facilities, customs and immigration clearance. Fuel is available as well as AIS and MET briefing.

The aerodrome is equipped with 3 fire rescue units (2) T-1500 Oshkosh, 1,500 gallons water rescue units and one 3,000 gallons water unit. Foam and dry chemical also available and can be delivered by these units.

## **1.11 FLIGHT RECORDERS.**

### **1.11.1 DIGITAL FLIGHT DATA RECORDER (DFDR)**

The Digital Flight Data Recorder (DFDR) was a Lockheed Aircraft Service Company unit, Model 209F, Part Number 10077A500 and S/N 3059. The recording system included a telephonic Flight Data Acquisition Unit which was part number 508-0011-003 and S/N 0301. It operated on a 115 Volt Alternating Current in the 400 Hz range.

The DFDR stopped working, during the climb out, as a result of power loss due to the failure of the ELEC DC Busses, L Ess / L. Main. This failure occurred 1 minute and 55 seconds from the beginning of the takeoff. However, information recorded on the



feet of scratch marks were measured from the northern edge of the tarmac to the start of the grassy area. Continuing in the direction of travel an additional 185 feet of scratch marks were measured from the start of the grassy area to the tip of the left wing. There were 198 feet from the left wing tip travelling south to the northern edge of the tarmac.

## **Structure and Systems**

### **A. Forward Fuselage**

1. The nose landing gear (Cylinder, Rims/Wheel Steering mechanism devices) had not collapsed but the wheel and tire received heavy damage and was mud covered.
2. Nose landing gear doors were not damaged.

### **B. Cabin section**

1. The main entrance door was not damaged.

### **C. Wing structure-Wing box**

1. The wing box on the left wing was possibly damaged, the extent was not known at the time of the onsite visit. However, the right wing box appeared to have been damaged as fuel was observed leaking from the point where the wing was attached to the fuselage.

### **D. Wing Structure**

1. This left wing was substantially damaged, as a result of contact with the runway and ground surface during the excursion into the muddy area.



2. Due to contact with the runway, the lower wing panel was damaged. The left wing tip, left aileron and left flap also sustained damages due to

contact with the runway and subsequent ground surface it travelled across during the excursion.

3. The right aileron, wing and flap of the aircraft did not appear to receive any obvious visible damage as a result of the accident sequence.

### **E. R/H Nacelle and Engine**

1. The right engine and engine nacelle did not appear to sustain heavy damages as did the left, which made contact with the runway and subsequent ground surface during the rollout until stopping in the marsh.

### **F. L/H Nacelle and Engine**

1. Four propeller blades were severely damaged and parts missing from the midway point between the tip and the hub
2. The air intake on the left engine while not significantly damaged was heavily mud covered.

## **Fuselage Interior - Cabin and Cockpit safety and settings**

### **G. Cabin Safety equipment**

1. In the RH forward bulkhead compartment, two oxygen bottles with masks and one fire extinguisher was found. Oxygen bottles and PBD were properly attached in their brackets. The extinguisher was still in its bracket.
2. The flashlight at the FA seat was secured and flashing red, indicating normal operation.

### **H. Belts**

1. All seatbelts were present and attached to the seat structure.
2. The seatbelt flap and buckle at the FA Station was found to operate as normal. Some resistance was found when extracting the belt by pulling.

### **I. Exits**

1. The main door, exit operated in a normal way as observed by the investigation team, upon arrival. It was reported to be the only door used for egress during the evacuation.
2. The RH fwd. emergency exit was reported as being opened post-accident however, as reported, it was not used for egress during the evacuation.

- Both LH and RH over wing exit doors were also reported as having been open post-accident, again no egress occurred through them.

#### **J. Seats**

- All passenger seats were accounted for and did not seem to sustain any damages as a result of the accident or evacuation process.

#### **K. Galley and toilet**

- No visual damage to the Galley structure noted.

#### **L. Cockpit**

- On the LH CB panel, the CB K10 for the ELEC-DC VOLT indicator was “tripped.”
- On the LH CB panel, the CB K9 for the ELEC-DC BUSSES L ESS / L MAIN was “tripped.”
- Both left and right engine fire “T” handles were also observed “pulled” and attached safety wire broken.
- Hydraulic Pump Switch was found in the “Override” position.
- No other abnormalities were noted on the flight deck.

### **1.13 MEDICAL AND PATHOLOGICAL INFORMATION**

There were no reported fatality, minor injuries were reported to the AAID as having been received by three (3) passengers as a result of the accident and evacuation process.

#### **1.14 FIRE**

There was no evidence of fire during the accident sequence.

#### **1.15 SURVIVAL ASPECTS**

##### **1.15.1 AVENUES OF ESCAPE**

All of the normal and emergency exits were examined for evidence of malfunction. The main cabin door was locked and attached to the fuselage upon arrival of the investigation team. The RH exit door was also found attached and locked upon arrival. The investigation team was advised that all

emergency exits including the over wing, were opened after the accident however, only the entrance door was used for evacuation egress.

The aft cargo door was also closed, locked and intact in the frame. It exhibited no damage as a result of the runway excursion.

##### **1.15.2 OCCUPANT SURVIVAL**

The SF340 is equipped with captain and first officer seats in the cockpit and one cabin attendant seat adjacent to the main entrance door. Additionally it has 11 rows of seats (3 per row) 2 double seats on the right side and 1 single row of seats on the left side.

An aisle separates the 2 rows of seat on the right from the single rows on the left. There is also a lavatory at the rear of the cabin after row 11.

All passenger seat-to-floor fasteners were intact and seats were not moved during the crash sequence. All seat belt were used and helped to restrain the passengers during the gear collapse and runway excursion sequence.

##### **1.15.3 CRASH FIRE RESCUE RESPONSE**

The crash and fire rescue unit at MYGF were notified of the accident by ATC and responded in a timely manner and assisted the occupants of the aircraft.

### **1.16 TESTS AND RESEARCH**

#### **Landing Gear Bolt**

In light of what was previously reported by the crew, it was suspected that landing gear bolt to the LH Main Gear Actuator Bracket P/N IR 134736 may have in and of itself been the cause of the landing gear failure which resulted in a runway excursion.

The bolt was subsequently removed and sent to the National Transportation Safety Board in Washington DC, USA for a metallurgic fracture analysis.

Results of the metallurgic analysis confirmed “the larger bolt was fractured and the head portion was not received. The fractured displayed bending deformation adjacent to the fracture and fracture features indicative of a bending overstress. No indications of progressive cracking was noted. The threads on the bolt was also partially sheared and sheared nut threads were present. The threads of the smaller bolt was also partially sheared but otherwise

the bolt was complete. Both bolts appeared to be steel alloys.

Prior to the return of the results of the bolt analysis, Western Air embarked on a proactive campaign to inspect all related attachments in the rest of the fleet. No abnormalities were found in the remaining fleet.



Also prior to the results of the bolt analysis, the CVR results were made available which appeared to exonerate the bolt as the cause of the accident, focus was placed on what role crew performance may have played in the cause of the accident as a result of CVR recordings.

The bolt analysis was subsequently completed and the results confirmed the bolt was not a contributing factor in the accident.

### **Recorders**

The Transportation Safety Board of Canada Engineering Laboratory in Ottawa Canada tested the FDR/CVR.

### **Summary of CVR and FDR Recorders**

#### **DFDR**

1. DFDR was found to have good quality information up until the point where electrical failure occurred, some 1 minute and 55 second from takeoff roll.

#### **CVR**

1. Quality of audio was good.
2. All radio channels were working and provided valuable information.

### **1.17 ORGANIZATIONAL MANAGEMENT INFORMATION**

Western Air Limited is a Bahamas Air Operator Certificate Holder with approved scheduled operations throughout the Bahamas. The airline operates a fleet of SF340A aircraft. Its main base is located at San Andros Int'l Airport, San Andros, Andros, Bahamas.

The airline has approval to conduct SF340A flight and ground training using its approved training program and company approved instructors and check airmen approved by the BCAA.

Western Air Limited has approval from the BCAA to use facilities, Pan Am International Flight Academy in the USA and CAE Stockholm Training Center, Sweden for simulator training. The simulator used for training of the captain was dry-leased from CAE Stockholm Training Center. The operator provided the instructor, training program and had the overall responsibility for the training quality.

### **1.18 REGULATORY OVERSIGHT**

The Bahamas Civil Aviation Authority (BCAA) holds the air carrier certificate of Western Air Limited and has the primary surveillance and oversight responsibility for the airline.

Operations and Maintenance training and general oversight is the mandate of the Operations and Airworthiness sections of the BCAA Safety Oversight Department. Approval of flight training programs and training oversight is the responsibility of the Operations Section of the Safety Oversight Department.

Guidance on the conduct of operations functions, including the approvals of training facilities, training programs, instructors and check airmen are contained in the Operations Inspector manual made assessable to all inspectors in the department. Job aids are also included in this manual so that inspectors can conduct their jobs in a thorough manner without relying on memory to complete assigned tasks.

The POI for Western Air Limited was recently assigned to the airline. He is qualified on other aircraft with BCAA oversight, however he is not qualified on the SF340. The POI's primary function is certificate management, which consists of conducting ramp inspections and enroute checks, reviewing training manuals and observing check rides, among other functions.

BCAA guidance does allow for an inspector with qualification on the SF340 or any other aircraft

to act as a Flight Operations Inspector to conduct aircraft specific oversight and approvals on behalf of the POI, who may not be rated on the SF340 or any other aircraft for companies which he has oversight responsibility.

As in the case of the approval of the facility in Sweden, as the POI was not rated on this particular aircraft type, the oversight responsibility for approval and evaluation of the facility was assigned to another inspector who was qualified on the SF340 aircraft.

## 2.0 ANALYSIS

C6-HBW was involved in a runway excursion almost immediately upon landing when the left gear collapsed when contact with the runway was made. Control was lost at this point as the left wing, left engine nacelle and the left propeller started to make contact with the runway surface, eventually causing the aircraft to veer off to the left side of the runway, across the runway edge, through a grassy area before ending up in the marshy area some additional 1,600 feet or more beyond the touch down point and the point where first contact was made with the runway and aircraft structure.

No large structures were in the path of travel to the final point where the aircraft came to rest. The left wing tip was shorn off during the excursion.

Impact marks were documented showing the point of propeller, engine nacelle and wing tip contact. The aircraft came to rest with the left wing and engine partially stuck in the mud. The right wheel and nose tire were also stuck in the mud and sustained damage. Fuel was observed leaking from the wing root on the right side. A puddle had developed in the trench that was created by the right landing gear and its attached wheel as it travelled through the grassy and marshy areas on the left side of the runway to the point where the aircraft came to a stop. *(The trench created was approximately 18 inches wide, by 6 -12 inches deep in certain areas and approximately 30 feet long)*. Fuel continued to be added to the puddle even on arrival of the accident team on the day after the accident.

Propeller slash marks along the wreckage path showed that the engine was operating during the crash sequence.

Heavy braking marks on the runway also showed that heaving braking was applied almost from the point of contact with the runway and failure of the left gear.

The Accident Investigation Department closely examined the experience level of the flight crew and the training provided to them by Western Air Limited to determine if and how training may have affected the flight crew's performance on the evening of the accident.

Analysis of the cockpit voice recorder (CVR) revealed a pattern related to ineffective crew systems knowledge and familiarity on this aircraft type, as well as lack of crew resource management and non-adherence to company's standard operating procedures.

A review of ATC tapes and the CVR revealed a lack of timely and constructive discussion in the cockpit and no assertiveness on the part of the captain in directing actions of the first officer to meet the extent of the abnormal system failure they encountered.

Analysis contained here focuses on several factors considered safety concerns, they are listed in no order of importance or significance, and recommendations were made to the BCAA and the operator where applicable to address the issues.

They were among others;

- Crew qualification
- Insufficient training
- Unapproved Flight Voice and Data

Recorder

- Emergency Amended Checklist and
- Inadequate Regulatory Oversight

### 1. 1. Flight Voice and Data Recorders

Both recorders CVR and DFDR found installed in the accident aircraft C6-HBW did not comply with ICAO Annex 6 and BASR Schedule 7.170 requirements as they were both magnetic strip and CVR was of 30 minute duration, which is no longer allowed.

This finding was addressed on February 20, 2017 in Safety Alert SI-17-000773 sent to the BCAA for resolution as per ICAO Annex 6, Part 1, Amendment 34 dated 8 Nov. 2010 the following requirements were introduced:

**CVR** (Cockpit Voice recorder)

- **6.3.2.2 Discontinuation**

- **6.3.2.1.1** The use of magnetic tape and wire CVRs **shall** be discontinued by 1 January 2016.

- **6.3.2.3 Duration**

- From 1 January 2016 all CVRs **shall** be capable of retaining the information recorded during at least the last two hours of their operation.

**FDR** (Flight Data Recorder)

- **6.3.1.3.6** The use of magnetic tape FDRs **shall** be discontinued by 1 January 2016.

In accordance with **BASR Schedule 7, 7.170**  
Cockpit Voice Recorders & Audio Recording Systems

***Retention of Recorded Information***

- A CVR **shall** be capable of retaining the information recorded during at least the last—
  - 30 minutes of its operation; or
  - 2 hours, for—
  - Aeroplanes required to have a CVR; or

**2. Questionable crew qualification and performance**

Safety Issue SI-17-00756 was sent to the attention of the BCAA on February 17, 2017 after a review of the CVR had occurred.

Based on the information contained on the CVR, it was observed that:

1. Proper procedures were not followed following an unsafe warning given by the aircraft Cockpit Warning Panel (CWP) and warning horns and indications which forms part of the cockpit alerting system.
  2. Preoccupation with getting home and ineffective Crew Resource Management (CRM) resulted in the checklist not being adequately followed when the initial and subsequent alerts occurred.
  3. The abnormal failures were allowed to progress to the point where other failures and alerts started to occur, because the initial alerts were not addressed timely and appropriately.
  4. Unsafe gear horn warning was not recognized in a timely manner and preparation of the aircraft or cabin crew for the possibility of a no gear landing did not occur.
  5. Preoccupation with photo documenting the abnormal situation resulted in other occurring system failures being ignored. Checklist was not requested in a timely manner nor executed effectively.
- Investigations also revealed that the captain should not have been recommended by the training captain of Western Air Limited for a

proficiency check, nor should a proficiency check been allowed by the Check Airman based on the following;

- The captain did not complete the required hours of flight and ground training required for an initial training program.
- No waiver for reduced training was requested, nor was any issued.
- During training conducted by Training personnel of Western Air Limited, on the second simulator session, there were four items / tasks annotated as unsatisfactory requiring further training.
- No evidence was documented to show where this additional training occurred. As the failures requiring further training occurred on the second simulator session, there should have been a third or subsequent simulator session showing retraining and successful accomplishment of the previously failed tasks.
- (iii) After 1 January 2016, all aircraft required to be equipped with a CVR.
- (ii) Helicopters that receive type certification after 1 January 2003; or
- The training captain on the same document showing failure and requiring additional training signed the captain's training record as satisfactory and recommended him for the proficiency check. This is unacceptable and a third or more simulator sessions should have been documented, as well as a new form should have been prepared to show adequate retraining and recommendation for the proficiency check.
- A proficiency check was conducted and annotated as satisfactory, despite failures being noted on the simulator training session and no subsequent training occurred to demonstrate satisfactory accomplishment of the failed areas.

**Recommendation Proposed:**

Based on the information uncovered, the following safety recommendation(s) were sent to the BCAA in respect of SI-17-001743:

- The BCAA should ensure that any reduction in training granted in respect of any training curriculum is fully documented in the Operator file.
- The BCAA should ensure that the captain undergoes a full initial training curriculum in the SF340A model aircraft, as his actions and responses were questionable and his system knowledge was inadequate and determined to be a contributing factor in this accident.
- BCAA should re-evaluate the authority given to the operator to conduct their own training and checking. Additionally, BCAA should ensure that any individual providing checking on its behalf is fully aware of the requirements for such checking.
- Recommendations were also made to the BCAA to ensure that the co-location of both SF340A and SF340B Quick Reference Handbook be discontinued. The manufacturers also disapproved of this method. *(During heightened and stressful situations, such as an emergency, it is easy for a crew to misread and misdiagnose a situation when options from both model aircraft are presented, usually on the same page).*

As in the case of this accident, the captain did in fact use and requested the wrong QRH checklist to address the abnormal condition he was faced with. The crew's unfamiliarity with the aircraft systems exacerbated an abnormal condition and escalated it to an emergency situation.

Also recommendation was made to the BCAA that as the operator does not have the SF340B model aircraft in its fleet, any reference to it should be removed from its training manuals, curriculums, check lists and quick reference handbooks to avoid any future confusion.

*Subsequent to the accident and prior to the completion of this Final report, the training program of Western Air Limited in accordance with recommendation contained in SI-17-000756 was re-evaluated over a period of time with successive candidates; the following segments of the approved pilot training program were re-evaluated with the following results:*

- *Recurrent - Satisfactory*
- *Requalification - Satisfactory*

*Also being evaluated was the*

- *Initial – In work*

*Not evaluated up to the time of this report was*

- *Upgrade and*
- *Transition*
- *Difference (recommendation made to cancel this program)*

*Also subsequent to the accident and prior to the draft final report publication, in accordance with SI-17-000756, both crews were re-examined for competency using a Requalification Program from the approved training curriculum approved for Western Air Limited.*

Both crews were unsuccessful in obtaining satisfactory result, due to lack of systems knowledge and unsatisfactory performance during retraining.

As a result both airman remains inactive for line duty and were enrolled in the Initial training program.

Results of their Initial program training were not unavailable up to publication of this Final Report.

1. Immediately ensure that the flight crew members involved in this accident was removed from active duty in the interest of public safety.
2. Ensure crew was re-examined for their privilege of holding a Bahamas issued Airline Transport Pilot License.
3. Reevaluate the training that is provided by Western Air Limited.
4. Ensure a qualified inspector observe all future training and conducts all future proficiency checks with crew of Western Air Limited until a comfort level is attained where the company can once again be allowed to conduct its own training and checking.

***The BCAA advised the AAID that as a result of the safety recommendation;***

- 1. The crew was removed from active line duty.***
- 2. The crew were scheduled for a re-examination and***
- 3. All further pilot training and checking by Western Air Limited instructors and check airmen were being closely monitored by the BCAA.***

### **3. Emergency Amended Checklist**

A comparison of the manufacturer and the operator's checklist revealed that the operator had modified their checklist and certain information in the notes below each checklist which were present in the manufacturer's checklist, were omitted in the operator's checklist.

This information may have been essential for the crew guidance and considerations. While the missing information may not have differed in an adverse way, its inclusion could possibly have led the crew into some further actions which may have averted the final outcome they experienced.

This safety finding was addressed as Safety Alert SI-17-00011, dated February 27, 2017 and presented to the BCAA for resolution with a recommendation to;

- Ensure that checklists required for emergency or abnormal situations for the SF-340 aircraft by this, and other operators of this type of aircraft are in conformance with the manufacturers' guidance

and notes and other information of a guidance nature are not excluded, as this additional information could possibly lead the crew into additional actions that could be taken.

### **4. Differences Training**

Safety Alert SI-17-00026 was addressed to the BCAA on April 24, 2017 as a result of further investigation where it uncovered that the captain of the aircraft, who was a new hire to company, may not have received sufficient training hours in accordance with the Bahamas Civil Aviation Safety Regulations Schedule 14.

- The captain was not qualified in accordance with BASR requirements as he received training based on the difference<sup>1</sup> training curriculum approved for Western Air Limited, whereas he should have been given training in accordance with an initial training curriculum.
- Investigation also uncovered that the captain was recently hired by Western Air Limited from another operator where he flew primarily the SF340B aircraft and now was training to fly the SF340A aircraft which is the only aircraft type in the fleet of Western Air Limited.

The authority (BCAA) after review and evaluation of documents submitted by one operator can grant a reduction in flight and ground training requirements; (credit for previous training<sup>2</sup>) if the operator can prove the applicant has indeed completed a full training program with the previous operator. However, a review of the Operator file kept by the authority (BCAA) did not reveal any such request for reduction or any grant of waiver for a reduction for this applicant

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<sup>1</sup> A difference training program is a reduced training curriculum given to crew who operates one particular aircraft type and now will transition to a different aircraft type of the same variant type of aircraft. (Example: SF340A vs SF 340B models / BE1900C vs BE1900 D).

<sup>2</sup> The authority (BCAA) after review and evaluation of "credit for previous training document" and other supporting documents submitted by an operator, can grant a reduction in flight and ground training requirements, if the operator can satisfactorily prove the applicant has indeed completed a full training program with the previous operator. In such instance the onus is on the approving inspector to compare the differences in both operators' training program, Standard Operating Practices (SOP), profiles and hourly requirements, before approving a reduction in training waiver for the applicant.

and therefore an initial training curriculum should have been used.

## 5. Additional Analysis

Post analysis of flight crew training information and training facility approval information gathered in the investigation of the accident involving C6-HBW the AAID have uncovered a number of issues that needed to be addressed urgently by the BCAA.

The AAID have uncovered that;

- The training facility CAE Center Stockholm Sweden though approved by EASA for flight training, was not validated in accordance with BCAA guidelines.

- Adequate oversight was not provided by the BCAA of the training being conducted at the Training Facility CAE Center Stockholm Sweden. The simulator used for training was dry-leased from the Swedish training organization and the operator provided the instructor, training program and had the overall responsibility over the training quality.

- BCAA failed to ensure operator was conducting adequate training using appropriate training curriculum. (*The operator conducted training using a reduced curriculum hours when they had no approval to do so*).

- The facility and simulator inspection for approval was not conducted as per BCAA guidelines outlined in Chapter 27, Training Inspections and Chapter 28, Flight Training Simulator Devices, of the Operations Inspector Manual.

- No documentation / letter of the parameters of approval were issued to the operator as required by Chapter 28 (28.3.2(c)) of the Operations Inspector Manual.

- The inspector that conducted the facility inspection and validation was not given written instructions or adequately briefed on the scope of what he was expected to accomplish during the facility evaluation. Nonetheless, the Operations Inspection Manual is clear on the requirements and directions to be followed in order that a training facility can be approved or validated.

- No evidence was provided by the approving inspector to substantiate the evaluation and approvals were done in accordance with BCAA guidance previously stated in Chapters 27 and 28 of BCAA Operations Inspector Manual.
- No additional audit of documents and processes were conducted by the BCAA upon the return of the assigned inspector, to validate the process of approval conducted by this inspector prior to issuing this facility and the operator approval to conduct critical flight training.
- A Training in Progress Job Aid (OP-010) was used in evaluation of the facility and training in progress that occurred. This document should not have been completed in its entirety as the inspector was not present for the training that occurred and did not observe several areas that he annotated as satisfactory namely sections 3, 4, 5, 6, 7, 8 and 11.
- Statement of Compliance and other critical Documents required as part of a simulator evaluation process, were not provided in the evidence requested to demonstrate how the simulator and facility was approved. These documents and others required by Chapter 28 of the Operations Inspector Manual should have been collected and presented to the POI upon satisfactory evaluation for his review and report to the Manager before final approval of the facility was issued.
- Evaluate Simulator Training and Checking Job Aid OP-022 was satisfactorily annotated which should not have occurred as its completion required physical presence and observation by the inspector which did not occur. Therefore as no observation by BCAA personnel was actually conducted as required by sections 16, 17 and 18 of the job aid, the form should not have been completed as satisfactory.
- No evidence was provided to substantiate whether the operators check and training personnel received adequate training on the use and parameters of the simulator by the training facility.

### 3.0 CONCLUSIONS

The Air Accident Investigation Department has determined that the probable cause of this accident was ineffective crew resource management and an unstable approach which led to the failure of the left main landing gear upon touchdown. Contributing factors to this accident includes; inadequate systems knowledge, lack of situational awareness and failure to diagnose and remedy multiple system failures in a timely manner resulted in compound failures being escalated to an emergency. The apparent rush to get on the ground without exploring other possible options to identify and verify landing gear security also contributed to the severity of this accident.

#### 3.1 FINDINGS

Findings were generated among others, in respect of the following items found as safety concerns. Findings are listed in no order of appearance or importance:

- Unapproved Flight Voice and Data Recorder
  - Questionable Crew performance and qualification
  - Questionable crew training received
  - Emergency Amended Checklist
  - Inadequate Regulatory Oversight
1. With the exception of the recorders found not in compliance with BASR schedule 7, the aircraft was otherwise certified, equipped and maintained in accordance with existing regulations and approved procedures.
  2. The aircraft had a valid Certificate of Airworthiness.
  3. The aircraft was airworthy when dispatched for the flight.
  4. The mass and the center of gravity of the aircraft were within the prescribed limits.
  5. Recording of total hours and cycles on Technical and Journey logs as required by regulations is not being conducted.
  6. Both recorders (CVR and DFDR) installed in the accident aircraft did not comply with ICAO Annex 6 and BASR Schedule 7.170 requirements as they were both magnetic strip and the CVR is of 30 minute duration, which is no longer allowed.
  7. Approach checklist was not requested and not conducted as evident from the CVR recording. Throughout the approach, almost to the point of touch down, the non-flying pilot continued to try and locate the appropriate checklist to address the previous abnormal condition.
  8. Crew resource management (CRM) was ineffective from the initial electrical bus failure, throughout the flight and up to the point of the evacuation and shutdown.
  9. Despite losing all flight information and instrumentation on the left side, the captain commanded control of the flight from the first officer (flying pilot), despite the first officer having all flight instrumentation available on his side.
  10. Aircraft airspeed during the approach was unstable and non-standard. A go around had to be executed as the captain, who had no available flight instrumentation, attempted to align the aircraft with the runway too high and too fast for a safe landing to be made.
  11. No instructions or confirmation were recorded on the CVR where;
    - a. the cabin attendant was advised of the possibility of a hard landing or no gear landing, or
    - b. the cabin crew was advised when to commence the evacuation nor
    - c. no confirmation of conduct or completion of the evacuation and shutdown checklist as required by SOP.
  12. There were several other options available to explore to ensure the landing gear was indeed down and lock. There was a hurried effort to return for a landing, as a result the words of ATC

- that they (gears) “appeared to be down,” was relied on and other possible options were not explored.
13. The flight crew was properly licensed, medically fit and adequately rested to operate the flight.
  14. The flight crew was in compliance with the flight and duty time regulations.
  15. Several important checklists were not accomplished as required, when an abnormal system failure was encountered.
  16. Sterile cockpit procedures were not followed after the initial electrical failure. Continued inappropriate conversation was recorded on the CVR during the critical moments when sterile cockpit is essential and only conversation related to dealing with the emergency and checklists should have been observed.
  17. The “Before Landing” checklist was partially conducted intertwined with system failure QRH instructions and neither were both effectively completed as required by company standard operating procedures. The non-flying pilot continued trying to locate abnormal system QRH reference while on descent for a landing.
  18. The crew flew a non-stabilized approach and speed was increased intentionally by the pilot throughout the final approach as he stated it was “because he had no flaps for landing.”
  19. The crew actions and statements indicated that their knowledge and understanding of the aircraft systems were inadequate.
  20. The crew failed to instruct the evacuation process. However, the cabin attendant took the initiative and initiated it as evidenced from the CVR recordings.
  21. The crew failed to conduct the emergency and evacuation checklist as required by company SOPs.
  22. There was no evidence of airframe failure or system malfunction prior to the accident.
  23. The aircraft was structurally intact prior to - impact.
  24. The flight crew carried out normal radio communications with the relevant ATC units.
  25. All control surfaces were accounted for and all damage to the aircraft were attributable to the severe impact forces and ground contact made after the gear failure.
  26. ATC provided prompt and effective assistance to the flight crew.
  27. The training facility CAE Center Stockholm Sweden was approved by EASA. However, it was not validated for use by Bahamas Operators in accordance with BCAA guidelines.
  28. The BCAA’s monitoring system had been ineffective in identifying and making the operator correct the procedural lapses.
  29. Adequate oversight was not provided by the BCAA of the training being conducted at the Training Facility CAE Center Stockholm Sweden.
  30. BCAA failed to ensure operator was conducting adequate training using appropriate training curriculum.

### **3.2 CONTRIBUTING FACTORS**

- Ineffective CRM, complacency and a complete departure from company standard operating procedures and regulatory requirements were evidently a contributing factor in this accident.
- Inadequate training and systems knowledge of both airman greatly contributed to the accident.
- Hurried approach to get on the ground and failure to explore all available options to remedy the gear unsafe situation encountered was also a contributory factor.

## 4.0 SAFETY RECOMMENDATIONS

### Recommendation 1

In respect of Safety Alert SI-17-00773 – Unapproved recorders, the AAID recommended that;

The BCAA should immediately ensure that all aircraft on Bahamas registry or operated by Bahamas Air Operators, if they are required to have an installed CVR or FDR, that they are in compliance with Annex 6 and BASR Schedule 7 requirements.

- ***Up to the publication of this report the BCAA has not provided evidence that this safety recommendation has been satisfactorily resolved.***

### Recommendation 2

Further recommendations of findings previously analyzed in Section 2 of this report in respect of SI – 17-001943 follows

1. A qualified inspector conducts all evaluation and approvals of training facilities in the future.
  2. All assignments of duties by a POI to anyone acting on his/her behalf are clearly documented and communicated to the assigned inspector.
  3. All inspector assigned duties are fully aware and knowledgeable of the functions they are assigned and required to perform.
  4. A full report of actions carried out when assigned, is documented and communicated back to the POI.
  5. An audit is carried out by the POI (or some other assigned person), of any evaluations for approvals prior to it being submitted to the manager for approval.
- ***The BCAA confirmed that training were conducted with its employees and items 1 – 5 above satisfactorily addressed.***

### Recommendation 3

It is the recommendation of the AAID that the BCAA ensure recurrent training and demonstration of the

correct method to complete job aids be reinforced among its inspectors.

- ***The BCAA confirmed that training was conducted with all of its inspectors.***

### Recommendation 4

In accordance with SI-17-00011, Emergency Amended Checklist, the following safety recommendations were made

1. Ensure that checklists required for emergency or abnormal situations for the SF-340 aircraft by this, and other operators of this type of aircraft, are in conformance with the manufacturers' guidance and notes and other information of a guidance nature are not excluded, as these additional information could possibly lead the crew into additional actions that could be taken to avoid the kind of accident that occurred.
2. The co-location of both SF340A and SF340B Quick Reference Handbook items should be disallowed, as in an emergency, it is possible to select and use the wrong checklist. This can consume considerable time and cause delays while dealing with an emergency if the wrong reference is selected.
  - ***Up to the publication of this report the BCAA has not provided evidence that the above safety recommendation has been satisfactorily addressed or resolved.***

### Recommendation 5

Based on information uncovered and issued under SI 17-00026 the following safety recommendations were sent to the BCAA stating that they (BCAA):

1. Should ensure that the difference training program previously approved for Western Air Limited be cancelled as they do not meet the requirement that warrants a difference training curriculum.
2. Should ensure that any reduction in training granted in respect of any training curriculum is fully documented in the Operator file.

3. Should ensure that this crew undergo a full initial training curriculum as their actions and responses were questionable and system knowledge was inadequate.

- ***The BCAA did not confirm that recommendations 1 and 2 above were satisfactorily addressed. Item 3 was addressed to unsatisfactory results.***

**Recommendation 6**

1. BCAA should re-evaluate the authority given to the operator to conduct their own training and checking. Additionally, BCAA should ensure that any individual providing checking on its behalf is fully aware of the requirements for such checking.

- *Subsequent to this accident and prior to the publication of this report, the BCAA did comply with the proposed recommendation and carried out an evaluation of Western Air's approved instructors and check airmen. The recommendation has been complied with and the evaluation was satisfactorily completed.*

**Recommendation 7**

1. Also addressed to the BCAA was the recommendation that as the operator does not have the SF340B model aircraft in its fleet, any reference to the B Model should be removed from its training manuals, curriculums check lists and quick reference handbooks to avoid any future confusion.

2. Additionally, also advised to the BCAA was the recommendation that the operator not be allowed to conduct training in a B model simulator and then conduct a difference training in the A model. They should only be allowed to train in the simulator for the model of aircraft in their fleet.

*Up to the publication of this report the BCAA had not addressed their intentions to carry out this safety recommendation.*

**Recommendation 8**

Recommendation was made to the BCAA to reevaluate the training that was provided by Western Air Limited to its crew.

*Subsequent to the accident and prior to the completion of the Draft Final report, the training program of Western Air Limited in accordance with recommendation contained in SI-17-000756 was re-evaluated over a period of time with successive candidates, the following segments of the approved pilot training program were re-evaluated with the following results:*

- *Recurrent - Satisfactory*
- *Requalification - Satisfactory*

*Also being evaluated was the*

- *Initial Training Program – In work*

*Not evaluated up to the time of this report was*

- *Upgrade and*
- *Transition*