Sint Maarten Civil Aviation Authority

Aircraft Accident Report

SkyWay Enterprises Inc., Flight 7101, Shorts SD3-60, N380MQ

Loss of Control – In flight, crash into the sea (LOC-I) near

Sint Maarten -Princess Juliana International Airport,

29 October 2014

Sint Maarten Civil Aviation Authority released … 23/09/2016

Airport Road # 69
Simpson Bay
Sint Maarten

Tel.: 1721-5452024 or 1721- 5454226/Fax.: 1721- 545 2998

Statement of purpose:

In accordance with Annex 13 to the Convention on International Civil Aviation, it is not the objective of this investigation to apportion blame or liability. The sole objective of the investigation and the Sint Maarten Civil Aviation Authority Final Report is the prevention of accidents and incidents.

Note - Unless otherwise indicated, recommendations in this report are addressed to the aeronautical 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.

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Synopsis:

On October 29, 2014, at about 1840 Atlantic Standard Time, a Shorts SD3-60, United States registered N380MQ was destroyed when it crashed into the sea shortly after takeoff from Runway 28 at Princess Juliana International Airport, Sint Maarten, Dutch Antilles, Kingdom of the Netherlands. The two crewmembers on board sustained fatal injuries. The aircraft was operated by SkyWay Enterprises Inc. on a scheduled FedEx contract cargo flight to Luis Munoz Marin International Airport, San Juan, Puerto Rico. At 1839 local, Juliana Tower cleared the aircraft for takeoff Runway 28 - maintain heading 230 until passing 4000 feet. At 1840 local, Tower observed the aircraft descending visually and the radar target and data block disappeared. There were no distress calls. Night conditions and rain prevailed at the time of the accident. Coast Guard search crews discovered aircraft debris close to the shoreline about 1 ½ hours later.

The Sint Maarten Civil Aviation Authority initiated an investigation in accordance with ICAO Annex 13. Local investigation authority personnel were joined by Accredited Representatives and advisors from the following states: the USA (NTSB/FAA), United Kingdom (AAIB and Shorts Brothers PLC), and Canada (TSB, TC, PWC). Organization of the investigation included the following groups: Operations, Accident Site and Wreckage, Powerplants, Aircraft Maintenance, Air Traffic Services, Meteorology, and GPS Study. The operator made available personnel for interviews but deferred to participate in the groups.

Flight recorders were not installed nor required on this cargo configured aircraft. The original FDR and CVR were removed following conversion to cargo only operations. A handheld GPS recovered from submerged wreckage was successfully downloaded. Data revealed the aircraft past the departure runway threshold on takeoff and attained a maximum GPS recorded altitude of 433 feet at 119 knots groundspeed at 18:39:30. The two remaining data points were over the sea and recorded decreasing altitude and increasing airspeed.

The wreckage was recovered from the sea and examined by technical experts. Assessment of the evidence concluded there were no airframe or engine malfunctions that would have affected the airworthiness of the aircraft. The experts concluded that the aircraft struck the sea while under normal engine operation.

Operations and human performance investigators evaluated the evidence and analyzed extensive interviews. The investigation concluded that the aircraft departed from the expected flight path in an unusual attitude. The pilot flying experienced a somatographic illusion as a result of a stressful takeoff and acceleration from flap retraction. The pilot's reaction to pitch down while initiating a required heading change led to an extreme unusual attitude. Circumstances indicate the pilot monitoring did not perceive/respond/intervene to correct the flight path and recover from the unusual attitude. The aircraft exceeded the normal maneuvering parameters, the crew

experienced a loss of control, and lacking adequate altitude for recovery, the aircraft crashed into the sea.

Safety issues raised in the Final Report include loss of situational awareness, pilot monitoring duties, loss of control, upset recovery, crew resource management, company safety culture, FAA oversight of Part 135 operations and maintenance and a recommendation to extend the Safety Management Systems culture to Part 135 operators.

Time used in the Report-Atlantic Standard Time (AST), Coordinated Universal Time (UTC) - 4 hours.

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List of Abbreviations

AAIB	United Kingdom Air Accidents Investigation Branch
AAIP	Approved Aircraft Inspection Program
AC	FAA Advisory Circular
AD	FAA Airworthiness Directive
APP	Appendix number to this report
AST	Atlantic Standard Time (AST), Coordinated Universal Time (UTC) - 4 hours.
CAA	United Kingdom Civil Aviation Authority (aviation regulator)
CFR	Code of Federal Regulations
CP	Chief Pilot
CRM	crew resource management
CVR	cockpit voice recorder
DM	Director of Maintenance
DO	Director of Operations
FAA	United States Federal Aviation Administration (aviation regulator)
FDR	Flight Data Recorder
FedEx	Federal Express Corporation
FSDO	Flight Standards District Office
GOC	Global Operation Center Caribbean
GOM	General Operations Manual
GPS	global position system, a receiver for satellite navigation signals
GPWS	ground proximity warning system
GS	ground speed
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
LOC	loss of control
LOC-I	Loss of control – in flight (IATA terminology)
nm	nautical miles
NTSB	United States National Transportation Safety Board
NWS	United States National Weather Service
Ops Specs	Operations Specifications
PAI	Principal Avionics Inspector
PF	Pilot Flying (maneuvering controls)
PIC	Pilot in command
PJIAE	Princess Juliana International Airport Operating Company N.V.
PM	Pilot Monitoring (PNF-pilot not flying)
PMI	Principal Maintenance Inspector

POI	Principal Operations Inspector
PWC	Pratt & Whitney Canada, also P&WC
SB	Safety Bulletin
SD3	type designation for all series Shorts 360 models
SIC	Second in command, (First Officer)
SJU	Luis Munoz Marin International Airport, San Juan, P.R. (FAA/IATA identifier)
SMCAA	Sint Maarten Civil Aviation Authority (aviation regulator)
SMS	Safety Management System
STC	Supplemental Type Certificate
SWE	SkyWay Enterprises Incorporated
SXM	Princess Juliana International Airport (IATA Identifier)
TC	Transport Canada (aviation regulator)
TCAS	Traffic Collision Avoidance System
TEMP	Turbine Engine Maintenance Program
TJSJ	Luis Munoz Marin International Airport, San Juan, Puerto Rico (IATA identifier)
TNCM	Princess Juliana International Airport (ICAO identifier)
Tower	Air Traffic Services control tower
TSB	Transportation Safety Board of Canada

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List of Appendices

Appendix 1—PJIAE Air Traffic Services Incident /Accident Report, dated 31-10-14, pages1-3.

Appendix 2---GPS Device Factual Report, DCA15RA018, pages 9-12.

Appendix 3---P&WC Accident/Incident Report No. 14-115, pages 1-2.

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1. FACTUAL INFORMATION

1.1 History of flight

1.1.1 SkyWay Enterprises Inc.(SWE), operates FAA approved 14 CFR 135 international operations in the Caribbean area under contract with FedEx Corporation. Shorts 360 aircraft and crews are based in San Juan, Puerto Rico. Prior to the accident flight, on the morning of October 29, 2014, the accident flight crew reported for duty at 0845 hours local time (AST)[1] and operated a scheduled revenue cargo flight from San Juan-Luis Munoz Marin International Airport (SJU) to Sint Maarten-Princess Juliana International Airport (SXM), arriving about 1130L. The crew departed airport property on free time and arrived back at the airport about 1700L for the scheduled return flight.

1.1.2 The accident flight, SKZ 7101[2], an SD3-60, U.S. registered N380MQ, operated as a scheduled cargo flight returning from SXM to SJU. The Captain observed the cargo loading and provided a cargo manifest to the ramp agent. A repetitive company flight plan was on file. The flight was approved for engine start by the Juliana Tower[3] at 1817L. The flight commenced taxi to runway 28 at 1828L. The flight was cleared for take-off at 1838L and instructed to maintain heading 230 until passing 4,000 feet[4].

1.1.3 At 1839L the flight was given their departure time and instructed to maintain heading 230 until passing 3000 feet. The crew read back the clearance. At 1840L Tower personnel observed a normal take-off and initial climb. Airport security video image recordings showed normal strobe and navigation light patterns. Then Tower personnel reported, passing the departure end of the runway, the aircraft began descending both visually and on radar. There was no response to calls from the Tower to the aircraft and the ATC data block for the flight no longer appeared on the airport radar screen. Emergency services were notified immediately (1841L) of the aircraft disappearance.

1.1.4 The surface weather observation near the time of the accident reported winds variable 200 to 270 degrees, 10 knots with gusts up to 20 knots from 230 degrees, visibility 2 ½ miles, light rain showers and broken ceiling of towering cumulus clouds at 1300 feet. Remarks stated towering cumulus clouds in all quadrants.

[1] Atlantic Standard Time, Coordinated Universal Time (UTC) -4 hours
[2] Air Traffic Services call sign of the accident flight
[3] Air Traffic Services call sign of the Tower at SXM. See APP 1 for complete report of chronological order of events.
[4] The altitude restriction was due to arriving IFR traffic maneuvering for Runway 10.

1.1.5 SMCAA personnel directed ATS preliminary playback of the local radar data for the accident aircraft departure. The aircraft was observed on radar departing RWY 28 and reached a mode C readout altitude of 200 feet. Subsequent radar antenna rotations indicated descent. Loss of the target was observed approximately 2.5 nm from the end of the runway.

1.1.6 The first Coast Guard vessel was dispatched at 1900L. A helicopter from Guadeloupe arrived at the search area at 2222L and remained in the area for 40 minutes. The Coast Guard Search and Rescue team notified the Tower at 2125L that debris from an airplane had been found off shore.

1.1.7 A handheld GPS device was later recovered from submerged wreckage. Following download[5], recorded data indicated the aircraft past the departure runway threshold on take-off and attained a maximum GPS altitude of 433 feet at 119 knots groundspeed at 18:39:30L. The two remaining GPS data points were over the sea and recorded decreasing altitude and increasing airspeed. A full reconstruction and graphical overlay of the data is available in APP 2.

1.1.8 A complete underwater plot indicated the wreckage location was 0.8 nm distant from the airport runway, bearing 244°.

1.1.9 Area sunset was at 1742L and end of civil twilight at 1804L; night conditions and rain prevailed at the time of the accident.

1.2 Injuries to persons

Injuries	Crew	Passengers	Total in Aircraft	Other
Fatal	2		2	
Serious				
Minor				
None				
TOTAL	2		2	

[5] A detailed description of the data recovery procedure is contained in Para 1.19.1

1.3 Damage to aircraft

1.3.1 The aircraft was destroyed upon contact with the sea.

1.3.2 A detailed description of the relative airframe components and major systems can be found in Section 1.12.

1.4 Other Damage

1.4.1 None

1.5 Personal Information

1.5.1 The accident Captain was a male, 49 years old. He was employed by SWE for about four months and had been assigned to the San Juan operation for about 3 weeks. He cited previous experience in the Caribbean area flying Shorts 360 and BN -2 aircraft[6]. He attended a Shorts 360 "Prior Experience Course" and completed a 14 CFR Part 61.157 type rating check ride at Flight Safety[7] on June 9, 2014. His initial 14 CFR Part 135 Pilot-in-Command check was conducted by the SWE Chief Pilot and he was designated a Captain on June 22, 2014.

1.5.2 The Captain's FAA certificates and ratings included Ground Instructor, Flight Instructor, Commercial Pilot and:

AIRLINE TRANSPORT CERTIFICATE issued 9 June 2014
Airplane Multiengine Land
BA-3100 CE-500 HS-125 LR-Jet SD3

MEDICAL CERTFICATE FIRST CLASS issued 21 May 2014
Limitation (Must have glasses available for near vision)

1.5.3 The Captain's log books were not available. The Captain's FAA certificate record indicated a SD3 SIC Privileges only endorsement was issued on May 3, 2013. The Captain's flight time based on SWE and FAA records indicated:

Total pilot flying time	5318.8 hours
Total Pilot-in-Command time(PIC)	3618.8 hours
Total SD-3 time	361.8 hours (Roblex Aviation SIC time not included)
Total SD-3 PIC time	361.8 hours
Flight time previous 24 hours	2.6 hours

[6] Roblex Aviation ceased operations, pilot experience records not available.
[7] Flight Safety International New York, an FAA Part 142 approved pilot training facility

Flight time previous 30 days	50.3 hours
Flight time previous 90 days	144.5 hours
Flight time previous 12 months	213.8 hours

1.5.4 The Captain resided in San Juan with his fiancée. She provided Information on his activities for the 72 hours prior to the accident. She related that he usually slept from 11-7 and that his sleep pattern was "normal" prior to the accident.

1.5.5 The First Officer was a male, 26 years old. He was employed by SWE for about 13 months. His employment application indicated he had 530 hours of flight experience, most recent was flying light aircraft for the Civil Air Patrol. He received SWE in-house Second-in- Command training. Training was conducted in a trailer behind the SWE Kissimmee, Florida hanger that was converted to a classroom. Ground training consisted of self-study of manuals, videos and CDs, a set curriculum with five tests - with a final examination by the Chief Pilot. The First Officer completed flight training and initial operating experience with SWE instructors. His Part 135 second-in command check ride was administered by the Director of Operations on December 27, 2013.

1.5.6 The First Officer's FAA certificates and ratings included:

COMMERCIAL PIOLT issued December 27, 2013
Airplane Single and Multiengine Land
Instrument Airplane
SD3
SD3-SIC Privileges Only

MEDICAL CERTIFICATE FIRST CLASS issued February 14, 2014
Limitation (must wear corrective lenses)

1.5.7 The First Officer's log books were not available. His flight time based on SWE and FAA records indicated:

Total pilot flying time	1040.9 hours
Total Pilot-in-Command time(PIC)	275 hours
Total SD-3 time	510.9 hours
Total SD-3 PIC time	0 hours
Flight time previous 24 hours	2.6 hours
Flight time previous 30 days	32 hours
Flight time previous 90 days	129.6 hours
Flight time previous 12 months	456 hours

1.5.8 The First Officer resided at the family home in San Juan. The family indicated his activities for the 72 hours prior to the accident were routine. He had no medical issues and slept more than 8 hours on the night before the accident. He had no difficulties with his sleep pattern. The family indicated that he always slept well and ensured he was rested up for work.

1.6 Aircraft Information

1.6.1 The accident aircraft, a SD3-60 (also known as an SD-3 or Shorts 360) was manufactured by Short Brothers PLC of Belfast, Northern Ireland, U.K. The original type certificate, BH11, was issued by the UK CAA. The US FAA approved airworthiness of the transport category aircraft design Model SD3-60 Variant 200 on October 29, 1982. The accident aircraft, serial number SH3702, was manufactured in 1986 and entered airline passenger service in the United States with a valid FAA Airworthiness Certificate.

1.6.2 SWE obtained the aircraft from American Eagle Airlines Inc. in 2000 and converted the aircraft interior to a cargo only configuration in accordance with Supplemental Type Certificate STC No. ST01615AT. There were no FAA or NTSB records of previous accidents or incidents for this airplane.

1.6.2 A valid FAA Certificate of Registration, N380MQ, was issued on 22 June 2000 to SkyWay Enterprises Inc., Kissimmee 34741, Florida, USA.

1.6.3 An FAA Form 337, Major Repair and Alteration, dated March 6, 2001 was submitted by the SWE DM, and approved by the FAA the same day to remove the following equipment: GPWS, Rad Act (Alt = altimeter), CVR, FDR, attitude gyro, and TCAS. The FAA Part 135 airworthiness requirements as a cargo only aircraft[8] did not require the accident aircraft (and all similar part 135 operators) to operate with items required for passenger carrying operations.

1.6.4 An FAA Form 337, Major Repair and Alteration, dated September 15, 2005 was submitted by SWE and approved by the FAA December 13, 2005 to install a GPS Antenna for use with a handheld GPS. An auxiliary 24Vdc power receptacle was also installed at the lower right corner of the instrument panel.

1.6.5 At the time of the accident, maintenance logs indicate the airplane had 25,061.7 total flight hours with 32,824 cycles.

[8] FAR Part 135.151 CVR requirements apply to aircraft carrying 6 or more passengers. FAR Part 135.152 FDR requirements apply to aircraft carrying 10 or more passengers.

1.6.6 SWE Operations Specifications (Ops Specs) listed a fleet of seven SD3-60 aircraft, including the accident airplane. These aircraft were part of an FAA Approved Aircraft Inspection Program (AAIP) to maintain airworthiness of the airframe and a Turbine Engine Maintenance Program (TEMP) for maintenance of the engines. All required regulatory requirements and recurring inspections for the aircraft were incorporated into the SWE AAIP.

1.6.7 The last inspections accomplished on the accident airplane were as follows: A-Check 10/26/2014, C-Check 9/03/2014, D-Check 8/20/2013, E-Check 12/29/2012. The maintenance inspections were current with the required AAIP intervals.

1.6.8 The accident airplane was equipped with two Pratt and Whitney Canada (PWC) PT6A-65AR engines; left engine, both modules S/N PCE97372, right engine gas generator S/N PCE97319 and power section S/N PCE97378. The engines were inspected and maintained in accordance with the TEMP, an on condition maintenance program allowing use of the engine until 12,000 operating hours[9]. Thereafter the engine must be overhauled. The highest engine component accumulated time since overhaul on the left engine was the gas generator, 7512.7 hours, on the right engine, the power section, 8272.0 hours. Both engines were within the allowable operating hour limitations.

1.6.9 The airplane was equipped with two Hartzell Propellers. The overhaul limit is 3000 hours. The total time since installation on the left prop, 1707.3 hours, on the right prop, 147.3 hours. Both props were within the allowable operating hour limitations.

1.6.10 The SWE maintenance logbooks and computerized records for N380MQ indicate all applicable Airframe, Powerplant, and Accessory Airworthiness Directives (AD) and mandatory Service Bulletins (SB) were accomplished and recurring ADs were being tracked. Only mandated SBs were accomplished on the airplane by the operator.

1.6.11 Recent maintenance history in the aircraft logbook indicated a discrepancy on October 19, 2014 - cavitations on hydraulics main system during engine run. Corrective action, serviced main system in accordance with the maintenance manual. Another discrepancy was entered as a result of a runway excursion upon landing at SXM on October 27, 2014 - Possible air lock in the hydraulic system causing loss of brakes and steering – Corrective action, Found air in the hydraulic system. Bled and serviced in accordance with the maintenance manual. Aircraft

[9] P&WC Service Bulletin No. 13003R7 dated Sep 14/2000 was referenced to establish the current 12000 hour TBO. SB Rev No. 8 dated Jul 08/2013 contains basic industry standard TBO of 6000 hours. TBO extension recommendations are presented to allow escalation in 500 hour increments based on engineering review.

returned to service. This write up did not include the pilot's comment that reverse thrust was also not available during the excursion event[10].

1.6.12 Prior to the accident flight, per instructions from FedEx, two ramp agents reported they loaded 10 boxes of cargo on N380MQ as the Captain observed. Then a loader and the Captain "put the netting up and closed the cargo doors".

1.6.13 A copy of the load sheet for the accident flight, signed by the Captain, was on file at SXM. Details follow: basic operating weight 16,420 lbs., fuel 3,650 lbs., cargo load 435 lbs., no declared dangerous goods, Mass at take-off 20,505 lbs., certificated maximum take-off mass 26,000 lbs., calculated CG., 24% (certificated allowable range for take-off and landing, 16-36 %). Weight and balance calculations at take-off were within the FAA prescribed operating limitations.

1.6.14 Operational Procedures – The SWE Training Manual Shorts Aircraft, TAKE-OFF Section 5/page 5-2 and Section 6 /page 6-2 states in part;

Pilot flying (PF)	**Pilot not flying (PNF)**
Accelerating thru 120 KIAS calls Flaps – 5. (Illustration indicates 400 Foot AGL (MIN)	Acknowledges and places flap handle to Flaps 5 position
Accelerating thru 125 KIAS calls Flaps – Up	Acknowledges and places flap handle to Flaps UP position
Accelerating thru 130 KIAS calls "Climb Power, After Take-off Checks"	Sets climb power and accomplishes the climb check. Calls check complete when complete

1.6.15 The SWE Training Manual Shorts Aircraft, Flight Maneuvers and Procedures Training, Table 12 within the document does not list "Night Take-off" as a required training event in an aircraft nor as a training briefing item.

[10] See further discussion of this event in Para 1.18.2 and 1.18.3

1.6.16 The SWE Training Manual Shorts Aircraft, Duties and Responsibilities, Takeoff Briefing section addresses the content of the pre take-off briefing. The ATC Clearance and climb out restrictions are included in the main points of the briefing.

1.6.17 The SWE Operations Manual "Thunderstorm and Airborne Weather Radar section directs, "When taking off in thunderstorm areas, the radar should be operated on the ground using some upward antenna tilt to determine the best climb out path. During ground operation the Off-Standby-Range control must be left in the standby position until the aircraft is clear of all large reflective surfaces by 100 feet.

1.7 Metrological information

1.7.1 The U.S. National Weather Service (NWS) Surface Analysis Chart for 1700L depicted a typical tropical environment over Sint Maarten with typically relatively high surface dew point temperatures during the evening hours. There was a tropical wave moving westward across the accident site at the time of the accident which provided a lifting mechanism for rain showers and thunderstorms.

1.7.2 The NWS Area Forecast issued at 1730L indicated scattered clouds at 2000 feet with a broken ceiling at 6000 feet, with occasional ceilings at 2000 feet. Cloud tops were forecast to be above flight level 240 with scattered rain showers and thunderstorms.

1.7.2 A SIGMET[11] for the San Juan Oceanic Area, including the accident site, was issued at 1645L and valid through 2045L. The SIGMET warned of stationary thunderstorms with tops to flight level 480.

1.7.4 A Global Data Assimilation System (GDSAS) upper air sounding was made for the accident site and values were plotted on a Skew T diagram. Data indicated a conditionally unstable vertical environment which was conducive for clouds, rain showers and thunderstorms. Also, convectively induced wind shear and downburst were likely at the accident site and time.

1.7.3 The official weather observations disseminated from the Princess Juliana International Airport on the evening of the accident are:
(1800 AST) TNCM 292200Z 22011Kt 180V260 9000 VCSH BKN013TCU28/25 Q1010A2982 RERA TEMPO SHRA/RMK TCU/SHRA NE to N AND SW to W=

[11] The purpose of SIGMET information is to advise pilots of the occurrence or expected occurrence of en-route weather phenomena which may affect the safety of aircraft operations.

(1838) AST TNCM 292238Z 23010G20KT 200V270 4000E -SHRA BKN013TCU 26/25 Q1010 A2983 TEMPO SHRA RMK TCU ALQDS=
(1900 AST) TNCM 292300Z 22008K 160V270 9000-SHRA FEW010CB BKN012TCU 27/25 Q1010 A2983 RERA/TEMPO SHRA RMK CB/LTG NW=

1.7.4 The NWS Sea State Analysis for 0800L October 29 indicated there was significant wave heights of 4 to 5 feet near the accident site with direction east to west. The 2000L Sea State Analysis indicated significant wave heights up to 13 feet just north of the accident site with a corresponding thunderstorm complex. Sea State Analysis the following morning indicated significant wave heights as high as 6 feet near the accident site.

1.7.5 SWE provided investigators a copy of a flight release signed by the DO. "Weather" was listed as an enclosure to the release. Several SWE pilots told investigators that flight followers[12] at KISM would send a weather package to the turnaround station. Others related that pilots would use personal Wi-Fi to get their weather information at Sint Maarten.

1.7.6 Interviews with cargo loading personnel following the accident indicated there was light to moderate rain showers present during loading. The loaders stated they did not observe anything different from other days of working FedEx. However, in later statements, one ramp agent stated, "when the airplane was ready to taxi, there was some heavy rain and it was pitch black to the south with clouds. The aircraft taxied to the east, the rain eased a little. The aircraft held to the east waiting for another aircraft to clear and then taxied on the runway where I lost sight of him. The next time I saw the aircraft is when he took off in some heavy rain." Two other agents confirmed the existing weather at departure and stated, "there was heavy rain that eased off and afterward started heavy again".

1.8 Aids to navigation

1.8.1 There were no reported anomalies or equipment outages regarding aids to navigation.

1.8.2 Items recovered from the wreckage included the enclosure from the Collins FGC-65 flight guidance computer and various navigation system components. Due to impact damage, sea water immersion, and separation of circuit boards, it was not possible to determine operational status or to extract useful data from the on board navigation equipment installed in the accident aircraft.

1.8.3 A hand held Garmin GPSMAP 96C yielded flight path information recorded on the accident flight. The downloaded data is described in the previous Para 1.1.7 and in APP 2.

[12] The DO described flight followers as dispatchers – not holding FAA certification.

1.9 Communications

1.9.1 A summary of Princes Juliana Air Traffic Services Tower communications to N380MQ (call sign SKZ7101) is contained in APP 1. There were no known communications difficulties regarding the accident flight.

1.9.2 Due to arriving traffic, ATC instructions to the accident aircraft after takeoff were, "maintain heading 230 until passing 3000 feet". A crew member read back the clearance.

1.9.3 A company filed flight plan for the accident flight requested routing via airway B520, which is the 292° radial from the Sint Maarten VOR (PJM) to Saint Thomas VOR (STT) and thence via route 6 to San Juan (SJU).

1.10 Aerodrome information

1.10.1 Princess Juliana International Airport (ICAO code TNCM) is located on the southwestern coast of Sint Maarten Island, one of the Leeward Islands of the West Indies. A low mountain range runs through the center of the island. The airport is located on a strip of land that separates Simpson Bay Lagoon from the mainland, and both runway ends are bordered by water.

1.10.2 Airport elevation is 14 feet. The airport has one runway 10/28. The runway is 7546 feet in length, 148 feet wide.

1.10.3 Prevailing winds[13] at the airport throughout the year (average monthly values) come from the East at 9 - 10 knots. Over 90% of the airport operations favor take-offs and landings on runway 10.

1.10.4 VMC conditions must exist to land on runway 28, and landing at night is prohibited. All night landings must use runway 10.

1.10.4 Take-offs from runway 28 present no visual landmass past the immediate shore line.

1.10.5 Published take-off minimums for runway 28 are 300 feet ceiling and 4500 meters visibility. Visibility at the time near the accident was 4000 meters. SWE FAA Ops Specs authorized take-off minimum equal to the lowest authorized straight-in Category 1 IFR landing minimum.

[13] Seasonal data provided in Jeppesen Airport Qualification TNCM/SXM page 19-02.

1.11 Flight recorders

1.11.1 CVR and FDR recorders were installed by the manufacturer during aircraft construction, in accordance with the state of manufacture approved type design and the FAA validated type design for transport category aircraft. Following SWE conversion of the SD3-60 to cargo only operations, the DM submitted an FAA Form 337, Major Repair and Alteration, and the recorders were removed. At the time of the accident, the aircraft was not equipped, nor was it required to be equipped, with either a cockpit voice recorder or a flight data recorder. See Paragraph 1.6.3 and 1.6.4 for specific equipment details.

1.11.2 A hand held GPS navigational device was recovered from the wreckage and successfully downloaded. See paragraphs 1.6.4 for installation information and paragraph 1.16.1 for details of the recovery of recorded information.

1.12 Wreckage and impact information

1.12.1 The wreckage was located in 20 meters of water depth about 0.8 nm from the threshold of runway 10, bearing 244°. A diving team from the Puerto Rico National Police provided underwater photos and video of the wreckage. The images showed that the aircraft had broken up on impact with the sea, was heavily fragmented, and spread about the sea bed.

1.12.2 The investigation authority made arrangements to recover the wreckage to shore, operations began on 29 November 2014. To facilitate investigation, the wreckage was placed quayside adjacent to the Sint Maarten CAA building at the airport. The SMCAA authorities were assisted by subject matter experts from the UK Air Accident Investigation Branch (State of manufacture) and the manufacturer, Short Brothers PLC trading as Bombardier Aerospace. Initial airframe assessment efforts were directed to ensure the entire aircraft was present at the underwater accident site. The wreckage assessment indicated that components of the nose, left and right outer wings and the tail surfaces were all accounted for.

1.12.4 The right and left main landing gear hydraulic actuators appeared to be in the fully raised position. The nose gear assembly had separated from its supporting structure and it was not possible to determine any degree of extension at impact. All landing gear tires were inflated. A majority of the flap sections were recovered and appeared to be in the fully-raised UP position.

1.12.5 The aircraft primary structure was highly fragmented and consistent with impact impressions resulting from high speed contact with water. The damage was not consistent with an attempted ditching. The largest portion of the wreckage was the rear fuselage (aft of the rear entrance door and including the vertical fin and the horizontal tailplane). Also intact was the left

inboard wing and engine nacelle and the right inboard wing with the engine nacelle and attached wing center section carry through structure.

1.12.6 The fractured ends of both the left and right outer wing boxes showed marked ductile overload failure in downward bending. The damage to the wings was symmetric. The roof structure of the rear fuselage had a distinctive bend in a forward direction. The lower nose skin beneath the forward cargo bay showed distinctive deformation between the internal stringers and frames, consistent with uniformly distributed load. The upper nose section skin did not exhibit any pronounced deformation between the internal stiffeners as would be expected in a steep or very vertical pitch attitude.

1.12.7 The cockpit wreckage, including the flight instrument panels and overhead system control panels were recovered. Deformation and corrosion damage from sea water immersion rendered indications such as burning or scorch marks and settings inconclusive. Twenty-three light bulbs from the caution and warning panel were examined. Some filament stretch was present in four units; however gross deformation as would be expected during illumination was not observed.

1.12.8 Flight controls – the airplane design incorporates unpowered controls with aluminum pushrods, steel cables and bellcranks. Considerable effort was expended to identify the recovered flight control components to search for any separations that could resemble a fatigue fracture or mechanical disconnection. No anomalies were observed in the examination and all the pushrod fractures identified were ductile overload in nature, consistent with a high energy impact with the sea.

1.12.9 Engines/ propeller assemblies were recovered to shore and removed from the associated wreckage using a hydraulic crane. Both propellers had detached from the respective reduction gearbox, both having been photographed as attached on the sea bed. Left engine – all five blades remained attached to the prop hub and were free to rotate in the hub. Right engine – three blades remained attached to the hub, one blade was free to rotate in the hub, one blade was not recovered. Freedom to rotate within the hub indicated the pitch change mechanism within both hubs had broken.

1.12.10 Both engines were packaged for shipment and sent to the P & W Canada Service Investigation Facilities in Saint Hubert, Quebec, Canada. There, on 3 to 5 March 2015, a team of investigators from Canada, TSB and TC, United States NTSB and FAA, Bombardier Aerospace, and PWC proceeded with teardown/disassembly, investigation examination and laboratory testing of the engines and fragmented parts.

1.12.11 Left and right engine accessory and reduction gearbox magnesium housings were in an advanced state of disintegration from corrosion as a result of being soak-immersed in seawater. Likewise, both engine propeller reduction and accessory drive gears, shafts and bearings had deterioration from corrosion. Visual examination of these components did not reveal any pre-impact anomalies. On both engines, the retention bolts that retain the outer race of the No. 4 ball bearing to the power turbine shaft housing were found fractured by overload with no evidence of fatigue propagation. Both engines' turbine exhaust ducts were distortedly deformed from unusual loads applied in compression and/or in torsion. The cumulative damage evident on both engines is characteristic of propellers striking with a sudden stoppage and the engines producing power at the time of the strike. A summary of findings and discussions with a conclusion can be found in APP 3.

1.13 Medical and pathological information

1.13.1 An autopsy report on the Captain indicated the cause of death was blunt force trauma.

1.13.2 The First Officer was identified through DNA testing; an autopsy was not possible.

1.14 Fire

1.14.1 There was no evidence of an in-flight fire present in any of the recovered debris.

1.15 Survival aspects

1.15.1 The first Coast Guard vessel was dispatched at 1900L. The sea and air search in the immediate hours of the crash confirmed aircraft debris in the area but there was no evidence of any flotation devices or survival equipment on the sea surface.

1.16 Tests and research

1.16.1 Following report of the accident, the investigation authority immediately ordered fuel samples of the bulk supply and the fuel truck that serviced N380MQ. Analysis of all 18 bulk system and 3 service truck samples indicated the fuel supply met quality standards and no discrepancies were noted.

1.16.2 The NTSB Vehicle Recorder Laboratory in Washington DC, downloaded GPS data from a hand held battery operated 12-channel WASS capable GPS unit that recovered from the underwater aircraft wreckage. The unit yielded date/time, latitude/longitude, recorded altitude, average groundspeed and average true course data at various time intervals. A portion of the data

is presented in Para 1.1.7. A graphical overlay of the take-off until the end of the recorded data can be seen in ATT 2.

1.16.3 The United Kingdom Royal Navy Lab in Portsmouth UK performed x-ray imaging of the caution and warning bulbs that were recovered from the accident aircraft. Assessment of the bulbs did not reveal gross deformation of any filament coils as would be expected if a bulb was illuminated.

1.17 Organizational and management information

1.17.1 SkyWay Enterprises Inc. was originally issued FAA Air Carrier Certificate number DKEA218D on August 24, 1979 in Detroit Michigan. In the 1980s SWE operated a fleet of four model 23 Learjet aircraft for cargo and on-demand passenger charter service. Due to a decline in the automotive industry, operations were moved to Kissimmee, Florida in 1990. SWE expanded with the purchase of two Shorts 330 aircraft in 1995. In 1998, SWE purchased two SD3-60 and began the process to obtain changes in the type design to install a Class E cargo compartment interior into the Shorts 3-60 aircraft in accordance with SkyWay Enterprises Report No. 100 "Modification Instructions". An FAA Supplemental Type Certificate (STC) Number ST016 15AT was issued by the FAA Atlanta Aircraft Certification Office dated May 13, 1998.

1.17.2 FAA Operations Specifications for SWE include numerous revisions during the history of the company. Authorized areas for en route operations include USA, Canada, Mexico., Central America, and the Caribbean Sea – including the islands/nations and the Havana FIR. In the most recent aircraft listing dated Nov. 11, 2008, the FAA authorized operation of 1 Learjet LR-24 and seven SD3-60 aircraft. The listed aircraft were authorized under the provisions of Title 14 CFR Part 135, Part 119.21(a)(5) On Demand 135 for Cargo Only. The Ops Specs authorized SWE to conduct flights under Part 91 for crewmember training and maintenance tests. The SWE primary business plan provided cargo service within the Caribbean from operating bases in Miami-KMIA and Puerto Rico-KSJU and KBQN.

1.17.3 The SWE President is listed in the FAA Ops Specs Management Positions as the FAA approved Director of Operations, Part 135 (DO). FAA Ops Specs also list Director of Maintenance (DM) and Chief Pilot (CP) management positions. The organization chart indicates line pilots report to the CP, who in turn reports to the DO.

1.17.4 When queried during the investigation both the DO and the CP stated that they had not been informed of any specific safety concerns nor had they seen the need to conduct safety

meetings or distribute further information dedicated to safety issues. The DO stated he was, "always concerned about safety with the pilots and airplanes, it's an ongoing thing".

1.17.5 The DO described the CRM training mandated by CFR 135.330 as "one on one", a discussion about accidents, procedures, "who does what", and challenges/responses. He mentioned a good portion of the training was on CD and video.

1.17.6 The CP described the Caribbean flying schedule as based on cargo support operations within the FedEx System. He said SWE flights routinely consisted of about one hour (Hobbs time) per flight, two hours of flight time per day, five days a week including a duty time of about 12 hours per day. Crews start at 08:30 am - push out at 10:00 am, destination arrival block in 11:15 am. Down time at midday-no set arrangements. The CP volunteered that some crew did touristy things, some went to the beach, some did electronic devices. Crews report back in for the return flight at 4 - 5 pm, the return flight is scheduled to push out at 6:30 pm –arrive at San Juan 7:30 pm. The duty day is finished about 8:15 pm.

1.17.7 SWE flight crews and flight followers work with the FedEx Global Operations Center (GOC) located in San Juan to manage all the Caribbean cargo feeder operations. The GOC personnel occasionally jump seat with SWE to observe their internal operations, auditing their own employees' performance, safety and procedures.

1.17.8 SWE has base operations at both Aguadilla and San Juan International. SWE maintains a maintenance hangar at Aguadilla and provided an apartment for crews on temporary assignment to that location.

1.17.9 The SWE Air Carrier Certificate is managed by the FAA Orlando Flight Standards District Office (FSDO).

1.17.10 At the time of the accident the Principle Operations Inspector (POI) for SWE had been in his position for 3 years. He was not type rated in the SD3-60. He was responsible in the FAA work program for oversight of 15 Part 135 carriers. He characterized his workload as "intense". His work activity included ongoing approvals of training improvements, the GOM, and changes to Ops Specs. He indicated oversight visits within the FAA Program Tracking and Reporting Subsystem (PTRS) included both Headquarters required items and planned items he added based on risk assessment. He described his observations of ground operations at SWE as, "a snapshot in time of the operator". He had observed some SWE ground school however it was not in his purview to observe Flight Safety training in New York. That responsibility was assigned to a dedicated FSO. He was aware of the content outline of the CRM training required by FAR

135.330. He had not observed nor was he required to observe the actual training course. He did not perform en route cockpit line evaluations of SWE aircrews. He was not aware of GPS use in the cockpit. Prior to the accident, he described SWE as a low risk operator.

1.17.11 A post-accident interview with the former POI (2005-2011) revealed he never received written or verbal concerns about the company; his personal observations were limited to administrative things, never safety issues.

1.17.12 During an interview, the former PMI (2010–2012) described his relationship with the DM and DO as "difficult". He related that any proposal brought up to the company management was challenged with "tell me why", or "show me the regulation". Other operators within his purview responded to his input in a more progressive manner. He expressed that SWE often "dragged their feet" and in his opinion more work was needed by SWE management to produce an acceptable General Operations Manual (GOM). A particular focus of disagreement centered around the engine TEMP program with an extraordinary unlimited on-condition TBO. On previous SD3-30 aircraft with PWC PT6A-45 engines, the overhaul schedule was considered to be unlimited and only on-condition. When the former PMI assumed his assignment with SWE, the TEMP was the subject of correspondence letters between the FAA and SWE. The issue was resolved with a revised Ops Spec D101 that authorized the use of on-condition engines until a TBO of 12,000 hours. The PMI did not agree that SWE data pertaining to progressive time extensions was gathered through an appropriate reliability program. However, short of rulemaking, he believed that there is no requirement for the operator to comply with the detailed SB guidance for time extensions provided by PWC.

1.17.13 The current PMI (2012-present) stated in an interview that the relationship with SWE management was normal and typical. The were no findings on his last oversight visit in May 2014. He indicated he was aware of the engine TBO issue and could turn to the FAA Engine Directorate if more assistance was needed. He was aware of the latest revision of PWC Service Bulletin No.13003R8 for TBO time extensions but stated there is no requirement for SWE to incorporate SBs in the TEMP. He stated that SWE was not required to maintain mechanic training records. The investigation inquired as to the FAA oversight of SWE operations in San Juan and Aguadilla. Records pertaining to numerous inspections over five years of SWE operations at both locations were provided. The inspections were conducted by the assigned PMI/PAI and also by the geographic inspectors in Miami and Puerto Rico. The PMI stated that a visit to meet the SWE maintenance person stationed at Aguadilla was rescheduled following an earlier cancellation.

1.17.14 An FAA Headquarters Air Safety Investigator participated in the powerplant investigation of the accident involved engines referenced in the previous paragraph 1.12.10. His observations of overall poor engine condition resulted in action to rescind the SWE Ops Specs TBO of 12,000 hours and to set limitations in accord with the current PWC SB (6,000 hours). SWE Ops Specs were revised May13, 2015 to reflect this change.

1.17.15 As a follow-up to the time in service interval for the SWE fleet equipped with P&WC PT6A-65AR engines, the FAA Orlando FSDO PMI signed amendment no. 9 to the Ops. Specs. Effective January 15, 2016 that required a TBO of 6000 hours. At the time only 2 aircrafts could meet the TBO limitation. The SWE corporate operations continued on a limited scale.

1.17.16 The investigation interviewed the ORL FSDO Front Line Manager about workload constraints on en route inspections and observations on check rides. At the FSDO level, the emphasis is on giving check rides and observing a check airman rather than en route inspections. On the subject of voluntary safety reporting programs and SMS, the manager emphasized that all subordinate staff inspectors were well versed on SMS. They have an FAA Safety Team (FAAST) to assist with the Part 135 program. However, when asked for specifics, particularly regarding SWE, the response emphasized that these programs are voluntary, "I guess that would go perhaps to the culture of the company that would encourage that. And that is as individual as every company is".

1.17.17. FAA later stated in response to follow up investigator correspondence that San Juan and Miami FSDOs can conduct geographic inspections of air carriers conducting in/out operations from Puerto Rico. This oversight can be provided upon request of the FSDO holding the Air Carrier Operating Certificate. SWE was seen as a low risk carrier, operations support was not requested.

1.18 Additional information

1.18.1 Crew records indicate the Captain and First Officer flew the same scheduled flights from SJU to SXM and return on the preceding Monday, October 27 and Tuesday October 28.

1.18.2 The SWE DO reported the accident crew experienced a runway excursion in the accident aircraft at SXM on October 27. The aircraft was towed to ramp. The Captain reported to the DM that during runway rollout, he experienced, "no steering, no brakes and no reverse". The DM directed some trouble shooting and an engine run. In a telephone conversation, the Captain reported that he was showing a "no brakes" indication on the panel. The DM directed a check of the emergency brake handle for proper position. The handle was not all the way in - and pushing

the handle all the way in corrected the "no brakes" condition. The Captain attributed the anomaly to a "bubble" in the system. The DM dispatched a SWE maintenance engineer from SJU to examine the aircraft. The engineer serviced the hydraulic system in accordance with the maintenance manual and declared the aircraft fit for return to normal operations. The crew then flew the aircraft, with the maintenance engineer on board, back to SJU as a normal scheduled flight.

1.18.3 Three months after the accident, the DO informed accident investigation authorities by letter of added information regarding the runway excursion of October 27, 2014 at SXM. Discussion of the incident among colleagues of the accident Captain and others revealed that after landing that day, the Captain shut off the fuel levers accidentally. The DO further explained his view of the incident in a letter to investigators. He stated, "Part of the after landing checks are to reduce the fuel lever from flight condition to ground followed by bringing the propellers from high RPM to ground. This helps slow the aircraft and reduce engine power on the ground. If the fuel condition levers are pulled too far aft of the detent, the fuel supply to the engines will be cut off shutting down the engines". By letter dated February 9, 2015, the Chief Pilot confirmed this understanding of the event to the operations investigator.

1.18.4 An FAA Form 337, Major Repair and Alteration, dated September 15, 2005 was submitted by SWE and approved by the FAA to install a GPS antenna on the accident aircraft with the cable routed to the instrument panel for use with a hand held GPS. A 24 Vdc power receptacle was also installed with a circuit breaker labeled AUX. Operations investigators were informed a hand held Garmin 96 was issued to each airplane. Flight crews described that the GPS use was for "situational awareness and navigation". Some said, "Every pilot used it". Other crewmembers said, "Almost every pilot used a GPS, some their tablets or personal GPS". As previously noted, the POI said he was not aware of GPS use in the cockpit.

1.18.5 As a result of separate FAA Fight Standards Service initiatives, and not related to the SMCAA investigation of N380MQ, the FAA adopted a Final Rule on January 8, 2015, mandating implementation of Safety Management Systems (SMS) for all certificate holders under CFR Part 121, passenger airlines and cargo operations. The FAA noted that the rule was developed as a uniform standard that could be extended to other certificate holders such as Part 135 operators[14]. Further, the FAA published Advisory Circular (AC) 120-111 Upset Prevention and Recovery Training (UPRT) dated April 14, 2015, and AC 1120-109A, Stall Prevention and Recovery Training dated November 24, 2015. Both ACs are directed at Part 121 air carriers, however all operators can use this guidance as applicable.

[14] 80 FR 1308, 1328 (January 8, 2015). Also see 14 CFR Part 5.

1.18.6 The FAA Study of Operators Regulated Under Part 135 dated April 2016 indicated 2,155 operators and 10,655 aircraft were authorized on Part 135 certificates as of October 2012.

1.19 Useful or effective investigation techniques

1.19.1 The recovered Garmin GPSMAP 96C device contained hardware and software permitting download of recorded waypoint, route, and track log information via a manufacturer's proprietary interface. The device from the accident aircraft was disassembled in the NTSB Research and Engineering Laboratory. Each component was rinsed in deionized water, cleaned with Menthol, scrubbed with an acid brush, and then re-rinsed with deionized water. After treatment all components were dried and vacuum-baked for 15 hours at 50 degrees Celsius and 15 inches of Mercury to remove any remaining moisture and salts. While there was some evidence of residual contamination, it did not affect the recovery operation of the unit. Graphical results of the recovered data are in APP 2.

2. ANALYSIS

2.1 General

2.1.1 The flight crew was properly certificated and qualified in accordance with applicable FAA regulations and company requirements. The Captain received his SD3-60 type rating at an FAA approved flight training center. The First Officer received his Second in Command SD3-60 type rating through an FAA approved training program conducted by his employer. Activities of the flight crew in the 72 hours prior to the accident were reported to be unremarkable. The accident occurred in the midpoint of a 5-day crew pairing that included typical scheduled workdays of 12 hours per day. Although a measure of crew fatigue could not be determined, there was no evidence that any medical, behavioral, or physiological factor affected the ability of the flight crew to perform their duties.

2.1.2 The aircraft was properly certificated, equipped and maintained in accordance with FAA regulations and approved procedures. There were no open or deferred maintenance items outstanding before the accident flight. All of the applicable ADs for the accident airplane were in compliance. Available evidence led the investigation to reject aircraft related accident causal hypothesis based on the following;

a) Structural failure – all components of the primary structure were present in the recovered debris and exhibited damage and deformation that would be expected in a water impact.
b) Powerplant failure – technical experts concluded both engines displayed a similar signature of impact damages characteristic as a result of propellers striking with sudden

stoppage. These damages allowed a definitive assessment that both engines were producing power at the time of impact strike.

c) Flight control systems failure –examination of available components by experts indicated the condition of all recovered control and bellcrank attachments were consistent with their being mechanically continuous prior to the accident. All observed fracture signatures were ductile overload in nature, consistent with high-energy impact with the sea.
d) Electrical failure – A view of the accident aircraft lighting was evident in security video images through much of the take-off profile. Also, the aircraft transmitted an acknowledgement of ATC instructions shortly before the crash. These observations allowed confirmation that electrical power was available up to the time of the crash.
e) Cargo load—evidence and interviews with loading personnel indicted that a light cargo load was properly placed in the appropriate load stations and securely netted. The aircraft load sheet indicated the weight and balance of the aircraft was within limits and cargo issues were not a factor in the accident.
f) Intended mishandling of the controls or outside party malicious interference – no evidence surfaced during observations or interviews by investigators that would indicate any intentional act was linked to the crash.

2.1.3. In summary, there was no evidence of any aircraft related defect or malfunction that could have contributed to the accident.

2.2 Loss of Control (LOC)

As the factual data was assembled and analyzed, the investigation team recognized the high probability of a Loss of Control[15] scenario. Data indicated a flight regime that progressed in less than 30 seconds from a normal flight path to an aircraft upset and unusual attitude outside the normal flight envelope resulting in a crash into the sea. The investigation sought to identify and address combinations and sequencing of LOC causal and underlying contributing factors which could be associated with this scenario.

Operations at SXM throughout the year favor runway 10 over 90% of the operating hours. Night departures from runway 10 overfly an illuminated area during initial climb out. On the night of the accident, the wind was from 230 degrees, 10 knots, gusting to 20 knots and direction variable from 220 to 270 degrees. The airport was operating for take-offs on both runway 28 and 10; night landings, runway 10 only. The investigation believes that take-off direction on runway 28 toward the open sea was relatively unfamiliar to the both the PF and the PM. A lack of visual

[15] See Aircraft Loss-of-Control Analysis C. Belcasto and J. Foster, NASA,2010

references after passing over a shoreline at night is described by many pilots as a "black hole" effect.

Although the possibility of thunderstorms and wind shear were forecast in the area, no severe weather was detected or reported by airport workers or search teams within the time frame of the accident. However, darkness, rain, and wind gusts were present during the accident scenario. These environmental conditions are cause related because they presented a loss of visual references after liftoff. The PF was required to transition from visual conditions to primary flight instrument references and to use attitude instrument flying skills. Facts indicate the aircraft was observed to take-off and attain a normal initial climb. Then a major deviation from the climb out profile occurred and the aircraft started to descend and disappeared from visual and radar view.

The operating company did not chose to participate in the investigation. The investigation could not confirm with certainty which crew member was the PF. However, both crew members had sufficient total flight hour experience and multi-crew flight hours operating the SD3-60 to be competent in their respective pilot flying and pilot monitoring duties. The investigation attempted to identify distractions in this scenario that could lead to loss of control and a crash.

The cockpit authority gradient was notable and may have affected crew performance. The experience of the Captain and the First Officer are shown in the preceding Paragraph 1.5, Personnel Information. To reiterate and compare Captain versus First officer – 5318/1049 total flight hours; the age difference - 49 /29 years; the PIC time 3618/275 hours. Peer comments indicated the two persons were comfortable with their crew pairing. Lacking CVR conversation, the investigation had no evidence upon which to make a determination on the Captain's attitude toward teamwork or the possible inadequate assertiveness of the First Officer in the performance of pilot not flying/pilot monitoring duties.

Wreckage inspection revealed the landing gear was retracted and the flaps were most probably retracted to UP. GPS data indicated that aircraft attained a maximum height of about 400 feet and 119 knots groundspeed after becoming airborne for about 30 seconds. Considering a westerly wind of 10 knots, the accident aircraft was approaching 130 KIAS. Operations procedures in the SWE Training Manual prescribe a schedule for flap retraction; accelerating thru 120 KIAS, Flaps – 5, and accelerating thru 125 KIAS, Flaps – UP. The Training Manual also presents the PF/PNF command/response and monitoring actions to accomplish the configuration changes. The longitudinal acceleration at this point provided an apparent pitch up moment (g force). Susceptibility varies between persons and circumstances as to the magnitude of misperception. In this case, external visual cues were nonexistent. The start of a left bank

combined with g effect is considered sufficient to be misinterpreted as a sensation of pitch up leading to a somatogravic illusion. [16]

Loss of situational awareness may have had an early effect on crew performance. The investigation believes the presence of an unfamiliar runway in a night and rain environment provided a basis for high stress. The obligation to comply with ATC instructions to turn left to 230 degrees after take-off, and commanded flap retraction with associated acceleration, combined to set in motion a somatogravic illusion for the PF. The PF's unintended mishandling of the flight controls and a desire to pitch down while initiating a left turn quickly led to an extreme unusual attitude and the subsequent crash.

2.3 CRM (and attempt to recover from an unusual attitude)

Training records for the accident pilots indicate the crew resource management subject required by FAR 135.330 was provided. However, specific content of this training program was not disclosed by the operator nor was oversight of the actual training provided by the FAA POI. A variety of industry sources[17] indicate an effective CRM program encompasses a wide range of technical knowledge, airmanship skills, interpersonal communications ability, situational awareness, problem solving, decision making and teamwork; working together to make optimum use of all available resources. The DO described the CRM training as "one on one", a discussion about accidents, procedures, "who does what", and challenges/responses. The investigation believes that the short explanation by the DO is a strong indication that the eight required elements of an effective CRM program were not presented in sufficient detail to be effective.

Early recognition of divergence from the intended flight path (situational awareness) is a necessary component of the CRM concept. Pilot monitoring[18] and effective crew coordination are key factors toward prevention of an aircraft upset and recovery from a loss of control situation. Much is unknown in this accident scenario because conventional on-board recording devices[19] were not available. The investigation could not analyze the adequacy of the pre-take-

[16] Somatogravic Illusion: At night or in IMC, lacking visual clues, rapid acceleration in flight generates a strong "tilt back" sensation which the pilot interprets (incorrectly) as a pitch up, despite the fact that the aircraft may still be on the intended flight path. To correct this imagined excess climb, the pilot will push the control column forward in an attempt to return to a normal flight path. Lowering the nose can result in a rapid descent.
[17] Flight Safety Foundation ALAR Tool Kit Briefing Note 2.2, U.K. CAA Standards Document 29, et al.
[18] See Monitoring Matters: Guidance on the development of Pilot Monitoring Skills, UK CAA Paper 2013/02
[19] The CVR and FDR were removed from the FAR Part 25 aircraft by the operator following conversion to a "cargo only" configuration. ICAO Annex 6, Part 1 requirements for recorders irrespective of passenger capacity are applicable for transport category aircraft with a type certificate issued after 1 January 1987 (CVR, Para 6.3.2.1.4) and (FDR, Para 6.3.1.2.4) after1 January 1989. The accident aircraft TC was issued in 1982.

off briefing, which should have included the ATC clearance and climb out restrictions[20]. It is unknown if there were any distractions from the cockpit activities. The professional atmosphere of the cockpit, and the extent to which the Captain extended his authority, could not be determined. It is unknown if there was any tendency toward complacency among the crewmembers. Also, without flight recorders, specific details of the last moments of the flight profile, particularly during the flap retraction sequence, are lacking. Therefore, the investigation was unable to establish if the PM perceived an imminent loss of control situation and took any immediate and necessary action toward intervention. Individual crew member performance and specific interactions between the PF and PM during this critical portion of the accident sequence could not be determined. However, results indicate the obvious, crew resource management performance and actions to recover from the unusual attitude before it progressed into full loss of control were insufficient to avoid the crash.

2.4 Company Safety Culture

The International Civil Aviation Organization and the FAA desire to foster an environment where aviation organizations are motivated to do more than simply comply with the regulations. Management is in the best position to create and promote a continuing safety culture. The owner of SkyWay Enterprises Inc. was also the DO of the organization and therefore the accountable executive responsible for fostering the manner in which attitudes toward safety carry through to all company employees. During interviews with investigators, the DO said that he was, "always concerned about safety with the pilots and airplanes - it's an ongoing thing". However, investigation revealed that an atmosphere to maintain the status quo prevailed within the company. Management did not provide any method to communicate safety issues with the employees through internal company media (email or bulletin) or to maintain a voluntary safety reporting system. Following conversion of the SD3-60 fleet to cargo only, SWE management removed the safety equipment mandatory for passenger carrying from the aircraft. The list included TCAS, GPWS, a radar altimeter, an attitude gyro, and the autopilot, along with removal of the FDR and CVR. This action provided considerable weight savings and eliminated continuing maintenance expenses on the units. However, the equipment removals are examples of the negative attitude toward safety and consideration of pilot workload exhibited by company management. Removal of the autopilot increased the exposure to crew fatigue and possible errors in a high air traffic environment. With the removal of the FDR, a flight data monitoring program is not possible. Removal of TCAS equipment increased the exposure of the traveling public and flight crews to the risk of an inflight collision between a passenger carrying aircraft and an SWE

[20] Content required per the SWE Training Manual, Section 5, Duties and Responsibilities.

operated cargo flight. Also note Manufacturers' Safety Bulletins applicable to the SD3-60 airframe and PWC engines were not incorporated into the fleet unless they were FAA mandated. There were no corporate provisions/arrangements for crew rest areas at local FBOs on the islands. Flight crew exposure to fatigue during their wait time between the outbound and return flights to Puerto Rico seemed of no concern to SWE. FAA inspectors described their relationship with SWE management as "difficult". There was a resistance and reluctance toward compliance and timely resolution of deficiencies.

In summary, the investigation recognized that geographical and cultural factors of the international operations at this carrier, and perhaps many worldwide, allowed the formation of attitudes in pilots and maintenance personnel that are less than proactive toward safety initiatives. SWE has a traditional approach toward minimum compliance with regulations and resistance to change. Training of the next generation of young pilots and maintenance engineers is seriously challenged in this environment. It can be a breeding ground for the learning of bad habits. As aviation activity and complexity continues to grow, understanding and managing these challenges and developing a more proactive safety culture encompassing modern SMS concepts will become the imperative for all Part 135 operators.

2.5 FAA Oversight

Interviews with FAA personnel associated with the oversight of the SWE operations and maintenance indicated difficulties in accomplishing their surveillance responsibilities. The issues are mentioned here as a matter of efficiency; FAA records of oversight activities showed no deficiencies directly related to the causal circumstances of the accident. SWE is typical of many small operators; availability to key officials is limited due to the executive's roles as management and operational commitments. Scheduling visit times with management required extra coordination to ensure their availability. Regarding communications with SWE managers, the POI was not type rated in the SD3-60 airplane. He did not perform en-route evaluations or check rides. His ability to assess the overall operation of the airline network was limited. Both the POI and PMI found constraints to travel to the Caribbean destinations due to work hours required and financial considerations of travel. Neither of them had visited the SWE facilities in Puerto Rico. The PMI said he formerly went to the DM for issue resolution, "but now goes directly to the owner as nothing will happen without his input". The FAA oversight responsibilities for Part 135 operations present a major challenge because the priorities are directed toward passenger carrying operators or those identified as high risk. The Orlando FSDO did not consider SWE to be a high risk carrier prior to the accident. Regarding the oversight in Puerto Rico, the FSDO was aware of ramp checks on SWE by local inspectors. The Orlando FSDO inspectors did not request any geographic support for en-route inspections.

As noted in 1.18.5, separate and not related to the SMCAA investigation of N380MQ, the FAA has mandated Safety Management Systems (SMS) for all certificate holders under CFR Part 121, passenger airlines and cargo operations. The FAA noted that the rule was developed as a uniform standard that could be extended to other certificate holders such as Part 135 operators[21].

It appears evident in the near future that FAA oversight will need to adopt more than the current self-described "a snapshot in time" form of compliance oversight. ICAO has published safety management system framework in Annex 6 (air operators), applicable to all member states. To harmonize with ICAO standards, the investigation believes the FAA will need to adopt a uniform, balanced approach that combines inspections for regulatory compliance along with audits of safety management practices that identify how operators manage their risks.

3. CONCLUSIONS

3.1 Findings

1. The flight crew was properly certificated and qualified in accordance with applicable FAA regulations and company requirements.

2. The aircraft was properly certificated, equipped and maintained in accordance with FAA regulations and approved procedures.

3. There was no evidence of any aircraft related defect or malfunction that could have contributed to the accident.

4. The aircraft was not equipped with flight recorders (CVR and FDR). Neither was required by regulation. The original flight recorders were removed from this transport category aircraft because the interior was converted to cargo only-FAA recorder requirements are based on passenger carry capacity.

5. The investigation was unable to establish whether the Captain or the First Officer was the PF.

6. A hand held GPS unit was retrieved from the cockpit and downloaded track information proved valuable to the investigation.

7. There was no severe weather present in the area at the time of the accident.

[21] 80 FR 1308, 1313 (January 8, 2015). Also see 14 CFR Part 5.

8. Prevailing winds at SXM throughout the year favor Runway 10. However, on the evening of the accident, Runway 28 was active.

9. Runway 28 terminates at the island shoreline thus lacking visual references and creating a "black hole" effect.

10. Darkness, overcast sky, rain, and wind gusts presented a challenging environment during the accident take-off.

11. The aircraft was observed to lift off and follow a normal climb out flightpath for about 30 seconds, then initiate a left turn and descend out of visual and radar view.

12. The crash site was located in the sea 0.8 nm from the threshold of the departure runway, bearing 244 degrees.

13. The two flight crew members were fatally injured due to impact with the sea.

14. Wreckage examination indicated the landing gear was retracted and the flaps were most probably retracted to UP.

15. Flap retraction was most probably on schedule with the "Flaps Up" command given by the PF passing 125 KIAS.

16. The ATC takeoff clearance required a turn from Runway 28 heading to 230 degrees after takeoff.

17. The PF experienced a somatogravic illusion as a result of the stressful take-off environment and acceleration during flap retraction.

18. The PF's reaction to pitch down while initiating a turn to the required departure heading led to an unusual attitude and loss of control.

19. Lacking flight recorder evidence, the investigation could not determine the effect of the cockpit authority gradient on assertiveness and decision making of the PF and the PNF/PM in the respective performance of their duties.

20. Lacking flight recorder evidence, it is unknown if the PM perceived an imminent loss of control situation and took any immediate and necessary action toward intervention. Crew resource management (CRM) performance was insufficient to avoid the crash.

21. The aircraft wreckage was consistent with impact impressions resulting from high speed contact with water. The damage was not consistent with an attempted ditching.

22. The cumulative damage evident on both engines is characteristic of the engines producing power at the time of impact with the sea.

3.2 Causes/contributing factors

The investigation believes the PF experienced a loss of control while initiating a turn to the required departure heading after take-off. Flap retraction and its associated acceleration combined to set in motion a somatogravic illusion for the PF. The PF's reaction to pitch down while initiating a turn led to an extreme unusual attitude and the subsequent crash. PM awareness to the imminent loss of control and any attempt to intervene could not be determined. Crew resource management (CRM) performance was insufficient to avoid the crash.

Contributing factors to the loss of control were environmental conditions including departure from an unfamiliar runway with loss of visual references (black hole), night and rain with gusting winds.

4. SAFETY RECOMENDATIONS

The Sint Maarten Civil Aviation Authority, as the State of Occurrence of accident N380MQ, has completed the ICAO Annex 13 investigation and Final Report. The Sint Maarten CAA believes this fatal accident involving loss of control of a transport category aircraft should be viewed as an event worthy of a safety recommendation of global concern. The operator was authorized by the United States Federal Aviation Administration to conduct en route operations in the USA, Canada, Mexico, Central America and the Caribbean Sea. The aircraft was properly certificated, equipped and maintained in accordance with United States Federal Aviation Administration regulations and approved procedures. The flight crew was properly certificated and qualified in accordance with the United States Federal Aviation Administration regulations and approved company operating requirements. The accident took place during an international scheduled revenue cargo flight. To summarize, the Sint Maarten CAA investigation, with the support of its ICAO Accredited Representatives and their advisors, identified, as a safety significant event, a somatogravic illusion experienced by the PF that led to a critical unusual attitude and loss of control. An underlying factor to the safety significant event was the ineffective crew resource management performance among the two crew members to recognize divergence of the flight path and to interrupt progression toward the fully developed upset that led to the crash.

Statistics from ICAO, IATA, NBAA, AOPA and numerous nation state accident investigation authorities indicate loss of control remains one of the most significant contributors to fatal accidents worldwide. ICAO, state regulatory agencies and industry leaders continue to focus global attention on revised training criteria including CRM, enhanced flight simulation devices and licensure changes to address upset prevention and recovery. The international aviation community further recognized that new strategies were needed to identify underlying causal factors and mitigate safety risk in air operations through a much broader proactive, performance based safety management approach. Early evidence of new strategies were the March 2006 amendments to Annex 6, Part I, Operation of Aircraft, which established an international commercial air transport standard for states to mandate that each air carrier establish an SMS.

Following a decade of developing safety management principles, the worldwide ICAO 2010 High Level Safety Conference called for the development of a new ICAO Annex dedicated to the management of safety risks in air operations, maintenance, air traffic services and aerodromes. The initiative resulted in modifications to Annex 6 (operations) Annex 14, (aerodromes), and a new ICAO Annex 19, Safety Management Systems, adopted on Feb 25, 2013.

As a means of harmonizing with ICAO standards, the United States FAA responded with a Final Rule mandating the implementation of SMS for all Part 121 passenger and cargo operations. The FAA SMS rule is found in 14 CFR Part 5 and 119. The FAA announcement in the Federal Register (80 FR1308, 1328, January 8, 2015) currently only applies to the Part 121 sector of the industry. This action effectively allows a two tier system for a desired level of safety culture. However, the FAA noted that the rule was developed as a, "uniform standard that could be extended to apply to Part 135 certificate holders, Part 145 repair stations and OEMs.

The Sint Maarten CAA recognizes and commends the United States for its move to embrace the SMS principles for the Part 121 air carrier sector of the industry (about 90 operators) with the new 14 CFR Part 5 mandate. Sint Maarten CAA notes that all ICAO member states are obligated to establish national legislation for their international commercial air transport operators to establish an SMS. However, the accident investigation of N380MQ highlights the difficulties experienced by international aeronautical authorities who are still faced with United States certificated commercial air transport Part 135 operators flying in international airspace to international destinations and who, as yet, are not covered by the FAA's 14 CFR Part 5 Safety Management Systems requirements.

Annual FAA statistics list over 2000 operators and 10,000 aircraft authorized on Part 135 certificates. The most recent study of Part 135 operators (April 2016)[22] contains a section on the safety record of these operations. However, published findings within the study fail to address any proactive measures such as SMS that may address the safety performance of the Part 135 fleet.

The Sint Maarten CAA is particularly concerned with the typical next generation of aircrew who will move upward in the commercial air carrier world. The Part 135 operations provide the experience platform for the great majority of next generation airline pilots and on-demand air charter crew members. Very few of the future airline staff will have a major carrier Ab Initio background. Unfortunately, the same can be said for the engineering staff supporting these operations. They will learn both the good and the bad of aeronautical decision making from this Part 135 operational experience. Their attitudes toward safety awareness and analysis of risk will be formed on every flight as these commuter, charter and air cargo pilots gain the experience to move up to more sophisticated equipment and added responsibility of larger scale passenger operations.

SMCAA recognizes the difficulties and impracticality of making a safety recommendation based on the single, local event of N380MQ. However, on a global scale, SMCAA recognizes there is a need to further embrace/extend the benefits of SMS/CRM to all FAA approved Part 135 operators to ensure a level of safety culture equal to that expected of the Part 121 operators. SMCAA calls attention to previous accidents, each with 9 fatalities; N8097W, CE 402, Marsh Harbor, Bahamas, August 25, 2001 and most recently N237WR, BAe-125, Akron/Canton Ohio, November 10, 2015. SMCAA identifies the entity able to take corrective action to reduce similar risk is the United States FAA Flight Standards Service. SMCAA notes that the ICAO, United States Congress[23], and the NTSB maintain positions that support the current FAA SMS rule. SMCAA is confident the United States FAA can move forward to further broadened SMS coverage scaled to fit the Part 135 air carrier operations, regardless of organizational size. SMCAA believes the FAA can employ its multiple resources, historical data base, technical and professional staff, and reputation for advocacy to further promote SMS safety goals. A most proactive way for the FAA to indicate commitment to improve safety management practices in commercial air transportation is to move forward to implement SMS rules within the Part 135 community of operators.

[22] FAA Study of Operators Regulated Under Part 135 dated April 2016.
[23] Airline Safety and Federal Aviation Administration Act of 2010 (Pub.L. 111-216, August 1, 2010)

As a result of the investigation of the N380MQ, SkyWay Enterprises Inc. accident, the Sint Maarten Civil Aviation Authority makes the following recommendation to the United States Federal Aviation Administration:

The Sint Maarten Civil Aviation Authority recommends the United States Federal Aviation Administration evaluate the facts, analysis and conclusions contained in the Final Report of this loss of control accident (N380MQ) and of similar recorded cases of CRM (cockpit resource management) breakdown during a loss of control. Following this evaluation and collection of detailed data from additional known sources, the Sint Maarten Civil Aviation Authority recommends the United States Federal Aviation Administration, within one year, publish a notice of proposed rulemaking (NPRM) to extend the current 14 CFR Part 5 Safety Management Systems(SMS) rule to all Part 135 operators.

Appendix 1 --PJIAE Air Traffic Services Incident /Accident Report, dated 31-10-14, pages1-3.

Princess Juliana International Airport
Operating Company N.V.

Date: 31-10-14	No. 424
Action by:	Due:
Sean Pras	FILE:

PJIAE AIR TRAFFIC SERVICES INCIDENT/ACCIDENT REPORT

ATSQA-2

TO:

Acting Director of Air Traffic Services

The following is a description of an incident/accident which affected the operation of this Air Traffic Control Facility. It appeared advisable to prepare a formal record and a copy is being forwarded to acquaint you with its particulars. It is requested, that as necessary, these details be brought to the attention of the pilot or other individuals involved. We hope that through review, recommendations leading toward action to prevent recurrence of incidents of this type will be obtained. No reply is required, however the undersigned will be glad to answer any questions at your convenience. Any action you can take to assist the Air Traffic Services to provide more efficient service will be appreciated.

INCIDENT/ACCIDENT REFERENCE NUMBER: 033/14

1. Category of occurrence:

ACCIDENT INCIDENT AIRPROX INFRINGEMENT

2. Occurrence position	3. FL/ALT/Ht.	4. Date:	5. Time-UTC	6. DAY/NIGHT
Approximately 2 NM SW of the departure end RWY 28	CFL 080	Oct 29, 2014	22:39	

OPERATOR	CALLSIGN	TYPE	FROM	TO	SSR CODE	MODE C DISPLAYED	I/V/SV
7. SKYWAYS	8. SKZ 7101	9. SH36	10. TNCM	11. TJSJ	12. 4762	13. YES / NO	14. I
15.	16.	17.	18.	19.	20.	21. YES / NO	22.
23.	24.	25.	26.	27.	28.	29. YES / NO	30.

31. RTF FREQUENCIES	32. RADAR EQUIPMENT	33. UNSERVICEABILITIES	34. RWY IN USE / QNH
118.7 MHz	PSR/MSSR	N/A	Wind 230/07 RWY 28/ 29.83

35. AIRSPACE CLASSIFICATION/S	36. TMA/CTR	37. TYPE OF ATC SVC APP / TWR / COR.	38. SID / STAR / ROUTE
C	CTR	TWR	B520 STT RTE6 SJU Initial H230/4000FT

39. SEPARATION LOST	40. MIN HORIZ/VER SEP	41. TFC ALERT/INFO PROVIDED
YES / NO N/A	N/A	N/A

42. AVOIDANCE ACTION TAKEN.	43. TCAS / ACAS ALERT
YES / NO N/A	YES / NO N/A

Princess Juliana International Airport
Operating Company N.V.

PJIAE AIR TRAFFIC SERVICES INCIDENT/ACCIDENT REPORT

44. BRIEF TITLE / SUMMARY:
REG/ N380MQ. DITCHING. SKZ7101 DEPARTED RWY 28 TNCM AND DITCHED APPROXIMATELY 2 NM SW OF THE AIRPORT

REPORT

45. CHRONOLOGICAL ORDER OF EVENTS

TIME	STATION	EVENT DESCRIPTION
22:17	SKZ7101	REQUEST START UP CLEARANCE
22:17	TWR	START UP GIVEN TO SKZ7101
22:24	SKZ7101	REQUESTED DEPARTURE ON RWY 28 AND INQUIRED AS TO HOW LONG A DELAY THEY CAN EXPECT
22:25	TWR	INFORMED SKZ7101 THAT THE DELAY FOR RWY 28 IS 10 MINUTES AND 3 MINUTES FOR RWY 10
22:28	SKZ7101	INFORMED TWR THAT HE IS REQUESTING RWY 28 AND IS READY FOR TAXI
22:28	TWR	INSTRUCTED SKZ7101 TO ENTER THE BY-PASS AND TAXI TO DELTA AND HOLD SHORT
22:28	SKZ7101	REQUESTED PROGRESSIVE TAXI
22:29	TWR	SKZ7101 ENTER THE BY-PASS FROM THE FIRST EXIT ON THE WEST RAMP, FOLLOW THE YELLOW
		LEAD LINE PASS THE FUEL FARM TO DELTA AND HOLD SHORT
22:29	TWR	INSTRUCTED WIA542 TO PROCEED OUTBOUND ON R318
22:30	TWR	REQUESTED IF SKZ7101 WOULD BE READY AT THE END
22:30	SKZ7101	AFFIRM WE WILL BE READY AND WE COPIED YOUR TRAFFIC
22:36	TWR	SKZ7101 VIA DELTA BACKTRACK RWY 28 FOR DEPARTURE
22:38	TWR	SKZ7101 RWY 28 CLEARED FOR TAKE OFF MAINTAIN HEADING 230 UNTIL PASSING 4000 SET
		COURSE
22:39	SKZ7101	DEPARTED RWY 28 WITH AN INITIAL CLEARANCE HEADING 230 UNTIL PASSING 4000 FT SET
		COURSE
22:39	SKZ7101	SKZ7101 GIVEN DEPARTURE TIME AND INSTRUCTED TO MAINTAIN HEADING 230 UNTIL PASSING
		3000 FT
22:39	SKZ7101	PILOT READ BACK CLEARANCE
22:40	TWR	OBSERVED SKZ7101 DECENDING VISUALLY AND ON RADAR
22:40	TWR	ATTEMPTED TO CALL SKZ7101 ON 118.7MHz AND ON 121.5 SEVERAL TIMES WITH NO RESPONSE
22:40	TWR	TARGET AND DATA BLOCK NO LONGER ON RADAR
22:41	TWR	RFF, SECURITY AND OPERATIONS INFORMED OF THE SITUATION
22:41	TWR	COAST GUARD CONTACTED AND COMMUNICATION ESTABLISHED WITH MR. THODE AND ALL
		REQUIRED INFORMATION PROVIDED
22:45	TWR	INFORMED BOTH ATS MANAGERS OF THE SITUATION
22:45	TWR	REQUESTED WIA542 ON 5NM FINAL IF THEY WERE ABLE TO SEE ANY SIGN OF THE AIRCRAFT
		IN THE WATER OR FLARES
22:59	TWR	REQUESTED LIA608 INBOUND FROM TQPF TO SCAN TO THE SW FOR POSSIBLE SIGHT OF AIRCRAFT
22:59	LIA608	REPORTED SEING A LIGHT BUT CANNOT ASSERTAIN IF IT WAS A BOAT OR A DITCHED AIRCRAFT
23:00	TFFR	TFFR TWR MR. [redacted] CALLED TWR AND REQUESTED INFORMATION ON THE DITCHING
23:00	TWR	MR. [redacted] OF COAST GUARD ST MAARTEN INFORMED TWR THAT A COAST GUARD VESSEL WAS
		DISPATCHED
23:09	TWR	REQUESTED WIA355 TO FLY OVER THE SEARCH AREA ONLY IF VISUAL DUE TO WEATHER
		CONDITIONS
23:18	WIA355	REPORTED SEEING A BLINKING LIGHT 5 NM SOUTH EAST HOWEVER UNABLE TO SEARCH THE AREA
23:23	COAST/G	MR. [redacted] INFORMED TWR THAT A SEARCH TEAM IS BEING ORGANIZED FOR SEARCH AND
		RESCUE
23:39	TWR	OBSERVED THE COAST GUARD IN THE AREA

[redacted]

Princess Juliana International Airport
Operating Company N.V.

PJIAE AIR TRAFFIC SERVICES INCIDENT/ACCIDENT REPORT

01:25	COAST/G	MR. [redacted] INFORMED TWR THAT PART OF THE FUSELAGE AND CARGO WAS FOUND IN THE
		VICINITY OF CUPECOY BEACH AND THE CLIFF

46. ATTACHMENTS: FLIGHT PROGRESS STRIP SKZ7101

47. NAME: [redacted] SIGN: [redacted]
48. ON DUTY AS: AERODROME/ APPROACH CONTROLLER
49. TIME SINCE LAST BREAK: 22:01
50. START TIME OF SHIFT UTC: 18:00 UTC
51. ATS UNIT: TWR/APP TWR

52. RADAR/RTF RECORDINGS HELD: YES / NO / UNDETERMINED NOTE: RT RECORDING MALFUNCTIONED

53: Supervisor on duty: N/A	Sign:
54. ATS Manager: [redacted]	Sign: [redacted]
55. Acting Director of ATS [redacted]**:** **N/A**	Sign:

COMMENTS ATS MANAGER/DATE REVIEWED:

Self-explanatory. October 29, 2014

COMMENTS DIRECTOR ATS/DATE REVIEWED:

N/A

Appendix 2---GPS Device Factual Report, DCA15RA018, pages 9-12.

Table 1: GPS Data Parameters

Parameter Name	Parameter Description
Date	Date for recorded data point (MM/DD/YYYY)
Time	Time (UTC) for recorded data point (HH:MM:SS)
Latitude	Recorded Latitude (degrees)
Longitude	Recorded Longitude (degrees)
GPS Alt	Recorded Altitude (feet)
Groundspeed	Average groundspeed (knots)
Track	Average true course (degrees)

OVERLAYS AND TABULAR DATA

All graphical overlays generated in this report were generated using Google Earth. Weather conditions and lighting depicted in the overlays do not necessarily represent weather conditions and lighting at the time of the accident.

Figure 9 shows an overview of the entire accident flight recording. The recording began at 22:31:28 UTC at the ramp area. After back taxiing on runway 28, the aircraft takeoff roll began at about 22:38:35 UTC. The last recorded point was at 22:39:40 UTC, about 0.6 nautical miles southwest of the end of runway 28.

Figure 10 shows the ground operations at Sint Maarten. The aircraft began to back taxi on runway 28 at about 22:36:22 UTC, and began the takeoff roll at about 22:38:35 UTC. Maximum groundspeed calculated during back taxi on runway 28 was 28 knots.

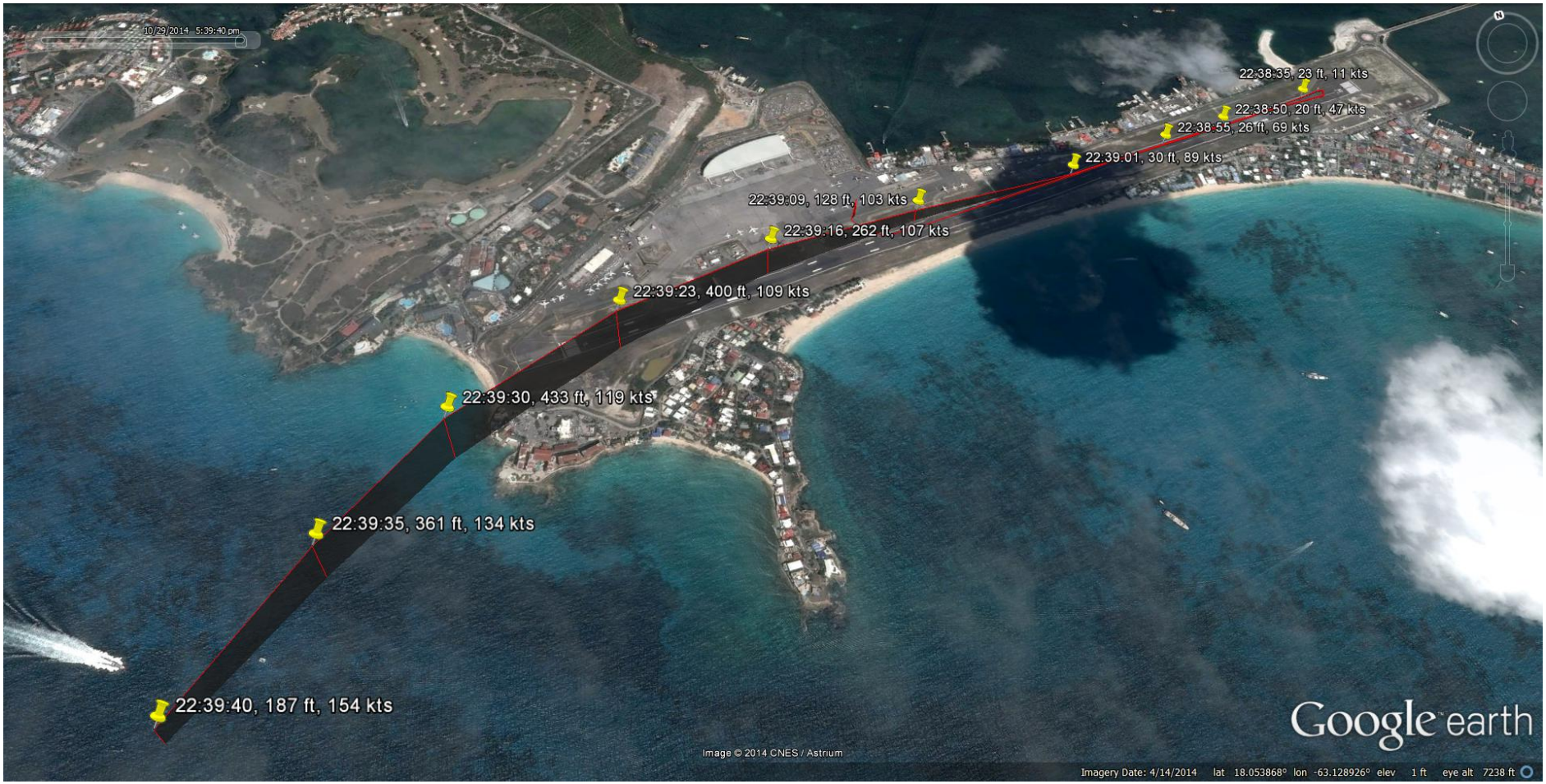
Figure 11 shows the takeoff run until the end of the recording. By about 22:39:09 UTC, the recorded GPS altitude was 128 feet, compared to 23 feet at the start of the takeoff roll. The maximum recorded GPS altitude of 433 feet was recorded at 22:39:30 UTC at a calculated groundspeed of 119 knots. The remaining two data points recorded decreasing GPS altitude and increasing calculated groundspeeds of 134 knots and 154 knots.

Downloaded data was provided to the Department of Civil Aviation of Sint Maarten.

Figure 9. Google Earth overlay of entire recording.

Figure 10. Google Earth overlay of ground operations.

Figure 11. Google Earth overlay of takeoff run until end of recording.



Appendix 3---P&WC Accident/Incident Report No. 14-115, pages 1-2.

I ANALYSIS

1.0 ACCIDENT SYNOPSIS

1.1 It was reported by the local authority that the Shorts 360-100 aircraft registration N380MQ being operated by Skyway Enterprises had impacted the Saint Maarten coastal waters of the Netherlands Antilles. This occurred shortly after takeoff from the runway 27 of Saint Maarten Juliana Airport (SXM) and after instructing the flight crew to change heading for 230 degrees and climb at 3000 feet. At this point, there were no further communications between the flight crew and the air traffic control crew. One of the two (2) crew members recovered was fatally injured and the other was not recovered.

2.0 SUMMARY OF FINDINGS & DISCUSSIONS

2.1 Both engines' accessory and reduction gearbox (AGB & RGB) magnesium housings were in an advanced state of disintegration from corrosion as a result of being soak-immersed in seawater (saltwater).

2.2 Both engines' propeller reduction and accessory drive gears, shafts and bearings of the AGB and RGB installations including oil pumps, and the main rotor high-speed bearings accounted during the investigation, were in an advanced state of deterioration from corrosion as a result of being soak-immersed in seawater (saltwater). In addition, visual examination of the aforementioned parts did not reveal any pre-impact anomalies.

2.3 Both engines' second-stage (2^{nd}) reduction carrier sets had shear-fractured through the carrier webs in the vicinity of the lightening holes in which the carrier front shaft fragment (integral No. 5 roller bearing inner race) remained attached to the propeller shaft. This resulted in the separation of the 2^{nd} stage carrier planet set from the propeller shaft followed by the loss of power turbines (PT's) and RGB drives.

2.4 Both engines, the four (4) retention bolts that retained the outer race of the No. 4 ball bearing to the PT shaft housing were found fractured by overload through the threaded section with no evidence of fatigue propagation. No evidence of metallurgical anomaly underneath the fracture surface and in the threaded section was observed.

2.5 The materials laboratory analysis indicated that both engines' turbine exhaust ducts (TED) were distortedly deformed from unusual loads applied in compression and/or in torsion. Cracks present located along crest and depression within the deformation revealed an inter-granular topography with no evidence of dimples along the grain facets indicative of a brittle fracture. The cracking most likely occurred by Hydrogen Embrittlement that associated with the immersion in seawater as being a corrosive environment. No evidence of fatigue cracking was observed.

X-ray examination of the CSU Py flapper area confirmed that there was no contamination blocking the Py flapper. It was not possible to disassemble the CSU due to the extent of contamination.
Four (4) of the left engine thermocouple probes had missing ceramic insulation, four (4) also had eroded tips, and one had insulation resistance that was below the test-point minimum limit.
Three (3) of the right engine thermocouple probes had broken tips, eight had eroded tips, and ten were electrically shorted and had fluctuating resistance.
Heavy contamination was present at each tip of the fuel nozzles that unable testing the fuel nozzles.
The gaskets, piston-rings and seats of both BOV were intact.

3.0 CONCLUSION

3.1 Evidence shows that both the left and right engines displayed a similar signature of impact damages such as the shear-fracturing of the RGB 2nd stage carrier, the torsional/compressional deformation of the turbine exhaust duct and overload fracturing of the No. 4 bearing retention bolts being confined to the power section module of both the left and right engines. This is characteristic as the result of both engine propellers striking with a sudden stoppage, and a definitive assessment of both engines producing power at the time of impact strike.

3.2 The gas generator module of both the left and right engines showed a satisfactory structural integrity where no indications of any pre-impact mechanical anomalies or distress to any of the components observed would have precluded normal engine operation and full power output from the engine prior to impact.

3.3 The engine accessories investigation revealed that there were no defects or damage evident that would have prevented normal operation prior to the event. The observations recorded during the investigation were suggestive of rigging adjustments, and contamination and damage caused during the event. The damage observed on some of the T5 thermocouples may have resulted in inaccurate T5 indications.

3.4 The advanced corrosion observed to the engines' internal/external parts and accessories/controls is attributed to the immersion of both engines soaked in seawater (saltwater) as being a corrosive environment that occurred after the aircraft impact.