

**BAID# A12-02189**



**BAID**

**Bahamas  
Accident  
Investigation  
Department**

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

## **AIRCRAFT ACCIDENT REPORT**

**LOSS OF CONTROL AND IMPACT WITH TERRAIN**

**AEROSPATIALE EUROCOPTER GROUP**

**C6-APV**

**GREAT GUANA CAY, ABACO  
BAHAMAS**

**November 22, 2012**





**BAHAMAS  
CIVIL AVIATION AUTHORITY  
ACCIDENT INVESTIGATION DEPARTMENT  
P. O. BOX AP-59244  
BLAKE  
NASSAU N. P., BAHAMAS**

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Abstract: This report provides an explanation of the circumstances surrounding the landing approach and crash of C6-APV, an Aerospatiale AS355F1 Helicopter owned by Pioneer Caribbean Logistics Ltd. while attempting a landing at the Baker's Bay Golf and Ocean Club in Great Guana Cay, Abaco, Bahamas. Based upon eye witness account and the evidence collected the pilot was intending to land in a vacant lot (designated landing zone by Baker's Bay Golf and Ocean Club) adjacent to the Resort. The pilot failed to execute the required maneuver for a safe landing resulting in one of the helicopter's main rotor blades striking a coconut tree resulting in loss of control and the subsequent crash. The accident occurred on November 22<sup>nd</sup> 2012 at approximately 1:10 pm local time (1810UTC) and resulted in one fatality and four serious injuries.



**BAHAMAS  
CIVIL AVIATION AUTHORITY  
ACCIDENT INVESTIGATION DEPARTMENT**

The Bahamas Accident Investigation Department (BAID) is the accident investigation unit of the Bahamas Civil Aviation Authority (BCAA).

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

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

**The BAID does not investigate for the purpose of apportioning blame or to provide a means for determining liability.**

The BAID performs its functions in accordance with the provisions of the *Bahamas Civil Aviation (Safety) (Amendment) Regulations (BASR) 2013, Schedule 19, International Civil Aviation Organization (ICAO) Annex 13* and, where applicable, relevant international agreements.

The Bahamas Accident Investigation Department is mandated by the Ministry of Transportation and Aviation to investigate air transportation accidents and incidents, determine probable causes of accidents and incidents, issue safety recommendations, study transportation safety issues and evaluate the safety effectiveness of agencies and stakeholders involved in air transportation.

The BAID makes public its findings and recommendations through accident reports, safety studies, special investigation reports, safety recommendations and safety alerts. When the BAID issues a safety recommendation, the person, organization or agency is required to provide a written response within 90 days. The response shall indicate whether the person, organization or agency accepts the recommendation, any reasons for not accepting part or all of the recommendation(s), and details of any proposed safety action(s) resulting from the recommendation(s) issued.

Official Copies of accident reports can be obtained by contacting:

Bahamas Accident Investigation Department  
JL Center, Blake Road  
P. O. Box AP-59244  
Nassau N. P., Bahamas  
(242) 397-4700 Ext 4778

Unofficial copies of the reports can be viewed on the BAID's website at [www.aaipu-bcaa.com](http://www.aaipu-bcaa.com)



**BAHAMAS  
CIVIL AVIATION AUTHORITY  
ACCIDENT INVESTIGATION DEPARTMENT**

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## ABBREVIATIONS AND TERMINOLOGY

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

ATS	Air Traffic Services	IIC	Investigator-in-Charge
ATC	Air Traffic Control	LZ	Landing Zone
BAID	Bahamas Accident Investigation Department	MET	Meteorological Office / Department
BCAA	Bahamas Civil Aviation Authority	MRB	Main Rotor Blades
BASR	Bahamas Civil Aviation (Safety) Regulations	MYNN	Lynden Pindling Int'l Airport
CB(s)	Cumulonimbus (rain) Clouds	MYAM	Marsh Harbour Int'l Airport
CFIT	Controlled Flight into Terrain	METAR	Weather Report furnished by Meteorological Department
C of A	Certificate of Airworthiness	NM or nm	Nautical Miles
C of R	Certificate of Registration	NTSB	National Transportation Safety Board
CVR	Cockpit Voice Recorder	NVM	Non Volatile Memory
DCA	Director of Civil Aviation	PIC	Pilot in Command
EST	Eastern Standard Time (-4 hours to convert from UTC)	SMOH	Since Major Overhaul
FAA	Federal Aviation Administration	TCU	Towering Cumulus Clouds
ICAO	International Civil Aviation Organization	USA	United States of America
		VFR	Visual Flight Rules
		UTC / Z	Universal Coordinated Time / Zulu Time

## DEFINITIONS

When the following terms are used in this report, they have the following meanings as per BASR 2013 and ICAO Annex 13;

**Accident** - An occurrence associated with the operation of an aircraft which takes place between the times any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, in which:

- a) a person is fatally or seriously injured as a result of:
  - being in the aircraft, or
  - direct contact with any part of the aircraft, including parts which have become detached from the aircraft, or
  - direct exposure to jet blast, except when the injuries are from natural causes, self-inflicted or inflicted by other persons, or when the injuries are to stowaways hiding outside the areas normally available to the passengers and crew; or
- b) the aircraft sustains damage or structural failure which:
  - adversely affects the structural strength, performance or flight characteristics of the aircraft, and
  - would normally require major repair or replacement of the affected component, except for

engine failure or damage, when the damage is limited to the engine, its cowlings or accessories; or for damage limited to propellers, wing tips, antennas, tires, brakes, fairings, small dents or puncture holes in the aircraft skin; or

c) the aircraft is missing or is completely inaccessible.

Note 1.— For statistical uniformity only, an injury resulting in death within thirty days of the date of the accident is classified as a fatal injury by ICAO.

Note 2.— An aircraft is considered to be missing when the official search has been terminated and the wreckage has not been located.

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

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

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

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

**CFIT** - Controlled Flight into Terrain occurs when an airworthy aircraft under the complete control of the pilot is inadvertently flown into terrain, water, or an obstacle. The pilots are generally unaware of the danger until it is too late.

**Fatal injury** - means any injury which results in death within 30 days of the accident.

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

**Investigator-in-charge** - A person charged, on the basis of his or her qualifications, with the responsibility for the organization, conduct and control of an investigation.

Note.— Nothing in the above definition is intended to preclude the functions of an investigator-in-charge being assigned to a commission or other body.

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

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

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

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

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

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

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

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

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

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

**FOREWARD**

August 28, 2015

Mr. Ivan L. Cleare  
Director (Acting)  
Bahamas Civil Aviation Authority  
P.O. Box N-975  
Nassau, N.P., Bahamas

Sir

The attached final report summarizes the investigation into the circumstances of the accident involving C6-APV, an Aerospatiale Eurocopter Group AS355F1 Helicopter, Registration C6-APV registered in the Bahamas to Pioneer Caribbean Logistics Ltd. This accident occurred on November 22, 2012 at approximately 1:10pm local (1810Z), the helicopter crash landed on Great Guana Cay, Abaco as the pilot attempted to land on the Baker's Bay Golf and Ocean Club property an uncertified landing area. The cabin of the helicopter came to rest at GPS coordinates N26.41.213 –W077.08.733W.

This report is submitted pursuant to Part XII, Regulation 80, and Schedule 19 of the Bahamas Civil Aviation (Safety)(Amendment) Regulation (BASR 2013) and in accordance with Annex 13 to the Convention on International Civil Aviation Organization (ICAO). In accordance with referenced regulations and annex, the fundamental purpose of such investigation is to determine the circumstances and causes of these events, with a view to the preservation of life and the avoidance of similar occurrences in the future. It is not the purpose of such investigations to apportion blame or liability.

This report contains facts which have been determined up to the time of publication. Information is published to inform the aviation industry and the public of the circumstances surrounding this accident. The contents of this report may be subjected to alterations or corrections if additional factual information becomes available.

Regards



Delvin R. Major  
Bahamas Accident Investigation Department  
Bahamas Civil Aviation Authority



**BAHAMAS  
CIVIL AVIATION AUTHORITY  
ACCIDENT INVESTIGATION DEPARTMENT**

**TITLE**

**Registered Owner:** Pioneer Caribbean Logistics Ltd  
**Operator:** Pioneer Caribbean Logistics Ltd  
**Manufacturer:** Aerospatiale Eurocopter Group  
**Helicopter Type:** AS355F1  
**Nationality:** Bahamas  
**Registration:** C6-APV  
**Place of Accident:** Great Guana Cay, Abaco  
**Date of Accident:** November 22, 2012  
**Notification:** DCA, NTSB, ICAO, FAA, Cessna  
**Investigating Authority:** Bahamas Civil Aviation Authority  
Bahamas Accident Investigation Department  
**Investigator in Charge:** Dion Q. Demeritte  
**Accredited Representative:** Robert Gretz – NTSB  
**Advisors to Acc. Rep** Jon Adam Michael – Rolls Royce  
Seth D. Buttner – American Eurocopter  
**Releasing Authority:** Bahamas Civil Aviation Authority  
**Date of Final Report:** August 28, 2015

## **1.0 FACTUAL INFORMATION:**

### **1.1 HISTORY OF THE FLIGHT**

According to reports, Lance O. Valdez and the pilot (Mr. David Brendon Pearce) flew the helicopter from Lynden Pindling International Airport (MYNN), to the Marsh Harbour International Airport (MYAM), in Marsh Harbour, Bahamas (approximately 95 NM).

Upon their arrival they met and picked up three friends and provided them a ride to the Baker's Bay Golf and Ocean Club, Great Guana Cay, Abaco, Bahamas. Baker's Bay Golf and Ocean Club is a private resort approximately 10 NM Northwest of MYAM. It was planned for the group to spend the holiday weekend.

The five occupants boarded the helicopter, a male passenger sat in the aft left seat, along with another female and male passenger who was seated in the aft center and aft right seats, respectively. There are conflicting statements as to, who was sitting where in the front two seats. However, the pilot alleged he was not the flying pilot at the time of the accident. The pilot further alleged that the left seat occupant (a non-rated helicopter fixed wing pilot) was at the controls.

The five occupants departed MYAM (reportedly with windy, visual meteorological conditions), and flew to Great Guana Cay. The winds at the Cay were reportedly just as strong as or stronger than they were in MYAM, and coming from the north approximately 30 kts, with gusts.

Once they arrived in the Baker's Bay Golf and Ocean Club area, witnesses reported seeing the helicopter pass low (approximately 60-100 feet) over the resort's grounds from south to north, out over the water. The helicopter then turned around and flew back to the south with the wind. Witnesses presumed they were attempting to land at the usual designated area which is an empty undeveloped lot near the shoreline. [See Appendix 1.](#)

No one at the resort expected a helicopter arrival. The on-lookers estimated the landing zone (LZ) was one of three adjoining empty lots near the central part of the resort, and closest to the north shoreline (approximately 100 feet from the shore). According to representatives of Baker's Bay Golf and Ocean Club, this was the first time this particular helicopter and hence either pilot had visited the facility.

According to the witness reports, the helicopter approached the LZ and made a turn as if it was going to turn into the wind. Once the helicopter made the turn, it appeared as if it uncontrollably and quickly turned fully in the other direction and back as the nose of the helicopter went up.

Witnesses stated the wind conditions on the day of the accident were "extremely strong" and "gusting" in the area. The helicopter continued moving south, with the wind, when one of its main rotor blades (MRB) struck the palm branches top of a ~ 30 foot coconut tree. The helicopter began to descend while still moving south into a construction zone and common area of the community, in-between buildings. As the helicopter was rotating around, the end cap of the right horizontal stabilizer impacted the top portion of a mound of dirt (approximately 10 feet high).

The tail section separated from the fuselage, striking a parked truck and then separating in-half again, from a MRB strike at the tail boom, just a few feet forward of the horizontal stabilizers. The mid-section of the tail boom came to rest approximately 100 feet southwest of the dirt mound. The aft tail section, with the tail rotor still attached, came to rest approximately 75 feet south of the dirt mound. [See Appendix 1.](#)

The fuselage continued on the trajectory, the two main rotor blades struck a stacked pile of lumber, the main rotor system inclusive of the transmission along with both engines separated from the fuselage. The crushed fuselage came to rest inverted resulting in the dimensions of the cockpit and cabin being sufficiently reduced. No post-crash fire was reported. First responders reported the smell of fuel present at the scene (shortly after the accident occurred).

Of the five persons on board, one was fatally injured, four were seriously injured [one was ejected during the crash sequence and the three others were rescued from the wreckage]. All of the surviving occupants had injuries of varying severity, they were stabilized and transported to Marsh Harbour for further evaluations prior to being airlifted to South Florida [3 persons] and Nassau [1 person].

The occupant in the aft left seat was fatally injured due to blunt force trauma and pronounced dead at the scene. The two front seat occupants were removed from the wreckage with the aid of first responders. The passenger in the aft right was thrown from the helicopter prior to the final resting location of the wreckage.

The aft female occupant was trapped in her seat by her hair; albeit, she was extricated from the wreckage with the aid of first responders.

It is unknown if all of the occupants were wearing their seat restraints. However, the fatally injured occupant in the left aft seat was cut free of his seat belt by first responders.

The aft three seat belts were found latched together; and the two front seats, four point restraints, were found unlatched as observed by investigators.

According to witnesses at the Marsh Harbour International Airport, the wind was blowing hard when the helicopter initially arrived to pick up the passengers and they saw the helicopter bounced hard upon landing, once on each skid, similar to a ground resonance event.

Observation at the location on the ramp where the helicopter was said to have landed, confirmed fresh impact signature in the pavement consistent with marks typically produced by helicopters skids.

The passengers' luggage was transported to the Baker's Bay Golf and Ocean Club by boat. The passengers carried only personal luggage with them on the helicopter. In the aft baggage compartment were the following items.

- Black bag = 15 lbs.
- Brown bag = 16.4 lbs.
- Black crate 20.6 lbs.
- Black crate (2) 10.8 lbs.
- Total 62 lbs.

## 1.2 INJURIES TO PERSONS

Injuries	Crew	Passengers	Others	Total
Fatal		<b>1</b>		<b>1</b>
Serious Injuries		<b>4</b>		<b>4</b>

## 1.3 DAMAGE TO AIRCRAFT

### Wreckage Examination Observations:

The wreckage was relocated to a rented area in a hangar at the Marsh Harbour International Airport. The engines, helicopter transmission, and rotor head were further separated to allow for examination. The compromised fuselage and the tail boom were separated in two main sections.

The tail rotor blades were intact with no leading edge damage noted. The main rotor blades were removed for transport and all three blades

displayed impact damage to the outboard half of the blades.

Both transmission input shafts were separated from the transmission with rotational signatures noted on the structure.

The shim packs on these shafts and the tail rotor drive shaft were separated and sheared.

The #1 engine driveshaft was fractured into two sections, one of which remained attached inside the engine power take off gear. The fracture surface did not exhibit progressive features and was consistent with torsional overload from a sudden stoppage.

The #2 engine driveshaft was intact and attached to the engine power take off gear.

The helicopter fuel system was compromised at several locations and the helicopter was inverted in the hangar; thus, the level could not be accurately determined. Fuel leakage was reported at the accident site.

The helicopter was equipped with engine scavenge oil filters, both of which were inspected and found to be clear of debris. (Although the #2 engine scavenge filter pending bypass button was extended, no contamination was observed within the filter.)

Engine #1 displayed foreign object damage (FOD) on the compressor first stage blades. The inlet bell mouth was crushed inward and the forward section of the front mount (which attaches to the helicopter main transmission) displayed rotational signatures from contact with the driveshaft during operation.

The rear portion of the output shaft was noted within the power take off gear.

Several of the external lines (fuel, lubrication and pneumatic) were bent inward from impact; however all of the connections were tight when checked by hand.

Both the outer combustion case (OCC) and left compressor discharge air tube were crushed inward. The N1 and N2 systems both rotated freely and continuously from the compressor and power turbine to the starter and output shaft respectively. The fourth stage wheel was normal in appearance. The engine controls were removed and all drive shafts were intact. The controls were normal in appearance with no obvious damage. The appropriate amount of fuel and oil were present in the respective supply and scavenge lines.

The fuel filter was inspected and a localized patch of fibrous debris (~ 3/4in area) was noted. The

contamination did not appear large or thick enough to disrupt the fuel flow.

Engine #2 displayed foreign object damage (FOD) on the compressor first stage blades. The forward section of the front mount (which attaches to the helicopter main transmission) displayed rotational signatures from contact with the driveshaft during operation. Several of the external lines (fuel, lubrication and pneumatic) were bent inward from impact; however all of the connections were tight when checked by hand.

The N1 and N2 systems both rotated freely and continuously from the compressor and power turbine to the starter and output shaft respectively. The fourth stage wheel was normal in appearance. The engine controls were removed and all drive shafts were intact.

The controls were normal in appearance with no obvious damage. The appropriate amount of fuel and oil were present in the respective supply and scavenge lines. The fuel filter was inspected and no observable contamination was noted.

Following the examination in the Bahamas, the helicopter was shipped to Atlanta Air Salvage where the NTSB oversaw the engine removal, repackaging, and shipment to Keystone Turbine Services for a detailed examination. The follow up exam took place on 9 and 10 January 2013 under the supervision of the BAID IIC at Keystone.

#### **1.4 OTHER DAMAGE**

On-site pictures depicted separation of the main rotor/transmission/engine section from the fuselage during the event.

Witness reports indicated the helicopter was spinning during the attempted landing and subsequently struck a palm tree, parked truck, a stack of lumber and a mound of dirt. The tail rotor section was also separated and the helicopter came to rest inverted against a small palm tree.

#### **1.5 PERSONNEL INFORMATION**

Mr. David Brendon Pearce the pilot of record is the holder of FAA Commercial Pilot license certificate number 2408168, and BCAA license certificate number 00772 with Airplane Single and Multi-Engine Land; Rotorcraft-Helicopter; Instrument Airplane and Helicopter ratings. Mr. Pearce is also the holder of a second class medical certificate with the requirement of corrective vision lenses.

#### **1.6 AIRCRAFT INFORMATION**

The accident helicopter was manufactured by Eurocopter/Aerospatiale in 1982 under the model number AS355F, as serial number 5191 by Eurocopter France, in Marignane. It was converted to an AS355F1 in 1986. The helicopter was registered in the Bahamas in September of 2012 as C6-APV; Flight Manual entries indicate that prior to September of 2012 helicopter C6-APV was Canadian registered as C-FIHC. Prior to that it had been registered in the United States as N355TD.

The Eurocopter AS355F1 is powered by two 420 horsepower Rolls Royce Allison 250 C20F engines. The helicopter is equipped with a three blade main rotor system, which rotates clockwise (when looking from above), a conventional tail rotor, and skid type landing gear. Additionally it was equipped with Apical Emergency Floats (6 water landing balloons) on the landing skids.

#### **1.7 METEOROLOGICAL INFORMATION**

Witnesses stated the wind conditions on the day of the accident were extremely strong and gusting in the area where the helicopter attempted to land.

The Meteorology Department report for November 22, 2012 called for partly sunny and very breezy conditions with isolated showers mainly across the extreme northern and southern islands. A broad surface low northeast of the Bahamas generating unstable weather over the northwest Bahamas was forecasted.

Over the northwest Bahamas few to scattered clouds between 1,800 feet and 2,500 feet with occasional scattered to broken clouds between 3,000 feet and 5,000 feet. Cloud tops to 6,500 feet with few showers and possible thundershowers in lines and clusters.

Towering cumulus and cumulonimbus clouds with tops above 16,000 feet and 24,000 feet respectively near 26.6N and 78.4W moving eastward. The ceiling and visibility to be reduced to below 1,500 feet and 3 nautical miles respectively in heavy showers and thundershowers. Moderate turbulence or greater can be expected in the vicinity of all TCU, CB and weakened frontal boundary. Surface winds for the northwest Bahamas forecast to be northwest to north at 15 to 25 knots.

## **1.8 AIDS TO NAVIGATION**

There were no navigation aids present.

## **1.9 COMMUNICATIONS**

At the time of the accident communications available to the helicopter was Unicom frequency 122.80 and also communication was possible with a local transceiver station at Baker's Bay Golf and Ocean Club Resort.

## **1.10 AERODROME INFORMATION**

Great Guana Cay the location of the accident does not have its own airport or airstrip. The nearest airport is Marsh Harbour Int'l which is located 8 miles away in the Marsh Harbour vicinity. Residents and visitors usually land at Marsh Harbour Int'l Airport and are then transported by ferry boat to Great Guana Cay. The island is also occasionally accessed by helicopter and seaplane traffic.

Reports are that the Pilot-in-Command attempted to land on the Baker's Bay Golf and Ocean Club property in an area that was designated but not certified.

## **1.11 FLIGHT RECORDERS**

C6-APV was not fitted with a flight recorder.

## **1.12 WRECKAGE AND IMPACT INFO**

*See Wreckage Diagram - Appendix 1.*

The helicopter was recovered to Marsh Harbour Int'l Airport, Abaco, Bahamas where investigators from Rolls-Royce and Eurocopter conducted a wreckage examination on 28 and 29 November 2012 under the supervision of the Bahamian BAID IIC. The team also travelled to the event site for a walk-through inspection led by the resort's VP of Safety.

The helicopter wreckage debris was located in the construction zone of the development and in-between buildings that are central to the common area of the community. The wreckage debris field was mostly along a track of 160° track (Note: wind was reported as being from ~ 350°@ 25-35 kts). The wreckage was in five major pieces: the tail section,

the tail boom, the engines, the transmission/main rotor and the fuselage

The mid-section of tail boom, exhibited blade strike impact damage from the MRB just forward of the horizontal stabilizers to the lower half of the boom (penetration from left to right) and overload separating at the forward tail boom attempt area to the fuselage (compressing type signatures on the left side and tension on the right).

The horizontal and vertical stabilizers remained attached and were relatively undamaged; however, the right horizontal stabilizer was compressed at the tip. The tail rotor was relatively undamaged and moved freely when rotated by hand.

The tail rotor push-pull rod was pulled from the TRG bell-crank. The push-pull rod and the thrust / reverse drive shaft were broken mid span approximately the same location where the tail boom was separated from the aft portion of the fuselage.

The left cabin door was separated from the main wreckage. The right was partially attached. All the windows and the windshield were completely shattered and broken away from the structure.

The landing skids were broken into four sections; however, the crossover bars were still attached to the fuselage. The left side of the crossover bars was bent slightly inward. All (6) of the water landing balloons were inflated.

The entire transmission separated from the helicopter at the four lift struts (mid-span in tension) and main gearbox suspension cross bar. The transmission remained attached to the main rotor system, which included all 3 blades (Red, Yellow & Blue), sleeves, and Starflex.

The Starflex remained in the center of the rotor hub with all of the star arms, broken mid-span with a diagonal component to their lateral axis, consistent with power on contact during separation, consistent with overload in lead/lag to the composite structure of the star arms (leading-edge = under tension, trailing-edge = under compression). The yellow sleeves exhibited the most severe damage from twisting and over-extending type damage.

The flex couplings that attach all three drive gears (tail rotor, and both engine inputs) to the combining gearbox, exhibited spaying separation damage with a power-on condition. The number one (left) engine drive shaft was fractured with the aft spline remaining attached to the gearbox.

The engine cowling was separated from the wreckage, and relatively intact.

Flight control continuity was confirmed from all the cockpit input controls to all their respective control end servos or bell-cranks.

The Caution-Warning Annunciator panel was not visibly damaged and retained for further analysis.

The helicopter's fuel system and tank were relatively intact; however, the remaining fuel was seen leaking out of the wreckage at the accident site. It is unknown how much fuel was on board at the time of the accident.

On 11-28-16 the investigative party, under the supervision of the Bahamas Civil Aviation Authority Accident Investigation Department's Investigator-in-Charge (IIC), assembled at the retrieval location at the Abaco Air hangar facility at the Marsh Harbour International Airport (MYAM) to examine the wreckage. The team later reassembled at the accident site to survey the accident location. The wreckage was placed into a shipping container and was sent to Atlanta Air Salvage in Griffin, Georgia for recovery and storage.

### **1.13 MEDICAL AND PATHOLOGICAL**

Of the five persons aboard the helicopter, one was fatally injured due to blunt force trauma and the four surviving occupants received varying degrees of injuries. The fatally injured was transported to the Rand Morgue of the Princess Margaret Hospital for an autopsy to be performed. The survivors were stabilized and transported to Marsh Harbour for further evaluations prior to being airlifted to South Florida (3 persons) and Nassau (1 person).

### **1.14 FIRE**

Examination of the wreckage concluded no fire was involved during the pre-crash or post-crash sequence.

### **1.15 SURVIVAL ASPECTS**

The nature of the crash was such that the helicopter was severely damaged to the extent that the tail section was separated from the cabin and the cabin came to rest in an inverted position.

However, the crash was survivable, especially if the occupants remained within the confines of the living space. The fatally injured and the most severely injured that survived were ejected from the helicopter.

## **1.16 TESTS AND RESEARCH**

### **Engine Examination Observations:**

Two Allison M250-C20F gas turbine engines, S/N CAE 840072 and CAE 840339, powered the helicopter. The engines arrived in a large box and were removed and installed in turnover stands for disassembly.

#### **Engine #1**

The upper and lower magnetic chip detectors were inspected and both displayed trace amounts of small particles. The debris was consistent with normal operation and did not bridge the gaps of the plugs. The N1 and N2 gear trains were smooth and continuous to their respective output drives. The gearbox was not disassembled.

The fuel nozzle was normal in appearance with carbon formation present on the air shroud and around the outer edge of the secondary orifice. The engine accessories (fuel control unit, power turbine governor, fuel nozzle, fuel pump, and bleed valve) were all bench tested. Slight deviations were noted on various test points, but they were consistent with performance on field returned units and none of these anomalies were significant enough to result in abnormal engine operation.

The compressor bearings (#1 and #2) were oil wetted and rotated freely and smoothly. The first stage compressor wheel blades were uniformly damaged on the leading edge consistent with FOD ingestion.

Damage was also noted on axial blades sporadically within the compressor rotor; but all were intact.

The compressor stator vanes were undamaged. The plastic lining of the case halves was rubbed on the #4, 5, and 6 stage blade paths. Impact marks were noted randomly on the plastic as well. The outboard 3/8in of the compressor impeller blade leading edges displayed contact rub marks and corresponding damage was noted to the impeller shroud. There was material transfer from the shroud abrasion coating to the impeller blades. The impeller "belly band" seal had also rubbed into the shroud.

The left compressor discharge tube and outer combustion case were dented inward from impact damage. The combustion liner displayed carbon formation and discrete sand deposits on the inner surface. Sand deposits were also observed on the 3<sup>rd</sup> and 4<sup>th</sup> stage turbine wheel blade shrouds as well as

the 3<sup>rd</sup> stage vanes. The turbine shafting was connected and all stages of turbine blades and vane airfoils were intact with consistent, light FOD indications throughout.

The turbine bearings (#5, 6, 7, 8) were oil wetted and turned freely. Shiny scratches were present on the 4<sup>th</sup> stage turbine wheel blade track at the 4 o'clock position. The spacing and appearance of these witness marks was consistent with rub contact from the 4<sup>th</sup> stage turbine wheel during the event.

### **Engine #1**

The last documented engine inspection in the logbook provided to the author was a 100/300hr inspection on 27 August 2012 at an engine time of 8728 cycles. The following logbook discrepancies were noted on the maintenance tracking report:

- The part number and serial numbers for the impeller are different on the hours vs. cycle's row.
- The serial numbers for the 2<sup>nd</sup> stage turbine wheel are different on the hours vs. cycle's row.

Manufacturer Allison

Engine Model 250-C20F

Rating 420 Shaft Horsepower

Serial Number CAE 840072

Total Time\* 5676hours / 8748 cycles

\*The engine and component times are from the Freestream Aircraft Ltd. tracking sheet dated 12 September 2012 (Appendix C). It is unknown at this time how much time accumulated between that date and the mishap.

### **Engine #2**

The upper and lower magnetic chip detectors were inspected and were free of ferrous debris (some particles noted but not magnetic). The N1 and N2 gear trains were smooth and continuous to their respective output drives, thus the gearbox was not disassembled.

The fuel nozzle was normal in appearance with carbon formation present on the air shroud and around the outer edge of the primary orifice. The engine accessories (fuel control unit, power turbine governor, fuel nozzle, fuel pump, and bleed valve) were all bench tested. Slight deviations were noted on various test points, but they were consistent with performance on field returned units and none of these

anomalies were significant enough to result in abnormal engine operation.

The compressor bearings (#1 and #2) were oil wetted and rotated freely and smoothly. The first stage compressor wheel blades were uniformly damaged on the leading edge consistent with FOD ingestion. Sporadic FOD indications were also noted on the axial blades within the compressor rotor; however, all blades were intact.

The compressor stator vanes were undamaged and the plastic lining of the case halves was worn consistent with normal use. The outboard 3/8in of the compressor impeller blade leading edges displayed contact rub marks and corresponding damage was noted to the impeller shroud. There was material transfer from the shroud abrasion coating to the impeller blades.

The combustion liner displayed carbon formation and discrete sand deposits on the inner surface. Sand deposits were also observed on the 3<sup>rd</sup> and 4<sup>th</sup> stage turbine wheel blade shrouds as well as the 3<sup>rd</sup> stage vanes. The turbine shafting was connected and all stages of turbine blades and vane airfoils were intact with consistent, light FOD marks throughout.

The turbine bearings (#5, 6, 7, 8) were oil wetted and turned freely. Shiny scratches were present on the 4<sup>th</sup> stage turbine wheel blade track at the 5 and 7 o'clock position. The spacing and appearance of these witness marks was consistent with rub contact from the 4<sup>th</sup> stage turbine wheel during the event.

### **Engine #2**

The last documented engine inspection in the logbook provided to the author was a 100/300hr inspection on 27 August 2012 at an engine time of 8785 cycles. No logbook discrepancies were noted on the maintenance tracking report.

Manufacturer Allison

Engine Model 250-C20F

Rating 420 Shaft Horsepower

Serial Number CAE 840339

Total Time 5412.9 hours / 9002 cycles

\*The engine and component times are from the Freestream Aircraft Ltd. tracking sheet dated 12 September 2012. It is unknown at this time how much time accumulated between that date and the mishap.

## **2.0 ANALYSIS**

- Wind conditions were a major contributing factor in this accident.
- The pilot was properly certificated and qualified for the flight.
- The helicopter was maintained in accordance with maintenance procedures and appropriate regulatory guidelines.
- No evidence of abnormal operation prior to the mishap was noted during the examination. The damage observed was consistent with impact forces during the event sequence. Both engines presented evidence supporting rotation at impact to include scratches on the turbine blade paths, rub indications in the compressor rotors, and circumferential scarring on the output shafts.

## **3.0 CONCLUSIONS**

### **3.1 FINDINGS**

- The pilot was properly certified and qualified for the flight.
- The helicopter was properly certificated and maintained in accordance with existing regulations.
- There were no airplane system or power-plant anomalies that contributed to the cause of the accident.
- No evidence of abnormal operation prior to the mishap was noted during the examination. The damage observed was consistent with impact forces during the event sequence. Both engines presented evidence supporting rotation at impact to include scratches on the turbine blade paths, rub indications in the compressor rotors, and circumferential scarring on the output shafts.
- The pilot landed the helicopter in an area uncertified for helicopter landing.
- The helicopter did not have permission to land at that facility.
- The wind conditions exceeded the aircraft manufacturers maximum wind conditions for a landing.
- Despite helicopters landing on the island the area in which this helicopter attempted to

land was an area not designated for such landings.

- Several eyewitnesses at the time of the accident stated that the wind conditions were extreme at the time the helicopter attempted to land.
- Witnesses also stated that the wind conditions were also excessive at the Marsh Harbour Int'l Airport where the helicopter landed initially.

### **3.2 PROBABLE CAUSE**

The probable cause of this accident has been determined as pilot error due to poor decision making and loss of situational awareness while attempting to land a helicopter in an uncertified landing zone with wind conditions exceeding the capabilities of the helicopter.

### **3.3 CONTRIBUTING FACTORS**

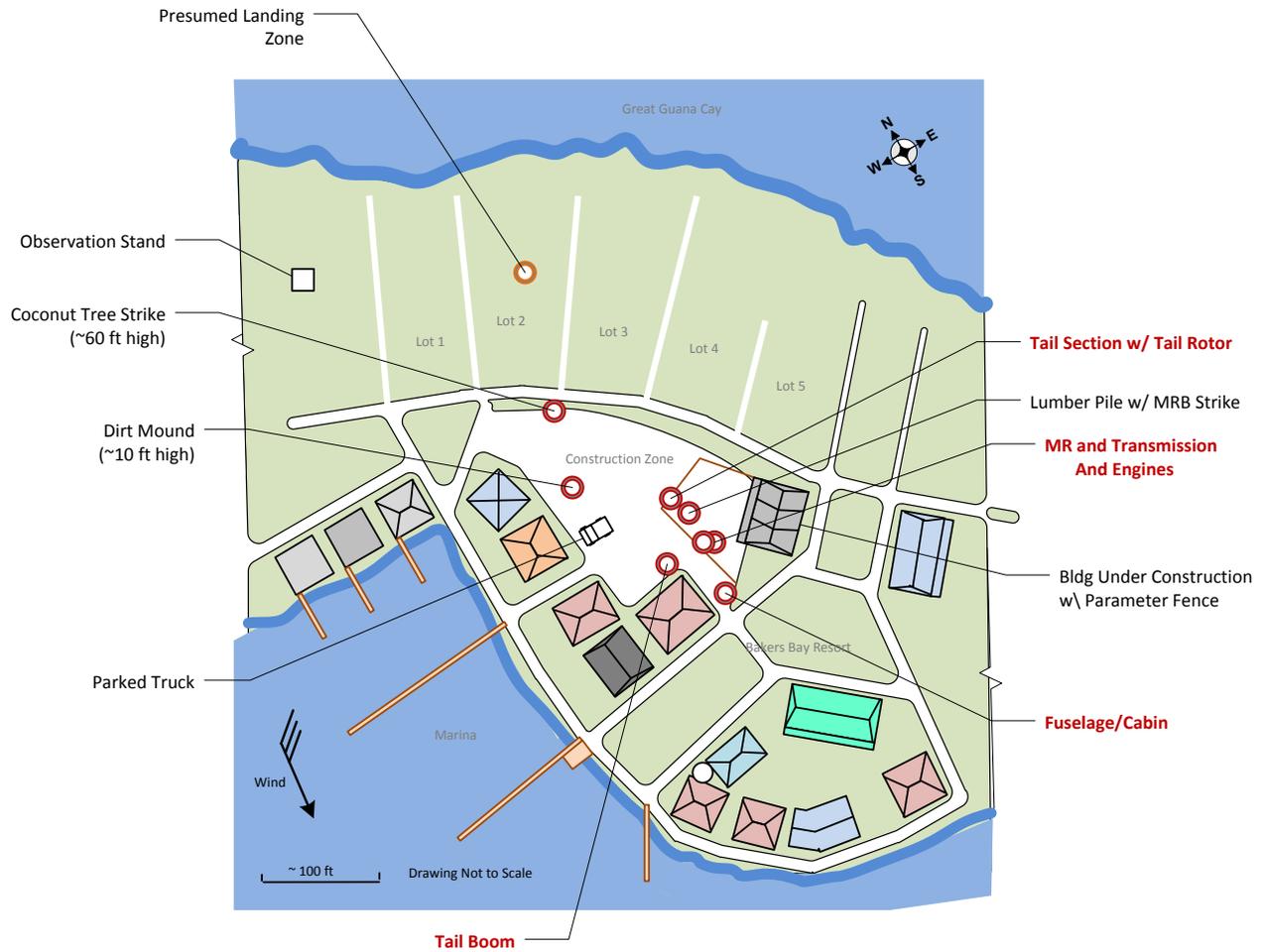
The excessive prevailing wind conditions as well as the pilots unfamiliarity with this landing area.

## **4.0 SAFETY RECOMMENDATIONS:**

The BAID recommends that the Civil Aviation Authority re-examine the pilot for his fitness to hold Bahamas Commercial Pilot License CP00772.

**5.0 APPENDICES**

**APPENDIX 1 LANDING ZONE**



**AS355F1, S/N: 5191, C6-APV, Bakers Bay, Abaco – Bahamas, 11-22-2012**