Aircraft Accident Investigation Authority of the Bahamas

Aviation Short Investigation Final Report

System Component Failure – Powerplant (dual) (SCF-PP)
Cessna 402B, N145TT

Near Chub Cay, Berry Islands, Bahamas
5th January 2022

AAIA Aviation Occurrence Investigation
Report # OCC-2022/0001
Date of Final Report – 22nd August 2022

Released in accordance with Section 25 of the Aircraft Accident Investigation Authority Act (AAIA) 2019 and Section 1.445 of the AAIA Regulations 2021.

Publishing information

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About the AAIA

The Aircraft Accident Investigation Authority (AAIA) is the independent accident investigation agency under the Bahamas Ministry of Transport & Housing (MOT&H) charged with the responsibility of investigating all aviation accidents and serious incidents in the Bahamas.

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

The AAIA performs its functions in accordance with the provisions of the Aircraft Accident Investigation Authority Act 2019 and Regulations 2021, International Civil Aviation Organization (ICAO) Annex 13 and, where applicable, relevant international agreements.

The Aircraft Accident Investigation Authority is mandated by the Ministry of Transport & Housing to investigate aviation 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 object of a safety investigation is to identify and reduce safety-related risk. AAIA investigations determine and communicate the safety factors related to the transport safety matter being investigated.

The AAIA makes public its findings and recommendations through accident reports, safety studies, special investigation reports, safety recommendations and safety alerts. When the AAIA issues a safety recommendation, the person, organization or agency is required to provide a written response without delay. The response shall indicate whether the person, organization or agency accepts the recommendation, any reasons for not accepting part or all of the recommendation(s), and details of any proposed safety action(s) resulting from the recommendation(s) issued.

About this report

Decisions regarding whether to conduct an investigation, and the scope of an investigation, are based on many factors, including the level of safety benefit likely to be obtained from an investigation. For this occurrence, a limited-scope, fact-gathering investigation was conducted in order to produce a short summary report, and allow for greater industry awareness of potential safety issues and possible safety actions.

Aircraft Accident Investigation Authority of the Bahamas

AIRCRAFT ACCIDENT

INVESTIGATION AUTHORITY

Registered Owner:	Venture Air Solutions INC
Operator:	Airway Air Charter INC
Manufacturer:	Cessna
Aircraft Type:	402B
Nationality:	United States of America
Registration:	N145TT
Place of Accident:	4.48 NM west of Chub Cay Airport (MYBC), Berry Islands, Bahamas
Date and Time:	5th January 2022; 8:32 am EST (1332 UTC)
Notification:	Civil Aviation Authority Bahamas (CAA-B) National Transportation Safety Board (NTSB) United States Federal Aviation Administration (FAA) United States International Civil Aviation Organization (ICAO)
Investigating Authority:	Aircraft Accident Investigation Authority, Ministry of Transport & Housing
Investigator in Charge:	Kendall Dorsett Jr.
Accredited Representatives:	Brian Rayner (NTSB)
Releasing Authority:	Aircraft Accident Investigation Authority
Date of Final Report Publication:	22nd August 2022

Occurrence Summary

On the 5th January 2022, the Aircraft Accident Investigation Authority (AAIA) was notified that a Cessna 402B aircraft with United States registration N145TT crashed into waters approximately 4.48 NM west of the Chub Cay Airport (MYBC), Berry Islands, Bahamas at 8:32 AM EST (1332 UTC).

The aircraft departed the Opa Locka Executive Airport (KOPF), Opa Locka, Florida, USA at 7:52 AM EST (1252 UTC) with 2 persons on board enroute to the Chub Cay Int'l Airport. The aircraft was operated by Airway Air Charter INC (Venture Air Solutions INC), a Part 135 certificate holder under Title 14 US Code of Federal Regulations (CFR),

Investigations revealed that the pilot in command arrived at the Opa Locka Airport at approximately 6:30 AM EST and conducted a pre-flight check of the aircraft, subsequently adding 66.5 gallons of 100LL avgas fuel to the main fuel tanks of the aircraft. No fuel was added to the auxiliary tanks.

After completion of all pre-flight checks, and gaining clearance from Air Traffic Control, the aircraft departed at approximately 7:52 AM EST.

Investigations revealed that the flight was uneventful, until descending into Chub Cay, at about 2,500 feet, when the left engine began to "sputter". At this point the pilot executed the engine failure checklist, but shortly thereafter, the right engine began to "sputter" also. The pilot then contacted Miami air traffic center and advised of loss of power to both engines, which resulted in the aircraft crashing into waters.

The United States Coast Guard along with the Royal Bahamas Defense Force (RBDF) and Police Force (RBPF) were alerted. Joint aerial and marine assets were dispatched and additional assistance was provided by local mariners and pilots flying in the area to conduct search and rescue. Both occupants were located and rescued. They were later airlifted to the United States to receive further medical attention for minor injuries.

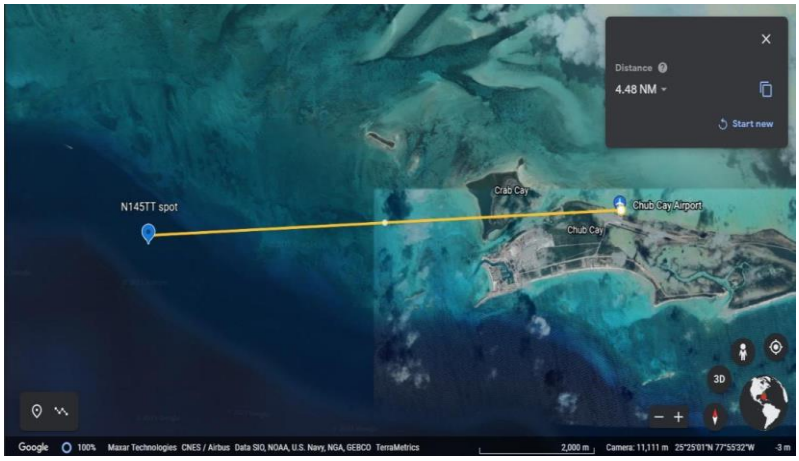

Image from Google Earth of accident site and distance from Chub Cay Airport

The location where the aircraft crashed was identified at coordinates 25° 24.884' N and 077° 58.030' W, approximately 4.48 NM west of the Chub Cay International Airport (MYBC), Berry Islands, Bahamas.

Aircraft Information

Aircraft Manufacturer	Serial Number
Cessna	402B1333

Manufacture Year	Type Aircraft
1977	Fixed Wing Multi Engine

Model / Series	Aircraft Category
402B	Normal

Engine Manufacturer	Engine Type
Continental Motors	Reciprocating

Engine Model	Classification
TSIO-520 SER	Standard

Investigation Findings

Pilot

The pilot in command was 50 years old at the time of the occurrence and possessed a valid Airline Transport Pilot (ATP) certificate with airplane multi-engine land rating issued by the Federal Aviation Administration (FAA) on 6th July 2021. He possessed type ratings for the Embraer ERJ-170 and ERJ-190 aircraft, and was also rated for commercial airplane single engine land, and single engine sea privileges.

Certificate limitations were: ATP Circling Approach – Visual Meteorological Conditions (VMC) only; ERJ-170, ERJ-190 Circling Approach – VMC only, ERJ-170, ERJ-190 subject to pilot-in command limitations.

The total flight time of the pilot was listed at 3,000 hours of which 350 hours was documented in the Cessna 402B aircraft.

He possessed a valid First Class medical certificate issued by the FAA April 2021 with the limitation, "Must have available glasses for near vision".

The pilot successfully completed his initial new hire training (flight and ground training certification) with Airway Air Charter for the Cessna 402 (B and C models) on 31st March 2021, in accordance with Code of Federal Regulations (CFR) Part 135.

The Aircraft

The Cessna 401 and 402 are series of 6 to 10 seat, light twin, piston engine aircraft. This line was manufactured by Cessna from 1966 to 1985 under the name Utiliner and Businessliner. All seats are easily removable so that the aircraft can be used in an all-cargo configuration.

The Cessna 401 and 402 were developments of the Cessna 411. All 401s and 402s are powered by 300 horsepower (224 kW) turbocharged Continental engines with three-bladed, constant speed, fully feathering propellers. On later models cruise power was limited to 75% to reduce cabin noise.

The Cessna 401s, 402s, 402As and some 402Bs built from 1966 to 1971 had four small oval windows, which gave the aircraft a similar appearance to the pressurized Cessna 340. Starting half-way through the production of the Cessna 402B the window configuration was changed to the more distinctive five rectangular windows, an arrangement that was retained through the 402C model, until the completion of production in 1987. All 402Bs were equipped with tip-tanks.

Fuel System

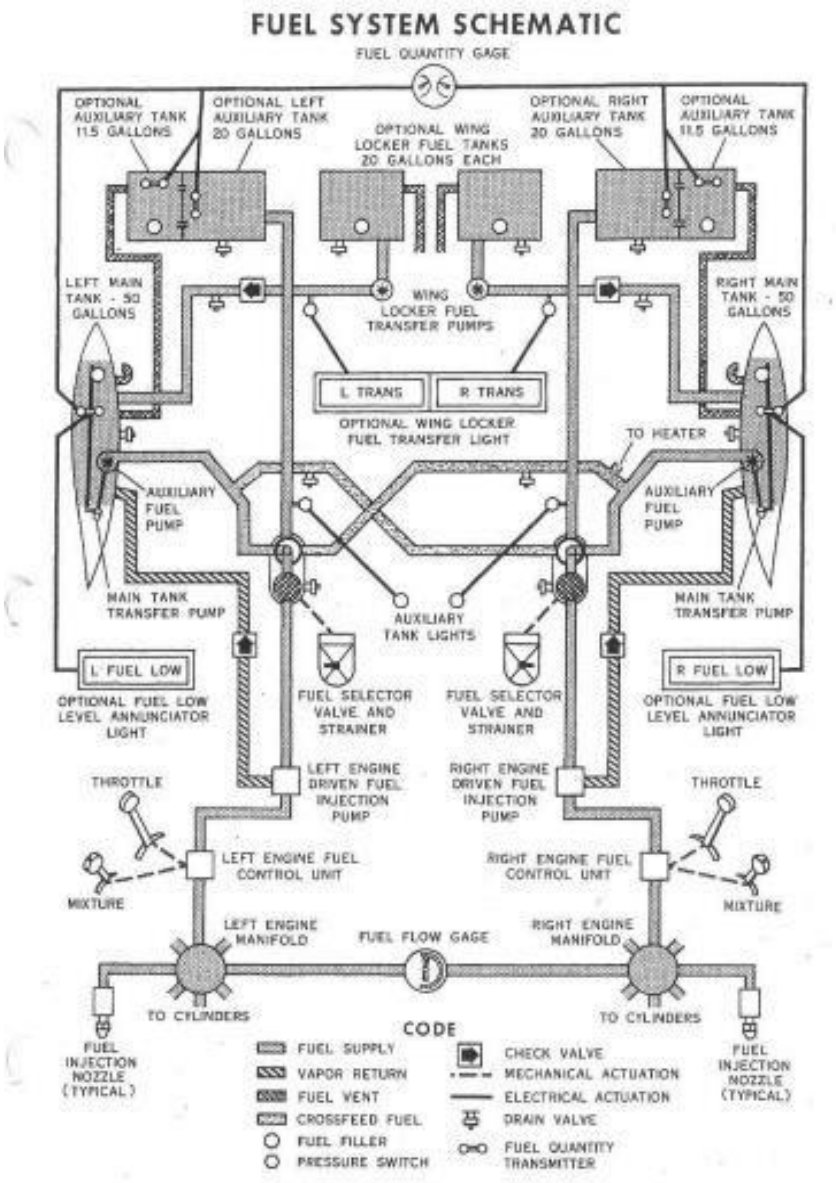

Diagram of fuel System schematic from Pilot's Operating Handbook, Cessna Aircraft Company, 1977 Model 402B Revision 1

The fuel system, see Figure 2, consist of two main tanks, two optional auxiliary tanks, two optional wing locker tanks, fuel selector for options of main, auxiliary or crossfeed fuel and other necessary components to complete the system.

Main Tanks

The main tanks are integrally sealed (wet) aluminum tanks mounted on each wing tip. Each tank contains an auxiliary fuel pump and transfer pump. The auxiliary fuel pump, mounted in the bottom of the tank, provides fuel pressure for priming during engine starting and supplies fuel to the engine in an emergency.

The auxiliary pump operation is controlled by an auxiliary fuel pump switch on the side console. The transfer pump, mounted on the aft side of the main tank rear bulkhead, transfers fuel from the nose section of the main tank to the center sump area, where it is picked up and routed to the engine by the engine driven or auxiliary fuel pump. The transfer pump permits steep descents with low main tank fuel quantity. The transfer pump operates continuously whenever the battery switch is positioned to ON. The main tank is vented to atmospheric pressure by a flush vented located on the lower aft portion of the main tank. These tanks are serviced through a flush filler located on the top forward portion of each tank.

Auxiliary Tanks

The optional auxiliary tanks are available in two sizes. These tanks are bladder type cells located between the spars in the outboard wing. These tanks provide an engine fuel supply during cruise operations. No internal fuel pumps are required. The auxiliary tanks are vented to the main tanks. The auxiliary tanks are serviced through a flush filler located on the upper wing surface outboard of the nacelles.

Fuel Selectors

Two fuel selectors, one for each engine, are provided on the floor between the pilot and copilot seats. The selector allows selection of the main fuel, auxiliary fuel, crossfeed, and no fuel.

The main position of each selector allows fuel to flow from the main tank through the fuel selector to the engine driven fuel pump. The AUXILIARY position allows fuel to flow from the auxiliary tank through the fuel selector to the engine driven pump. The crossfeed position allows fuel to flow from the opposite engine main tank to the engine driven fuel pump. The crossfeed position is used for balancing asymmetric fuel loads and supplying the engine driven fuel pump from the opposite main tank. When the OFF position is selected, no fuel is allowed to flow from the engine driven fuel pump.

The fuel selector handles form the pointers for the selector. The ends of the handles are arrow shaped and point to the position on the selector placard which corresponds to the valve position.

Auxiliary Fuel Pump Switches

A 3-position auxiliary fuel pump switch is provided for each main fuel tank pump. In the LOW position, the auxiliary fuel pumps operate at low speed, providing 5.5 psi pressure for purging. The ON position runs the auxiliary pumps at low speed, as long as the engine driven pumps are functioning. With an engine driven pump failure and the switch in the ON position, the auxiliary pump on that side will switch to high speed automatically, providing sufficient fuel for all partial power engine operations.

Fuel Flow Gage

The fuel flow gage is a dual instrument which indicates the approximate fuel consumption of the engine in pounds per hour. The fuel flow gage used with the injection system senses the pressure at which fuel is delivered to the engine spray nozzles. Since fuel pressure at this point is approximately proportional to the fuel consumption of the engine, the gage is marked as flowmeter.

The gage dial is marked with arc segments corresponding to proper fuel flow for various power settings and is used as a guide to quickly set mixtures.

The gage has takeoff, cruise, and climb markings for various percentages of power. The takeoff range (white arc) presents the desired fuel flow (full rich schedule for proper engine cooling) for full power (2700 RPM and 34.5 inches of Hg. manifold pressure) operation under all conditions up to 16,000 feet altitude. The climb range (blue segments) presents the desired fuel flow for best power mixture at 75% power with an enriched mixture with high power settings to allow for proper engine cooling during climb conditions. The cruise range represents the desired fuel flow for recommended lean mixture at the specified percent power.

Fuel Quantity Gage

The dual indicating fuel quantity gage is calibrated in pounds and will accurately indicate the weight of fuel in the tanks; however, fuel density varies with temperature, therefore a full tank will weigh more on a cold day than on a warm day. This will be reflected by the weight shown on the gage. A gallons scale is provided in blue on the indicator for convenience in allowing the pilot to determine the approximate volume of fuel on board.

The dual indicating fuel quantity gage continuously indicates fuel remaining in the tanks selected. When the fuel selectors are in the AUX position, AUX TANK indicator lights will illuminate and the fuel quantity gage will indicate the fuel in the auxiliary tanks (pounds in white and gallons in blue). When the fuel selectors are in the MAIN position, the fuel quantity gage will indicate the fuel in the main tanks. A 3 positon switch, spring loaded to center, allows checking fuel quantity in the tanks not selected. The switch, adjacent to the auxiliary tank indicator lights, is labeled MAIN and AUX. By positioning the switch to the appropriate tank position, the fuel quantity in that tank will be indicated on the fuel quantity gage.

Fuel Low Level Warning Lights

The optional fuel low level warning lights provide a warning when the left/and or right main tanks contain approximately 60 pounds of fuel. The warning is provided by L FUEL LOW and R FUEL LOW lights located on the annunciator panel. These lights are actuated by a float switch located in each main tank. Each light operates independently from the fuel quantity indicator.

Engine Driven Fuel Pumps

Each engine is equipped with a mechanically engine driven fuel pump which provides fuel to the metering unit. Each pump also contains a bypass which returns excess fuel and vapor to the main tanks at all times. Should these pumps fails, the main tank auxiliary pumps can provide sufficient fuel flow for all

partial power engine operations. These auxiliary pumps, however, operate at fixed pressure, consequently the mixture must be leaned when operating at a low power setting to prevent flooding the engine. Conversely, if an engine driven pump failure should occur during high power operation, adequate fuel flow may not be available to insure rated power and adequate engine cooling.

Weather

Meteorological Information:

Conditions at Accident site	**Condition of Light**
Visual Meteorological Conditions	Day
Observation Facility Location Lynden Pindling Int'l Airport (MYNN) Nassau, Bahamas	**Observation Time** 1300 UTC; 8:00 AM EST
Distance from Accident Site	**Temp /Dewpoint**
35 NM	22° C /21° C
Lowest Cloud Condition	**Wind Speed / Gust Direction**
SCT	
Altimeter Setting	**Visibility**
30.06 in HG	>6 SM

According to the Bahamas Area Forecast, with validity from 1200 UTC (7:00 AM EST), VFR conditions were forecasted for the Northwest and Central areas of the Bahamas.

Due to the above reported and forecasted conditions, it has been determined that weather was not a factor in this occurrence.

Analysis

Due to the depths of the waters where the aircraft crashed, a recovery was not possible, therefore no analysis or testing of aircraft parts and components was conducted. A review of information obtained during the investigative process (i.e. aircraft maintenance logbooks (engine, airframe), air traffic control logs and reports, pilot's account of occurrence, weather forecasts and reports, airman training records etc), provided insights from which conclusions and contributing factors were determined.

The aircraft and its engines were maintained in accordance with the Cessna service manual, Cessna progressive care and current applicable Federal Aviation Administration Regulations.

The likelihood of a dual engine failure due to mechanical defects, while not impossible, is quite rare. Historically, dual engine failures have been attributed to some sort of fuel management techniques.

Maintenance records for the aircraft reviewed, did not indicate any previously reported mechanical irregularities that would have contributed to the loss of both engine power as experienced by the pilot on that day.

The pilot was reluctant to speak with the investigation team, however, a written account of the occurrence from the pilot, as provided to the operator, was obtained. According to pilot's account, shortly after commencing the descent into Chub Cay and at approximately 2,500 feet, the left engine began to "sputter" (operate erratic / lose power), which prompted him to conduct the engine failure checklist from memory which entailed switching from left main tank to left auxiliary tank. After descending through approximately 1,000 feet the right engine began to "sputter" same as the left engine did previously. The engine failure checklist was again utilized, with no positive result.

Subsequently, after the sputtering of the left engine, the left engine fuel selector was positioned from the main tank to the auxiliary tank position. Additionally, it was further noted that with the sputtering of the right engine, the same corrective action may have been undertaken.

The pilots' account did not mention whether he consulted the written emergency checklist as required, at any point during the emergency, only memory items were documented as having been conducted.

Based on the corrective action taken to address the engine sputtering in both engines, it appears the action taken were not consistent with that required by the checklist contained in the Cessna pilots operating handbook (POH).

Although it was reported that 66.5 gallons of avgas was loaded into the main tanks, there was no mention of whether fuel was in the auxiliary tank previously or whether any was added prior to flight.

It is unclear why the pilot would switch fuel selectors from the main tanks to the auxiliary tanks considering no fuel was added to the auxiliary tanks and no mention of how much fuel remained in the auxiliary tanks prior to departure. According to the POH, auxiliary fuel on the side of the failed engine is unusable.

Additionally, according to the Cessna 402B POH, Engine Failure During Flight Checklist, once an inoperative engine has been determined, item 4 requires Fuel Selector to be positioned to the Main Tanks. It is possible the action taken of positioning the fuel selector to "Auxiliary Tanks" instead of "Main Tanks" may have exacerbated the engine emergency resulting in dual engine failure. (See note and Checklist below)

NOTE

- Auxiliary fuel on the side of the failed engine is unusable.
- Position operative engine fuel selector to MAIN TANK and feel for detent if below 1000 feet AGL or if nearest airport is within range of fuel remaining in MAIN TANK. If necessary, range can be extended by using wing locker fuel, opposite main fuel or auxiliary fuel on the side of the operative engine. Crossfeed as required to maintain lateral balance.

Cessna MODEL 402B (ABBREVIATED PROCEDURES) SECTION 3 EMERGENCY PROCEDURES

ENGINE FAILURE DURING FLIGHT

1. Inoperative Engine - DETERMINE.
2. Operative Engine - ADJUST as required.

Before Securing Inoperative Engine:

3. Fuel Flow - CHECK. If deficient, position auxiliary fuel pump to ON.
4. Fuel Selectors - MAIN TANKS (Feel For Detent).
5. Fuel Quantity - CHECK.
6. Oil Pressure and Oil Temperature - CHECK.
7. Magneto Switches - CHECK ON.
8. Mixture - ADJUST. Lean until manifold pressure begins to increase, then enrichen as power increases.

Findings

These findings should not be read as apportioning blame or liability to any particular organization or individual.

a) The aircraft was certified and equipped in accordance with existing US CFR Part 135 regulations and approved procedures.

b) The maintenance records indicated that the aircraft was maintained in accordance with existing regulations and approved procedures.

c) There was no evidence of airframe failure or system malfunction prior to the accident.

d) There were 66.5 gallons of 100LL fuel added to the aircraft main tanks prior to the accident flight. Based on calculations the fuel uploaded with the amounts already in the main tanks were adequate to conduct the proposed flight.

e) No evidence of fuel being added to the auxiliary tanks prior to the accident flight, was noted on the pilots' written statement, therefore the total amount remaining in the auxiliary tanks could not be determined.

f) The pilot in command of the aircraft was licensed, trained, and qualified for the flight in accordance with existing US CFR Part 135 regulations.

g) The aircraft was not equipped with a flight data recorder (FDR) or a cockpit voice recorder (CVR); neither was required by regulation.

h) Engine failure emergency activities were not executed in accordance with approved pilot operating handbook procedures.

i) Weather was not a factor in this occurrence.

Probable Cause

The AAIA has determined the probable cause of this accident to be dual system component failure – powerplant.

Contributing factor to this occurrence includes;

- loss of engine power as a result of mismanagement of available fuel.

Safety Recommendations

There were no safety recommendations issued in relation to this occurrence.