ACCIDENT

Aircraft Type and Registration:	Cessna T210N, XB-LLD
No & Type of Engines:	One Teledyne Continental TSIO-520-R piston engine
Year of Manufacture:	1981 (Serial no: 210-64265)
Date & Time (UTC):	14 November 2011 at about 04:00 hrs
Location:	9 miles north-east of Gerrard Smith International Airport, Cayman Brac, Cayman Islands
Type of Flight:	Unknown
Persons on Board:	Crew - 2 Passengers - None
Injuries:	Crew - 2 (Fatal) Passengers - N/A
Nature of Damage:	Aircraft destroyed
Commander's Licence:	Commercial Pilot's Licence
Commander's Age:	N/K
Commander's Flying Experience:	N/K
Information Source:	AAIB Field Investigation

Synopsis

The aircraft was destroyed when it struck poles and trees while landing at night on an unlit road on the island of Cayman Brac. Both occupants were fatally injured. There was a large spill of Avgas from tanks carried in the cabin as part of a modified fuel system, but no fire.

Times in this report are UTC; local time was UTC –5 hrs.

History of the flight

At about 0345 hrs residents on the southern coast of Cayman Brac heard a light aircraft piston engine. They later considered that the aircraft appeared to be crossing the coast from south to north. At about 0400 hrs the owner of a nearby property heard an aircraft engine and, as this was unusual, walked out onto his driveway, where he saw a single engine aircraft pass from west to east overhead. The aircraft was displaying no lights and was difficult to see. Another witness heard the engine noise decrease to nothing, then sharply increase before suddenly stopping. Believing that a crash may have occurred, this witness called the emergency services. Wreckage was located and the crash site secured at 0500 hrs. Two crewmembers were discovered by rescue personnel; both had received fatal injuries.

No international flight plan relating to this flight could be found. At the time of the accident the three airports on the Cayman Islands group were closed and Cayman Brac's airport was unlit. Although ATC was closed, radio recording equipment at the airport was operational

and no radio calls were recorded. There had been no reports of aircraft noise from the north coast or western areas of the island.

Meteorological information

At the time of the accident all local airfields were closed, as were their respective met offices. The Police Air Support Unit (ASU) which responded to the accident reported excellent visibility, no low cloud and that there was a bright, almost full moon. The wind was easterly at about 12 kt. The road at the accident site stood out clearly from the surrounding terrain.

Personnel information

Pilot A: A Commercial Pilot's Licence issued to Pilot A by the state of Mexico was recovered from the wreckage. The Mexican authorities reported that the pilot's licence was renewed by practical examination in February 2006 and this revalidation expired in February 2008. He held multi-engine and instrument ratings as well as a Lear Jet series 20 type rating. Other details of his experience were not available. A flight plan recovered from the aircraft, for a flight to XFQC, named him as the Pilot in Command.

Pilot B: Pilot B held a Commercial Pilot's Licence issued by the state of Columbia in 1976. No other details of his qualifications or experience were available.

Pathological information

Post-mortem examinations conducted on behalf of the Cayman Island's Coroner revealed that both pilots had received injuries during the accident that would have been immediately fatal. Toxicology results for Pilot A were positive for the presence of Cocaine Metabolites with associated compounds and Chlorphenamine, a substance commonly used in anti-histamines. Pilot B's results were negative.

Aircraft details

The recent history of the aircraft could not be established in any detail, although some documentation was found in the wreckage. This included a Certificate of Airworthiness, issued on 17 October 2010, valid to 18 October 2012 and newly issued engine and airframe log books. The latter contained a 'Revalidation' Inspection stamp dated 19 October 2011, with total airframe hours of 2,404. An earlier stamp, dated 22 May 2010, indicated that the aircraft had been repaired following an accident. The engine log book also contained Inspection stamps dated 22 May 2010 indicating that both the engine and propeller had been overhauled. There were 'Revalidation' Inspection stamps for these components, dated 19 October 2011, indicating that both engine and propeller had achieved 22 operating hours since overhaul. There was no documentation relating to operation of the aircraft after this date, or any entries detailing actual flights.

The aircraft serial number was found on the left door frame. Reference to the aircraft manufacturer revealed that the aircraft was constructed in 1981 and registered in the USA. It was deregistered in the USA in September 2003 and was registered in Mexico in September 2009. No records of the period 2003-2009 were located.

The aircraft fuel system had been the subject of a significant, amateur modification that added approximately 600 litres (158 US gals), which is described in the 'Detailed examination of wreckage' section of this report. In addition, the wing tips had been extended to include additional fuel capacity. No obvious manufacturer's details were observed on the components, although the installation appeared similar to a modification kit that is commercially available as an FAA Supplemental Type Certificate (STC); this adds

approximately 16 gals (US) per side. The total fuel capacity of the aircraft would probably have given it a range considerably in excess of 2,500 nm.

Documents recovered from the aircraft

Relevant documents recovered from the aircraft included:

- A receipt from Guadalajara Airport, Mexico dated on the day of the accident.
- An arrival report at Chetumal Airport, Mexico, dated the day of the accident at 2035 hrs, stating that the aircraft had arrived from *'FQC'*.
- A handwritten ATC flight plan from Chetumal Airport, Mexico to *'XFQC'*. The flight was estimated to take 50 minutes and the aircraft was reported to have four hours endurance. XFQC is not a recognised ICAO code and the letter X is not issued by ICAO. The flight plan included the route *'CTM DCT FQC*[1]*'*. FQC is not a recognised navigation aid.

The Mexican authorities suggested that FQC could have been mistakenly entered instead of FCQ a staffed airfield in south-east Mexico. However, their enquiries found no record of the accident aircraft having visited that airfield in November 2011. Further enquiries with four other staffed airfields in this area found no records of any visit by the accident aircraft.

Recorded data

No radar or RT recordings were available.

Two Garmin 495 GPS units were recovered from the aircraft wreckage. Both had sustained significant damage during the accident and would not power up normally. When recovered, one GPS (GPS A) had a battery pack attached, and other (GPS B) did not. No other battery pack was located in the wreckage. However, a Garmin cigarette lighter adaptor cable was recovered which could have enabled GPS B to be plugged directly into the aircraft's electrical power supply.

Following recovery to the AAIB's facilities at Farnborough both GPS units were downloaded. GPS A had an Active Route selected to a location in Venezuela near its border with Columbia. GPS B had an Active "GO TO" selected to a point mid way between Jamaica and the northernmost point of Columbia. It also contained a track log. The relevant sections of the track log commenced at Chetumal Airport, Mexico, crossed the border to Belize where the aircraft appeared to land, though not at the location of any known airfield, before departing to the east across the southern Caribbean Sea. This track log terminated at 0202 hrs, at a point 196 nm south of Cayman Brac when either power to the GPS or a satellite signal was lost. Figure 1 is a screen dump taken from GPS B of the map page which would have been available at the time of the power/signal loss. This page also shows the track. The recorded altitude at this point was 8,450 feet amsl. The end of the track log was 300 nm short of the Active "GO TO" point which is just visible on the lower right edge of Figure 1.

Footnote

[1] This indicates an intended route from Chetumal direct to *'FQC,'* a position that was not identified by the investigation.

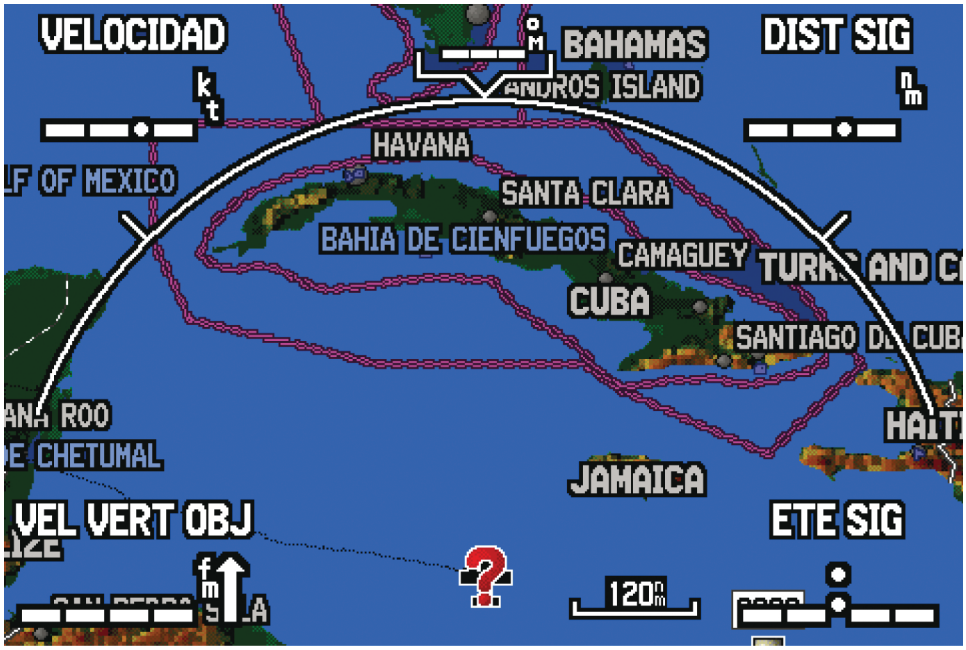

Figure 1

GPS map display showing track (thin black line at bottom left) to the point where power/signal was lost (indicated by question mark). (Note Cayman Islands are not displayed)

Accident site details

The accident site was immediately adjacent to an isolated straight road approximately 28-30 ft (8.5-10 m) wide that had been built in preparation for proposed residential development. (The wingspan of a standard Cessna 210 is 36 ft 9 in.) A line of substantial wooden telephone/power cable poles had been installed at approximately 70–80 m intervals along the southern edge of the road, which was orientated approximately east to west. Evidence suggested that the aircraft had attempted to land westbound along the road. The ground each side of the road was covered with dense vegetation consisting of bushes, cacti and small trees growing out of a rough, frangible limestone base. The nature of the terrain was such that smaller pieces of wreckage were not found.

Accident site

The first evidence of aircraft contact with a ground-based obstacle was a light scuff on one of the wooden poles, approximately 8 m above the base. A small fragment of fibreglass from the left wingtip was found on the road nearby. It was apparent that the left wing had subsequently struck a number of trees to the left of the road, resulting in pieces of wing structure breaking away. Approximately 140 m from the initial contact there had been a major impact with another pole, most probably on the nose of the aircraft. This had caused major disruption to the airframe, and was probably responsible for the severity of the injuries sustained by the crew. The impact had resulted in the top half of the pole snapping off, coming to rest approximately 10 m further down track. The disposition of the wreckage, together with the damage to the vegetation, indicated a steepening left bank angle that resulted in the aircraft performing a cartwheel before coming to rest in an upright attitude, pointing approximately 90º to the right of its impact track.

The aircraft had been carrying ten 60-litre detergent containers that held varying amounts of Avgas fuel; these were found in the aircraft cabin and in the immediate vicinity. In addition, lengths of flexible hose and quick-release couplings, originating from the wing roots, protruded from the cabin roof.

The major impact with the pole had resulted in the engine becoming detached and the propeller hub sustaining extensive damage. Only one of the three propeller blades had remained attached to the hub. Another was found earlier in the wreckage trail close to the telegraph pole and the third was not recovered. The furthest flung piece of wreckage was the right wing tip, with its integral fuel tank, which was found some 20-30 m beyond the main wreckage site. The vegetation nearby displayed the staining/withering effects of exposure to gasoline, indicating that the tank contained fuel at the time of the accident.

In general, the extent of the wreckage trail combined with the severity of the damage to the aircraft indicated a moderate speed (ie above stall speed) with the engine developing power.

The wreckage was gathered up during 16-17 November 2011 and taken to a secure part of a local dockyard, where it was examined further by the investigating team.

Detailed wreckage examination

The row of seats behind the pilots had been removed in order to accommodate the 10 plastic containers of fuel in the cabin. Three containers were ruptured and were empty; another was damaged but still contained approximately 12 litres. One was nearly full, containing an estimated 50 litres, with the remainder containing smaller amounts. The total fuel recovered was around 126 litres. The containers were fitted with screw caps, with pieces of polythene sheeting inserted into them, perhaps in an attempt to improve sealing or to minimise the escape of fuel vapour. A photograph of the fuel containers, taken after they had been removed from the wreckage, is shown in Figure 2.

The lengths of hose were attached to an electric fuel pump mounted within the structure of each wing root; the pump outlets were connected to the wing tanks. The two motors were identical, with the data plates indicating

Figure2

Fuel containers carried in the aircraft cabin

that they were 24 volt DC units. The associated wiring was traced to the rear of the instrument panel, where the left and right pumps were connected to the 'FLOOD LITES' and 'PITOT HEAT' rocker switches respectively. After removal from the aircraft the pumps were connected to a 24 volt supply and appeared to operate. The other ends of the hoses terminated in the cabin area, where another, unattached length of hose was found. This may have served as an extension to enable it to reach the furthermost container. The investigation concluded that the modified fuel system enabled the fuel carried in the cabin to be pumped into the wing tanks during flight by operating the 'FLOOD LITES' and 'PITOT HEAT' switches on the instrument panel, the labelled functions of these switches having been disabled. Once the plastic containers had been disposed of, the hoses could be concealed behind the headlining of the cabin roof, giving the appearance of a standard aircraft.

An electrically operated screwjack-type flap actuator was located in the underside of the left wing. The position of the nut on the threaded jack-screw indicated that the flaps were in the retracted position at impact; this was verified with the aid of advice received from the aircraft manufacturer. The flap operating lever, however, was found in the flaps fully down position. The adjacent position indicating needle indicated '10º', although this was not considered reliable because its associated linkage had been disrupted during the impact and could be moved freely.

The front left cylinder head on the engine had broken off during the impact. The remaining part of the cylinder was removed and the piston and bore were noted to be in good condition. There was a large quantity of oil around the engine generally, including within the filter, and it was concluded that the engine was in good condition. This accorded with the limited documentation, which indicated a recent overhaul, with the Hobbs meter indicating 18 hours of operation. The manifold valve was removed and the internal fuel screen was noted to be clear of debris. The propeller control unit, located on the forward left side of the engine, had broken off and was not recovered. The turbocharger had broken open, with significant damage being observed on the impeller blades and the associated shroud; this was considered to be an indication of the engine developing power at the time of impact.

The landing gear was found to be down when the wreckage was lifted. After being placed on the ground, the main landing gear legs appeared to engage with their uplocks and did not subsequently hang down again when the fuselage was next lifted. This suggested that the gear had been extended at the time of the accident. The cabin area was too badly disrupted to determine whether the emergency landing gear handle had been used.

The aircraft battery had been thrown clear of the main wreckage and was substantially damaged. What appeared to be a date, 20/05/2010, was written in permanent ink on top of the battery; this was around the time of the log book Inspection stamps and may be an indication of a capacity check conducted at that time. The alternator, located at the front of the engine, had broken up on impact; its drive belt was not recovered or identified. The aircraft had a solid state alternator regulator; this was damaged and was removed for subsequent testing.

Inside the cockpit, rocker switches that had not been damaged were found in the OFF position. Photographs provided by the police, taken on the night of the accident, showed the battery master/alternator switches at their OFF positions, and the magneto switch selected to BOTH. The panel lighting rheostats were in the DIM positions.

Many of the circuit breakers, particularly those from the right side of the instrument panel, were missing,

including the 60 amp Alternator Breaker. None of the remaining circuit breakers, which included the 5 amp Alternator Regulator circuit breaker, were found to have tripped.

The left and right cabin doors were of slightly different designs. Both doors had sustained damage to their leading edges, resulting in the hinges breaking off. The latches, at the rear of the doors, were noted to be in relatively good condition and the doors were probably closed at impact.

Subsequent testing

When the alternator regulator was tested in an avionics workshop, a short circuit occurred immediately after power was applied. A detailed examination of the unit was not possible because, as is typical for this type of component, the circuitry had been encased in potting resin at manufacture. The resin, intended after setting to protect the components against moisture and vibration, renders them subsequently inaccessible. However, it was noted that a component, possibly a resistor or capacitor, partially protruded from the resin and had been severely distorted as a result of having been crushed by the metal casing, which had been damaged in the accident sequence. It was not possible to assess the pre-impact condition of the component, which may have been responsible for the failure of the regulator to function.

Analysis

There was insufficient evidence to determine the purpose of the flight, but there were indications that it was intended to be clandestine, including the modified fuel system, the intended route and the unidentified flight plan destination.

The recovered documents and GPS data indicated that the aircraft had previously departed Guadalajara for a flight to Chetumal, Mexico; a great circle distance of approximately 858 nm. This was within the theoretical range of a standard Cessna 210 and appears to have occurred without incident, arriving at 2035 hrs. The crew filed a flight plan for an unidentified destination then departed, initially to the north before turning south and crossing the border into Belize. The aircraft landed briefly at an improvised airstrip, then departed and flew east for some 490 nm, at which point the GPS track ended. If GPS B was powered solely by the aircraft electrical supply then a failure of the electrical system could result in the recorded track ending in the manner found. Equally, the GPS could have been deliberately or inadvertently unplugged.

The reason for the deviation from the original track was not determined. However, there was evidence of failure of the electrical system, which would have affected navigation instruments and prevented use of additional fuel carried in the cabin. The crew may not then have been confident either of maintaining their original course or of having sufficient fuel to complete their intended journey. They may have decided instead to follow a northerly route towards the large landmass of Cuba. Thus, the aircraft's arrival at Cayman Brac may have been a coincidence. It is possible that the straight road, which according to the ASU would have been clearly visible in the moonlight, appeared to present an opportunity for a forced landing and an alternative to continuing the flight. The unsuitability of the road as a landing site suggests it was not the planned destination and it is more likely that the landing was attempted following problems with the aircraft or crew.

It was not possible to establish the cause of any electrical failure due to the general disruption to the aircraft and some components not being recovered, but there was evidence that one might have occurred.

The electrically operated flaps were found in the retracted position, whilst the flap selector was found in the fully down position, as would be normal practice for landing. The landing gear, which also required electrical power for extension, could have been extended using the emergency, manually operated, system.

Other items of electrical equipment, such as the anti-collision beacon and lights, had been switched off. The battery master/alternator switches might have been turned off in preparation for a forced landing, but there would be no need to turn switches off separately for these other services. Their positions as found, and the absence of radio calls, might indicate attempts earlier in the flight to shed electrical load, or an intention to remain unobserved.

Witness evidence indicates that the aircraft crossed the coast of Cayman Brac to the west of the accident site, heading north. The fact that no-one reported hearing an aircraft further north or east suggests that the aircraft did not continue far beyond that point before turning downwind, and commencing its approach to land. One ear witness report of engine noise was consistent with the aircraft making an approach to the road; the subsequent increasing engine note indicated an attempted go-around. Either before or during the go-around the aircraft struck the first pole, resulting in loss of control and the subsequent impact.

Despite the large quantity of fuel on board, there was no post-impact fire. Common ignition sources in aircraft accidents are fuel splashing onto hot engine exhausts, and sparks arising from disruption of the electrical system. In this case, the aircraft's impact with the pole resulted in the engine and exhaust detaching and coming to rest away from the main wreckage. A serviceable battery might have generated sparks during the impact; an exhausted battery would have had little or no capacity to do so.

Conclusion

The aircraft probably suffered an electrical failure which prevented use of the modified fuel system intended to provide additional range. The aircraft then deviated from its original flight path, possibly because the crew intended to divert to Cuba, and its track passed over Cayman Brac. Evidence indicates that the pilot attempted to land on a road. The aircraft was destroyed when it encountered obstacles, including poles, beside the road.

The manner of operation of this aircraft, including extended flights over water and the modified fuel system, introduced risks to the flight of which the crew must have been aware. No Safety Recommendations were made.