

Piper PA-31 Navajo, G-ILEA

AAIB Bulletin No: 11/2003	Ref: EW/A2003/05/01	Category: 1.2
Aircraft Type and Registration:	Piper PA-31 Navajo, G-ILEA	
No & Type of Engines:	2 Lycoming TIO-540-A2C piston engines	
Year of Manufacture:	1978	
Date & Time (UTC):	18 May 2003 at 2046 hrs (local time -4hrs)	
Location:	54 miles west of Barbados	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - 1
Injuries:	Crew - 1 (Missing)	Passengers - 1 (Missing)
Nature of Damage:	Aircraft lost at sea	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	56 years	
Commander's Flying Experience:	390 hours (approx) (of which 70 hrs (approx) were on type)	
	Last 90 days - unknown	
	Last 28 days - 1.6 hours	
Information Source:	Air Accidents Investigation Branch Field Investigation	

Synopsis

The aircraft was on a flight from Canouan, a small island in the St Vincent group, to Barbados. Shortly after entering Barbados airspace, radar recordings show the aircraft deviated to the south of a direct easterly track to Barbados and descended from cruise flight level (FL) 55 to an altitude of 2,300 feet. The aircraft levelled at 2,300 feet and resumed an easterly track for about six minutes before once again deviating to the south and commencing a further descent. About 16 minutes after the aircraft's initial descent from FL55, the pilots of a commercial aircraft flying from Grenada to Barbados relayed a MAYDAY call from G-ILEA to Barbados Arrivals reporting that the pilot "had lost one engine; it appeared he was losing fuel and he doubted that he would be able to make it to Barbados". Some three and a half minutes after the initial MAYDAY call, the pilot of the commercial aircraft relayed a further message stating that the pilot intended to ditch. The final radar return for the aircraft showed it at an altitude of 600 feet about 55 miles on the 259° radial from Barbados Airport. Despite an extensive search and rescue operation, no trace of the aircraft or its two occupants was found. A reconciliation of fuel receipts and flight times shows that, at best, the aircraft would have been short of fuel for the flight, and at worst could have run out of fuel.

History of the flight

The pilot and owner of G-ILEA planned to fly with his wife, stepson and fiancée from Barbados, where the aircraft was kept, to the small island of Canouan for Sunday lunch at an hotel. On the

morning of the planned flight the pilot's stepson and fiancée cancelled their trip, but the pilot and his wife continued with their plan and set off for the airport from their home in the north of Barbados in the late morning.

On arrival at Grantley Adams International Airport the pilot and his wife proceeded to the local flying club on the south side of the airfield where the aircraft was normally parked. As Customs and Immigration clearance could only be completed at the passenger terminal on the north side of the airfield, the pilot started the aircraft and taxied across the main runway to the terminal. Whilst taxiing, Barbados ATC allocated the aircraft a parking position on the western end of the apron near refuelling facilities, but the pilot stated that he was "running late" and he requested, and was granted, a parking position closer to the passenger terminal entrance. Having completed the immigration formalities the aircraft started up again and took off for Canouan at 1628 hrs. The hotel manager in Canouan remembered receiving two telephone calls from the pilot that morning. In the first he requested a table for lunch at 1630 hrs and sometime later in a second telephone call he stated that he was running a bit late and would not arrive until around 1700 hrs.

The aircraft arrived at Canouan after an apparently uneventful flight. Before travelling to the hotel, the pilot visited the ATC control tower where he filed a flight plan for the return flight to Barbados on which he declared an endurance of two hours. During his visit to the tower he also paid his landing fee and, during a brief conversation with the ATC controller, he asked if fuel was available at the airfield. Having been advised that there was no AVGAS and only a limited amount of jet fuel available, the pilot departed for the hotel without further comment.

The pilot and his wife arrived back at the airfield later that afternoon and proceeded direct to the aircraft. An eyewitness recalls that they both boarded the aircraft immediately and shortly thereafter the engines started, although there seemed to be some difficulty starting the right engine. The ATC controller recalled that the aircraft sat on the ramp with engines running for an unusually long time after starting engines. Before departure ATC asked the pilot on the radio for his fuel endurance to which the pilot reportedly replied "two and a half hours".

The aircraft took off at 2001 hrs and, in accordance with normal procedures, the pilot changed RTF frequency to Joshua (an airfield on a small island to the north of Canouan) control tower. Joshua ATC asked the pilot to report at the boundary with the Barbados FIR which is about 30 miles from Canouan. At 2018 hrs the pilot was advised to contact Barbados Arrivals. There were no other radio exchanges between the pilot and Joshua ATC, and the controller considered the departure from Canouan and flight through Joshua's airspace to be routine in every respect.

On changing to Barbados Arrivals RTF frequency the pilot stated that he was 81 miles to the west of Barbados at FL55 and estimated his arrival at Barbados at 1706 hrs local (2106 UTC). This was the only complete transmission between the aircraft and Barbados.

Barbados radar first recorded contact with the aircraft during the climb from Canouan, and showed that the aircraft levelled off at FL54 and that it established a cruise at a groundspeed of 100 kt. Some three minutes after entering the Barbados FIR the radar recorded that the aircraft turned on to a southerly track and descended. It descended at about 400 feet per minute for about eight minutes before it levelled at about 2,300 feet and turned back on to an easterly track. Six and a half minutes later the aircraft descended to 1,900 feet and turned on to a roughly south-easterly track. The aircraft maintained 1,900 feet for about two minutes before recommencing the descent until radar contact was lost.

At 2038 hrs, some 16 minutes after the aircraft first deviated from its track toward Barbados, the pilots of a commercial flight inbound to Barbados from Grenada heard a MAYDAY call from G-ILEA. Barbados ATC were unable to receive the MAYDAY transmission due to the emergency aircraft's range and low altitude, and they requested a relay from the crew of the commercial flight. It took several radio exchanges between the commercial crew and the pilot of G-ILEA before all the details of the emergency were understood. However, at 2040 hrs the commercial crew relayed the MAYDAY call in which they stated that the pilot of G-ILEA "had lost

one engine; it appeared he was losing fuel and he doubted that he could make Barbados". Whilst this message was being relayed, recordings of the Barbados Arrivals RTF frequency picked up a breakthrough transmission made by the pilot of G-ILEA in which can be heard "...FUEL.....GOING TO HAVE TO DITCH IT HERE".

The final radar return from G-ILEA was received at 2043 hrs, at which point the aircraft was on the 259° radial at 54.76 miles from Barbados at an altitude of 600 feet. An immediate search and rescue operation was launched, but no sign of the aircraft or its occupants was discovered. The search was called off after 74 hours.

Meteorological information

An aftercast issued by the Meteorological Office shows no significant weather for the period of the flight in either Barbados or the Grenadines. The wind at cruise altitude over the sea to the south west of Barbados was reported as 110°/20 kt.

Pilot's flying experience

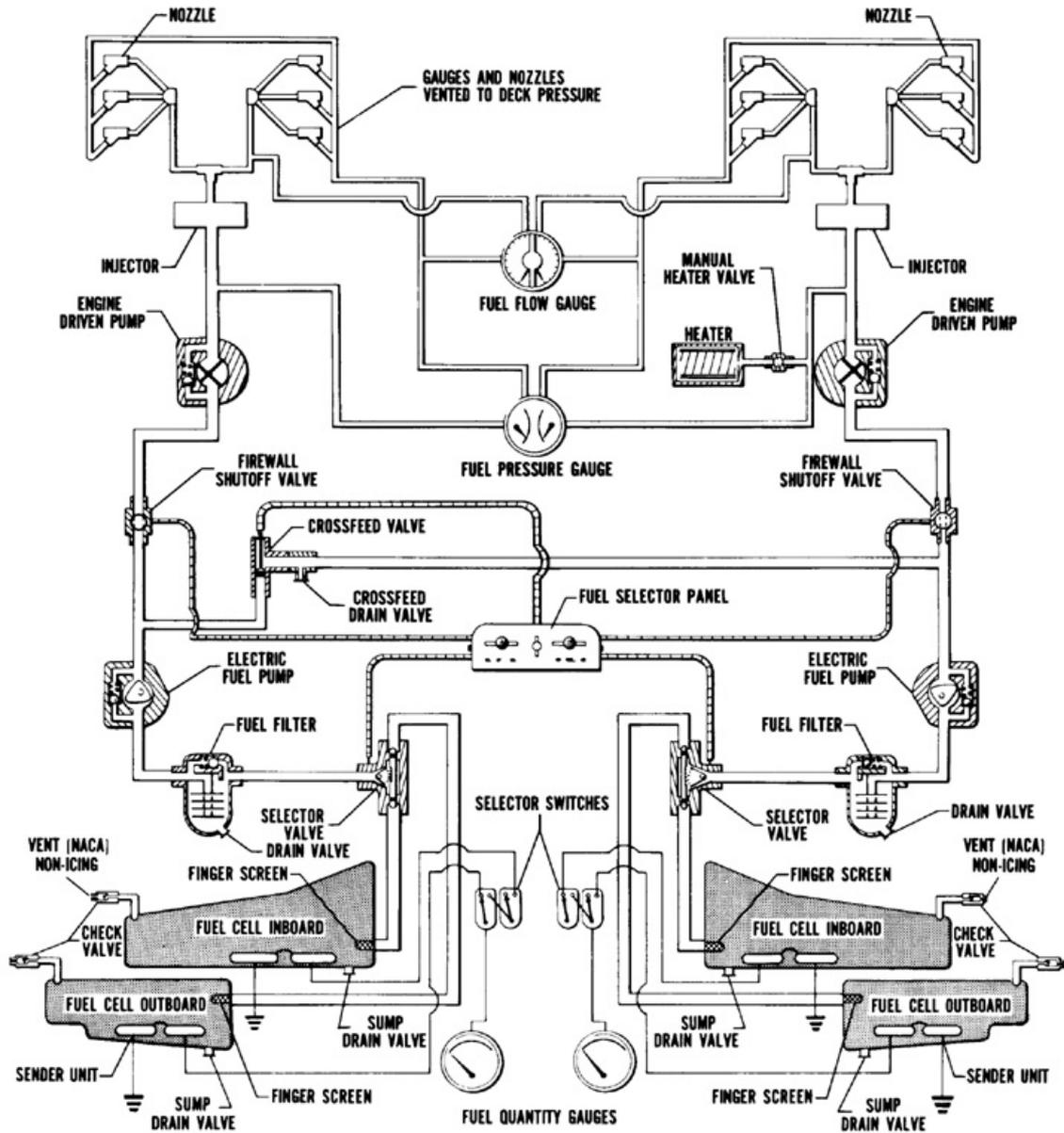
The pilot's flying licence and logbook have not been traced and are assumed to have been lost with the aircraft. However, an idea of the pilot's experience and training has been obtained from CAA records and evidence from various witnesses.

It is reported that the pilot underwent flying training in the USA in the early 1980s. He obtained a UK Private Pilot's Licence with a Single Engine Piston (Land) class rating in April 1981, but seems to have given up recreational flying in the mid-1980s. In June 2000 he underwent a series of training flights to revalidate his licence and rating. He continued his training over the next two years and obtained a Multi-Engine Piston (Land) class rating, a Night Qualification and an IMC Rating. A year before the accident the pilot declared, for insurance purposes, a total of 373 hours of which 100 hrs were on multi-engined aircraft with 50 of these hours on the Piper Navajo.

In late 2001 the pilot purchased G-ILEA and it was flown to Barbados in May of the following year. The accident pilot flew on some of the transatlantic sectors and his instructor recalls discussing ditching procedures with him before the flights.

Since its arrival in Barbados the aircraft had been used primarily for short pleasure flights around the eastern Caribbean. Anecdotal evidence indicates that the pilot was not in the habit of making detailed fuel plans for these short flights. Instead he relied on an assumption that the aircraft had seven hours endurance with full tanks, and he deducted his flight time since the aircraft was last filled to give an estimate of fuel on board. A witness reported a previous incident involving the accident pilot in which both engines failed due to fuel starvation shortly after landing from a landing gear down ferry flight from Barbados to Antigua.

Aircraft Fuel System, Figure 1



Fuel is stored in four bladder type tanks in inboard and outboard cavities within each wing. Selection of the fuel supply to the engines is made via a fuel selector control panel located between the two pilot seats. The fuel selector, for each engine may be set to either inboard or outboard tanks, and the fuel from the selected tank is then supplied to the engine. The engine fuel supply may be interconnected by a crossfeed valve which, in an emergency, allows fuel from one side to be used by the engine on the opposite side. This aircraft was also fitted with nacelle tanks from which the fuel can be transferred into the inboard tanks by gravity feed. Each inboard tank has a capacity of 56 US gallons and each outboard tank has a fuel capacity of 40 US gallons. Each nacelle tank holds 27 US gallons.

There are three fuel drains on each wing, one at the bottom of each of the outboard and inboard tanks and one located on a pipe at the base of the fuel filter in each engine compartment. There is an

additional fuel drain located at the crossfeed valve under the left wing. The accident pilot's business partner recalled that the left inner fuel drain had a tendency to stick open after use.

Two fuel contents gauges, one for each side, are mounted on the instrument panel and are connected to their respective fuel selector, such that each gauge displays the selected tank contents as a proportion of its full capacity. Thus there is no quantitative indication of fuel contents; the pilot must relate the indicated proportion to the capacity of the tank selected in order to calculate fuel remaining. The contents of each tank can only be checked by the appropriate selection of that tank.

Maintenance details

The aircraft was maintained under a UK CAA authorisation by a maintenance organisation in Antigua. It had last visited for a 50 hour check in March 2003. There had been some history of rough running on the left engine, an ignition fault was found and one of the magnetos replaced. The left and right outer fuel drains were also replaced as they did not close correctly due to corrosion. The engineer who was familiar with the aircraft noted that large amounts of water were regularly found in the tanks when the fuel drains were operated. He concluded that this was caused by condensation, as the tanks were not kept full while the aircraft was parked for long periods of time. He recalled that, prior to accompanying the aircraft on the positioning flight to Antigua for the last maintenance check, he operated the fuel drains for some time to ensure all the water had been drained.

The right inboard fuel cell was replaced in August 2002 after a leak was found. At the last maintenance visit the aircraft had flown 4321.57 hours.

Fuel reconciliation

Records of aircraft flight time and fuel loads were on board the aircraft when it disappeared and have therefore not been recovered. However, by using the information contained on ATC flight progress strips, refuelling receipts and witness information, it has been possible to calculate the likely amount of fuel on board for the accident flight.

The aircraft was privately owned and was flown by a very small group of pilots that included the accident pilot, his business partner and a few instructor pilots. During the month preceding the accident only the accident pilot and his business partner had flown the aircraft on a total of eight flights. The business partner had flown the aircraft on five of these flights and had refuelled the aircraft twice. The five flights included two return flights to Canouan and a local sightseeing flight around Barbados. Importantly, the business partner recalled filling both the inner and outer tanks before the first flight in the series on the 19 April 2003. The remaining three flights, which included one local flight around Barbados and a return flight to Crown Point, Tobago, were undertaken by the accident pilot on the 7 and 10 May. The flight to Tobago was made with a total of five people plus baggage on board and the pilot refuelled the aircraft with 66 US gallons. This was placed in the inner tanks only prior to the flight.

During the eight flights there was at least one occasion where the aircraft was known to have spent an above average amount of time with engines running after start. A test on an aircraft of a similar type was therefore conducted to determine fuel consumption during taxi and when at low power on the ground. The business partner advised that it was their normal practice to cruise at 160 kt IAS with the fuel mixtures leaned to give a fuel consumption of about 32 US gallons per hour. Using this information plus the Pilot's Operating Handbook (POH) fuel consumption figures for start up, taxi, takeoff, climb and descent, it was possible to develop an indication of how much fuel was on board for each flight.

Calculations based on the above data indicate that there would have been approximately 81 US gallons of fuel on board before the aircraft departed for Canouan on the 18 May. Based on the same data the two previous return flights to Canouan in the series used 67 US gallons and 72 US gallons. Thus although there would appear to have been sufficient fuel on board, the margins would have been very slim.

However, there are two factors that make it possible that there was less than 81 US gallons on board when the aircraft departed for Canouan. First, it has been assumed that the cruise fuel consumption of 32 gallons per hour applied to the two local flights around Barbados. These flights were flown as sight seeing trips at 1,500 feet altitude around Barbados Island and it is unlikely that the pilots would have had time to establish cruise flight with fuel flows accurately set. It is possible therefore that fuel consumption for these trips was considerably greater than the calculations have assumed. Second, the accident pilot refuelled the inner tanks with 33 US gallons each side before the Tobago flight. Calculation of the likely fuel distribution prior to this refuelling reveals that each inner tank should have had the capacity to take only 24 US gallons. This would tend to indicate that the inner tanks had been used to a greater extent than assumed or that fuel consumption was greater than assumed or a combination of both. Furthermore there is some variation in witness evidence on fuel consumption, and it is possible that 32 US gallons per hour is a conservative assumption. In any event, the assumed consumption would depend on the mixtures being set accurately immediately the aircraft reached cruise level and climbs and descents being flown exactly in accordance with the POH.

Survival aspects

The aircraft was fitted with three exits that could have been used in a ditching. The cockpit left side window is designed to provide convenient access to the cockpit when the cabin area is loaded with cargo but can also be used as an emergency exit if required. On the right side, the window aft of the co-pilot's seat is a combination window and emergency exit, and a large, two piece cabin entrance door is located aft of the wing trailing edge of the left side. This too is available for emergency use.

The aircraft carried sufficient life jackets for a full complement of crew and passengers and these and a life raft were located to the rear of the cabin entrance door. The life raft had a static line that should have been attached to the fuselage near the cabin entrance door. The line is designed to prevent the raft from drifting away from the aircraft before the passengers are able to board, but it had been detached during a recent Customs and Excise search of the aircraft and apparently had not been re-attached. Both the pilot and his wife were able to swim.

At the time of the accident a large Naval and Coast Guard exercise was in progress in the waters near Barbados. The first emergency call was relayed to the Barbados Coast Guard at 2045 hrs and the first surface vessels were deployed at 2105 hrs. Naval and coastguard vessels from five different countries were deployed as well as a number of private vessels, aircraft and helicopters. The search continued for 74 hours and covered an area of approximately 3,040 square nautical miles, but no trace of the aircraft or its occupants was found.

The POH for the accident aircraft did not contain an emergency checklist for ditching. Handbooks for similar twin engine types made by other manufacturers contain a checklist and general advice on ditching, although the advice is based on the manufacturer's best judgement rather than information derived from ditching trials. Appendix 1 to JAR-OPS 1 requires that public transport operators include an emergency procedure for ditching. This requirement would not have applied to G-ILEA, which had a Private Certificate of Airworthiness.

Discussion

No trace of the aircraft or its occupants has been discovered and the lack of any wreckage makes it difficult to come to firm conclusions on the cause of this accident. The reported pilot's statement from the relayed MAYDAY transmission that "it appeared he was losing fuel" points to some problem with the fuel system, but there was no indication on how the pilot came to this judgement. A rupture in a fuel tank or a leak from one or more of the aircraft's fuel drains would have been difficult or impossible to detect visually from the cockpit. Loss of a fuel filler cap may have resulted in loss of fuel. However, the relatively low fuel level in the tanks would probably have limited or precluded such a loss and since the caps on both sides are visible from the cockpit it might be expected that the pilot would have stated the problem in his emergency call. Alternatively, the pilot's assessment that he was losing fuel may have been based simply on a perceived rate of change of fuel contents on the

fuel gauges. Indeed the reported use by the pilot of the phrase "appears to be losing fuel" may point to some uncertainty on the matter or that there was no physical evidence of fuel loss.

The two sides of the fuel system are independent and in the event of a fuel leak from one side the aircraft should have been able to maintain altitude and continue to Barbados using the operative engine and the fuel remaining in its associated tanks. It is theoretically possible that a leak in a critical area followed by the opening of the crossfeed valve could have led to the loss of all fuel on board. There is little supporting evidence for this, although it is not possible to dismiss such a scenario.

Apart from corrosion problems with some of the aircraft's fuel drains there is no indication in the engineering records of any previous defect that might account for a loss of fuel. Although the pilot's business partner recalled a problem with the left inner fuel drain, the outer fuel drains had been replaced during recent servicing and there is no evidence that fuel had leaked from the aircraft whilst it was parked in Canouan.

There is conflicting evidence relating to the pilot's fuel planning. On departure from Barbados he was "running late" and his request to park close to the terminal and away from the normal refuelling stands indicates that he had decided not to refuel before leaving Barbados. Although he had visited Canouan previously with his business partner, it is not clear if he was aware prior to departure that AVGAS was not available. His question of the ATC controller at Canouan regarding fuel availability may have been prompted by a desire to refuel but the unexplained extended period of time on the ground after engines start is not consistent with a concern about fuel quantity. Moreover, if the pilot had real concerns about whether there was sufficient fuel to reach Barbados, it is difficult to understand why he did not enquire about making a refuelling stop on the return flight or at least turn back toward Canouan when the first engine is assumed to have failed. On the other hand the radar data indicates that the pilot was not using his normal cruise speed for the return journey, and this may be accounted for by a desire to save fuel.

Evidence from radar recordings indicates that the aircraft deviated from a direct track to Barbados and started to descend just after entering the Barbados FIR. It is possible that the descent was prompted by a desire to find less severe headwinds. However, although the aircraft should have been able to maintain FL55 with one engine inoperative, it seems more likely that the combination of a turn on to south and the descent was indicative of the loss of at least one engine, especially since the pilot referred to loss of an engine in his MAYDAY call. The fact that the aircraft eventually levelled off at 2,300 feet is evidence that at least one engine was operating at that stage.

The fuel reconciliation conducted during this investigation provides an approximation of the fuel on board at the start of the accident flight. Unfortunately various unknown factors including the mixture leaning technique used and precise information on how the aircraft was operated make it impossible for the calculations to be exact. There are, however, indications that the consumption assumptions might be quite conservative, and the reconciliation makes it clear that, at best, the aircraft would have been very short of fuel on arrival at Barbados. At worst, the aircraft could simply have run out of fuel, and any fuel leak would have worsened an already critical fuel situation.

It is impossible to know whether the availability of a suitable checklist might have had an effect on the outcome of the ditching; however, there would appear to have been ample time to refer to a checklist had one been available. The POHs for other similar types have ditching checklists, and JAR OPS requires commercial operators of the Navajo to have a ditching checklist in their operating manuals. The following recommendation is therefore made:

Safety Recommendation 2003-77

It is recommended that New Piper Aircraft Ltd develop advice on ditching and ditching checklists for inclusion in the Aircraft Flight Manuals and Pilot Operating Handbooks of the PA-31 and other Piper types.