SOUTH AFRICAN CIVIL AVIATION AUTHORITY

Section/division **Accident and Incident Investigation Division** Form Number: CA 12-12a

AIRCRAFT ACCIDENT REPORT AND EXECUTIVE SUMMARY

				Reference:	CA18/2/3/8346		
Aircraft Registration	**ZS-MNJ**	**Date of Accident**	8 August 2007		**Time of Accident**	1550Z	
Type of Aircraft	Piper PA-34-220T (Aeroplane)		**Type of Operation**		Private		
Pilot-in-command Licence Type		Private	**Age**	47	**Licence Valid**	No	
Pilot-in-command Flying Experience		Total Flying Hours	453,3		Hours on Type	Unknown	
Last point of departure	Lanseria Aerodrome (FALA), (Gauteng Province)						
Next point of intended landing	Rand Aerodrome (FAGM), (Gauteng Province)						
Location of the accident site with reference to easily defined geographical points (GPS readings if possible)							
25 Wingfield Avenue, Birdhaven, Johannesburg. GPS co-ordinates: S26°08.422' E028°03.209'							
Meteorological Information	Surface wind: 020°/3 kt; Temperature: 12°C; Dewpoint: 1°C; Visibility: > 10 km						
Number of people on board	1 + 1	**No. of people injured**	1 + 1	**No. of people killed**	0		

Synopsis

The pilot, accompanied by a passenger, was on a private flight from Lanseria Aerodrome to Rand Aerodrome. While they were flying at approximately 6 500 ft above mean sea level over a residential area, the engines lost power and the aircraft began losing height. A witness on the ground who saw the aeroplane heard the engines "spluttering and stalling".

The pilot tried to perform a forced landing on a golf course dead ahead of them, but was unable to reach it and came down in the garden of a private home. The left wing struck two small trees, and about 20 m further on, the aircraft collided with an entertainment area and a large tree. The pilot was flung from the wreckage by the impact while the passenger was trapped inside the aircraft and had to be freed by rescue personnel using the jaws of life.

Both occupants were seriously injured and were taken to hospital, where they underwent surgery. The aircraft and entertainment area were destroyed.

Probable Cause

Unsuccessful forced landing after the aircraft was unable to sustain height due to an engine failure in flight.

IARC Date		Release Date	

AIRCRAFT ACCIDENT REPORT

Name of Owner	**:** Pleasure Air Partnership
Name of the Operator	**:** Pleasure Air Partnership (Private)
Manufacturer	**:** Piper Aircraft Corporation
Model	**:** PA-34-220T
Nationality	**:** South African
Registration Marks	**:** ZS-MNJ
Place	**:** Birdhaven, Johannesburg
Date	**:** 8 August 2007
Time	**:** 1550Z

All times given in this report are Co-ordinated Universal Time (UTC) and will be denoted by (Z). South African Standard Time is UTC plus 2 hours.

Purpose of the Investigation

In terms of Regulation 12.03.1 of the Civil Aviation Regulations (1997), this report was compiled in the interest of the promotion of aviation safety and the reduction of the risk of aviation accidents or incidents and ***not to establish legal liability****.*

Disclaimer

This report is produced without prejudice to the rights of the CAA, which are reserved.

1. FACTUAL INFORMATION

1.1 History of Flight

1.1.1 On 5 July 2007, ZS-MNJ was refuelled with 200 litres of avgas 100LL at Lanseria Aerodrome. The aircraft remained on the ground after the refuelling and according to the flight folio, next flew on 24 July 2007 from Lanseria to Rand Aerodrome. The flight time was recorded as 0,3 of an hour or 18 minutes in the aircraft flight folio. The next flight took place on 2 August 2007, when the aircraft was flown from Rand to Lanseria and back. The flying time was recorded as 0,6 of an hour or 36 minutes.

1.1.2 On the afternoon of 8 August 2007, the pilot, accompanied by a passenger, who was also the holder of a pilot's licence, flew from Rand to Lanseria for maintenance

on the radio. The flight from was uneventful. After the repair was effected, the occupants departed Lanseria at about 1540Z for Rand.

1.1.3 According to an eyewitness in Morsim Road, Hyde Park, Johannesburg, the aircraft flew overhead in a southerly direction at approximately 1545Z. He then heard the engines spluttering and stalling, and saw the aircraft lose altitude and its right wing dip. He could not recall hearing the engines after the aircraft disappeared from his sight and was certain it would crash, probably in the nearby suburb of Oaklands. Listening to a local radio station approximately one hour later, he heard that an aircraft had indeed crashed in Birdhaven, a suburb close by.

1.1.4 According to the pilot and passenger, the right engine failed while they were flying at an altitude of 6 500 ft above mean sea level (AMSL) over a large residential area. The pilot, assisted by the passenger, tried to identify the problem but was unable to do so, and could not maintain altitude on the left engine alone. During an interview with the two occupants after they had been discharged from hospital, neither could recall whether the left engine had merely lost power after the right had failed, or had failed completely. Following the failure of the right engine, the pilot elected to perform a forced landing on the Killarney Golf Course, which was straight ahead of them. However, their rate of descent was substantially higher than anticipated and they came down in the garden of a private home in Birdhaven, opposite the Bellavista School sports grounds and 574 m to the northwest of the golf course. The left wing struck two small trees and approximately 20 m further on, the aircraft collided with an entertainment area and a large tree. The wreckage came to rest in a nose-down attitude between the wall of the entertainment area and the tree.

1.1.5 The pilot was flung through the windscreen on impact and was found next to the perimeter wall some distance in front of the aircraft. The passenger was trapped inside the cockpit and was freed by emergency personnel, who used the jaws of life to cut open the roof. Both occupants sustained serious injuries and underwent surgery.

1.1.6 The accident occurred during twilight conditions, approximately six minutes after official sunset (1544Z), at the co-ordinates S26°08.422’ E028°03.209’ and at an elevation of 5 432 ft above mean sea level (AMSL).

Figure 1. The location of the accident site relative to the golf course, the intended point of landing.

1.2 Injuries to Persons

Injuries	Pilot	Crew	Pass.	Other
Fatal	-	-	-	-
Serious	1	-	1	-
Minor	-	-	-	-
None	-	-	-	-

1.3 Damage to Aircraft

1.3.1 The aircraft was destroyed following impact with a large tree and an entertainment area on a residential property.

Figure 2. The wreckage of ZS-MNJ.

1.4 Other Damage

1.4.1 The aircraft crashed into an entertainment area of a residential house in Wingfield Avenue, Birdhaven, Johannesburg. The entertainment area and a section of the perimeter wall were destroyed during the impact sequence.

1.4.2 An additional section of the perimeter wall was knocked down by rescue and fire-fighting personnel to gain access to the injured occupants as the property was completely walled in and the only vehicular gate was locked at the time of the accident.

Figure 3. Structural damage to the entertainment area.

Figure 4. Another view of the damage to the entertainment area and the aircraft.

1.5 Personnel Information

1.5.1 Pilot

Nationality	South African	Gender	Male	Age	47
Licence Number	0270288343	Licence Type	Private		
Licence valid	No	Type Endorsed	Yes		
Ratings	Night Rating				
Medical Expiry Date	30 October 2005				
Restrictions	Must wear corrective lenses				
Previous Accidents	Yes 6 October 2000: Piper PA-34-200T, ZS-MDV 22 May 2005: Piper PA-34-220T, ZS-MNJ				

Previous accidents

On 6 October 2000, the pilot, accompanied by four passengers, was flying from Rand Aerodrome to Virginia Aerodrome when he experienced a power loss in the right engine. Unable to maintain altitude on the left engine alone, he executed a forced landing in an open field east of Heidelberg. This accident had similarities to the accident in question, with the main exception being that the pilot had an open area on which to land.

On 22 May 2005, the pilot accompanied by four passengers, was flying from Kruger Mpumulanga International Aerodrome to Grand Central Aerodrome (FAGC). He performed a hard landing on runway 35 at Grand Central and the aircraft bounced several times, both propellers making contact with the surface. He then applied power, flew a circuit and made an uneventful landing. During the after-flight inspection, propeller damage and structural damage was observed, and this defined the occurrence as an accident.

According to available information (SACAA pilot's file), the last practical flight test (form CA 61-161) that the pilot underwent prior to the accident flight was on 31 July 2005. During this, he was tested on the execution of a forced landing, but no other in-flight emergency procedures were dealt with during the flight.

Flying Experience

Total Hours	453,3
Total Past 90 Days	2,0
Total on Type Past 90 Days	2,0
Total on Type	Unknown

*NOTE: The pilot's licence was invalid at the time of the accident flight, due to the fact that he did not meet the requirements of Part 61.01.6 of the Civil Aviation Regulations of 1997, which state the following:

Part 61.01.6 (Medical requirements and Fitness)

(1) An applicant for a pilot licence in terms of this Part must hold an appropriate valid medical certificate issued in terms of Part 67 of these Regulations.

(2) The holder of a pilot licence issued in terms of this Part may not exercise the privileges of that licence –

(a) unless that person holds an appropriate valid medical certificate issued in terms of Part 67 and complies with all medical endorsements on that medical certificate;

(b) while he or she is aware of having a medical deficiency that would make him or her unable to meet the medical standards for his or her medical certificate, until he or she has been assessed medically fit again by an aviation medical examiner designated in terms of Part 67; or

(c) when he or she is unable to act as a flight crew member of an aircraft because of the circumstances prescribed in sub-regulations 91.02.3 (1) and (2) of Part 91 of these Regulations.

1.5.2 Passenger (holder of a private pilot's licence)

Nationality	South African	Gender	Male	Age	48
Licence Number	0270406580	Licence Type	Private		
Licence valid	Yes	Type Endorsed	Yes		
Ratings	Night Rating				
Medical Expiry Date	31 December 2007				
Restrictions	Must wear corrective lenses				
Previous Accident	No				

Flying Experience

Total Hours	398,2
Total Past 90 Days	5,5
Total on Type Past 90 Days	5,5
Total on Type	Unknown

*NOTE: The passenger was seated in the right front seat. The aircraft was equipped with dual flight controls but had no flight instruments on the right-hand instrument panel.

According to available information (SACAA pilot's file), the last practical flight test (form CA 61-161) that the pilot underwent prior to the accident flight was on 3 February 2007. During this, he was tested on the execution of a forced landing, but no other in-flight emergency procedures were dealt with. On his test report, under the heading "Forced Landing", the flight instructor wrote: "Too fast, undershooting the obstacles."

1.6 Aircraft Information

Airframe

The Piper PA-34-220T (Seneca III) is a multi-engine, piston-driven, unpressurised aircraft equipped with six seats in a club-seating arrangement. It is certified for single pilot, IFR day and night operations, provided that it is equipped in accordance with FAR 91 or FAR 135.

Type	Piper PA-34-220T	
Serial Number	34-8133002	
Manufacturer	Piper Aircraft Corporation	
Year of Manufacture	1981	
Total Airframe Hours (at time of accident)	4 161,9	
Last MPI (Hours & Date)	4 132,9	6 December 2006
Hours since Last MPI	29,0	
C of A (Issue Date)	15 January 2007	
C of A (Currency Fee)	14 January 2008	
C of R (Issue Date) (Present Owner)	3 March 2003	
Operating Categories	Standard	

Engine No. 1 (left)

Type	Teledyne Continental TSIO-360-KB
Serial Number	315006
Hours since New	4 161,9
Hours since Overhaul	929,4

Engine No. 2 (right)

Type	Teledyne Continental LTSIO-360-KB
Serial Number	319280
Hours since New	Unknown
Hours since Overhaul	615,4

Propeller No. 1 (left)

Type	Hartzell PHC-C3YF-2LKUF
Serial Number	EB6178B
Hours since New	65,8
Hours since Overhaul	TBO not yet reached

Propeller No. 2 (right)

Type	Hartzell PHC-C3YF-2LKUF
Serial Number	EB6511B
Hours since New	29,0

Hours since Overhaul	TBO not yet reached

Weight & Balance

The maximum certified takeoff weight for the aircraft, according to the pilot's operating handbook, Section 1, pp 1-5, was not allowed to exceed 4 750 lbs (2 155 kg).

At the time of the accident, there were only two occupants on board without any cargo or baggage. The aircraft's weight was therefore not considered to be a factor in the accident.

1.7 Meteorological Information

1.7.1 The following weather report for 8 August 2007 (1540Z) at Birdhaven, Johannesburg, was obtained from the South African Weather Services:

Wind direction	020°TN	Wind speed	3 kt	Visibility	+ 10 km
Temperature	12°C	Cloud cover	No cloud	Cloud base	No cloud
Dew point	1°C				

1.8 Aids to Navigation

1.8.1 This was a visual flight rules (VFR) flight from Lanseria Aerodrome to Rand Aerodrome. The straight-line distance between the two aerodromes was 22 nautical miles.

1.8.2 The aircraft was fitted with standard navigational equipment required for the flight. In addition to this, it was equipped with a panel-mounted Garmin 430 GNS (Global Navigation System). Three portable GPS devices were also found on the accident site. However, none of these was used during the flight.

1.9 Communications

1.9.1 The aircraft departed from Lanseria Aerodrome on a visual flight rules (VFR) flight

for Rand Aerodrome. Takeoff clearance was obtained from Lanseria air traffic control prior to departure,.

1.9.2 The flight was conducted under the terminal control area (TMA) and outside of controlled airspace. Any radio transmission during the emergency would therefore have been broadcast on the VHF frequency 124.80 MHz. However, none was recorded by any air traffic service station.

1.10 Aerodrome Information

1.10.1 The accident did not occur at, or near, an aerodrome.

1.11 Flight Recorders

1.11.1 The aircraft was not equipped with a flight data recorder or cockpit voice recorder. Neither was required by regulations to be fitted to this type of aircraft.

1.12 Wreckage and Impact Information

1.12.1 The first impact, on a heading of 130°M, occurred when the left wing struck two small trees in the garden of private home. About 20 m further on, the aircraft collided with the roof of an entertainment area attached to the house and came to rest in a nose-down attitude of approximately 45°. The right wing and a section of the right side of the fuselage collided with a large tree three metres behind the entertainment area. The wreckage ended up lodged between the brick wall of the entertainment area and the tree.

1.12.2 The left engine separated from the nacelle during the impact sequence, ending up three metres in front of it, upright and facing rearwards. The left propeller, which had fractured at the crankshaft attachment to the engine, was found about six metres in front of the engine against the perimeter wall.

The right engine was founded wedged in a large tree. The propeller had fractured at the crankshaft attachment to the engine and was wedged in front of the engine in the tree. The propeller blades did not display any deformation or rotational signatures.

Figure 5. The right-hand propeller entangled in a tree.

1.12.3 The nose-gear assembly collapsed during impact but remained attached to the fuselage. The two main undercarriage assemblies also remained secured to the wing. The left gear strut was found in the fully extended position, indicating that the gear had been selected down prior to impact. The right gear torque tube had failed during the impact sequence but was still attached to the wing.

Figure 6. The left wing with the main gear in the extended position.

1.12.4 The empennage, being elevated, sustained the least damage. The roof structure of the aircraft was cut open by rescue personnel to free the trapped passenger in the right front seat. The large tree behind the entertainment area and the building itself absorbed most of the impact energy. The fuel tanks on both wings were ruptured by the impact.

1.13 Medical and Pathological Information

1.13.1 The pilot was not in possession of a valid aviation medical certificate at the time of the accident.

1.14 Fire

1.14.1 There was no pre- or post-impact fire.

1.14.2 Several vehicles from the Johannesburg Fire Brigade were dispatched to the accident scene and sprayed the area with fire-retardant foam as a precautionary

measure.

1.15 Survival Aspects

1.15.1 Both occupants survived the accident.

1.15.2 The pilot, who was in the left front seat, was flung from the aircraft during the impact sequence and lay approximately eight metres in front of the wreckage. He was treated by emergency personnel on the scene, stabilised, and admitted to hospital by ambulance with serious injuries. He had been wearing the aircraft-equipped safety harness (lap strap only) during the flight.

1.15.3 The passenger, who was in the right front seat, was trapped inside the cockpit. Rescue and fire-fighting personnel used the jaws of life to cut off the roof pillars and free him. He suffered facial injuries as well as an injury to his lower back, and was treated at the scene before being admitted to hospital for surgery. He had been wearing the aircraft-equipped safety harness, which was cut off by the rescuers in order to free him.

1.16 Tests and Research

1.16.1 Teardown inspection of engines:

Both engines were removed from the wreckage after recovery and taken to an approved engine maintenance facility for a teardown inspection to determine whether they had failed due to mechanical malfunction. The following observations were made:

Engine No. 1 (left)

Engine Model	**Teledyne Continental TSIO-360-KB**
Engine Serial No.	**315006**
Fuel flow divider	The diaphragm and filter assembly were undamaged. The unit was opened during the on-site investigation and found to contain a substantial amount of fuel.
Turbo	The unit was undamaged.

(Roto-Master) Part # 646396 Ser # 223343	Both the impeller and rotor rotated freely. The exhaust attachments were severely damaged.
Overboost Valve Part # 643511-1 Ser # JJ0117	The unit was undamaged. It was subjected to a bench test and the valve opened at 42,75 in Hg, which was within the limits stipulated in the Garret Manual.
Fuel control unit Part # 640563-6 Ser # Unreadable	The unit was undamaged. It was bench-tested at 10psi pressure as called for in the maintenance manual. Fuel flow at closed throttle was 22 lbs/h. Fuel flow at maximum throttle was 120 lbs/h.
Spark plugs Champion RHM38E	These were undamaged. They were removed and tested, and no anomalies were noted. They displayed a greyish colour consistent with normal engine operation.
High-tension leads	These appeared to be in an acceptable condition, apart from exhibiting impact damage.
Vacuum pump Part # 211CC Ser # 117846	The unit, which was undamaged, was still attached to the engine. The driveshaft and the blades inside the unit remained intact.
Fuel pump Part # 639568-6 Ser # J158007B	The unit sustained impact damage and could not be bench-tested. A teardown inspection was performed and no anomalies were noted. The bearing, seals and gaskets were all in good condition.
Magnetos (Bendix) Part # S6LN-25 Ser # A126353 A276061	Both magnetos had failed at their attachments to the gear drive train. They were still secured to the HT leads, which were in turn secured to the spark plugs. Timing could not be checked, however. Both units were bench-tested and functioned satisfactorily.
Oil filter	The filter was still attached to the engine. The oil displayed a dark greyish colour and no metal particles were observed.
Gear drive train	This was undamaged and intact.
Fuel nozzles (Ref. No. 12D)	These were removed from the cylinders, visually checked and found to be free of obstructions.
Cylinders	These appeared to be in good overall condition and within dimensional limitations.
Pistons and rings	The pistons were in good condition with no evidence of carbon build-up or visible wear/scouring. None of the rings was broken.

Main and big-end bearings	All were in a good overall condition.
Connecting rods	All six were found to be undamaged and in good condition.
Camshaft	The camshaft and gear drive assembly were in good condition.
Crankshaft	The crankshaft flange/hub assembly attached to the propeller had been fractured in overload. Apart from this, the crankshaft appeared to be in good condition.
Oil pick-up tube and sump assembly	The sump assembly suffered severe impact damage, with a substantial area of the lower casing having broken away. There was evidence of oil throughout the engine, however, and the oil pick-up screen was free of debris.
Oil pump	This was undamaged and in good condition.

Engine No. 2 (right)

Engine Model	**Teledyne Continental LTSIO-360-KB**
Engine Serial No.	**319280**
Fuel flow divider Part # 641092-11A8 Ser # 318612RC	The diaphragm and filter assembly were undamaged. The unit was opened and a small amount of fuel (± one teaspoon) was observed in the outlet port.
Turbo (Roto-Master) Part # Unknown Ser # Unknown	The unit sustained impact damage to the outer casing. Both the impeller and rotor assembly were intact and rotated freely. The exhaust attachments were severely damaged.
Overboost valve Part # 481066-1 Ser # 9092-1	The unit was undamaged. It was subjected to a bench test and the valve opened at 42,75 in Hg, which was within the limits stipulated in the Garret Manual.
Fuel control unit Part # 640563-7 Ser # G048805AR	The unit was undamaged. It was bench-tested at 10psi pressure as called for in the maintenance manual. Fuel flow at closed throttle was 22 lbs/h. Fuel flow at maximum throttle was 120 lbs/h.
Spark plugs Champion RHM38E	It was not possible to remove the two spark plugs on the No. 5 cylinder due to impact damage. The other plugs were removed and tested, and no anomalies were noted. They displayed a greyish colour consistent with normal engine operation.

High-tension leads	These appeared to be in an acceptable condition apart from exhibiting impact damage.
Vacuum pump	The unit had failed at the engine attachment and was not located.
Fuel pump Part # 639508-10 Ser # D038409B	The unit had sustained impact damage and it was not possible to bench-test it. A teardown inspection was performed and no anomalies were noted. The bearing, seals and gaskets were all in good condition.
Magnetos (Bendix) Part # S6RN-25 Ser # 5110095 A266515	Both magnetos had failed at their attachments to the gear drive train. They were still secured to the HT leads, which were in turn secured to the spark plugs. Timing could not be checked, however. Both units were bench-tested and functioned satisfactorily.
Oil filter	The unit, which had sustained impact damage, was severed at its attachment to the engine. It was recovered, cut open and found to display no abnormalities.
Gear drive train	This was undamaged and intact.
Fuel nozzles (Ref No. 12D)	These were removed from the cylinders and examined. Only one exhibited damage: the top section of the nozzle on the No. 5 cylinder had been severed during the impact. None of the nozzles had any obstructions.
Cylinders	These appeared to be in good overall condition and were within dimensional limitations.
Pistons and rings	The pistons were in good condition with no evidence of carbon build-up or visible wear/scouring. None of the rings was broken.
Main and big-end bearings	All were in good general condition.
Connecting rods	All six were undamaged and in good overall condition.
Camshaft	The camshaft and gear drive assembly were in good condition.
Crankshaft	The crankshaft flange/hub assembly attached to the propeller had been fractured in overload approximately 15 mm aft of the flange. Apart from this, the crankshaft appeared to be in good condition.
Oil pick-up and sump assembly	The sump assembly was intact and oil was evident throughout the engine in the required locations. The pick-up screen was free of debris.

Oil pump	The unit was undamaged and in good condition.

The inspections revealed no evidence of pre-impact failures or mechanical malfunctions that could have contributed to, or caused, the engines to fail in flight. The engines were found to be in good overall condition.

1.16.2 Propeller examination

The propellers were recovered to an approved maintenance facility where they were dismantled and inspected to determine their condition at the time of the accident. The following observations were made:

Propeller No. 1 (left)

Model	**Hartzell PHC-C3YF-2KUF**
Serial No.	**EB-6178B**
Constant speed unit Ser # 3016SJ	Although the unit appeared to be intact, it had suffered impact damage in the area of the attachment housing and could therefore not be bench-tested. A teardown inspection was carried out and no anomalies were noted.
Hub assembly	The hub assembly outer casing was essentially undamaged.
Blades	All three displayed similar damage: the outer blade tips were bent backwards and showed evidence of twist. The pitch change pin on one of the blades had been severed in overload.
Spinner	This was severely damaged during the impact sequence.

Propeller No. 2 (right)

Model	**Hartzell PHC-C3YF-2KUF**
Serial No.	**EB-6511B**
Constant speed unit Ser # 3016SJ	Although the unit appeared to be intact, it had suffered impact damage in the area of the attachment housing and could therefore not be bench-tested. A teardown inspection was carried out and no anomalies were noted.

Hub assembly	The hub assembly outer casing was essentially undamaged. Internal inspection revealed evidence of substantial impact damage on the internal flange of blade no. 2.
Blades	These displayed minimal evidence of rotation; if any did occur, it was in all likelihood due to windmilling. The pitch change pins on blades No. 1 and 2 had failed in overload. Blade number 2 also displayed signs of severe impact, making it probable that this was the first blade to strike the tree. The propeller assembly was lodged in the tree.
Spinner	This was severely damaged in the impact.

Based on the above findings, it was concluded that there was no propeller failure during flight that could have contributed to, or caused, the accident.

1.16.3 On-site investigation

This revealed that both wing fuel tanks had ruptured during the impact sequence. When the wreckage was recovered in the late afternoon of the following day, no evidence of fuel could be found – no fuel leaked from the wings during the recovery process nor was there the usual strong smell of avgas. A fuel spill resulting from a crash typically kills surrounding vegetation, especially the leaves of plants, very rapidly, but there was no evidence of this at all.

During examination of the wreckage, both fuel tank selector levers (ie, for the left and right engines) were found in the OFF position. Interviewed after their discharge from hospital, neither occupant could recall having made this selection. Emergency response personnel also confirmed that they had not tampered with the wreckage in any way, apart from cutting open the roof to free the trapped passenger.

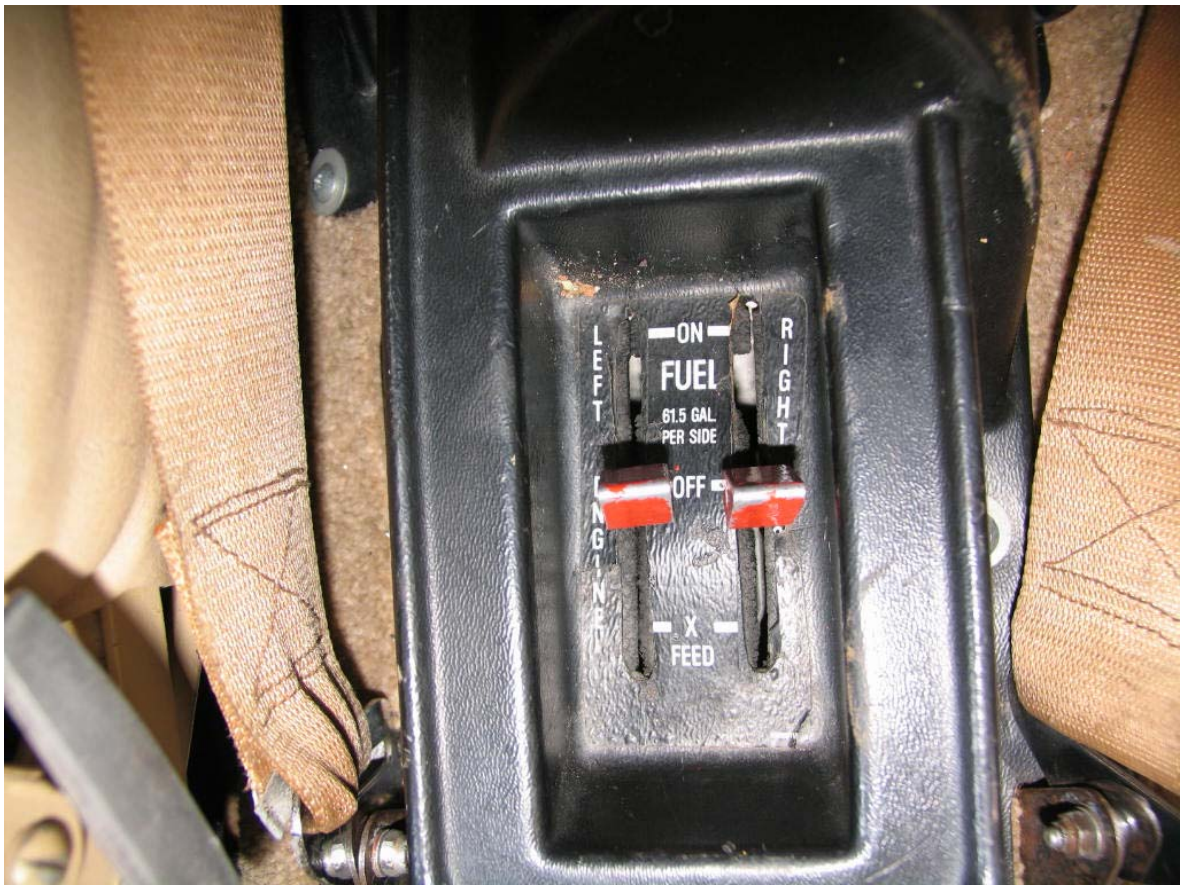


Figure 7. The fuel tank selector levers as found on site.

1.17 Organisational and Management Information

1.17.1 This was a private flight. Both occupants on board at the time were part-owners of the aircraft.

1.17.2 The aircraft maintenance organisation (AMO) that certified the last mandatory periodic inspection (MPI) prior to the accident flight had been in possession of a valid AMO approval certificate at the time.

1.18 Additional Information

1.18.1 Aircraft Fuel System

The aircraft fuel system could be found attached to this report as Annexure A.

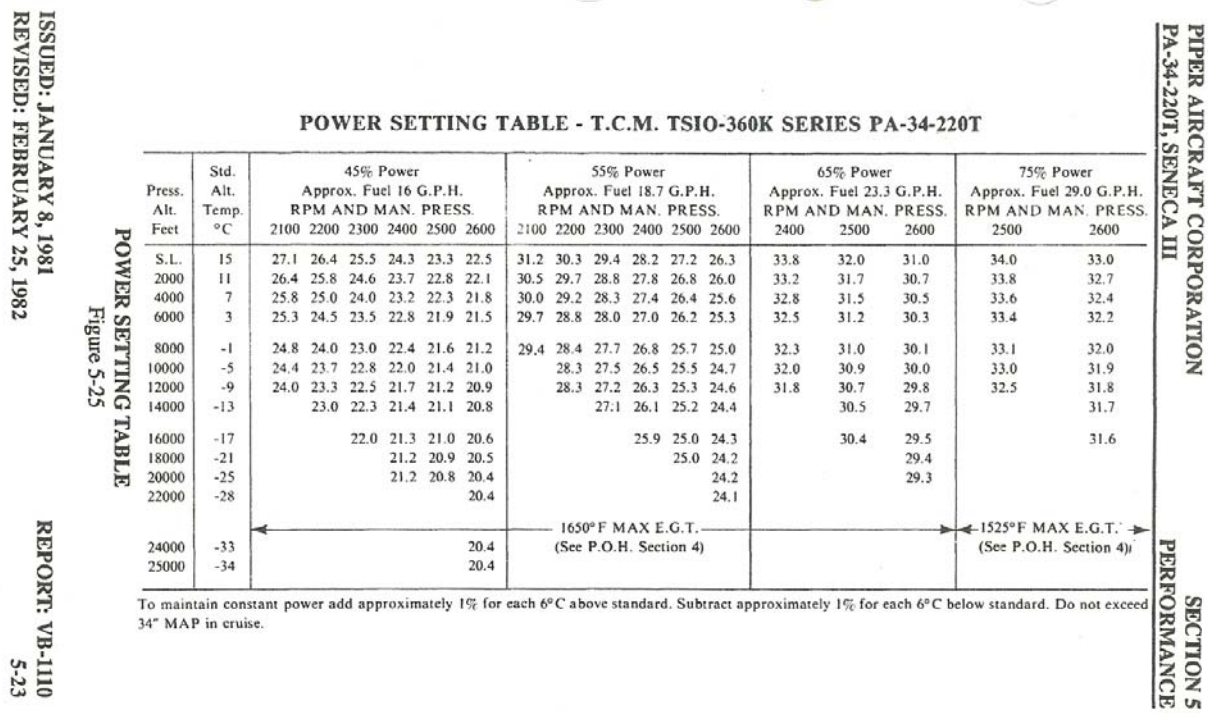
1.18.2 Flight folio records (refuelling)

Date	Place of fuel uplift	Fuel uplifts (litres)	Flight time	Aircraft hours (hobbs meter)
17 Jan 2007	Lanseria	400	0,4	1 399,2
19 Jan 2007			1,3	1 400,5
21 Jan 2007			0,7	1 401,2
21 Jan 2007		296	1,0	1 402,2
24 Jan 2007			1,0	1 403,2
28 Jan 2007	Rand	416	0,5	1 403,7
3 Feb 2007	Rand	283	2,3	1 406,0
16 Feb 2007			0,8	1 406,8
7 Mar 2007	Rand	324	1,0	1 407,8
13 Mar 2007			1,2	1 409,0
14 Mar 2007			0,8	1 409,8
20 Mar 2007	Margate	232	1,6	1 411,4
21 Mar 2007	Rand	296	1,6	1 413,0
31 Mar 2007			0,4	1 413,4
1 Apr 2007			0,3	1 413,7
9 Apr 2007			3,1	1 416,8
13 Apr 2007	Rand	150	0,8	1 417,6
14 Apr 2007			0,4	1 418,0
15 Apr 2007			0,9	1 418,9
21 Apr 2007	Rand	200	1,0	1 419,9
26 May 2007	Lanseria	200	0,3	1 420,2
7 Jun 2007			0,3	1 420,5
9 Jun 2007	Rand	200	0,2	1 420,7
10 Jun 2007			0,6	1 421,3
14 Jun 2007	Rand	321	1,0	1 422,3
22 Jun 2007	Rand	142	1,6	1 423,9
24 Jun 2007	Margate	275	1,6	1 425,5
24 Jun 2007			0,3	1 425,8
4 Jul 2007	Lanseria	200	0,8	1 426,6
24 Jul 2007			0,3	1 426,9
2 Aug 2007			0,6	1 427,5
8 Aug 2007			0,3	1 427,8

The information above was obtained from the last four pages of the aircraft's flight

folio. All the original invoices were made available to the investigating team.

With the assistance of the POH (power-setting table) and the data obtained from the aircraft's flight folio, the *average* fuel consumption for ZS-MNJ was calculated to be between 90 litres (23,8 US gallons) and 110 litres (29,0 US gallons) per hour. It should be stressed that fuel consumption could have varied between flights.



PIPER AIRCRAFT CORPORATION
PA-34-220T, SENECA III

POWER SETTING TABLE - T.C.M. TSIO-360K SERIES PA-34-220T

Press. Alt. Feet	Std. Alt. Temp. °C	45% Power Approx. Fuel 16 G.P.H. RPM AND MAN. PRESS. 2100	2200	2300	2400	2500	2600	55% Power Approx. Fuel 18.7 G.P.H. RPM AND MAN. PRESS. 2100	2200	2300	2400	2500	2600	65% Power Approx. Fuel 23.3 G.P.H. RPM AND MAN. PRESS. 2400	2500	2600	75% Power Approx. Fuel 29.0 G.P.H. RPM AND MAN. PRESS. 2500	2600
S.L.	15	27.1	26.4	25.5	24.3	23.3	22.5	31.2	30.3	29.4	28.2	27.2	26.3	33.8	32.0	31.0	34.0	33.0
2000	11	26.4	25.8	24.6	23.7	22.8	22.1	30.5	29.7	28.8	27.8	26.8	26.0	33.2	31.7	30.7	33.8	32.7
4000	7	25.8	25.0	24.0	23.2	22.3	21.8	30.0	29.2	28.3	27.4	26.4	25.6	32.8	31.5	30.5	33.6	32.4
6000	3	25.3	24.5	23.5	22.8	21.9	21.5	29.7	28.8	28.0	27.0	26.2	25.3	32.5	31.2	30.3	33.4	32.2
8000	-1	24.8	24.0	23.0	22.4	21.6	21.2	29.4	28.4	27.7	26.8	25.7	25.0	32.3	31.0	30.1	33.1	32.0
10000	-5	24.4	23.7	22.8	22.0	21.4	21.0		28.3	27.5	26.5	25.5	24.7	32.0	30.9	30.0	33.0	31.9
12000	-9	24.0	23.3	22.5	21.7	21.2	20.9		28.3	27.2	26.3	25.3	24.6	31.8	30.7	29.8	32.5	31.8
14000	-13		23.0	22.3	21.4	21.1	20.8			27.1	26.1	25.2	24.4		30.5	29.7		31.7
16000	-17			22.0	21.3	21.0	20.6				25.9	25.0	24.3		30.4	29.5		31.6
18000	-21				21.2	20.9	20.5					25.0	24.2			29.4		
20000	-25				21.2	20.8	20.4						24.2			29.3		
22000	-28						20.4						24.1					
		←						1650°F MAX E.G.T.						→			← 1525°F MAX E.G.T.	
24000	-33						20.4	(See P.O.H. Section 4)									(See P.O.H. Section 4)	
25000	-34						20.4											

To maintain constant power add approximately 1% for each 6°C above standard. Subtract approximately 1% for each 6°C below standard. Do not exceed 34" MAP in cruise.

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POWER SETTING TABLE
Figure 5-25

REPORT: VB-1110
5-23

SECTION 5
PERFORMANCE

Figure 8. The power-setting table for the Seneca III.

Following the fuel uplift of 200 litres on 4 July 2007, the aircraft conducted three flights during the following 35 days. In each case this included:

(i) Start-up and warm-up
(ii) Taxiing to the active runway threshold
(iii) Awaiting takeoff
(iv) Takeoff and climb-out
(v) Cruise flight to destination
(vi) Descent and approach as per air traffic instructions
(vii) Landing, and taxiing to the apron or hangar area.

The total flight time for the three flights was logged as 1,2 hours. It should be noted that this was obtained from the Hobbs meter and therefore does not necessarily

provide a completely accurate reflection of the actual engine running time.

These three flights equate to a fuel consumption of approximately 140 litres. The fuel consumed could have been slightly higher taking into consideration the factors referred to above. The distances required to taxi at both Lanseria and Rand Aerodromes could be substantial, depending on the active runway and the intended location on the aerodrome.

The aircraft was equipped with long-range fuel tanks. The total unusable fuel for this aircraft type, according to the POH, Section 7, pp 7-13, was five US gallons (19 litres).

It was not possible to obtain any fuel samples from the wreckage as both tanks had ruptured on impact.

1.19 Useful or Effective Investigation Techniques

1.19.1 None.

2. ANALYSIS

2.1 Pilot

The person flying the aircraft at time of the accident did not hold a valid pilot's licence as his aviation medical certificate had lapsed on 30 October 2005, 21 months prior to the accident flight. He was therefore not regarded as being proficient regulatory not allowed to fly the aircraft. However, he had made a conscious decision to do so. It could be argued that he was accompanied by a licensed pilot rated on the type at the time, but that in itself cannot justify his actions. The aircraft did not have any flight instruments on the right-hand side of the panel, and with the flight being conducted in twilight, the pilot in the right-hand seat would have had difficulty in reading the instruments on the left-hand side of the panel should he have needed to take over.

As a result of the severity of the crash and their injuries, neither occupant was able to remember the exact sequence of the events leading up to the impact. The most

contentious question was whether one or both engines had failed during the flight – and neither occupant was clear about this.

A second question that could not be answered was why the two fuel selector levers were found in the OFF position. Neither of the occupants nor any member of the rescue personnel could recall making this selection. However, it cannot be ruled out that one of the occupants made this selection as a safety measure shortly before impact. With the fuel selector levers located on the floor pedestal between the two seats, it is highly unlikely that the selection could have been performed inadvertently.

2.2 Aircraft

The aircraft was serviceable prior to the flight and no mechanical defect or malfunction was identified that could contributed to, or caused, the accident. The investigation found no fuel in the wreckage or evidence that fuel had spilled on site. There was also no evidence of a post-impact fire.

The right propeller, which was found lodged in a tree after it had severed at the crankshaft flange, did not display any evidence of rotation, with only minor bending, attributed to impact, noted on the blades. The left propeller, which had also failed at the crankshaft flange in overload mode, showed evidence of damage following impact with the brick wall of the entertainment area: the blades were bent backwards along their tip area, with two of them displaying substantially more bending then the third. Both engines were subjected to a detailed engine teardown procedure and all relevant components that were still intact were bench-tested. No mechanical evidence was found that could have contributed to, or caused, the in-flight stoppage.

Reciprocating engine stoppage can be attributed to several factors, which could include:

(i) Absence of fuel to the engine, (i.e., fuel starvation, fuel pump failure, governor failure, incorrect fuel tank selection on the selector valve or valve selected to the OFF position, which can be done inadvertently by a passenger or crew member depending on the selector valve position in the aircraft);

(ii) Lack of lubrication, usually associated with engine seizure;

(iii) Electrical system malfunction, resulting in a lack of spark to the cylinders;
(iv) Mechanical failure of a component within the engine (conrod, piston, gearbox, etc.);
(v) Incorrect fuel/air mixture, e.g. a rich cut;
(vi) Incorrect fuel grade or contaminated fuel;
(vii) Blockage of fuel nozzles or carburettor jets;
(viii) Lack of cooling;
(ix) Air filter clogged or damaged, restricting air flow to the engine;
(x) Blocked fuel tank vents (often caused by insect nests);
(xi) Blocked or failed fuel filter / gascolator;
(xii) Flooded carburettor floats (fuel seeping into the float);
(xiii) Leaking fuel selector valve, resulting in an air lock;
(xiv) Ruptured or damaged fuel diaphragms on the injectors or flow dividers.

The witness report stated that he heard the engines spluttering and stalling, where after the right wing dipped and the aircraft started to lose altitude. He said that he could not hear the engines as the aircraft disappeared from his sight. The spluttering of the engines at that stage could have been associated with inadequate fuel flow to the engine/s and possible cavitation. Should one of the engines have remained fully functional at this stage, the aircraft would most probably have been able to maintain altitude or experienced only a slight reduction in altitude until the failed engine was secured and the propeller feathered. It is evident from the post field investigation that neither of the propellers where in the feathered position at the time of impact. This resulted in substantial drag being induced, a situation further aggravated by the fact that the landing gear had also been selected.

The fact that the undercarriage was down indicates that the aircraft was ready for landing. The intended emergency landing spot on the golf course and the point of impact were more than 500 m apart. The actual rate of descent of the aircraft immediately following the emergency was substantially higher than anticipated by the two occupants, which resulted in their undershooting the intended landing area. This further indicates that engine power was not available.

The fuel tank layout of the Seneca does not allow a pilot to use a dipstick to measure the fuel below a certain level, due to the wing dihedral. Fuel gauges are the only indication. It is therefore essential that such gauges be accurate at all times. Unfortunately, the gauges and their associated system could not be tested after the accident due to the damage sustained by the fuselage.

A period of 35 days had elapsed from the last refuelling until the accident flight. The actual fuel state prior to the fuel uplift was unknown. The unusable fuel according to the POH was approximately 20 litres and with the three flights that were conducted prior to the accident, it was determined that approximately 140 litres of fuel had been consumed. It should be noted that fuel usage could have been substantially higher due to engine starts and warm-ups, taxiing intervals and waiting for takeoff. None of this information was recorded, however. The possibility that fuel might have been stolen from the aircraft while it was parked during the 35-day period could not be ruled out.

2.3 Flight

This was a private flight, from one licensed aerodrome to another, to return the aircraft to its home base. Both occupants had flown this journey several times before, together and individually. The flight was conducted at an altitude of 6 500 ft AMSL, which was just over 1 000 ft AGL at the accident location. The mission was therefore routine, apart from the fact that the person flying the aircraft was not in possession of a valid pilot's licence due to his having an invalid medical certificate.

2.4 Environment

The weather, which was good at the time of the flight, had no bearing on the accident. The sun had already set and the twilight conditions might have increased the workload slightly. However, the occupants were still able to identify the golf course and select it for an intended forced landing.

3. CONCLUSION

3.1 Findings

3.1.1 The person flying the aircraft (left-seat occupant) was not in possession of a valid pilot's licence at the time of the accident.

3.1.2 According to available information, the pilot's aviation medical certificate had expired on 31 October 2005 and had not been renewed subsequently. At the time of the accident, he had thus been without a valid aviation medical certificate for 21 months.

3.1.3 The last practical flight test undergone by the pilot prior to the accident flight was on 31 July 2005.

3.1.4 The occupant in the right front seat was the holder of a valid private pilot's licence. However, the aircraft had no flight instruments installed on the right-hand side of the instrument panel.

3.1.5 The aircraft was properly maintained and had a valid certificate of airworthiness.

3.1.6 The maintenance release for the aircraft was valid and the investigators found no technical fault with the aircraft.

3.1.7 Neither of the engines displayed any mechanical defect that could have contributed to, or caused, either engine to fail in flight.

3.1.8 The flight was operated as a General Aviation flight under VFR rules. No flight plan was filed.

3.1.9 A witness reported hearing the engines "spluttering and stalling". He said: "I couldn't recall hearing the engines after the aircraft disappeared from my sight."

3.1.10 ~~Neither of~~ the occupants on board the aircraft could not recall whether both engines had failed or only one.

3.1.11 The aircraft collided with an entertainment area and a large tree on a residential property.

3.1.12 The pilot and passenger were seriously injured in the accident.

3.1.13 The investigation determined that the aircraft had been loaded within its allowable weight limitations at the time of the accident.

3.1.14 The accuracy of the fuel gauges could not be determined due to the substantial damage sustained by the airframe structure.

3.1.15 The landing gear was found to be in the DOWN position prior to impact.

3.1.16 Neither propeller was found to be in the feathered position.

3.1.17 The last refuelling took place 35 days before the accident. A total of 200 litres of fuel was uplifted and three flights were subsequently undertaken.

3.2 Probable Cause/s

3.2.1 Unsuccessful forced landing after the aircraft was unable to sustain height due to an engine failure in flight.

3.3 Contributory Factor/s

3.3.1 A period of 35-days had elapsed between the last refuelling of the aircraft and the accident flight. During this time, three flights were undertaken.

3.3.2 Due to the design of the wings the pilot was unable to inspect the fuel status of the aircraft prior to the flight this was aggravated by the fact that the fuel gauges of the aircraft was not accurate.

4. SAFETY RECOMMENDATIONS

4.1 None.

5. APPENDICES

5.1 Annexure A (Description of the Aircraft Fuel System)
5.2 Annexure B (POH, Engine-inoperative Procedure)

Compiled by

Jacobus Grobbelaar Date: ……..

For: Director of Civil Aviation

Investigator-in-charge: …….. Date: ……..

Co-investigator: …….. Date: ……

ANNEXURE A

Aircraft Fuel System

Source: Pilot's Operating Handbook (POH), Section 7, Description & Operation

Fuel is stored in fuel tanks located in each wing. The tanks in each wing are interconnected to function as a single tank. All tanks on each side are filled through a single filler in the outboard tank, and as fuel is consumed from the inboard tank, it is replenished by fuel from the outboard tank. Only two-and-one-half (2½) gallons of fuel in each wing is unusable, giving the Seneca III a total of 93 usable gallons with standard tanks or 123 useable gallons with the optional fuel tanks installed. The minimum fuel grade is 100 or 100LL Aviation Grade. The fuel tank vents, one installed under each wing, feature an anti-icing design to prevent ice formation from blocking the fuel vent lines.

The fuel injection system is a "continuous flow" type that utilises a vapour return line leading back to the fuel tanks. This line provides a route back to the tanks for vapour laden fuel that has been separated in the injector pump swirl chamber. Each engine has an engine-driven fuel pump that is a part of the fuel injection system. An auxiliary fuel system is provided. The purpose of the electrically powered auxiliary fuel system is to supply fuel to the engine in case of engine-driven fuel pump shaft failure or malfunction, for ground and in-flight engine starting, and for vapour suppression. The two auxiliary fuel pump switches are located on the lower left side of the instrument panel and are three-position rocker switches: LO, HI and OFF. The LO auxiliary fuel pressure is selected by pushing the top of the switch. The HI auxiliary fuel pressure is selected by pushing the bottom of the switch, but this can be done only after unlatching the adjacent guard. When the HI auxiliary fuel pump is activated, an amber light near the annunciator panel is illuminated for each pump. These lights dim whenever the pump pressure reduces automatically and manifold pressure is below approximately 21 inches.

In case of a failed engine-driven fuel pump, HI auxiliary fuel pressure should be selected. Adequate pressure and fuel flow will be supplied for up to approximately 75% power. Manual leaning to the correct fuel flow will be required at altitudes above 15 000 ft and for engine speeds less than 2 300 RPM. An absolute pressure switch automatically selects a lower fuel pressure when the throttle is reduced below 21" Hg manifold pressure and the HI auxiliary fuel pump is on.

NOTE

Excessive fuel pressure and very rich fuel/air mixtures will occur if the HI position is energised when the engine fuel injection system is functioning normally.

Low auxiliary fuel pressure is available and may be used during normal engine operation both on the ground and in-flight for vapour suppression should it be necessary as evidenced by unstable engine operation or fluctuating fuel flow indications during idle or at high altitudes.

Separate spring-loaded OFF primer button switches, located adjacent to the starter switches, are used to select HI auxiliary fuel pump operation for priming, regardless of other switch positions. These primer buttons may be used for both hot and cold engine starts.

On aeroplanes equipped with an optional primer system, the primer switch location and actuation is the same as the basic aeroplane. However, this system does provide a separate primer system as an integral part of the engine fuel system. An electrically operated diverter valve is located in the metered fuel supply line between the air throttle valve and the manifold valve. Other components are two primer nozzles located in the intake manifold on each side of the engine, and the interconnecting fuel lines. Actuation of the primer switch operates the auxiliary electric fuel pump on HI and energises the diverter valve which supplies fuel to each primer nozzle. The diverter valve does not shut off fuel flow to the manifold valve, therefore some quantity of fuel is also supplied to each cylinder nozzle during priming. Normal operation of the auxiliary fuel pump is unchanged.

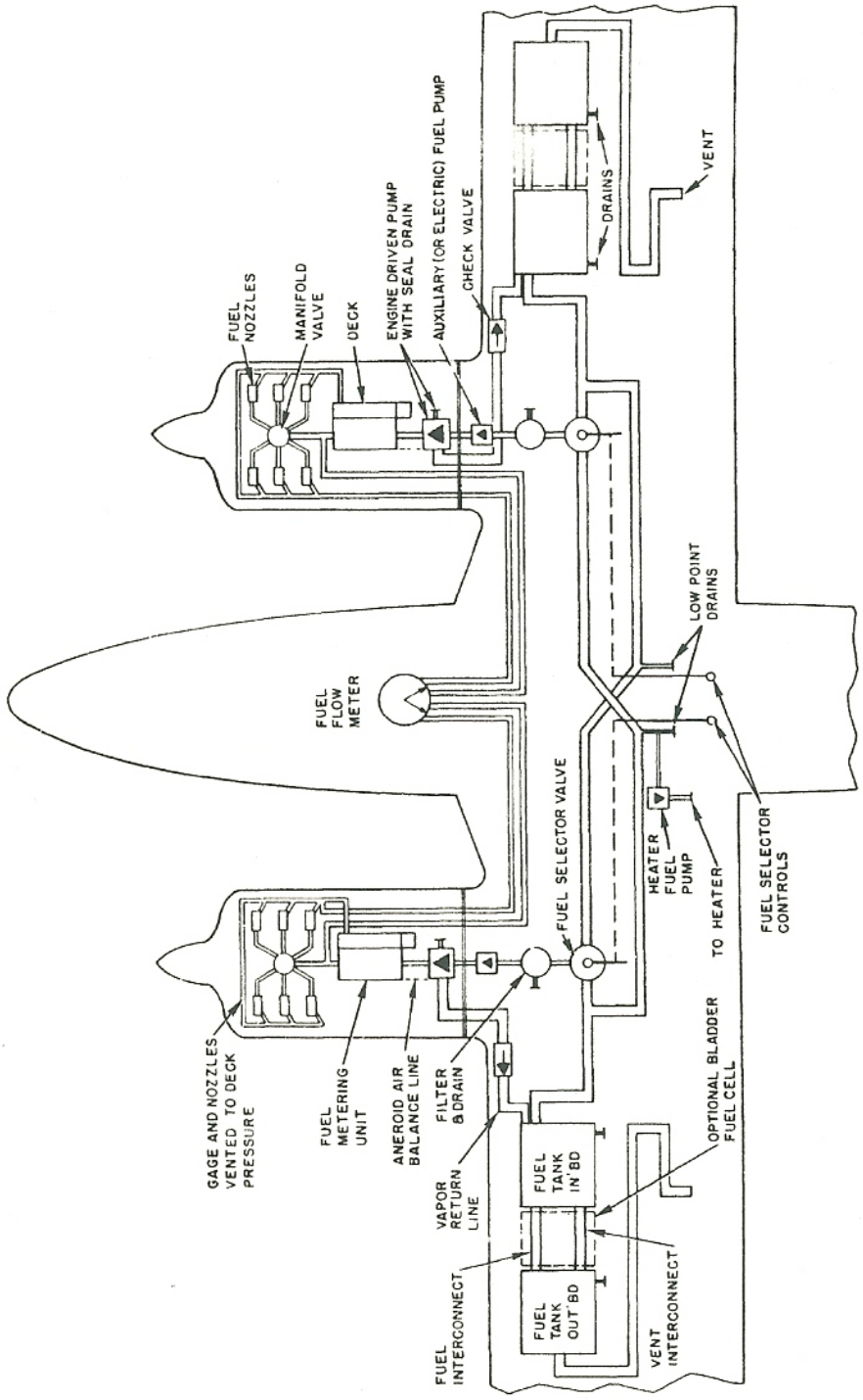
Fuel management controls are located on the console between the front seats. There is a control lever for each of the engines, and each is placarded ON – OFF – X FEED. During normal operation, the levers are in the ON position, and each engine draws fuel from the tanks on the same side as the engine. The two fuel systems are interconnected by crossfeed lines. When the X FEED position is selected, the engine will draw fuel from the tanks on the opposite side in order to extend range and keep fuel weight balanced during single-engine operation. The OFF position shuts off the fuel flow from a side.

NOTE

When one engine is inoperative and the fuel selector for the operating engine is on X FEED, the selector for the inoperative engine must be in the OFF position. Do not operate with both selectors on X FEED. Fuel and vapour are always returned to the tank on the same side as the operating engine.

Before each flight, fuel must be drained from low points in the fuel system to ensure

that any accumulation of moisture or sediment is removed from the system and to check for proper fuel. Fuel drains are provided for each fuel filter (2), each fuel tank (4), and each crossfeed line (2). The fuel filter drains are located on the outboard underside of each engine nacelle; two fuel tank drains are located on the underside of each wing; fuel crossfeed drains are located at the lowest point in the fuel system, on the underside of the fuselage, just inboard of the trailing edge of the right wing flap.



The fuel system of the Seneca III.

ANNEXURE B

Engine-inoperative Procedure

Source: POH, Section 3, pp 3-2, 3-3, 3-13, 3-14

Detecting a Dead Engine

A loss of thrust will be noted and with co-ordinated controls, the nose of aircraft will yaw in the direction of the dead engine.

Engine Securing Procedure (Feathering Procedure)

Keep in mind that the one engine inoperative air minimum control speed is 66 KIAS and the one engine inoperative best rate of climb is 92 KIAS.

Maintain direction and airspeed above 85 KIAS.

Mixture controls	-	*forward*
Propeller controls	-	*forward*
Throttle controls	-	*forward*
Flaps	-	*retract*
Gear	-	*retract*
Identify inoperative engine		
Throttle of inoperative engine	-	*retard to verify*

To attempt to restore power prior to feathering

Mixtures	-	*as required*
Fuel selector	-	*ON*
Magnetos	-	*left or right only*
Aux, fuel pump	-	*unlatch, ON HI, if power is not immediately restored - OFF*
Alternate air	-	*ON*

If power cannot be restored, continue with feathering procedure.

Prop control of inoperative engine	-	*feather before RPM*

		drops below 800
Mixture of inoperative engine	-	*idle cut-off*
Trim	-	*as required (3° to 5° of bank toward operative engine ball ½ to 1 out)*
Aux fuel pump of inoperative engine	-	*OFF*
Magnetos of inoperative engine	-	*OFF*
Cowl flaps	-	*close off inoperative engine, as required on operative engine.*
Alternator of inoperative engine	-	*OFF*
Electrical load	-	*reduce*
Fuel selector	-	*OFF inoperative engine, consider crossfeed.*
Aux, fuel pump operative engine	-	*OFF*
Power of operative engine	-	*as required*

To feather a propeller, maintain direction and an airspeed above 85 KIAS. Move the mixture and propeller controls forward. The throttle controls should be moved forward to maintain a safe airspeed. Retract the flaps and landing gear if required and identify the inoperative engine. The aeroplane will yaw in the direction of the dead engine. Retard the throttle of the inoperative engine to verify loss of power.

NOTE

If circumstances permit, in the event of an actual engine failure, the pilot may elect to attempt to restore power prior to feathering.

If circumstances permit an attempt to restore power prior to feathering, adjust the mixture control as required, move the fuel selector control to ON, and select either L (left) or R (right) magneto. Move the ALTERNATE AIR control to ON and the AUX fuel pump to the ON-HI position. If power is not immediately restored, turn off the AUX fuel pump.

The propellers can be feathered only while the engine is rotating above 800 RPM. Loss of centrifugal force due to slowing RPM will actuate a stop pin that keeps the propeller from feathering each time the engine is stopped on the ground. One engine inoperative performance will decrease if the propeller of the inoperative

engine is not feathered.

The propeller control of the inoperative engine should be moved to the feather position and the mixture control of the inoperative engine to idle cut-off.

Trim the aircraft as required and maintain a 3° to 5° bank toward the operating engine. The ball will be ½ to 1 out of the minimum drag. The AUX fuel pumps should be off except in the case of an engine-driven fuel pump failure. Turn OFF the magnetos and close the cowl flaps on the inoperative engine. Cowl flaps should be used as necessary on the operative engine. The alternator of the inoperative engine should be turned OFF and the electrical load reduced to prevent depletion of the battery. Move the fuel selector control for the inoperative engine to the OFF position. If necessary, consider the use of crossfeed (refer to Fuel Management During One Engine Inoperative Operation, paragraph 3.11). Turn OFF the operative engine's AUX fuel pump.

NOTE:

When an engine is feathered, the alternator, gyro air, and oil annunciator warning lights will remain illuminated.