FINAL REPORT

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The Inspector-on-Call (IOC) for the 1 October 2005, Mr. Graham Liddy responded to this particular notification and attended the scene. In accordance with the provisions of SI 205 of 1997, the Chief Inspector of Air Accidents, on 28 March 2007, appointed Mr. Leo Murray as the Investigator-in-Charge (IIC) to carry out an Investigation into this Incident and prepare a Synoptic Report.

Aircraft Type and Registration:	Piper PA 28-181, EI-DDZ
No. and Type of Engines:	1 x Avco Lycoming O-360-A4M
Aircraft Serial Number:	28-7690211
Year of Manufacture:	1976
Date and Time (UTC):	1 October 2005 @ 17.05 hrs
Location:	Navan Airfield
Type of Flight:	Private
Persons on Board:	Crew – 1 Passengers – 1
Injuries:	Crew – 1 (Minor) Passenger – Nil
Nature of Damage:	Substantial
Commander's Licence:	Private Pilot's Licence (Aeroplanes)
Commander's Details:	Male, aged 41 years
Commander's Flying Experience:	177 hours, of which 97 were on type
Notification Source:	Airfield owner
Information Source:	AAIU Field investigation

SYNOPSIS

The Pilot had intended a short circuit detail at a private airstrip near Navan, County Meath. There were two occupants in the aircraft, the Pilot and a passenger. Although there was some difficulty starting the engine, the power checks revealed no defects during the engine run-up. Take-off was made on the westerly Runway (RWY) 27, with a slight crosswind from the right. The aircraft accelerated normally and initial climb rate was good. The engine stopped while passing through 100 feet above ground level (AGL) during the initial climb. A forced landing was carried out into an adjacent field where the aircraft sustained substantial damage. The Pilot suffered minor injuries. There was no fire.

FINAL REPORT

1. FACTUAL INFORMATION

1.1 History of the flight

The Pilot had initially intended a round trip to Abbeyshrule for familiarisation purposes, but due to the expected onset of darkness (and the end of Visual Flight Rules) he decided to complete a circuit detail at Navan instead. The airstrip at Navan has a 28-day currency rule, and keeping current was also a factor in this decision. The Pilot completed a thorough pre-flight inspection, noting the fuel level in both main tanks to be '*visible approximately halfway between the metal bracket (1/2 tank marker) and the base of the tank.*' The Pilot stated he knew this to equate to about 1 hour 10 minutes endurance. He added that fuel samples he took from the wing tanks were '*free of particulate and water contamination as was the sample from the fuel strainer*'. The engine started on the second attempt from cold, the Pilot's report comments: 'the engine noise was *a rumbly growl at 1,500 RPM, not the normal whine at 1,700 RPM that it normally produces' Furthermore it did not respond to an increase in throttle for a good few seconds'*. The Pilot indicated he was a little concerned at the initial lack of throttle response, but the engine ran smoothly as it warmed up. During the initial run-up he noted the left magneto drop by 100 RPM and repeated the run-up checks again to be certain the engine was running satisfactorily, including changing of the selected tank. Between the run-up checks he states: '*out of concern over the initial engine behaviour I moved the mixture to halfway between lean and rich and ran the engine at 2,000 RPM for approximately 60 seconds in an attempt to clear any lead deposits on the plug'*. Take-off was performed on RWY 27 with the engine developing full static power against the brakes. The runway initially has a shallow upslope; the aircraft accelerated normally and reached 55 kts by the brow of the slope, with rotation at 60 kts. The Pilot remarked on the good climb rate, but at approximately 100 AGL the engine '*coughed once*' and stopped (see **Photo No.1**).

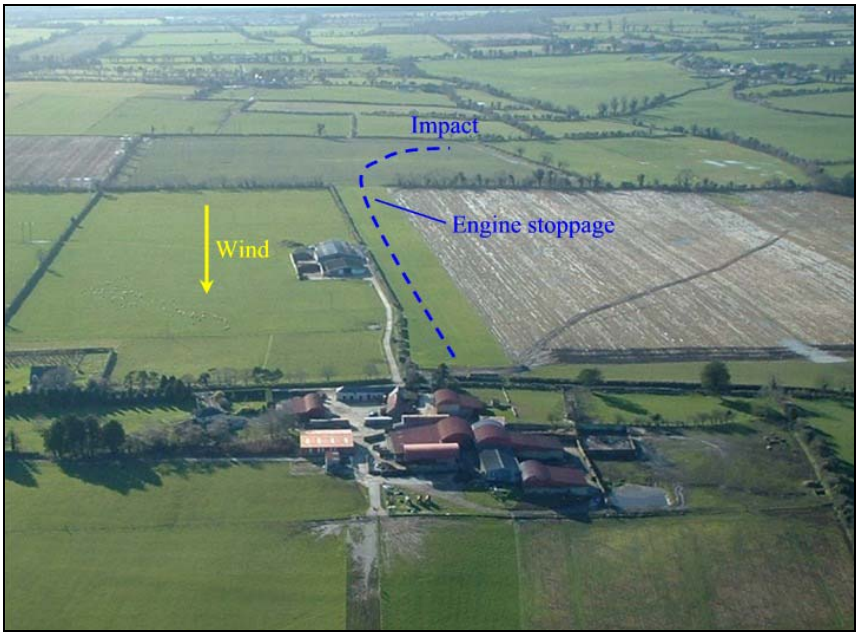

Photo No. 1: General view of airstrip and adjacent fields

The Pilot checked the engine controls, but with little time available an immediate forced landing became necessary. The Pilot stated: '*I noted the wind direction and longest diagonal possible and made for it, as we neared the end of that field I was concerned we were heading for some very solid trees. I felt due to the very low airspeed no lateral control was advisable. I selected master (switch) off and mixture lean and went for a nose first landing in the hayfield*'

Once the aircraft came to a stop, the Pilot checked that his passenger had sustained no injuries. The passenger and Pilot evacuated through the door situated on the right-hand side of the aircraft.

1.2 Subsequent events

The Pilot contacted the airfield owner by hand-held radio and informed him of the accident. He arrived at the accident site some minutes later. The airfield owner took some photographs, including the instrument panel, which were made available to the Investigation. They then left the site and went to the airfield owners' house for some tea. After about 30 minutes the Pilot and airfield owner returned to the aircraft. The Pilot then noted the Fuel selector selected to 'OFF'. The Pilot stated that another individual, who was identified to the Investigation, had turned the Fuel selector to 'OFF' after the Pilot had left the scene and prior to the arrival of the AAIU Inspector.

1.3 Aerodrome Information

Navan Airfield is a privately owned airstrip situated to the northeast of Navan. It has a single grass runway orientated east-west (designated RWY 09 and 27) along the southern edge of a large field.

1.4 Weather Information

The weather was good on the day of the accident, with a wind from 290 degrees at approximately 8 kts and scattered cloud. The runway surface was dry.

1.5 Aircraft Information

The Piper PA 28-181 Archer II is powered by a four-cylinder, Lycoming O-360-A4M horizontally opposed engine, rated at 180 hp, driving a Sensenich propeller (Serial No. 21521K). The engine then installed in EI-DDZ, Serial No. L-19545-36A, was manufactured in 1989. Fuel is stored in two 25 US Gallon (USG) tanks, giving a total capacity of 50 USG of which 48 USG is usable. Each tank is equipped with a filler neck indicator tab to aid in determining fuel remaining when the tanks are not full. The fuel level at the bottom of the indicator tab equates to 17 USG. Minimum fuel grade is 100/130 Octane Avgas.

Fuel is drawn from either the Left Tank or Right Tank (as selected by the fuel tank selector control) and fed to the carburettor via a fuel strainer and engine driven pump. An auxiliary electric fuel pump (connected in parallel to the engine-driven pump) is provided in case of the failure of the engine-driven pump. The electric fuel pump should be selected ON for take-off and landing and when switching between fuel tanks. An engine primer control is fitted to facilitate cold weather starting which is locked after use.

A fuel tank selector control is located on the left side panel forward of the pilot's seat, which controls the position of the fuel tank selector valve. A safety mechanism comprising of a button on the selector cover must be depressed and held while the selector is moved to the 'FUEL OFF' position. The mechanism releases automatically when the selector is moved back to the 'L TANK' or 'R TANK' position (**Diagram No. 1)**.

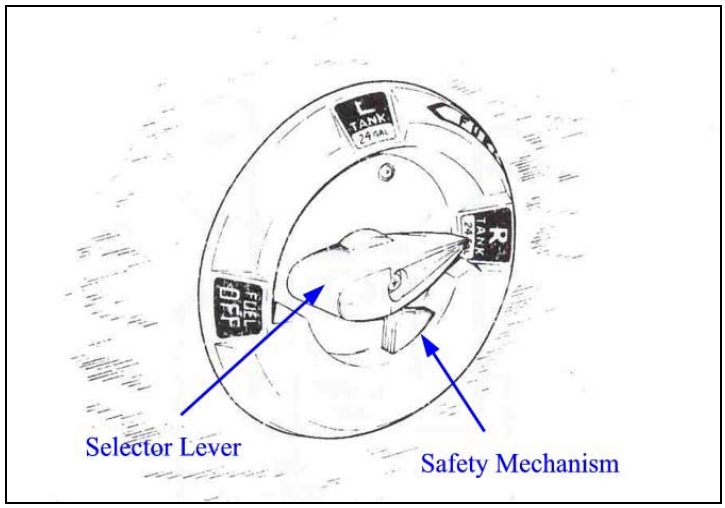

Diagram No. 1: Fuel Selector

1.6 Maintenance

The aircraft was maintained by a Licensed Maintenance Engineer at Kilrush Airfield. An annual inspection was carried out on the airframe and engine/propeller prior to the aircraft being imported to Ireland. This inspection was in accordance with Light Aircraft Maintenance Schedule (LAMS)/A/1999/Issue1/Ammend/1 and Manufacturer inspections. The aircraft logbooks reveal the following maintenance inspections were carried out since the aircraft's transfer from the Dutch register as PH-PDW:

Inspection type:	Date:	Airframe hours:	Engine hours:
Annual Inspection:	27 May 2004	3,596.00	996.70
50 hr Inspection:	01 Aug 2004	3,646.30	1,048.50
2nd 50 hr Inspection:	21 Dec 2004	3,696.70	1,099.55
Annual Inspection:	03 June 2005	3,738.80	1,142.65
50 hr Inspection:	20 Sep 2005	3,786.10	1,189.95
At time of accident:	01 Oct 2005	3,789.20	1,193.05

The aircraft had flown a total of 3.1 hours (a return trip to Galway) since its 50 hr inspection on 20 September 2005.

1.7 Damage to aircraft

The aircraft was damaged beyond economic repair in the accident. The right main landing gear detached at initial impact, followed by the nose wheel as the aircraft decelerated and swung around. The lower engine cowl, propeller, right wing, and fuselage underside suffered damage as the aircraft decelerated. Damage to the engine during impact precluded the engine being test-run safely by the Investigation.

1.8 Tests and research

An Inspector from the AAIU arrived at the accident site approximately 1.5 hours after the accident. The aircraft came to rest facing back towards the impact marks left on touchdown. The position of the Cockpit controls were noted as follows: Primer - Locked, Throttle - OPEN, Mixture - Idle Cut-Off, Fuel selector - OFF, Master switch - OFF, Fuel pump - OFF, Flaps selector - 25 degrees. The Fuel Strainer was examined on site with no visible fuel quantity present. The Investigation noted the lower engine cowl was distorted as a result of impact, adjacent to the position of the Fuel Strainer. The Carburettor bowl contained a trace amount of fuel. Fuel samples were taken from the Right and Left wing drains of EI-DDZ and the fuel facility at Navan Airfield. These three samples were sent for independent analysis, and apart from a small amount of dirt particles from the left wing drain, no free water or contamination was found. The tests on these samples are consistent with those of Defence Standard 91-90, Grade 100/130 Octane. The Carburettor, a Marvel Scheeler Model MA-4-5, Serial No. G-46-6455 was removed and sent for inspection. Fuel level and leakage checks were carried out and found satisfactory. The Carburettor body was split from the bowl and a leakage check made on throttle shaft seals. No leakage was found. The Fuel Tank selector was checked for correct operation. The selector indents were good with a good positive lock. However, it was found easy to over-ride the safety mechanism, which is designed to prevent inadvertent selection to OFF. Rotation of the fuel selector from Left Tank to Right Tank is made by clockwise rotation of the selector to the Right Tank indent. Rotation of the fuel selector from Left Tank to OFF is made by anti-clockwise rotation of the selector past the safety mechanism to the OFF indent.

Consideration was given as to how long the engine would run should the fuel selector be positioned to OFF immediately prior to take-off. A test was carried out on a similar aircraft, a PA 28-180 with a Lycoming O-360-A4A engine (also rated at 180 hp). This test revealed the engine to run for approximately 28 seconds after the fuel selector is turned OFF. A similar test was also performed by the manufacturer on a PA 28-181, identical to the accident aircraft, and revealed the following:

'*With the fuel selector OFF and the electric fuel pump OFF and full throttle applied, the engine ran for 23 seconds. With the fuel selector OFF and the electric fuel pump ON and full throttle applied, the engine ran for 27 seconds. The fuel pressure fell off quickly in both cases.*'

1.9 Pilot Statement

The Pilot-in-Command was asked as to whether there was a possibility that the Fuel Selector may have been inadvertently turned to OFF just prior to take-off. He told the Investigation that the fuel selector was selected to the Right Tank prior to take-off, and was not adjusted after the engine stoppage, or prior to the evacuation of the aircraft.

2. ANALYSIS

The engine was cold at starting and took a few moments to respond to throttle input. Once the engine had warmed up it functioned normally. The Pilot, concerned at the engines' behaviour during the start, repeated the run-up checks a second time. On aircraft with selectable fuel tanks, it is normal practice to start the engine on the lower quantity tank, complete the run-up checks and then select the higher quantity tank for take-off. This was the procedure followed by the Pilot. It is important, however, to allow sufficient time after switching tanks to ensure proper flow from the newly selected tank. The Pilot performed a prolonged engine run-up ensuring the power checks were completed and the engine was warm before take-off.

There were no pre-impact defects found with the engine or propeller. The engine lost power shortly after take-off and during the initial portion of the climb. The power loss was sudden with no mechanical damage or oil leak evident. The engine stoppage was symptomatic of fuel starvation, with only trace amounts of fuel found in the carburettor. Inspection of the fuel system revealed sufficient quantity of fuel in both tanks (each 1/4 full). This indicates a loss of fuel supply to the engine causing a stoppage. The Fuel Strainer did not contain any significant amount of Fuel, consistent with this scenario. However, it is possible that the lower engine cowl may have exerted pressure on the drain mechanism and drained the contents over a short period of time.

Independent tests, conducted by the AAIU and the Manufacturer, indicate that the Lycoming O-360 will run at full-power for between 27 and 28 seconds after the Fuel selector is positioned to OFF, which would have taken the aircraft to a height of about 50-100 feet. The engine-driven fuel pump and electrical pump are connected in parallel, which means that, assuming the electric pump has been selected for take-off, both pumps must fail to cause a loss of supply to the carburettor. The Investigation considers this unlikely.

The Pilot stated that he turned the fuel selector from the left tank to the right tank just before take-off and did not move the selector after this. Photographic evidence taken by the airfield owner shortly after the accident supports this.

3. CONCLUSIONS

(a) Findings

1. The Pilot was properly licensed.

2. The aircraft was properly registered in the State and was properly maintained with a valid Certificate of Airworthiness at the time of the accident.

3. The aircraft had sufficient fuel and oil on board for the intended flight. The fuel used was of the correct grade and free of contamination.

4. The engine and propeller had no pre-impact defects that caused, or contributed to, the engine stoppage.

5. The engine stopped suddenly during the initial climb with full throttle and Fuel Booster Pump selected ON.

6. Tests reveal the Lycoming O-320 will stop after 27-28 seconds when the Fuel Selector is positioned to OFF with the full throttle and Fuel Booster Pump ON.

7. The Pilot-in-Command stated he did not move the fuel selector after the selection of the Right Tank prior to commencing take-off.

8. An individual who came on the scene after the evacuation of the Pilot and passenger positioned the Fuel Selector to OFF. This occurred prior to the arrival of the AAIU Inspector.

9. Photographic evidence, taken shortly after the accident by the airfield owner, reveals the Fuel Selector positioned to the Right Tank.

(b) Probable Cause

The engine stopped due to a loss of the fuel supply shortly after take-off. The Investigation was unable to determine with certainty why this occurred.

4. SAFETY RECOMMENDATIONS

This Investigation does not sustain any Safety Recommendations.

- END -