ACCIDENTS INVESTIGATION BRANCH
Department of Trade and Industry

Piper PA 30 Twin Comanche G–ASRN
Report on the accident at Newbury, Berkshire on 18 June 1972

LONDON: HER MAJESTY'S STATIONERY OFFICE
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Department of Trade and Industry
Accidents Investigation Branch
Shell Mex House
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London WC2R 0DP

19 June 1973

The Rt Honourable Peter Walker MBE MP
Secretary of State for Trade and Industry

Sir,

I have the honour to submit the report by Mr G M Kelly, an Inspector of Accidents, on the circumstances of the accident to Piper PA 30 Twin Comanche G–ASRN which occurred at Newbury, Berkshire, on 18 June 1972.

I have the honour to be
Sir
Your obedient Servant

V A M Hunt
Chief Inspector of Accidents

Accidents Investigation Branch
Civil Aircraft Accident Report No 11/73
(EW/C413)

Aircraft:	Piper PA 30 Twin Comanche G–ASRN
Engines:	2 x Lycoming 10 – 320
Registered Owner and Operator:	Mr G S Cameron
Pilot:	Mr G S Cameron – Killed
Passengers:	Four – 3 injured – 1 uninjured
Place of Accident:	Newbury, Berkshire
Date and Time:	18 June 1972 at 0950 hrs
	All times in this report are GMT

Summary

The aircraft was on a charter flight from Newbury to Brussels via Ashford (Kent) and had just become airborne at Newbury when the port engine lost power. The aircraft yawed to the left, banked steeply and then dived to the ground. The report concludes that the accident resulted from a loss of flying speed following a loss of power in the port engine during the initial climb after take-off. Obstructions near the boundary of the aerodrome probably deterred the pilot from lowering the nose to gain speed or throttling back the good engine to reduce the yaw. It was not possible to establish the cause of the power loss but it was most probably the result of misalignment of the appropriate fuel selector.

1. Investigation

1.1 History of the flight

The aircraft was one of a pair of Twin Comanches which were operated by the pilot for both charter and private flights. On the day of the accident arrangements had been made to carry passengers in both aircraft from Newbury to Brussels with an intermediate stop at Ashford (Kent) for fuel and customs formalities. Four passengers embarked in G–ASRN, and three of them shared the rear bench-type seat.

The pre-flight engine power checks were completed apparently satisfactorily and the aircraft, which had been parked overnight close to the western end of the grass runway, taxied the short distance to the runway and took off towards the east. At the time the windsock indicated a fairly strong crosswind from the south-southwest. The take-off was normal but shortly after the aircraft had left the ground the rate of climb decreased until the aircraft was hardly maintaining height. Witnesses on the ground heard one of its engines misfiring. The passengers realised that the aircraft had lost power in some way but later could not recall hearing any unusual noises. They observed that the pilot was extremely busy checking the aircraft's selectors, switches and engine controls but he gave no indication of the nature of the emergency. He also appeared to them to be having great difficulty in controlling the aircraft in the turbulent flying conditions, for the aircraft began to yaw to the left and then suddenly developed a pronounced bank to port and dived steeply to the ground.

The impact with the ground ruptured the staboard fuel tanks and a small fire started in the starboard engine. The cabin was split open and the one uninjured passenger was able to help those who had been injured out of the aircraft. Before the unconscious pilot could be rescued, however, the fire spread and the cabin burst into flames.

1.2 Injuries to persons

Injuries	*Crew*	*Passengers*	*Others*
Fatal	1	–	–
Non-fatal	–	3	–
None	–	1	–

1.3 Damage to aircraft

Destroyed.

1.4 Other damage

Three overhead electricity cables were severed by the aircraft and one supporting wooden pole was damaged by fire.

1.5 Crew information

Mr G S Cameron, aged 39, served as a pilot in the Royal Air Force until 1960. He then left the service and became a civilian flying instructor. No record of his recent flying experience was found during the investigation but it was possible to estimate his total flying experience at about 4,500 flying hours of which some 3,000 had been in instructional flying. At the time of the accident he held a current Commercial Pilot's Licence endorsed in Group 1 for PA 30 aircraft, and a full instructor's rating which was endorsed for single- and multi-engined landplanes. He was last medically examined for the renewal of his licence on 9 December 1971.

On the day of the accident Mr Cameron had already made one short flight in another Twin Comanche to collect three passengers who were to join the party to Brussels.

1.6 Aircraft information

The aircraft was a twin-engined low-wing monoplane, fitted with a fuel injection system. It was built by the Piper Aircraft Corporation, United States of America, in 1964 and put on the British Register the same year. It was acquired by Mr Cameron in June 1970 and had at the time of the accident a current two year certificate of airworthiness in the general purpose category and a current certificate of maintenance. All the documentation on board the aircraft was destroyed by fire – and the aircraft's recent maintenance history, with the exception of the certificate of maintenance, was lost.

G–ASRN was equipped as a four seater aircraft with a bench-type seat in the rear fitted with two safety belts. On the accident flight the aircraft carried five people including the pilot. The passengers said they all were secured to their seats but it is not clear how the three in the rear bench seat managed to do this as only two safety belts were provided.

The weight of the aircraft at take-off was about 3,560 lb. The maximum authorised weight was 3,600 lb. The centre of gravity was within the specified limits.

Each wing of the aircraft was fitted with a main fuel tank and an auxiliary tank whose capacities were 25 and 12.5 imperial gallons respectively. The flight manual states that the auxiliary tanks were to be used in level flight only. Each engine had its own fuel selector, positioned on the cabin floor between the two front seats, consisting of a short pointed lever rotating in the horizontal plane to select either fuel off, auxiliary tank, main tank, or crossfeed. This lever was connected by a short tie rod to a lever on the fuel cock fitted with a spring loaded ball to register in a detent when the required tank was positively selected.

The aircraft was fitted with a fuel gauge for each set of tanks. Each gauge was connected electrically to its associated fuel selector valve so that the gauge indicated the contents of the tank selected. When the selector lever was 'off' or in an intermediate position between tanks, the related gauge read zero.

G–ASRN had been refuelled to capacity at Doncaster the day before the accident. Since then the aircraft had flown approximately 2 hours 50 minutes. The pilot who last flew the aircraft stated that at the end of his flight the main tanks were about three-quarters full and the auxiliary tanks almost empty.

For the purposes of the Air Navigation (General) Regulations G–ASRN was classified in performance Group C. In this Group data for determining the effect of an engine failure below 200 feet on the take-off weight are not normally scheduled in the Flight Manual and were not scheduled in this case.

1.7 Meteorological information

At the time of the accident the weather at Newbury was overcast with a 500 foot cloud base and light drizzle. According to a weather appreciation subsequently prepared by the Meteorological Office a moist southwesterly airstream covered the area. The surface wind was estimated as 200° at 15 knots and the ground temperature 12°C with a 95 percent relative humidity. Near the surface there was turbulence due to the gusty wind.

1.8 Aids to navigation

Not applicable.

1.9 Communications

Not applicable.

1.10 Aerodrome and ground facilities

A grass area in the northeast corner of Newbury racecourse has been set aside for use as an aerodrome. Its height is approximately 250 feet above mean sea level. A strip running along the north side of the race track aligned 102°/282°(M) has been designated as a runway and is 3,300 feet long and 150 feet wide.

At the time of the accident the surface was level and in good condition with short grass. An area near the western end of the runway is used as a parking space for visiting aircraft.

A line of trees approximately 50 feet high forming the boundary of the racecourse runs across the eastern end of the runway. Beyond the trees is an area of marshy ground bounded on the north by a main line railway and on the south by the Kennet and Avon Canal. It is crossed by several lines of overhead electricity cables 25 to 50 feet above the ground.

The aerodrome is unlicensed and has no aviation facilities other than a windsock.

1.11 Flight recorder

Not required and not fitted.

1.12 Wreckage

The wreckage was found in a marshy field less than a quarter of a mile north of the eastern end of the runway from which it had just taken off. The aircraft had dived steeply into the ground striking a line of three 25 foot high electricity cables. The starboard wing took the main force of the impact and both the main and auxiliary petrol tanks were ruptured. From the resulting fuel spillage a fire developed that destroyed the main cabin area, including all the instruments and engine controls.

Examination of the wreckage revealed that the undercarriage and the flaps were fully retracted when the aircraft hit the ground. No defect or evidence of malfunction was found in the control runs and surfaces.

The damage to the starboard propeller indicated that it had been turning under considerable power. The damage to the port propeller indicated that it had not been turning on impact. The blades were unfeathered.

Between 19 and 20 gallons of petrol remained in the port main tank but the auxiliary tank contained only a negligible quantity. Both fuel booster pumps were serviceable and no evidence of obstruction was found in the fuel supply lines. The starboard engine was selected to the starboard main tank but the port fuel selector was positioned a third of the way between the auxiliary and main tank positions.

The port engine was removed from the wreckage intact and bench-tested, without further adjustment. The engine was started and subjected to several power checks. It proved capable of producing maximum power and all magneto checks were satisfactory up to 2,400 rev/min. At 2,700 rev/min, however, the engine fired intermittently with the starboard magneto switched off, and ran at reduced power. The results were the same after a new set of plugs had been fitted. The cause was traced to a worn bearing in the port magneto. No other defect or evidence of malfunction was discovered in the engine.

1.13 Fire

A small fire developed on impact in the region of the starboard engine. The presence of petrol from the ruptured fuel tanks caused the fire to spread and a few minutes later the main area of the wreckage burst into flames. The fire fighting services were soon on the scene but the vehicles were unable to negotiate the marsh and the equipment had to be manhandled over the last quarter of a mile. The severed electricity cables remained alive for a short period and presented something of a hazard.

Two 20lb dry powder extinguishers and one 10lb carbon dioxide extinguisher were required to put out the fire in the cabin.

1.14 Survival aspects

The accident is classified as survivable, only the pilot having received fatal injuries. The starboard wing absorbed the main force of the impact and the electricity cables probably provided some retardation.

1.15 Tests and research

Because of the position in which the port engine fuel selector was found a series of tests was carried out on another aircraft of a similar type to examine the effects of various selector positions. The fuel valve is so constructed that when the main tank is selected all other inlet ports are closed. As the selector is moved towards the auxiliary tank position the main tank port gradually closes and the auxiliary tank port opens progressively until when the selector is fully home it is the only one open. It was found on test that because of this the engine ran satisfactorily at full power with the selector at any intermediate position provided there was petrol in both tanks. When the fuel was switched off completely the engine ran at full power for 12 seconds before it started to surge, misfire and die away.

Further tests were carried out after the auxiliary tank had been emptied. It was found that the engine would run at idling speeds with the selector at any intermediate position. However, when the throttle was opened fully the results varied according to the position of the selector. The engine continued to run satisfactorily as long as sufficient fuel could be supplied from the main tank but a point was reached on the selector's travel towards the auxiliary tank position beyond which signs of fuel starvation appeared. In a test carried out with the selector in a position similar to that found in the wreckage examination, the engine ran at full power for approximately 20-30 seconds and then started to surge before dying away completely.

Tests were carried out on the fuel selector to see whether it could be moved accidentally. It was found that a blow from an object such as a book or a brief-case or the movement of the feet of an occupant of the rear seats could knock the selector out of position. A modified type of selector fitted to later models of the PA 30, with a detent plate below the selector lever and a spring loaded plunger in the lever was similarly tested and could not be moved by such a blow.

The electrical interconnection between the fuel gauge and the tank selection was examined on a serviceable PA 30 and it was found that the gauge would read only the contents of the tank to which the fuel valve was positively positioned. The slightest movement of the fuel selector away from this position caused the pointer on the gauge to return to zero.

1.16 Medical aspects

Despite a post mortem examination, the precise cause of the pilot's death is uncertain. It was probably the result of asphyxia due to the inhalation of blood, his injuries having rendered him unconscious. A comparison of his injuries with those of the other occupants showed that the failure of the seat mounting under 'g' loadings greater than their design figure led to his death. Two passengers received injuries that rendered them unconscious for only a brief period, one was uninjured, and able to extricate himself when the cabin of the aircraft split open. His prompt action in returning to rescue the other passengers undoubtedly saved their lives, but the cabin became enveloped in flames before the pilot could be extricated.

2. Analysis and Conclusions

2.1 Analysis

2.1.1 *The loss of power in the port engine*

Examination of the wreckage revealed that the port engine had not been under power when the aircraft struck the ground, and it is clear from eyewitness reports that the engine had been running erratically and had lost power in the air. The technical examination, however, revealed no evidence of mechanical failure in the engine and, moreover, the engine ran satisfactorily when later put on a test-bench. It seemed, therefore, that the malfunction was probably caused by a failure in the supply of either the electricity or the fuel to the engine.

The engine test run revealed a worn bearing in the port magneto which caused the engine to misfire and lose power at full throttle. However, as the engine ran satisfactorily when both ignition systems were switched on the defect is not considered significant in the context of this accident. It is interesting to note, however, that the defect was only apparent at full throttle and therefore would not have been discovered by the pilot during the pre-take-off engine checks, which are carried out at 2,000 rev/min.

Although the weather conditions were conducive to the formation of engine icing the possibility that this was responsible for the power loss was discounted since the engine was fitted with a fuel injection system.

The significance of the position of the port engine fuel selector was then considered. The tests conducted after the accident on another aircraft showed that symptoms of engine malfunction similar to those observed in G–ASRN could be produced by misalignment of the selector whenever the auxiliary tank was empty. Although the left auxiliary tank on G–ASRN contained a very small quantity of petrol it was considered that it was probably not enough to cover the tank's outlet pipe at all times and that, therefore, the effects would be similar to those obtained with an empty tank. The way in which the fuel selector might have become misaligned was therefore investigated.

It was considered unlikely from the examination of the wreckage that the fuel selector had moved during the impact, although the possibility could not be ruled out entirely. Alternatively it could have been placed there inadvertently by the pilot either in the air or on the ground, or it could have been moved by an accidental knock. Careless initial selection by the pilot on first entering the aircraft can be discounted since his attention would have been brought to the error by the zero reading on the associated fuel gauge when he checked the

fuel for take-off. There is the possibility that the pilot moved the selector in the air while attempting to clear the engine malfunction by changing the fuel supply to a different tank, but this implies that the engine was already malfunctioning for some reason that has not been discovered. The final alternative is that the selector was moved by an accidental blow. If this occurred about the time that the take-off was commenced then it most probably would not have been noticed by the pilot. The tests suggest that the first symptoms of fuel starvation would have occurred shortly after the aircraft left the ground in consistency with the event observed immediately before the accident. There was insufficient evidence to establish how the fuel selector came to be in its post-impact position, but since the symptoms of malfunction observed in G–ASRN at the time of the accident were markedly similar to those reproduced in tests on another aircraft, and in the absence of any other explanation for the power loss, it may be inferred that fuel starvation resulting from a wrongly positioned fuel selector was the most probable cause.

2.1.2 *Aircraft performance*

The trees at the end of the runway would have obliged the pilot to make the initial climb at the aircraft's best angle of climb speed. According to the owner's handbook this speed is 90 mph, and at this speed the aircraft would have cleared the trees comfortably – as in fact it did. However, when the engine failed the minimum control speed became dominant. This is the speed (determined by test pilots) below which a twin-engined aircraft cannot be controlled with one engine operating at take-off power and the other engine windmilling – ie with the propeller not feathered. The owner's handbook advised: 'When operating under single-engine flight conditions, either in training or in emergency conditions, maintain indicated airspeed above 97 mph'.

It was imperative, therefore, in the case of failure during a climb at the best angle of climb speed to lower the nose of the aircraft without delay, so as to increase speed to the minimum control speed to regain control of the aircraft. While this was being done the situation could have been further relieved by feathering the propeller on the failed engine, and it may have been necessary to reduce power momentarily on the good engine.

2.1.3 *Probable cause of the accident*

If an incipient engine failure manifests itself in erratic running, as appears to have happened in G–ASRN, it is understandable that the pilot's first reaction would be to try to rectify the fault. From the evidence of the passengers it is apparent that this is what Mr Cameron was trying to do. It was unfortunate that he did not feather the propeller immediately. The combined effect of the best angle of climb speed, take-off power on the good engine, and the unfeathered propeller on the failing engine would have made control of the aircraft extremely difficult, if not impossible. There would be a strong inhibition against lowering the nose to gain speed and against reducing power

on the good engine, since either would be likely to result in an emergency landing, for which the terrain below G–ASRN was highly unsuitable. The pilot would have felt bound to try to maintain height for as long as was necessary to put the aircraft in a more favourable position. It is most probable that during this brief period fuel starvation caused so much loss of power that the aircraft became uncontrollable.

2.1.4 *Compliance with Air Navigation (General) Regulations*

The owner's handbook contains charts for calculating the aircraft's actual performance. It can be calculated, for example, that at Newbury, at a temperature of 12°C, the aircraft at the maximum authorised weight of 3,600 lb would require, in still air, a distance of 2,250 feet to take-off and clear a 50 foot obstacle. The length of the runway at Newbury was 3,300 feet. However, it is clear from the evidence of the passengers that G–ASRN was being used for public transport, and it had to comply with the performance requirements laid down in the Air Navigation (General) Regulations. For compliance with these Regulations 'net' performance data is published in the aircraft's flight manual in which the actual performance is theoretically reduced by including factors to allow for variations in aircraft performance and piloting technique.

The flight manual charts indicate that at Newbury, at 12°C the aircraft at 3,600 lb would require, in still air, a distance of 3,000 feet to reach a height of 50 feet. This figure assumes take-off from a hard level dry surface. For grass surfaces, such as Newbury, the flight manual requires 5 per cent to be added to the calculated distance. The operation's manual raised by Mr Cameron suggested that this increment should be 25 per cent, but that it may be reduced to not less than 10 per cent at the pilot's discretion. With an increment of 10 per cent the distance required for a take-off in still air to 50 feet at 3,600 lb becomes 3,300 feet, the length of the runway at Newbury.

These calculations take no account of obstructions in the take-off flight path, and at Newbury there are trees at the eastern end of the runway. For a take-off towards the east, therefore, to allow for a 50 foot clearance over the trees the take-off weight would have to be reduced to about 3,200 lb. If the tailwind component that probably existed on the day of the accident is taken into consideration the take-off weight would have to be further reduced to about 2,900 lb. G–ASRN was thus technically overweight for a take-off towards the east.

Apart from the fact that the aircraft had been parked near the west end of the runway there seems no obvious reason why the pilot chose to take-off towards the east. It is not possible to say whether observation of the windsock in gusty wind would have shown any definite head or tail component in the crosswind.

The aftercast of the Meteorological Office is too general for such a close determination of local wind direction. However, it may be supposed that he detected some advantage in the wind component that outweighed the disadvantage of taking-off towards the more obstructed boundary of the field.

2.1.5 *Safety considerations*

In this instance the fact that there was one more occupant than authorised was not contributory to the accident or to the injuries received by those on board. The take-off weight and the centre of gravity were within the authorised limits and it is unlikely that the performance or the handling qualities of the aircraft were impaired in any way. Although it is to be expected that the safety of those on board would be affected by there being too few safety belts and a reduction in the effectiveness of the emergency exits and equipment, the passengers in G–ASRN were apparently able to overcome these deficiencies by adapting the existing safety belts to their requirements, and by making use in the accident of the circumstance that the cabin split open to allow them enough room to escape in time.

2.2 Conclusions

(a) *Findings*

(i) The pilot was properly licensed.

(ii) The aircraft had a valid certificate of airworthiness and a valid certificate of maintenance, and was on a public transport flight.

(iii) The number of people on board exceeded by one the number authorised in the flight manual.

(iv) The take-off weight was less than the authorised maximum and the centre of gravity was within the prescribed limits, but the aircraft was technically overweight for an easterly take-off at Newbury.

(v) The port engine lost power during the initial climb.

(vi) The loss of power was most probably the result of the misalignment of the port engine fuel selector cock to a position between the almost empty auxiliary tank and the main tank. The evidence was insufficient to establish how the misalignment occurred.

(vii) The misalignment was not discovered by the pilot, and the propeller on the failed engine was not feathered.

(viii) Obstructions near the boundary of the aerodrome deterred the pilot from lowering the nose to gain speed or throttling back the good engine to reduce the yaw, and the aircraft lost speed and went out of control.

(b) *Cause*

The aircraft lost speed and went out of control after a power loss in one engine during initial climb. The power loss was most probably the result of fuel starvation due to a misalignment of the engine fuel selector. The cause of the misalignment has not been established.

G M Kelly
Inspector of Accidents

Accidents Investigation Branch
Department of Trade and Industry
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