

No. 5

Trans-Canada Air Lines, Vickers Viscount 757, CF-THT, accident at Toronto International Airport, Ontario, Canada, on 13 June 1964. Report undated, Serial No. 2287, released by the Department of Transport, Canada.

1. - Investigation1.1 History of the flight

The aircraft departed Toronto at 1440 hours EST on a scheduled domestic flight Toronto-Montreal-Toronto. The flight from Toronto to Montreal was routine except for a radar malfunction and an intermittent synchronization problem with No. 2 engine which was not considered serious. The radar accessory was changed at Montreal and the aircraft departed Montreal at 1640 hours on an IFR clearance as Flight 3277. The en-route flight was normal except for the recurring synchronization problem with No. 2 engine. After reporting over the Peterborough intersection, successive descent clearances were given until the aircraft was at 4 000 ft. With the airport in sight, from a position about 8 NM east of Toronto Airport, the instrument flight was cancelled and a visual approach was made for a landing on runway 28.

About 2 miles east of the runway threshold on final approach at an altitude of about 700 ft above airport level, the No. 2 engine began to surge. The airspeed was 120 to 123 kt, and the aircraft was descending at about 600 ft/min with the undercarriage down and the flaps set at 32°. The No. 2 engine instruments showed wide fluctuations from normal rpm with a slight torque variation and fairly steady fuel flow. The pilot-in-command exercised the throttle in the prescribed manner, but this appeared to aggravate the surging. He stated that the fuel flow indicator was then fluctuating between 0 and 500 lb/hr.

The pilot-in-command decided to feather No. 2 engine but inadvertently shut down No. 1 engine by moving the HPC (high pressure cock) back through the closed position to the feather position. He immediately attempted to relight No. 1 engine and at the same time ordered the co-pilot to feather No. 2 propeller. The relight attempt was unsuccessful. The pilot-in-command then increased power on engines Nos. 3 and 4 and devoted his attention to maintaining control of the aircraft. He instructed the co-pilot to relight No. 1 engine.

The co-pilot made two attempts to relight No. 1 engine without success. During these attempts the stick shaker stall warning operated twice. By this time the aircraft was about 3 500 ft short of runway 28, 300 ft above ground and had deviated to the left of the runway heading. The aircraft was in about a 20-degree left bank attitude with full right aileron and rudder applied. When ground impact was imminent, the co-pilot closed Nos. 3 and 4 throttles and the pilot-in-command partially levelled the wings. The aircraft swung to the left, losing altitude, and struck upsloping ground heavily with the left main wheels while in a left wing low nose high attitude. It continued on a heading of 231° magnetic making intermittent contact with the ground for a distance of about 700 ft, during which it struck trees and two snow fences. About 900 ft from the first impact, the left wing began to separate and the aircraft started to curve to the left and continued across runway 14-32. The left wing complete with the left main wheels and Nos. 1 and 2 engines separated from the aircraft 240 ft west of runway 14-32. The remainder of the aircraft

continued to the left and came to rest on a heading of 076° magnetic, 157 ft beyond the detached wing. The distance travelled from first impact to where the fuselage came to rest was about 1 790 ft. The accident occurred at 1809 hours. The accident site was Lat. 43°41'N, Long. 79°38'W.

1.2 Injuries to persons

Injuries	Crew	Passengers	Others
Fatal			
Non-fatal		1	
None	3	40	

1.3 Damage to aircraft

The aircraft was substantially damaged.

1.4 Other damage

None reported.

1.5 Crew information

The pilot-in-command occupied the left-hand seat and was flying the aircraft. He held an airline transport pilot's licence with a Class I instrument rating and had accumulated a total of 10 060 hours flying experience. His total experience on Viscount aircraft amounted to 117 hours, all of which had been flown in the 90 days prior to the accident.

The co-pilot also held an airline transport pilot's licence with a Class I instrument rating, and had accumulated a total of 2 657 hours flying experience. His total experience on Viscount aircraft was 46 hours, all of which had been flown in the 90 days prior to the accident.

Also aboard was one stewardess.

1.6 Aircraft information

A certificate of airworthiness had been issued for the aircraft.

No mention is made in the report as to the loading of the aircraft or the type or amount of fuel being carried.

1.7 Meteorological information

Weather was not considered to be a factor in the accident.

1.8 Aids to navigation

Not pertinent to the accident.

1.9 Communications

Not mentioned in the report.

1.10 Aerodrome and ground facilities

Not pertinent to the accident.

1.11 Flight recorders

Not mentioned in the report.

1.12 Wreckage

See paragraph 1.1.

1.13 Fire

Although fuel was escaping from the accident, there was no fire.

1.14 Survival aspects

No information was contained in the report.

1.15 Tests and research

Examination at the scene and subsequent exhaustive investigation of the Nos. 1 and 2 engines, their propellers and their associated systems, including test stand running of the engines, failed to reveal any fault, with the exception of the pitch control unit for the No. 2 propeller.

During dismantling of the No. 2 propeller pitch control unit, pieces of a rubber "O" ring were found in the unit. This material could have interfered with the high and low pitch ports. The unit had been installed on 13 October 1963, and had not been changed during the course of 870 hours flown since installation. A number of aircraft snags concerning engine surging or synchronization had been recorded during this time, any or all of which, including that which occurred on this flight, could have been the result of the interference noted above. The portion of "O" ring was foreign to any used in the system and its origin was unknown.

2. - Analysis and Conclusions

2.1 Analysis

There was no evidence of malfunction or failure in the aircraft, its engines or controls except for No. 2 engine. During the investigation the only fault found with this engine was the presence of foreign material in the pitch control unit. This fault could account for the surging observed by the pilot-in-command, but could not account for a complete loss of power.

The action of exercising the throttle when the surging was noted was the procedure recommended for a "partial flame out". The throttle is snapped shut, then opened rapidly to the three-quarter open position and then closed again. This gives the engine a slight thermal shock and would propagate the flame from the lit to the unlit engine burners. Under the circumstances, the use of this procedure was correct. Following this action, the high pressure cock was left in the open position and the throttle closed. The engine remained in this power situation until the high pressure cock was closed and the propeller feathered by the co-pilot.

Prior to the feathering of the No. 2 propeller, the pilot-in-command considered that the engine had stopped and the fuel flow was indicating zero. Unless there was a fault in the fuel system, zero fuel flow could not be indicated with the HPC in the open position and the propeller rotating, regardless of the throttle position.

Reasons for the failure to relight No. 1 engine were sought. When the pilot-in-command shut down the No. 1 engine in error, he did so by moving the HPC back through the closed position to the feather position; however, the feathering button was not pushed. Placing the HPC in the feather position would shut off the fuel supply to the engine and would initiate a coarsening of the propeller pitch. About 5 seconds is required to feather the propeller by use of the HPC alone. Feathering action is more rapid when the feather button is used, as it operates an electric feathering pump. Since the HPC was only momentarily in the feather position, the propeller could not have feathered although the engine would have flamed out.

The relight attempt by the pilot-in-command was made after the HPC had been reopened and with the throttle still set for 145 lb of torque. When he pulled the feathering button to apply ignition, a relight should have occurred.

The second and third attempts to relight No. 1 engine were made by the co-pilot. He carried out a portion of an "unfeathering - air relight" drill and in fact called out the items of the drill to the pilot-in-command on the final attempt. The procedure the co-pilot intended to carry out is as follows:

1. Close HPC (closed but not in the feathered position).
2. Check throttle closed.
3. Pull and hold the feathering button.
4. When rpm indication (approximately 1000 rpm) open HPC ... etc.

The co-pilot did not get beyond item No. 3: "Pull and hold the feathering button".

At this point in the drill, the co-pilot was waiting for an indication on the No. 1 engine rpm gauge. Since there was no apparent rpm indication, he did not reopen the HPC and thus fuel was not fed to the engine and the relight could not occur. Evidence shows that No. 1 propeller was windmilling and also that the rpm gauge was operable. Experiment established that a steady rpm indication of 7 200 could have been expected. Under the existing circumstances, the engine could not relight until the HPC was opened.

Technical examination of the engine revealed that it should have been capable of restarting. Lack of carbon on the igniter plugs established that they had been firing during the relight attempt.

It was determined from witnesses' statements and from a photograph of the aircraft taken about 12 seconds before impact, that the No. 2 propeller was feathered and that the No. 1 propeller was windmilling.