Tipsy Nipper T.66 Series 2, G-ATBW

AAIB Bulletin No: 7/99 Ref: EW/G99/02/06 Category: 1.3

Aircraft Type and Registration:	Tipsy Nipper T.66 Series 2, G-ATBW
No & Type of Engines:	1 Volkswagen 1834 (ACRO) piston engine
Year of Manufacture:	1962
Date & Time (UTC):	7 February 1999 at 1355 hrs
Location:	Stapleford Tawney Airfield, Essex
Type of Flight:	Private
Persons on Board:	Crew - 1 - Passengers - None
Injuries:	Crew - Minor - Passengers - N/A
Nature of Damage:	Propeller broken, landing gear collapsed and local deformation to fuselage
Commander's Licence:	Commercial Pilot's Licence with Instrument Rating
Commander's Age:	33 years
Commander's Flying Experience:	283 hours (of which 39 were on type)
	Last 90 days - 3 hours
	Last 28 days - 3 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and further enquiries by AAIB

On the Tipsy Nipper aircraft the standard fuel tank is fitted in the nose between the engine and the wing spar which passes through the cockpit in front of the pilot at chest height. Two auxiliary tanks within the wing tips had been added on G-ATBW. These tanks were intended to feed fuel under gravity into the main tank via a tee-piece and an "ON/OFF" valve. Fuel contents indication was available to the pilot only for the main tank through a clear plastic tube sight-gauge. This was wrapped around the spar and held within a vertical channel fitting on its aft face. Graduations were marked on a white card strip behind the plastic tube but this had not been calibrated against tank contents and consequently had no values indicated alongside the scale. This aircraft was also fitted with a 'flop-tube' in its main fuel tank to allow inverted flight; this supply was selected by the 'AERO' position on the fuel cock. With the cock selected to the 'MAIN' position fuel was taken from a sump in the floor of the main tank which was designed to minimise the unusable fuel.

Following the modification of the aircraft when the tip tanks were installed a flow test was carried out. Starting with 15 litres in each tip tank and an empty main tank it took 8 minutes 46 seconds for transfer to complete and it was found that 5 litres remained in each tip tank. The pilot on the accident flight was unaware of these results. A flight test was also carried out during which fuel transfer from the auxiliary tanks to the main tank was tested. It was not possible to determine exactly the rate of transfer but the pilot saw that transfer was taking place from an increase in the level in the main tank. The transfer cock was kept open for 20 minutes and after the flight it was found that all of the fuel in the right tank had transferred and only half a gallon remained in the left tank. The post-flight report noted that the actual capacities of the main and auxiliary tanks should be checked and the fuel gauge calibrated with the 'empty' position to be shown. It also reported that the 'empty' position had been temporarily marked and that the graduations in place indicated approximately 1 gallon per division. As stated above, at the time of the accident flight the sight tube carried no calibrated markings and did not have the 'empty' position marked other than by the chinagraph line drawn by the test pilot.

The aircraft was refuelled for its first flight of the day. The main tank was filled (35 litres) and 10 litres shared between the two wing tip tanks (reportedly 16 litres capacity each). The aircraft operating group used a figure of 13.5 litres per hour for fuel consumption calculations. A check of the group's records after the accident indicated that overall consumption was 11 to 12 litres per hour based on the Hobbs time recorder ie including taxiing time which probably influenced this figure as most flights were of short duration. When the first flight lasted for 35 minutes the pilot, about to undertake what was to be the accident flight, calculated that 8 litres had been used. He had not flown the aircraft for over a year and so had not flown it since the tank modification had been installed. He estimated his endurance only on the capacity of the main tank, assuming that there would be sufficient transfer from the tip tanks to compensate for that used during the first flight. Allowing for 6 litres unusable fuel he arrived at an estimated endurance of 2 hours 15 minutes, slightly more than these figures would indicate (about 2 hours 10 minutes). Two hours 15 minutes was the endurance which was quoted in the operating manual used by the group based on the capacity of the main tank alone. He planned for a flight time of 1 hour 30 minutes and, therefore, considered that he could rely on a 45 minute reserve.

About 10 minutes after departure he marked the fuel level on the sight tube with a chinagraph pencil and opened the transfer cock. The flight conditions were turbulent and the fuel level indication was fluctuating but when he carried out his next FREDA check he considered that the mean level had risen by 1 cm and he was satisfied that fuel was transferring, albeit slowly. During his next few FREDA checks the level appeared not to have changed and he was satisfied that transfer had taken place. Some 40 minutes after opening the transfer cock he closed it again. When he carried out his airfield approach checks he estimated his remaining endurance as 55 minutes and was happy with the fuel contents indication but when he was on the downwind leg of his landing circuit there was an abrupt loss of power. He selected a nearer runway for landing and announced his intentions to ATC but the engine then lost all power and, as he realised that he could not now reach the runway, he elected to make an into-wind forced landing in a field**.** Faced with upsloping ground and with a high rate of descent the considers that he flared too late to prevent a heavy landing. The ground was soft and at touchdown the left main and the nose landing gear collapsed. The aircraft tipped on to its nose but settled back to come to rest with its left wingtip on the ground. When the aircraft was examined some days later the main tank was found to be virtually empty, the right wingtip tank was also empty and the left wingtip tank contained 7 litres.

During the flight, when he was estimating the main tank contents from the sight gauge the pilot used the bottom edge of the wing spar, which was level with the floor of the tank**,** as the zero datum

and made an allowance for unusable fuel. Later he learned that the zero indication was actually a chinagraph mark, higher on the tube, which had been put on after the test flight. He had thought that it was merely a temporary indication used by another pilot checking for fuel transfer as he had done.

As 7 litres was found in the left tip tank out of 10 litres originally in both tip tanks this suggests that transfer from right to left had occurred, probably after the accident, and also that little had transferred out of the auxiliary tanks during flight (particularly as some may have been lost after the accident through the left tank vent). After the aircraft had been righted it was found that the tip tank fuel did equalise and it was subsequently transferred to the main tank and drained. This showed that there was no blockage in the auxiliary system and full transfer was possible. However the fuel transfer tests carried out when the tip tank modification had been completed show that the amount remaining as unusable in the tip tanks could be as much as was put into the tip tanks before the accident flight. Aircraft attitude could, presumably, affect transfer but it is not known how the attitude compared between these different transfer cases.

At the start of the accident flight the fuel in the main tank was probably about 27 litres (35 litres minus 8 litres used in the previous flight). Assuming no transfer from the wingtip tanks this should have provided an endurance to dry tanks of 2 hours at 13.5 litres per hour. Unusable fuel was reported as 6 litres and this would reduce the endurance to about 1 hour 30 minutes, the actual flight time, but, after the accident, the residual fuel in the main tank appeared to be much less than that amount. Higher power settings would entail higher flow rates up to about 18 litres per hour at maximum (climb) power which would result in an endurance of 1 hour 30 minutes. As maximum power would not have been used throughout the whole flight, the pilot reports generally using 2,950 RPM, the actual endurance ought to have been greater than this.

If any defect is uncovered during the aircraft's repair, engine inspection or ground runs it will be reported in an addendum to this bulletin.