INCIDENT

Aircraft Type and Registration:	Piper PA-32-300, N2989M
No & Type of Engines:	1 Lycoming IO-540 SER piston engine
Year of Manufacture:	1977
Date & Time (UTC):	6 October 2007 at 1140 hrs
Location:	Newmarket Racecourse, Cambridgeshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 3
Injuries:	Crew - None Passengers - None
Nature of Damage:	Damage to both lower wing skins and right wing leading edge, wing spars distorted
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	28 years
Commander's Flying Experience:	1,490 hours (of which 32 were on type) Last 90 days - 70 hours Last 28 days - 50 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and follow-up AAIB investigation

Synopsis

Immediately after touchdown at Newmarket, at the end of a flight from Middleham, the pilot retracted the flaps to prevent 'float' in an attempt to improve the aircraft's braking performance. It passed over an undulation in the grass runway surface and became airborne again. The pilot was unable to arrest the subsequent descent and the aircraft made what was described by the pilot as a 'firm' landing. No specific inspection of the aircraft, other than its normal pre-flight inspection, was carried out at Newmarket and the aircraft returned to Middleham without incident. Two days later, during a routine maintenance inspection, serious structural damage was found affecting both lower wing skins and the right wing leading edge. This damage was considered to have weakened the wing structure sufficiently such that there was a risk of a structural failure during the aircraft's return flight to Middleham.

History of the flight

The aircraft had flown from Middleham to the airstrip at Newmarket Racecourse. After making a normal approach and touchdown the pilot had immediately retracted the flaps in an attempt to ensure positive ground contact and reduce any tendency of the aircraft to 'float'. However, shortly after touching down, the aircraft passed over an undulation in the runway which caused it to become airborne again. The pilot attempted to minimise the sink rate with the application of power but the aircraft

made what the pilot described as a 'firm' touchdown. The pilot, based on his experience, did not consider the landing to be excessively firm and did not judge that any additional inspection of the aircraft was required prior to flying the aircraft back to Middleham.

On 8 October, whilst the aircraft was undergoing a 50 hr inspection, buckling was found on the lower wing skins, outboard of the landing gear, and the right wing leading edge. Removal of the wing skins showed that a significant download had been applied to the outer wings which had resulted in compressive buckling and cracking of the lower spar webs outboard of the main landing gear. Both wings were subsequently removed for repair.

Fuel

The PA-32-300 is fitted with four fuel tanks within the wings, two inboard, each holding 25 US gallons, and two outboard tanks, each holding 17 US gallons. The normal procedure for fuel management, detailed in the PA-32 Pilot Operating Handbook (POH), calls for the fuel in the inboard tanks to be consumed prior to using the fuel in the outboard tanks, presumably to provide bending moment relief for the wings. In the event of a hard landing with fuel in the outboard tanks, their mass (in excess of 100 kg when full) would exert a significant downward bending moment to the wings outboard of the main landing gear. The pilot reported that the aircraft had left Middleham carrying approximately 70 US gallons of fuel, evenly distributed. Given a flight time to Newmarket of approximately 1.5 hours, and a fuel burn of approximately 14 US gallons per hour (PA-32 POH data), the fuel in the outer wing tanks would have remained largely unused prior to the landing.

Landing technique

The short field landing technique used by the pilot, of retracting the flaps immediately after touchdown, was intended to reduce the lift from the wings, and allow wheel braking to be started earlier in the landing run. A secondary effect of this technique, however, is that the aerodynamic drag produced by the aircraft is significantly reduced and this results in a decrease in the rate of deceleration prior to the application of the brakes. If, as in this event, the aircraft bounced or became airborne during this phase of the landing, it is probable that there would be insufficient lift available to reduce the aircraft's subsequent rate of descent. Whilst the pilot did not consider the landing to be sufficiently 'firm' to warrant additional inspection of the airframe, the areas of damage, particularly that on the wing leading edge, was sufficiently large to have been easily observed during the pre-flight inspection carried out prior to the return flight to Middleham. The subsequent operation of the aircraft in its damaged condition meant that the wing's ability to carry design flight loads would have been severely compromised.