Yak-52, RA44546

AAIB Bulletin No: 2/2002	**Ref: EW/C2001/8/1**	**Category: 1.3**
Aircraft Type and Registration:	Yak-52, RA44546	
No & Type of Engines:	1 Ivchenko Vedeneyev M-14P piston engine	
Year of Manufacture:	1988	
Date & Time (UTC):	11 August 2001 at 1430 hrs	
Location:	1 nm north of Compton Abbas Airfield	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - None
Injuries:	Crew 1 (fatal)	Passengers N/A
Nature of Damage:	Aircraft destroyed	
Commander's Licence:	Commercial Pilot's Licence	
Commander's Age:	47 years	
Commander's Flying Experience:	More than 2,100 hrs (of which 90+ were on type)	
	Last 90 days - unknown	
	Last 28 days - unknown	
Information Source:	AAIB Field Investigation	

History of the flight

The pilot arrived at Compton Abbas Airfield, Wiltshire, in the early afternoon having planned to fly from there to Kemble Airfield, Gloucestershire, to participate in a fly in. The weather at Kemble was poor so he elected to wait for an improvement. He spent some time at the flying club and then when it appeared the weather at Kemble had improved, he decided to depart. He carried out a pre-flight inspection of the aircraft and was seen to put something in the rear cockpit. At about 1410 hrs he booked out in the clubhouse and advised that he would like to carry out some aerobatics over the airfield before departing en-route.

After starting the engine, the pilot called for a radio check and then before take-off explained that he would carry out aerobatics in the overhead for eight minutes before leaving the area. Compton Air to Ground radio station advised other traffic to remain clear of the circuit for that time. The aircraft took off from Runway 26 and was later seen to do one inverted pass along the runway before pulling up and carrying out a number of manoeuvres just to the north of the airfield. Observers stated that the aircraft remained clear of cloud and was in sight all the time.

After a few minutes, the aircraft was observed to pull up into a vertical climb from which a stall turn was carried out. After the stall turn was completed the pilot was heard to make a radio call advising "display complete" and stating that he would now be departing to Kemble. Then he pulled straight up into a second vertical climb at the top of which the aircraft was seen to begin a stall turn. It was next observed to be in a spin and performed approximately four rotations before impacting the ground. A fire started immediately on impact and burned fiercely for some time. The local fire service arrived on the scene 15 minutes after receiving the emergency call, despite difficult access to the accident site.

Meteorological conditions

The general weather conditions at Compton Abbas at the time of the accident were as follows: surface wind 250°/18 to 20 kt, visibility more than 10 km and QNH 1026 mb. A pilot report from an aircraft gave the cloudbase to the north of Compton as broken at 2,300 feet amsl. The elevation of Compton Abbas is 810 feet and high ground, two miles to the north, rises to 910 feet. This would have given a general cloudbase in the area of 1,500 feet agl which was confirmed by several pilots who were airborne in the local area around the time of the accident.

Witness evidence

There were a number of witnesses to the accident, located both on and off the airfield. None of the witnesses was able to recall clearly the direction of the final stall turn or the direction of rotation of the spin. However most witnesses described seeing a spin or spiral through three or more turns with little variation or sign of recovery. The engine was heard to be running at high power during the vertical climb and to have reduced to idle at some time before impact.

Pilot experience

The pilot had flown regularly since he first learned to fly in 1975. In April 1999 he joined a group of pilots who owned two Yakovlev aircraft. The group required that all members wishing to carry out aerobatics in one of the aircraft should have to undergo training in aerobatics and stall/spin recoveries. There was also a requirement for any member who had not flown one of the aircraft within the last 28 days to have a dual check flight.

After joining the group in 1999 the pilot carried out eight hours of dual aerobatics training in the Yak 52. This training comprised basic general aerobatics including recoveries from normal spins. The pilot's wife thought that he had also attended a residential aerobatics course at some time during year 2000 but there was no record of such training in his logbook. However, the final logbook entry was dated 29 June 2000 (13 months before the accident). There was no indication that during the 8 hours aerobatics training, or at any other time, the pilot had carried out any training in recoveries from flat spins.

In October 2000 the pilot had applied for a provisional Display Authorisation (DA) and had reportedly started to work towards the issue of the qualification. This involved him practising various manoeuvres, preparing an aerobatic sequence and gradually lowering his practice height. Other pilots considered that he had adopted a cautious and methodical approach to achieving his aim. The Civil Aviation Authority recommends that pilots working towards a DA should find an experienced pilot to act as a mentor and oversee their development. There was no indication that the pilot had formally progressed to this stage.

On the day before the accident the pilot was seen to practise some aerobatics in the accident aircraft. By chance this was observed by another of the group members and consisted of a number of separate manoeuvres; it was believed he had yet to develop a full sequence. In particular, it was noted that he appeared to be having some difficulty with completing stall turns successfully.

It was the pilot's usual practice to wear a parachute and helmet whenever he flew the aircraft. He had some previous parachute experience. The parachute he wore should have been useable down to 1,000 feet agl.

Aircraft information

The aircraft was a low wing, two seat, tandem cockpit type, with all-metal fuselage construction and fabric covered control surfaces. Solo flight was from the front cockpit which had a sliding canopy operated with a single lever.

The aircraft had been based in the United Kingdom (UK) for a number of years, initially as LY-ALM (Lithuanian registry) and for the last year as RA44546 (Russian registry). Were the aircraft to have been issued a UK Permit to Fly, a number of modifications would have been required. These modifications were all concerned with rear cockpit equipment.

The aircraft was refuelled with 66 litres of aviation gasoline on the afternoon of the previous day and was not flown again before the accident flight. It was the normal practice to fill the aircraft to its total capacity of 120 litres. Had this been done, the Centre of Gravity (CG) would have been within the allowable range.

The Yak 52 aircraft recovers conventionally from a normal spin using the standard spin recovery technique. In a normal erect spin the aircraft will lose 300 to 400 feet per turn. If a spin develops in which the pitch attitude is less than 45° the height loss will be less per turn, but the rotation rate will be higher and the recovery may be more difficult and take longer. A recent editorial written for the European Yak Club covered the subject of the characteristics of a flat spin. The following observations were made in the article:

> "It is not difficult to get into a flat spin through a mishandled stall turn"
>
> "Once the flat spin has fully developed it can take up to four complete rotations for the recovery to be made"
>
> "Stick forces on both elevator and rudder in order to move the stick forward and to obtain opposite rudder can be extremely high-requiring a great deal of strength. This can give the impression of jammed controls if one is not used to it and this can only be achieved through practise with an appropriate instructor."

Other information

A post mortem was carried out on the pilot. There was no evidence of any pre-existing disease or condition which would have affected his ability to carry out the flight. The performing of aerobatics in the vicinity of Compton Abbas airfield was common practice. To the north of the airfield there is a steep sided valley (some 1400 metres long by 400 metres wide) the bottom of which is at 450 feet amsl. Often pilots performed aerobatics over this valley which gave more height for recovery than would be the case directly over the airfield.

Engineering investigation

The aircraft had struck the ground in an upright attitude with the left wing and nose low. On site it had appeared that the impact was probably about 30 degrees nose down. However, a more detailed examination of the engine and fuselage later showed that the angle of impact had been steeper, perhaps about 45 degrees, but not as steep as 60 degrees nose down. The ground impact marks and the damage to the aircraft showed that after impact the aircraft had come to rest in a distance of only a few feet and that there was only a low horizontal velocity over the ground at impact. They also confirmed that the aircraft had been spinning to the left when it struck the ground. The propeller had been turning but with very low engine power at ground impact. The aircraft had caught fire and was extensively burned away, particularly in the cockpit area. From the burned residue it was possible to establish with reasonable certainty that there were no personal items or bags in the aircraft which were not accounted for, or which could have adversely affected the balance, or interfered with flight controls. It was apparent from the damage that the vertical speed at impact was high, causing the wings to break downwards at the landing gear positions. Examination of the flying controls showed that the flaps had been retracted at impact, and the flying control cables had all been connected. Due to the extensive fire damage it was not possible to establish if any kind of control restriction could have occurred.

The aircraft log book showed that since October 1998 routine inspections had been carried out at 50, 100 and 200 hour intervals. There was no evidence in the aircraft documents that any significant technical problems had arisen in that period.

Discussion

The pilot did not bring his usual flight bag to the airfield but the aircraft cover and flight log were later found to be missing. It is likely that these were the items stowed by the pilot in the rear cockpit. There was no evidence that these were other than correctly stowed. The pilot wore a parachute and safety helmet. He would have expected to have been able to use the parachute successfully down to 1,000 feet agl. In this case at best he would have had only 500 feet in which to identify a problem, decide upon and effect an escape from the aircraft. Therefore, in practical terms, the parachute could not have been of use to him on this occasion.

The pilot made a radio call in which he was heard to say that he was proceeding to Kemble. He then apparently carried out a further aerobatic manoeuvre. Several explanations for this inconsistency were considered including the radio operator being mistaken about the timing of the RTF message, a medical problem, a control problem or a mishandled recovery from a zoom climb to transit altitude. None of these explanations seemed more likely than a decision by the pilot, after making the radio call, to carry out one more manoeuvre.

The Yak52 aircraft has spinning characteristics such that recovery from certain types of spin can be difficult and can lead to considerable height loss. The manoeuvre being attempted by the pilot was one that he had found difficult on several previous occasions and if mishandled, could have resulted in a flat spin, leaving him with limited airspace available for recovery. The pilot's recovery action from an unintentional spin would have been delayed by the time taken to recognise and react correctly to the event. The attitude of the aircraft during the spin could not be determined but the impact attitude was approximately 45°. This attitude could have been as a result of recovery action from a flatter spin or alternatively the result of a normal spin without a recovery.

The pilot was reported to have been careful and methodical in his approach to improving his aerobatic flying. His decision to carry out vertical aerobatic manoeuvres with the available cloudbase was inconsistent with his normal behaviour. There is a possibility that his judgement on the day was affected by unknown circumstances but it seems unlikely that he appreciated the degree of risk in the manoeuvres he was attempting.