From: Sam Whatmough---------- --- ---------- --
Sent: Thursday, April 01- ----------
To: Keliher Zoe
Subject: Re: Yak 52- spins, etc.

Dear Zoe,

Having looked at the footage and the stills I'm afraid that I am only able to come up with a supposition of the final stages of the flight, from when the photograph and video footage was taken onwards. I have been unable to tell control surface deflections, propeller RPM or indeed the exact nature of the flight path.

The still photograph would indicate from the smoke trail that the aircraft was in a spin. I have been unable to determine the nature of the spin as to whether it was fully developed, flattened or with power, or if any recovery control inputs were initiated. It would appear that from the smoke trail that the aircraft was in a spin of at least 3 turns and would therefore likely be fully developed. The smoke "corkscrew" tightens (smaller diameter) significantly after 2 visible turns which would indicate a lower nose attitude and therefore the aircraft recovering from the spin.

The height loss per rotation doesn't appear to alter too much when the aircraft is in the recovery stage which would indicate the aircraft was in a conventional spin rather than a flattened one (an aircraft in a flattened spin presents a larger plan area to the airflow and thus descends less per rotation).

The video footage appears to show the aircraft in a forwards descending flight path which would mean that the aircraft successfully managed to recover from the spin albeit at a very low height. The aircraft then impacts the ground in forward descending flight meaning that although spin recovery was successful there was insufficient height to recover from the descending flight path.

The aerial photograph would support this theory as it would appear that the aircraft impacted the ground in a relatively flat attitude, as opposed to a nose low attitude as experienced in a spin, or during spin recovery. the relative lack of damage to the forward of the aircraft wings, despite the rocky terrain would indicate that the aircraft impacted with a low forward speed though high vertical rate of descent. The best way to describe this would be as a pancake or belly flop. I could not determine if the final impact of the aircraft was under a stalled condition or not.

My conclusion would be that the aircraft was in a conventional spin which it managed to recover from though tragically at a height from which a safe flight path was not possible and the aircraft impacted the ground in a slow speed condition with a high descent rate,

As I have said, there has been very little to go on, and these are purely my suppositions based on my experience of displaying the Yak 52 during low level aerobatics. I can only apologise for having to make suppositions due to the lack of available evidence.

I should be interested to hear your feedback and receive any findings that you have. As ever, if I can be of any further assistance either now or in the future then please don;t hesitate to get in contact.

best wishes,

Sam Whatmough

From: Richard Goode [mailto:-------- ---------- ----- ----- --------
Sent: Tuesday, April 06, 2010----------
To: Keliher Zoe
Subject: Yak-52 ---- Spins

Dear Zoe

Thanks for the attachments/photos. To be frank none of them convey a huge amount, although the picture of the aircraft post-accident, showing the fuselage broken behind the cockpit would indicate to me that the aircraft had not been in a flat spin.

I have seen either aircraft or photos of such accidents, and the aircraft tends to be almost intact, having impacted in an absolutely flat attitude.

In your case, I would suggest that there was quite a degree of vertical inclination – possibly 45º or so – for there to be that much forward energy to break off the tail.

I would suspect that you could see from the impact site whether the aircraft had been still spinning at the time of impact or not.

The point that I always make is that the Yak-52 will ALWAYS recover from a spin, and certainly relatively easy from a conventional spin. BUT if the spin is allowed to go flat, then recovery can be protracted, and does need the absolutely correct recovery action.

I hope that this helps a little bit.

Regards
Richard

http://www.yak-52.com/spinning.htm

Aerobatics and Spinning in the Yak-52

I am writing this because I feel that many of us – and I include myself - have been too casual about the characteristics of the Yak-52, very particularly during spinning.

The Yak-52 is a delightful aeroplane, offering great aerobatic ability and 'fun to fly' characteristics with military-build quality for unbelievably little money.

Nevertheless, its spin recovery can be difficult and particularly after a recent accident involving a highly experienced aerobatics pilot I am concerned that too many people are flying Yak-52 in aerobatics, which can intrinsically lead to spins through mishandling, or indeed deliberately spinning without sufficient training to be absolutely certain of recovery.

To be specific:

- Ø It is not difficult to get into a flat spin through a mishandled stall turn – particularly, as is normally the case, power is kept on. Therefore one should not think that because one is not deliberately spinning that one would never get into a spin.

- Ø The 52 is a heavy aircraft with a significant amount of rotational inertia in a flat spin. This is because there is heavy engine in the front and a heavy radio and other equipment behind the rear seat and therefore once the aeroplane begins spinning, it will take time for that inertia to be destroyed and for the aircraft then to recover from the spin.

- Ø In particular, if the spin is allowed to fully develop into a power-on flat spin, the rate of rotation can be rapid and disorientating, and importantly, the more rapid the spin, the greater the rotational energy to be stopped before the spin slows down and therefore the longer the spin recovery.

- Ø Closing the throttle will not in itself cause any recovery.

- Ø Once the flat spin has fully developed it can take up to four complete revolutions for recovery to be made and of course much more if the absolutely correct control movements are not used. Additionally there will be further height loss during the return to level flight.

- Ø It is also possible while recovering from a spin with a lot of in-spin aileron and forward stick, for the rotation to convert rapidly into an inverted spin. Again, this must only be demonstrated with an appropriate instructor.

- Ø 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 practice with an appropriate instructor. It is interesting to note that the Russian manual says that the rudder forces can be as high as 100 kilos (220 lbs) and stick forces 40 kilos (90 lbs), and says that two hands maybe necessary to move the stick forward.

- Ø We know of at least two Yak-52 aircraft that after a fully developed flat spin (ie four or so turns) will NOT recover with the conventional spin recovery of full opposite rudder and full

forward stick, but need in-spin aileron to recover. Again, this should not be experimented but practised with an instructor.

- If practising spinning, total height loss can be dramatic and even with absolutely correct recovery procedures, height loss can be in excess of 2000 ft and a bit more to level regain flight. For this reason spin practice of this sort should be commenced at a minimum of 6000 ft and recovery initiated by 5000 ft.

- Several 52 accidents have been attributed to one of the pilots harnesses catching the brake lock on the stick. This obviously varies with pilots, but before any aerobatic flight is commenced, a very complete 'full and free' check should be made to ensure that this cannot happen. Specifically there are two types of brake catch (the new one dating from approximately 1989) and two types of harness, the early buckle type and the later pin type. Apart from anything else the old 'buckle type' should never be used today, but the newer 'pin type' can catch with the old model brake catch.

- Finally, there is the potential problem by virtue of being a tandem cockpit aeroplane that there is misunderstanding between the two cockpits. This is common to all such aircraft, but it emphasises the need for a thorough briefing on all procedures before any aerobatic flight. This should also cover all emergency procedures, and a formal understanding about a bottom height during spinning at which the occupants will jump clear of the aircraft if the spin has not stopped. In Russia this is 1000m / 3300 ft.

In conclusion, any Yak-52 pilot who intends to do anything more than pure straight and level flight must undertake proper instruction with an instructor who is completely familiar with all aspects of the aircraft's behaviour, particularly during fully developed spin recovery.

None of the above should deter a potential purchaser or pilot of a Yak-52. The aircraft has a superb safety record despite being used by a huge variety of organizations and people throughout the world. However like any aircraft it must be flown correctly. Recovery from simple power-off 'competition-type' one or two turn spins is conventional and rapid. All the above only refers to established flat spins and is why proper instruction should be mandatory for any aerobatic pilots on Yak-52s.

13th March 2001