

Scheibe SF25E Super-Falke, G-KDFF

AAIB Bulletin No: 9/2003	Ref: EW/C2003/02/02	Category: 1.3
Aircraft Type and Registration:	Scheibe SF25E Super-Falke, G-KDFF	
No & Type of Engines:	1 Limbach L 2000-EA1 piston engine	
Year of Manufacture:	1977	
Date & Time (UTC):	15 February 2003 at 1340 hrs	
Location:	Bowland Forest Gliding Club, near Preston, Lancashire	
Type of Flight:	Private	
Persons on Board:	Crew - 2	Passengers - None
Injuries:	Crew - 2 (Fatal)	Passengers - N/A
Nature of Damage:	Aircraft destroyed	
Commander's Licence:	UK Private Pilot's Licence and BGA Motor Glider Instructor	
Commander's Age:	44 Years	
Commander's Flying Experience:	255 hours (of which 63 were on type)	
	Last 90 days - 10 hours	
	Last 28 days - 6 hours	
Information Source:	AAIB Field Investigation	

Synopsis

On takeoff, the tailwheel of G-KDFF became entangled with one of two cables, which had been laid for glider launches. The cable remained attached to the tailwheel and the aircraft crashed; both pilots received fatal injuries. Prior to takeoff, the commander had been informed that the cables were laid out. Club rules allowed him to approve a takeoff in that situation.

Background to flight

The Chief Flying Instructor (CFI) had overall responsibility for all flying operations at the gliding club. This included the operation of G-KDFF, which was the only self-launching powered glider owned by the club. This aircraft had been operated by the club for about a year and was used primarily for training purposes.

When the CFI was absent, although retaining overall responsibility, he delegated day-to-day supervisory duties of the gliding operation to nominated British Gliding Association (BGA) qualified instructors. However, the CFI and his nominated deputy always retained responsibility for the operation of G-KDFF and this aircraft would only fly whenever the CFI or his deputy was in attendance. Normally, one would fly in the aircraft but, if not, one of them would authorise flights by other pilots. It was the responsibility of the CFI or his deputy to ensure that the movements of G-KDFF were co-ordinated with glider operations. Written procedures for the

operation of G-KDFF had been produced in June 2002 and a copy of these procedures was displayed on the club notice board for the information of all club members.

In the written procedures, the club used the terms 'P1' and 'P2' to describe the duties of the pilots in G-KDFF. 'P1' was the pilot-in-command. To be considered to fly as 'P1', a pilot required a Touring Motor-Glider Licence or a Private Pilot's Licence (PPL) with a Touring Motor-Glider Rating. Any pilot flying as 'P1' had also to be approved by the CFI. Furthermore, certain additional minimum qualifications were detailed in the written procedures for solo or 'P1' flights.

A chapter on 'Operational Protocol' was also included within the document. This included the instruction that: *'NO takeoff is to take place whilst winch cables are laid out on rwy 12 unless approved by the CFI or his deputies. DP (Duty Instructor at the departure point for the gliders) and winch to be contacted if possible by radio. If radio contact cannot be made use EXTREME CAUTION when taxiing out.'*

Both pilots involved in the accident were named in the written procedures as designated motor glider instructors. However, the pilot in the left seat had not yet been cleared to operate as an instructor by the CFI, although that was the intention. The pilot in the right seat was the designated deputy CFI of the gliding club and had been nominated as P1 for the flight in the club 'Flight and Payment Log' for G-KDFF. Both pilots had extensive gliding experience. The pilot in the right seat had achieved approximately 1,300 flying hours in gliders in addition to his powered flying experience. The pilot in the left seat was also the holder of a UK PPL with a Motor Glider Rating. He had previously flown two flights in G-KDFF, both on 11 May 2002 in company with the other accident pilot.

The runway at the gliding club has a grass surface and is orientated 120°/ 300°. It has a total length of about 900 metres and the centre-line has a firm surface, about 3 metres wide, along the full length. The threshold of Runway 12 is at the highest point of the airstrip and there is a downslope for about 205 metres before the ground levels off for approximately 143 metres to a point abeam the clubhouse. Thereafter, the surface remains level for a further 27 metres before becoming undulating. Towards the threshold of Runway 30, the ground becomes more even again.

The CFI stated that the normal procedure would be to use the centre-line for a takeoff on Runway 12. He would normally start his takeoff from a marked 'circle' on the runway, about 210 metres from a point on the runway abeam the clubhouse. Using this take-off point, the aircraft was always airborne before getting abeam the clubhouse. In his experience, the deputy CFI would use the same procedure.

The 'Flight Manual and Operating Handbook' includes the information that the aircraft, with the Limbach SL 1700 EA I engine, requires about 250 metres to get airborne. The written procedures produced by the club includes the information that, with the more powerful engine fitted to G-KDFF, the take-off run would be shorter.

History of flight

On the day of the accident, Runway 12 was in use. The weather was good with clear skies and a surface wind of 120°/ 5 to 10 kt. The left seat pilot had already flown three gliding flights, each lasting 6 minutes. The right seat pilot had flown three flights in G-KDFF prior to the accident flight; these were the only flights flown by G-KDFF during the day. In the club 'Flight and Payment Log', the deputy CFI was annotated as P1 for all these flights. There were no reported aircraft unserviceabilities and no reported co-ordination difficulties between the gliders and G-KDFF.

Prior to engine start on the accident flight, another club member approached the aircraft. He had flown twice in G-KDFF that day with the deputy CFI, and he informed the right seat pilot (deputy CFI) that two gliders were being towed towards the rear of G-KDFF and that a tractor was towing two cables from the winch; the deputy CFI acknowledged this information. Later, the same club member heard the aircraft taxiing and saw it turning on the runway in preparation for takeoff. This club member had used the normal 'circle' take-off point on his takeoffs in G-KDFF and his impression was that, on the accident flight, the aircraft had turned earlier on the runway than he would have expected. He saw the take-off run, during which the aircraft appeared to bump up off the ground twice before

lifting off. After lift-off, he observed that the aircraft's nose was lowered slightly and he then turned away. Shortly after, he heard a change in engine noise and, when he looked back he saw G-KDFF diving towards and impacting the ground. He was some 400 metres away from the impact point and ran towards the clubhouse to phone the emergency services.

There were other witnesses to the accident. One of these was standing near the clubhouse with a good view of the runway. He had heard the engine of G-KDFF start and had noticed it taxiing towards the runway. He watched it commence its take-off run and considered that the engine sounded normal. However, as it passed abeam his position, his impression was that it was going slower than normal, was "bumping along the field" and was "struggling to build up speed". However, approximately 100 metres past the clubhouse, it was airborne. With the aircraft clear of the ground, the witness saw a cable "snagged" on the tailwheel of G-KDFF. The aircraft climbed straight ahead to about 100 feet agl before turning right through 90° with the cable still attached. Then, as G-KDFF seemed to be starting a further turn to the right, the aircraft banked sharply to the right and "spun in" to a field just beyond the club boundary.

The driver of the tractor also saw the accident flight as he returned to the winch after laying the winch cables on the runway. His impression was that the aircraft bounced about three times on the ground before getting airborne and that it seemed to climb at a shallower angle than normal. He also saw something attached to the tailwheel and realised that it was the winch cable. Prior to the accident, the tractor driver had checked with the winch operator as to how the cables should be laid. As instructed, he laid them along the runway and with a slight bow to the right.

Witnesses at the glider launch point also saw the accident and some of these saw one of the cables moving along the ground as G-KDFF tookoff.

Medical information

Both pilots were killed instantly and died of multiple injuries. There was no evidence of any natural disease, which could have caused or contributed to the accident. Similarly, there was no evidence of any alcohol or drugs, which may have caused or contributed to the accident.

Runway Inspection

Three distinct sets of tyre tracks were found on the runway, at a position some 150 metres west from the position on the runway abeam the clubhouse, ie about 60 metres further along Runway 12 than the normal start of takeoff. These had evidently been produced by the single main-wheel and the tail wheel of G-KDFF as it turned left to line up prior to takeoff. The tracks intersected a pair of winch cables, which were still in their post-accident positions on the ground, before continuing to turn to the left to align with the runway at a position a few metres to the right of the cables. From this position, further wheel marks made by the aircraft during its takeoff could be seen extending down the runway, mostly angled at a fine angle back towards the cables which, visually, did not stand out very clearly. The take-off tracks became intermittent at a position approximately abeam the clubhouse, consistent with the aircraft having reached the stage where it was starting to develop lift, and bouncing. A short distance beyond this region, the tracks could be seen crossing over the line of the cables in a region of undulating ground where, in several places, the cables were raised by as much as 10 cm (4") above ground level as they bridged the undulations.

Shortly after the position where the tyre tracks crossed the cables, the left hand cable deviated to the right, overlaying the right hand cable and extending out to form a large loop off to the right side of the runway before curving back towards the winch at its far end. The furthest extent of this loop passed within a few metres of the aircraft wreckage, and it was evident that the cable had become attached to G-KDFF at some stage during the takeoff, and had remained so until shortly before ground impact.

Further west along the runway, other less clearly defined tyre marks were found, also consistent with those produced by G-KDFF as it turned to line up in preparation for takeoff. These marks were consistent with the position on the runway reportedly more typically adopted for the start of takeoff in G-KDFF.

Examination of the wreckage

The aircraft had crashed into an open field approximately 250 metres to the right of the upwind end of Runway 12. The impact marks in the ground, together with the disposition of wreckage and the pattern of damage sustained, was consistent with a steep spiralling descent before impacting the ground with the nose approximately 70° below the horizontal, and slightly right wing low. Because of the rotational momentum which built up during the dive, G-KDFF continued to rotate post-impact through a further 90° clockwise (viewed from above) before finally coming to rest pointing back towards the runway. The impact, which destroyed the right wing and also resulted in major disruption of the forward fuselage and left wing, was non-survivable.

Clear evidence of a cable contact was found on the left side of the tailwheel assembly, comprising a wear groove on the upper surface of the axle stud and its retaining nut on the left side of the tailwheel. This groove was of a type characteristically produced by a sustained and heavy sliding engagement with a stranded steel cable, and its width corresponded with the 4 mm diameter winch cable found lying near the wreckage. Further evidence of a cable contact was found on the left side of the tailwheel tyre, comprising an abrasion groove that extended radially out across the sidewall from the centre of the wheel.

A general examination of the wreckage showed that all primary flying controls were connected and intact at the time of impact, and, with the exception of the cable contacts described, no evidence was found of any pre-impact abnormality.

Probable sequence of events

From the evidence found on the tailwheel, it was clear that the cable had become hooked over the outer end of the axle stud, which extended slightly beyond the retaining nut on the left side of the wheel. This had evidently occurred whilst the aircraft was running at a fine angle relative to the line of the cable, and as the tailwheel descended into an undulation in the runway, allowing it to hook beneath the cable. As the tailwheel subsequently lifted off the ground, the sliding movement of the stranded cable across the top of the stud and its retaining nut had rapidly worn a groove, which helped to maintain the cable in position. The cable damage to the left sidewall of the tyre shows that, as the aircraft gained height, it was tracking progressively to the left of the runway resulting in the cable being pulled downward and progressively to the aircraft's right.

The principal effect of the attached cable would have been to produce an increasingly large downward pull on the tail, due to both the increasing *angle of pull* exerted by the cable, as the aircraft gained height, and the increasing weight of cable being lifted. This would have tended to pitch the nose of the aircraft up, ultimately overpowering any attempts made by the pilot to prevent the nose from rising, causing the aircraft to stall.

A lesser, but still significant, effect of the cable would have been to pull the tail wheel to the right, which would have had two separate and opposing effects. Firstly, it would have tended to yaw the whole aircraft left: this would have increased its tendency to track left of the runway, increasing the side force exerted by the cable. Secondly, because the tailwheel had a castering offset relative to its steering axis, and was connected to the rudder horns by strong tension springs, the side-force would have *steered* the tailwheel to the right, and transferred forces into the rudder circuit tending to apply right rudder. This would have tended to yaw the aircraft right, although probably not to an extent capable of counteracting the turning moment to the left produced directly by the cable's pull to the right. If the aircraft stalled with right rudder applied, which in the circumstances appears likely, then this would have precipitated a steep spiralling dive to the right, of the type suffered by G-KDFF.

Aircraft documentation

Given the circumstances of this accident and the evidence of cable entanglement found, a full investigation of the aircraft's maintenance history was not appropriate.

The aircraft log book shows that the aircraft was built in 1977 and had accumulated a total of 4,229 flight hours at its most recent entry on 4 January 2003. It had a current Certificate of Airworthiness in the Private Category valid until January 2005, and had undergone an annual inspection on 15 November 2002 at 4,220 flight hours.

Analysis

The accident occurred following a take-off run when the aircraft tracked over and picked up a cable, which had been laid in preparation for a glider launch. Both pilots were familiar with operations at the gliding club and the commander was the designated deputy CFI. As such, he was one of only two pilots at the club who could approve a takeoff by G-KDFF with cables laid on the runway. This regulation was a sensible one and is one that is in place at other gliding clubs. However, the approval of takeoff in that situation was dependent on two essential and related elements. Firstly, the pilot involved must know exactly where the cables were positioned and secondly must be sure that his take-off run would be well clear of any cable. Post accident inspection of the scene indicated that the cables are not easily seen when in their normal position on the runway.

Prior to the accident flight, another club member advised the commander in the right seat that the tractor was towing cables out; he received an acknowledgement to this message. The message was passed prior to engine start so it is possible that the left seat pilot also heard the message. Even if he did not, he may subsequently have been informed by the commander or may have seen the activity as the aircraft was taxied to the take-off position. Nevertheless, the commander was aware that cables were on the runway and the fact that the aircraft continued for takeoff indicated that he had approved the takeoff with cables on the runway. Therefore, he must have been confident that he knew the location of the cables and was confident that the take-off run of G-KDFF would be clear of the cables. It was not possible to determine who was the handling pilot during takeoff.

Evidence indicated that the aircraft was still on the ground as it passed abeam the clubhouse on its takeoff. From this position towards the east, the runway is more undulating and therefore any cable would be more likely to have portions standing clear of the surface and be more likely to become entangled with any portion of the aircraft in contact with the ground. Normally, the aircraft would have been airborne when it was abeam the clubhouse but there could have been reasons for it still being on the ground.

A performance degradation could have accounted for a longer than normal take-off roll. However, the aircraft weight, runway and wind conditions were little changed from earlier flights, and there were no witness reports of any abnormal engine noise. It was therefore unlikely that a performance degradation resulted in a longer than normal take-off run.

A more likely reason for the aircraft still being on the ground when it was abeam the clubhouse was if the takeoff had been commenced from further down the runway, rather than from the normal 'circle' markings. These markings are some 210 metres from a runway point abeam the clubhouse and the aircraft was normally airborne by this point. However, evidence indicated that the takeoff commenced some 150 metres from a point abeam the clubhouse and this would explain why the aircraft was still on the ground as it passed the clubhouse. Considering the length of the runway, the use of this take-off point would normally cause no major problems; there was evidence that this later take-off point had been used on more than one occasion. Additionally, if the aircraft had crossed a cable on even ground, it is possible that the cable, flush with the surface, would not have been picked up by the tailwheel. Unfortunately, the take-off run continued to the more undulating ground where portions of the cable were standing clear of the ground.

Once the cable had been picked up by the tailwheel, the conditions were such that it remained in position and the developing situation quickly became critical. It was probable that the pilots could not understand what was happening in the short time before the aircraft impacted the ground.

During the investigation, inquiries were made of the British Gliding Association (BGA) to determine if there were association rules relating to takeoffs by powered aircraft with cables on the runway. Although many clubs, including the one where the accident took place, have local rules imposing

limitations on takeoff with cables on the runway, the BGA have no specific rules. It would therefore be appropriate for the BGA to issue guidance to their member clubs to make rules to minimise such occasions, but when they arise, to ensure that the positions of the cables are known to the pilot of the powered aircraft and that a take-off run, well clear of the cables, is available to him.

A Safety Recommendation to that effect is, therefore, made.

Recommendation 2003-71:

It is recommended that the British Gliding Association issue guidance to their member clubs to have rules to ensure that, with cables laid on or near the runway, a takeoff by a powered aircraft is only undertaken when the positions of the cables are known to the pilot and the take-off run can remain well clear of the cables.