Aerospatiale AS355F2 Ecureuil II, G-MENI, and Katana DV20, OE-AMH

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Aircraft Type and Registration:	i) Aerospatiale AS355F2 Ecureuil II, G-MENI
	ii) Katana DV20, OE-AMH
No & Type of Engines:	i) 2 Alison C250 turbine engines
	ii) Rotax 912 piston engine
Year of Manufacture:	i) N/K
	ii) N/K
Date & Time (UTC):	12 August 1997 at 1128 hrs
Location:	6 nm west of York
Type of Flight:	i) Public Transport
	ii) Private
Persons on Board:	i) Crew - 2 - Passengers - None
	ii) Crew - 1 - Passengers - None
Injuries:	i) Crew - None - Passengers - N/A
	ii) Crew - Minor - Passengers - N/A
Nature of Damage:	i) Severe damage to tail boom, rotors and cabin
	ii) Substantial damage to canopy, forward fuselage and propeller
Commander's Licence:	i) Airline Transport Pilots Licence (Helicopters)
	ii) Private Pilot's Licence
Commander's Age:	i) 42 years
	ii) 67 years
Commander's Flying Experience:	i) 5,277 hours (of which 202 were on type)

	Last 90 days - 132 hours
	Last 28 days - 44 hours
	ii) 5,000 hours (of which 700 were on type)
	Last 90 days - 100 hours
	Last 28 days - 45 hours
Information Source:	AAIB Field Investigation

Synopsis

The pilot of the aircraft (OE-AMH) was on a VFR flight from Prestwickto the gliding site at Rufforth, 4 nm west of York, cruising initiallyat FL 055 at a speed of 100 kt. The helicopter, (G-MENI), havingcompleted a rotors running refuel at Coney Park industrial siteon the northern boundary of Leeds Bradford airfield was on a VFRflight cruising at an airspeed of 120 kt to a private landingsite at Givendale, 11 nm east of York (Leeds Bradford 080°/32nm). Approximately 6 nm west of York the aircraft and the helicopterwere involved in a mid-air collision, in VMC conditions, at analtitude of approximately 1,900 feet amsl.

History of the flights

At 1058 hrs the aircraft pilot made contact with the Leeds approachcontroller giving details of his flight and stating that he was"33 MILES OUT OF HARROGATE VRP *(VisualReference Point)* MAINTAINING FL 055 AND TRANSPONDERIS 1460". The controller replied that he had allthe details and assigned him a transponder code of 0415. Oneminute later the helicopter pilot contacted Leeds approach withdetails of his flight inbound to Coney Park to refuel.

The aircraft reached Harrogate VRP at 1120 hrs whereupon the pilotrequested a descent for 'York'. The Leeds controller replied"OSCAR MIKE HOTEL ROGER I HAVE NO KNOWN CONFLICTINGTRAFFIC". At the same time, the helicopter pilot,who was in contact with the Leeds tower controller, lifted fromConey Park and departed for his flight to the east of York. Hewas cleared to route "REMAINING NORTH OF LEEDSAT ALL TIMES.....ROUTE OUT TO THE EAST VFR NOT ABOVE 2,000 FEETON THE QNH 1021 SQUAWK 0417". The helicopter pilotselected the assigned squawk but did not select mode 'C' (heightencoding). At 1122:30 hrs he was handed over to the Leeds approachcontroller who transmitted "...GOOD AFTERNOON;FLIGHT INFORMATION SERVICE". Two minutes later theaircraft pilot requested permission to leave the frequency. Thecontroller said "SQUAWK 7000 BYE BYE". The aircraft pilot complied with this instruction andchanged frequency to Rufforth Air Ground Station on 129.975 MHzwhereupon he was told "....OPERATING ON RUNWAY18 LEFT-HAND CIRCUIT DO NOT FLY BELOW 800 FEET".

At 1125 hrs the helicopter pilot reported at Weatherby and askedto "QSY TO LEEMING". He was alsotold to squawk the conspicuity code of 7000 by the Leeds approachcontroller. The pilot, however, squawked 'standby' in anticipationof being assigned another code by the next ATC controller. Hemade a brief call to Leeming and was told to contact the Linton-on-Ousezone controller on 129.15 MHz. The helicopter pilot establishedcontact with the Linton controller and transmitted "...TWINSQUIRREL OUT OF LEEDS TO A PRIVATE SITE AT GIVENDALE WHICH ERI'M JUST SOUTH OF THE RACE COURSE *(meaning Weatherby)* WITH ABOUT ANOTHER NINETEEN AND A HALF MILES ON ZERO EIGHT ZEROTRACK, LEVEL AT 2,000, 1021 (QNH), SQUAWKING STANDBY REQUEST RADARINFORMATION". The transmission was given in a ratherhurried manner with only the fundamental elements being assimilatedby the controller. He noted the helicopter's height and headingbut was confused as to its position.

The Linton-on-Ouse controller, who had not been aware of the helicopter'sflight until he received the initial call, instructed the pilotto select code 2641 on his transponder. VHF Direction Finding(VDF) facilities were not available on the Linton zone frequencyso the controller took some time to scan his radar display inorder to locate the helicopter's primary and secondary radar return. Before he could do so the helicopter pilot transmitted "MAYDAYMAYDAY MAYDAY STARSPEED 20 A TWIN SQUIRREL HELICOPTER WITH A MID-AIRCOLLISION....FORCED LANDING JUST TO THE EAST OF WETHERBY". The aircraft pilot was unable to transmit any emergencymessage because his radio had been destroyed.

The other helicopter crew member, also a qualified helicopterpilot seated in the front left-hand seat, did not see the aircraft. Although the helicopter was being navigated using GPS, he wasreferring to a map and his attention was directed within the cockpit. The helicopter commander, seated on the right, only sighted theaircraft, as a white shape on the lower left side through theleft door window, a fraction of a second before the impact. Hehad taken immediate avoiding action by banking and turning rapidlyto the right. This manoeuvre, however, was not sufficient toavoid the collision.

In the collision the helicopter lost its tail rotor and a sectionof tailboom. It immediately gyrated uncontrollably and the forwardspeed reduced to zero. The commander promptly lowered the collectivelever and lowered the nose to increase the forward speed. Healso instructed the other pilot to shut down both engines. Positivecontrol was regained after several rotations as the forward speedincreased to 40 to 60 kt. At approximately 100 feet agl the commanderinitiated the flare using cyclic pitch control. The helicopterresponded by levelling in the normal attitude with the skids atcorn top height. The final descent from this height was arrestedby use of collective pitch control. Just prior to touchdown thehelicopter developed a drift to the left causing the left skidto contact the soft soil first. The cabin rolled around the skidand settled onto its left side. It then spun through 180°as the still rotating rotor blades made contact with the surface. The two crew, who were uninjured, vacated the wreckage immediately. Once clear of the wreckage the helicopter commander used hismobile phone to summon the assistance of the emergency services.

The light aircraft suffered extensive damage to the forward fuselagein the collision but the pilot was able to carry out a forcedlanding into a field. Landing along the furrow line the aircraftwas brought to rest without further damage. The pilot, who hadsuffered minor injuries to his right hand, from fragments of shatteredcanopy, vacated the aircraft immediately.

The weather, recorded at RAF Linton-on-Ouse at 1150 hrs, was finewith a visibility of 10 km, few clouds at 12,000 feet, brokencloud at 25,000 feet, surface wind of 230/05 kt. temperature +28°C,dew point +15°C and a QNH of 1020 mb. The helicopter commanderassessed the In-flight visibility (IFV) as being 9 km.

Aircraft Examination

Figure 1, derived from damage and witness marks caused to eachairframe, illustrates the relative positions of the helicopterand aircraft at the moment of collision. The initial point ofcontact appeared to have been between the lower fin/sting of thehelicopter and the aircraft canopy , approximately at its centreline,with the sting then striking the upper portion of the centrallymounted avionics units. As it did so, the tail rotor blades struckand caused serious damage to themselves and the right outer surfacesof the aircraft cockpit and engine cowling (see Figure 2) withaircraft's wooden propeller disintegrating to leave two stubsas it cut through the tailboom. In the collision, the helicopter'stail boom had been completely severed by the aircraft's propellerat a position some 1 to 2 feet forward of the fin. This removed,as a unit, the tail rotor and gearbox, the fin and approximately17 kg of trim weights (see Figure 3) which resulted in a significantforward shift of the helicopter's centre of gravity. Relativelyminor damage/scuff marks were present on the upper surface ofthe aircraft's left wing, and the leading edge of its right tailplanehad been hit by debris to leave a small area of relatively seriousstructural damage.

After the collision both the aircraft and helicopter landed inopen countryside, some 1.75 nm apart. The helicopter landed ina field of standing wheat; the aircraft in a harvested field thathad contained oil seed rape. The separated portion of the helicoptertailboom was found some 250 metres to the south-east of the mainhelicopter wreckage. The area between the aircraft and helicopterwas strewn with minor debris, mostly comprising of aircraft canopyfragments and loose cockpit items. Despite the helicopter comingto rest on its left side, almost no fuel was spilt and there wasno fire. Examination of the aircraft revealed damage associatedonly with the mid-air collision. The helicopter had additionalserious damage to the left skid, tailboom/horizontal stabiliserand main rotor system caused during the landing.

Recorded Data

GPS data

The helicopter was equipped with a sophisticatedglobal positioning system (GPS), comprising a Garmin GPS satellitereceiver coupled to an Argus 7000CE moving map display. The Arguswas connected to the helicopter's compass and so could displayheading. It also contained an accurate piezo-electric sensorto determine current atmospheric pressure and hence altitude. Furthermore, it could self calibrate the pressure sensor to QNH,whilst the helicopter was stationary on the ground, using knownairport elevations from its built-in database. The altitude ofthe helicopter could be displayed to an accuracy of better than50 feet provided that flight sectors were not flown in areas ofhigh pressure gradients. The Argus had an internal battery-backedmemory which would retain, even in the absence of aircraft power,a history of the last ten hours of the helicopter's progress. Spot readings of position, heading, track and altitude were takenevery five seconds, date/time stamped and recorded in the memory.

With the assistance of the manufacturer andthe installer of the equipment, the history data was downloadedfrom the Argus. The data showed that the helicopter had takenoff, made a climbing right turn onto a heading of 084°M andfinally levelled at between 2,100 feet and 2,350 feet.

At the time of the collision the data recordedthat the helicopter was at 2,106 feet and achieving a ground speedof 123 kt. Following the collision, the helicopter made a right-handrapid descent, achieving a maximum descent rate of 5,000 ft/minby 400 feet agl reducing to less than 1,000 ft/min prior to touchdown. The time from collision to touchdown was between thirty and thirtyfive seconds. It was not possible to determine the yaw rate duringthe descent as the five second recording interval of heading datawas probably longer than the period of rotation of the helicopter.

Radar data

Radar Information displayed in the Leeds approach control roomwas recorded. Primary returns are processed from the radar headon the airfield. Secondary returns and mode 'C' information areadded electronically to the radar display from the radar headat Claxby. A playback of the recorded data showed that the aircraft'sprimary return, secondary response and mode 'C' height readoutwere displayed continuously within the radar's range up to thetime of the collision. The helicopter's primary return was displayedfrom the time of take off to the time of the collision. Its secondarysquawk, without mode 'C,' was displayed until 40 seconds beforethe impact and again 8 seconds before the collision, when theLinton-on-Ouse assigned squawk was displayed.

Manual of Air Traffic Services (MATS) Part 1

MATS Part 1, contains instructions and guidance to controllersproviding air traffic services. Chapter 1 gives detailsof Air Traffic Services. Relevant extracts are reproduced below:

Flight Information Service

A flight information service is a non-radar service provided forthe purpose of supplying information useful for the safe and efficientconduct of flight. This includes information about weather (includingSIGMET), changes of serviceability of facilities, conditions ataerodromes and any other information pertinent to safety. Somecontrollers may wish to allocate a discreet squawk to aircraftin receipt of a flight information service, for monitoring andco-ordination purposes. If this is done then the aircraft mustbe identified and the correct validation and verification procedureused. Pilots must be left in no doubt that they are receivinga flight information service only.

.... All air traffic units shall provide flight information andalerting service to aircraft under their jurisdiction.

....Traffic information shall be passed and traffic avoidancegiven to aircraft on any occasion that a controller considersit necessary in the interests of safety.

Information literature

The Civil Aviation Authority publish a series of General AviationSafety Sense leaflets one of which (leaflet 8C) is titled 'AirTraffic Services Outside Controlled Airspace'. Included in thecontents is a section on 'Non-Radar Services'. The paragraphsrelating to Flight Information Services (FIS) are reproduced below:

Flight Information Service (FIS)

This non-radar service provides information to assist with thesafe and efficient conduct of your flight. You should considerthis service as a minimum when planning a flight. The informationavailable may include:

Weather.

Serviceability of navigation and approach aids.

Conditions at aerodromes.

Other aircraft reported in your area, which are in contact withthe FIS.

Other information pertinent to flight safety.

Remember that use of FIS is not intended to replace pre-flightplanning, nor is it intended to be a comprehensive source of informationon the presence of other aircraft. The controller may be ableto provide information aircraft in your vicinity that have beenreported to him, but it is unlikely that he will be aware of allaircraft that may affect your flight. ie warnings of conflictingtraffic are far less likely to be given under a FIS than underRAS (Radar Advisory Service) or RIS (Radar Information Service). Most ATSUs can provide a FIS within their local areas. ThoseATSUs which provide RAS and RIS can normally offer a FIS whenconditions prevent them from providing a radar service.

Conclusions

The collision took place outside controlled airspace in VMC conditionswhen neither aircraft was receiving a service from an ATC unit. The Leeds approach controller had terminated his 'contract' witheach pilot when they had changed frequency to Rufforth and Linton-on-Ouserespectively. The Rufforth A/G station could only pass airfieldinformation to the aircraft pilot and the Linton-on-Ouse controller,who had not yet identified the helicopter, entered into a verbal'contract' with him. The primary means for collision avoidancetherefore was 'see and avoid' in which each pilot was responsiblefor his own lookout in order to see and avoid conflicting traffic.

The light aircraft was fitted with a 'bubble' canopy allowingexcellent vision horizontally through some 270°, subjectto the physical limitations of pilot head movement and fuselagestructure behind him. The helicopter was however approachingthe aircraft, with a closing speed of 20 kt, from behind the pilot'sright shoulder; an area of the sky that was difficult, if notimpossible, to scan. The helicopter was in a gentle decent atthe time of the collision with the aircraft on a bearing of 350°relative. The commander's view of the area ahead, below and tothe left, was obstructed by the instrument panel. The left seatoccupant, who was in a better position to have seen the Katana,was 'head down' studying a map.

When the pilot of the light aircraft requested a descent fromFL 055 the Leeds approach controller was not aware of any trafficto conflict with his descent. The pilot had already been assigneda squawk and the aircraft's primary and secondary radar returns,with a mode 'C' height readout, were visible on the radar displayin the Leeds approach control room. Two and a half minutes later,at 1122:30 hrs, the helicopter pilot made contact with the approachcontroller for his flight to the east of York. He had also beenassigned a Leeds squawk and the helicopter's primary and secondaryreturns were visible on the radar display. The helicopter's heightwas not displayed as mode 'C' had not been selected by the helicoptercommander. In response to the helicopter pilot's initial callthe controller confirmed that he was to receive a flight informationservice.

Notwithstanding the above, for two minutes both aircraft werein contact with the Leeds controller and both aircraft were onconstant converging tracks. The controller had allocated eachaircraft a discreet squawk which could have been used for monitoringand co-ordination purposes. The controller was very experienced,the traffic load was light and he could have been expected, as'best practice' to have predicted that the aircraft would comewithin close proximity to each other and hence could have informedeach pilot as to the possible conflict. Armed with this informationboth pilots would have been alerted to scan the relevant sectorsof the sky thus enhancing their abilities to 'see and avoid'.

The Linton-on Ouse controller was in contact with the helicopterat the time of the collision but it had not been identified onradar and he was not providing it with any service. The helicopter'smode 'C' was not visible and, as the helicopter commander hadselected standby on his transponder as he left the Leeds frequency,the only indication of the helicopter's presence on the Lintoncontroller's display was a primary return. The pilot of the lightaircraft did not contact Linton-on-Ouse, neither was he obligedto, and therefore the Linton controller was not aware of the aircraft'spresence and thus of the potential conflict.