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Cessna F 150L G-BAZP

Socata Rallye 150ST G-BEVX

Report on the collision at Biggin Hill

Aerodrome, Kent on 25 November 1978

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1/79	Piper PA32R (Cherokee Lance) PH-PLY Holly Hill Snodland Kent April 1978	May 1979
2/79	Vickers Viscount Series 802G-AOJF Leeds/Bradford Airport November 1978	January 1980
3/79	Piper PA24 Comanche 180G-ARSC Preston Hitchin Herts December 1978	February 1980
4/79	Rockwell Commander 114HB-NCM Waterloo Farm Nr. Dundry Bristol Sept. 1978.	May 1980
5/79	Cessna 337A (Skymaster) G-ATNY Moel Siabod North Wales June 1979	February 1980

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1/80	Strojirni Prvni Potiletky Super Aero 145 G-ASWS Lydd Airport July 1978	May 1980
2/80	Piper PA 28 (Cherokee) Series 140 G-AYMJ Carlisle Municipal Airport Cumbria November 1978	
3/80	Fuji FA 200 G-BEUB Fowey, Cornwall July 1979	
4/80	Cessna F150L G-BAZP Socata Rallye 150ST G-BEVX Biggin Hill Aerodrome Kent November 1978	

Department of Trade
Accidents Investigation Branch
Kingsgate House
66-74 Victoria Street
London SW1E 6SJ

13 August 1980

The Rt Honourable John Nott MP
Secretary of State for Trade

Sir,

I have the honour to submit my report on the circumstances of the accident to Cessna F 150L G—BAZP and Socata Rallye 150ST G—BEVX which occurred at Biggin Hill Aerodrome, Kent on 25 November 1978.

I have the honour to be

Sir

Your obedient Servant

W H Tench
Chief Inspector of Accidents

Accidents Investigation Branch
Aircraft Accident Report No 4/80
(EW/C646)

Operator: Aircraft 1 – Biggin Hill Flying Club
Aircraft 2 – Air Touring (Rallye) Club Limited

Aircraft: Type: Aircraft 1 – Cessna
Aircraft 2 – Socata Rallye

Model: Aircraft 1 – F 150L
Aircraft 2 – 150ST

Nationality: Aircraft 1 – British
Aircraft 2 – British

Registration: Aircraft 1 – G–BAZP
Aircraft 2 – G–BEVX

Place of Accident: Biggin Hill Aerodrome, Kent
Latitude 51° 19' North
Longitude 00° 02' East

Date and Time: 25 November 1978 at 1202 hrs

All times in this report are GMT

Synopsis

The accident was notified by the London Air Traffic Control Centre (LATCC) at 1225 hrs on 25 November 1978 and the Accidents Investigation Branch commenced an investigation on the same day.

The Rallye aircraft, after breaking off an approach to land at Biggin Hill, carried out an overshoot and flew parallel to the active runway. The Cessna was rejoining the circuit and was about to cross over the mid-section of the active runway when the two aircraft collided. The Rallye went into an uncontrolled dive into the ground and its pilot was killed. The Cessna continued flying but the pilot decided to land in a small grass field. The aircraft touched down heavily, nosed over and came to rest inverted. Both occupants released themselves from the wreckage and suffered only minor injuries.

The collision resulted from the failure of the commander of the Cessna to see and give way to the Rallye which was on his right. His failure to manoeuvre the Cessna as he approached the busy circuit caused his field of view to be restricted by the windscreen pillar. The failure of the commander of the Rallye to keep a sufficient look-out to ensure that his aircraft did not collide with other aircraft was a contributory factor.

1. Factual Information

1.1 History of the flights

On the morning of the collision, runway 29 and its associated grass strip were in use at Biggin Hill. The day was bright and sunny with good visibility. The Rallye, G-BEVX, was being flown solo by a student pilot who had been authorised by his instructor to practice take-offs and landings for one hour. After some delay caused by circuit traffic limitations the aircraft eventually took off at 1121 hrs and proceeded to carry out a series of circuits and touch-and-go landings.

The Cessna, G-BAZP, took off from Biggin Hill at 1119 hrs for a local flight. The pilot was accompanied by his five year old son who was sitting in the front right hand seat. After take-off the aircraft cleared the circuit and flew a short triangular course. At about 1150 hrs the pilot reported to Biggin Hill Aerodrome Flight Information Service (AFIS) that he was approaching the aerodrome from the south and wished to rejoin the circuit. He was advised that runway 29 was in use with a right hand circuit and that the aerodrome altimeter setting (QFE) was 1001 mb. He stated that after receiving the message he set 1001 on his altimeter subscale, noted that the change in height corresponded to the aerodrome elevation (600 feet) and then commenced a descent from about 1400 feet above aerodrome level (aal). His intentions were to fly straight over the aerodrome at the circuit height of 800 feet in order to join the circuit on the downwind leg and, because he thought that the strong wind would steepen the climb of any aircraft which had just taken off, to cross runway 29 at approximately its mid-position. He therefore positioned his aircraft about 4 miles south of Biggin Hill and flew directly towards the aerodrome on a northerly track.

About this time the pilot of the Rallye was preparing to make another approach to runway 29. He reported 'finals' when his aircraft was lined up with the runway and was told by the Aerodrome Flight Information Service Officer (AFISO) that he was number three to land. However, when his aircraft was on short finals he reported that he was carrying out an overshoot to the left. The aircraft started to climb, turned to the left and then flew parallel to the runway on its south side while continuing to gain height.

The duty AFISO acknowledged the Rallye pilot's overshooting call and watched the aircraft start to climb. When it had passed the runway threshold the AFISO no longer watched its progress but transferred her attention to those aircraft waiting at the holding point. When she next looked at the Rallye she also saw the Cessna for the first time, approaching from the south. The two aircraft were in very close proximity and there was no time to broadcast a warning before they struck one another.

The pilot of the Cessna stated that his aircraft was level at 800 feet (aal) as it neared the aerodrome boundary. There appeared to be plenty of space in the circuit to allow him to enter the downwind leg and he could see no conflicting aircraft at his own height. He did not hear the RTF transmission from the Rallye reporting that it was overshooting. (He was using the cockpit loudspeaker without the use of headphones.) When the Cessna was just south of the mid position of runway 29, the pilot suddenly saw on the right of his aircraft and just below it, the canopy of another aircraft which he recognised as that of a Rallye. It was very close and before he could take any action he felt something hit the underside of his aircraft. He looked for the other aircraft and saw it diving steeply towards the ground. He transmitted a 'Mayday' message reporting the collision.

Several witnesses on the ground described how they saw the two aircraft converge at approximately right angles. Both aircraft were flying in a straight line but while the Cessna was maintaining level flight it seems probable from a consensus of witness accounts that the Rallye was still in a climbing attitude when the two aircraft collided. Estimates of the height at which the collision occurred varied from about 300 to 800 feet. Neither aircraft took any avoiding

action and contact was made between the tail unit of the Rallye and the nose and main landing gear of the Cessna. A major part of the Rallye's horizontal tail surfaces, and its rudder, detached from the rest of the fuselage and the aircraft pitched rapidly nose-down. It went into a steep dive, turning through approximately 90 degrees, and struck the ground near to an aircraft park in front of the premises of one of the flying clubs (see Appendix 1). There was no fire, but the pilot was killed.

Since the collision did not appear to have affected control of the Cessna, the pilot turned downwind with the intention of making a close circuit for a landing on runway 29. His recollection of subsequent events is unclear, but he suddenly realised that the aircraft was diving steeply towards some trees and he immediately took recovery action. Witnesses said that the aircraft appeared to stall at this time and lose height rapidly. The pilot was then uncertain whether the collision had affected the condition of the Cessna and, seeing two small grass fields lined up ahead of him, decided to make an immediate landing. The aircraft touched down heavily just short of the boundary between the two fields. It nosed over, slid through a low wire fence and came to rest inverted just inside the second field. The aircraft did not catch fire and the pilot and his son escaped from the wreckage having suffered only minor cuts and bruises.

1.2 Injuries to persons

Injuries	Crew	Passengers	Others
Fatal	1	—	—
Serious	—	—	—
Minor/None	1	1	—

1.3 Damage to aircraft

The Rallye was destroyed by the combined effects of collision damage and ground impact. The Cessna was damaged beyond repair in the landing subsequent to the collision.

1.4 Other damage

Minor damage to a section of wire fencing.

1.5 Personnel information

1.5.1 Cessna G—BAZP

Commander:	Aged 38 years
Licence:	Private Pilot's Licence (permanent)
Last medical examination:	13 December 1976 valid until 13 December 1978
Ratings:	Night rating
Total flying hours:	141
Hours on type:	In command 9 hours 35 minutes Dual 5 hours 50 minutes

1.5.2 Rallye G—BEVX

Commander :	Aged 24 years
Licence :	not applicable (Student Pilot)
Last medical examination:	13 January 1978 valid until 13 January 1980
Total flying hours:	In command 6 hours 45 minutes Dual instruction 31 hours 55 minutes

1.6 Aircraft information

G-BAZP was a Reims Cessna F 150L single engine 2/3 seat high wing monoplane constructed in June 1973 fitted with a Rolls Royce Continental O-200-A engine. This aircraft had flown a total of 2346 hours since new.

G-BEVX was a SOCATA Rallye 150 ST single engine 4 seat low wing monoplane constructed in June 1977 fitted with a Lycoming O-320-F2A engine. The aircraft had flown 392 hours since new.

Both aircraft had been maintained in accordance with approved maintenance schedules and both held valid Certificates of Airworthiness.

1.7 Meteorological information

The weather conditions at Biggin Hill on the day of the accident were bright and sunny. A cold unstable north-westerly airstream covered the area and there was a gradual build up of cumulus cloud during the day. The visibility was good. There was no meteorological office at Biggin Hill but the following observation was made by the AFIS at 1215 hours:

Wind:	290 degrees at 15-25 knots
Visibility:	more than 10 kilometres
Cloud:	4 oktas at 2500 feet
QNH:	1021 millibars
QFE:	1000 millibars

Shortly before the collision, Biggin AFIS made a general broadcast advising aircraft that the QFE had changed from 1001 to 1000 millibars.

The accident occurred in bright daylight. At 1202 hours the true azimuth of the sun was 184° and its altitude was 18° 11'.

1.8 Aids to navigation

Not applicable.

1.9 Communications

The Biggin Hill AFIS was operating on 129.4 MHz and both aircraft were using this frequency. As the aerodrome has no VHF direction finding or radar facilities for holding, let-down or approach aids, Article 70 of the Air Navigation Order (ANO) 1976 requiring that radio transmissions be recorded did not apply and no recording apparatus was installed. However, Civil Aircraft Accident Report No 10/76 contained the recommendation that: 'a review of the current provisions of Article 72(2) of the Air Navigation Order 1974 be made with a view to extending the scope of the requirement for RTF recording apparatus to those airfields not presently covered by the Order but which had a large volume of general aviation traffic'. In Civil Aircraft Accident Report No 2/78 another recommendation was made that: 'RTF recording apparatus be installed at Biggin Hill on a permanent basis'.

1.10 Aerodrome and ground facilities

Biggin Hill aerodrome is at an elevation of 600 feet and has two paved runways, 03/21 and 11/29. A light aircraft landing strip is marked out on the grass a short distance from each runway and running parallel to it. Runway 29 is tarmac and is 875 metres long. To the north of it lies its associated grass strip which is 540 metres long. At the time of the collision runway 29 was in operation and both paved and grass surfaces were being used for taking-off and landing. The circuit direction was right hand and the circuit height 800 feet.

The aerodrome is licensed for public use although it must not be used for the take-off or landing of aircraft engaged on any scheduled journey. At the time of the accident the United Kingdom Air Pilot indicated that only an air/ground service was available at Biggin Hill, but in fact this information was out of date and an AFIS unit had been introduced and was in operation. This type of air traffic service may only be provided by holders of an AFISO's licence valid for the particular aerodrome. The service issues information useful to the safe conduct of flights in the Aerodrome Traffic Zone (ATZ); the AFISO may not give ATC instructions or advice except for the purpose of averting a dangerous situation. Both the person on duty when the collision occurred and her assistant were qualified AFISOs.

Because of the large number of aircraft which use Biggin Hill, a local arrangement had been introduced whereby, in order to avoid congestion, the number of aircraft carrying out circuits and landings at any one time was normally restricted to five, this figure being reduced in bad weather. However, no restriction was imposed on any aircraft which wished to join the circuit for a landing after a flight away from the aerodrome. Whenever the circuit was 'full', aircraft requesting taxi clearance to make circuits and landings had the option of either carrying out local flying or of waiting before take-off for a space in the circuit. On the morning of the collision, the Rallye's take-off was delayed due to such circuit congestion.

Because, at the time of the accident, no RTF recording apparatus was installed at the aerodrome, it was difficult to ascertain which aircraft were either in or near to the circuit in the period preceding the collision. The movements log maintained by the AFIS recorded only the times of an aircraft's initial take-off and final landing. However, from this information and other sources a plot was constructed showing the probable disposition of the aircraft in the circuit pattern at the time of the collision (see Appendix 2). From this can be deduced the most probable positions of the aircraft at the time when the Cessna was approaching the aerodrome and before the Rallye had commenced its overshoot. Of the seven aircraft actually in the circuit one had just rejoined directly downwind and another was making a second circuit having rejoined from a local flight. The other five aircraft were engaged in circuit training. The Rallye, G-BEVX, was following two aircraft of a similar type both of which made full stop landings, the first one on the grass strip and the second, shortly afterwards, on the tarmac runway.

1.11 Flight recorder

Not fitted in either aircraft and none required.

1.12 Examination of the wreckage

1.12.1 *Estimation of collision point*

Direct evidence of the height of the collision could not be established from the wreckage of either aircraft. Trajectory and wind drift estimates applied to the various detached portions of the Rallye's tail unit did not indicate the height of collision better than between 250 and 850 feet. It was estimated that the collision occurred over a point approximately 450 metres along runway 29 from its threshold and 240 metres to the left of the runway centre line.

1.12.2 *Socata Rallye 150ST*

The leading edge of the Rallye's left hand horizontal tailplane was struck by the Cessna's nose wheel which then progressed inboard and rearward through the tailplane causing considerable damage. Almost simultaneously the tip of one of the Cessna's propeller blades sliced through the leading edge of the Rallye's rudder. The rudder and fin were then struck by the right side of the Cessna's engine cowling. Finally, the Cessna's left hand main wheel and leg struck the left hand tip of the Rallye's elevator.

The rudder, left hand horizontal tailplane and the left half of the one piece elevator separated from the rest of the aircraft during the collision. The right half of the elevator detached shortly before the aircraft struck the ground in a substantially vertical nose-down attitude. The aircraft crashed near to the premises of one of the flying clubs on the aerodrome.

Examination of the wreckage revealed no evidence of any pre-collision failure or malfunction in the aircraft. The instrument panel was severely damaged on ground impact. The altimeter pressure setting subscale was found set to 1001.

1.12.3 *Cessna F 150L*

The Cessna's nose gear, left main gear, propeller and engine cowling made contact with the Rallye's tail unit. Collision damage was minor and consisted of paint markings and minor scratches and dents. There was no evidence that the engine or its ancillary components suffered as a result of the collision and there was no evidence of aircraft damage resulting in structural failure or control difficulty.

The Cessna made a landing in a field approximately three quarters of a mile north east of runway 29 threshold on a heading of 040° (M). The touch down was heavy with low forward speed. The impact caused the right main gear leg to bend and the nose leg to fail. The aircraft nosed over and slid through a wire boundary fence and came to rest inverted.

The aircraft's instrument panel was undamaged except that the spindle of the altimeter's pressure setting knob was bent upwards through approximately 60°. There was no evidence as to the cause of this damage. The altimeter pressure subscale was found on first examination of the wreckage to be set to 993. It is possible that the blow that caused the spindle to bend could also have caused rotation by a crank action; thus no reliable indication of pre-collision subscale setting was available. A standard leak check on the static system showed no evidence of leakage or blockage, and a calibration check on the altimeter showed it to be operating within limits.

1.13 **Medical and pathological information**

A full post mortem and toxicological examination was carried out on the body of the Rallye pilot. Death was due to multiple injuries and there was no evidence of a medical condition which could have had a bearing on the accident.

1.14 **Fire**

There was no fire in either aircraft.

The tender from the aerodrome fire service arrived at the scene of the Rallye crash about two to three minutes after the aircraft hit the ground. It was joined about ten minutes later by three appliances from the local authority fire service which also dispatched two vehicles to the site where the Cessna landed.

1.15 **Survival aspects**

The occupants of both aircraft survived the mid-air collision; the Rallye's subsequent impact with the ground was non-survivable. The Cessna's heavy landing was survivable even though the aircraft nosed over. The pilot was able to extricate himself and his small son from the inverted aircraft.

1.16 **Tests and research**

1.16.1 *Estimated flight paths of the two aircraft prior to the collision*

A plot, based on the evidence obtained during the investigation, was constructed showing the probable flight path of each aircraft prior to the collision (see Appendix 3). The precise point at which the Rallye commenced its overshoot could not be determined. However, the evidence indicated that the approach was discontinued when the aircraft's height was between 300 feet and 150 feet aal. Therefore two alternative tracks were drawn for the Rallye, illustrating an overshoot commenced at each of these heights. The information obtained during the test flight described in paragraph 1.16.3, when adjusted for the accident conditions, indicated that the collision could have occurred at 800 feet in the case of an overshoot from 300 feet but would not have taken place above 500 feet if the overshoot had started at 150 feet. Based on these assumptions, tables were devised showing the probable relative

bearing and elevation of each aircraft from the other at ten second intervals as they converged (see Appendix 4). The relative bearings have been incorporated into the diagram at Appendix 3.

1.16.2 *Aircraft external visibility diagrams*

Cockpit visibility diagrams were constructed for both aircraft and are shown at Appendix 5. In practice there would be small variations in the field of view due to the effect of binocular vision and movement of the pilot's eye from the mean position.

1.16.3 *Flight test*

A flight test was conducted in a Rallye aircraft similar to the one involved in the collision in order to assess its performance during an approach and overshoot. The test aircraft's weight was approximately the same as that of G-BEVX but the wind was 260° (M) at 10–15 knots and therefore the headwind component was about 5 knots less than on the day of the accident. Normal powered approaches were made and overshoots were initiated at 300 feet, 200 feet and 150 feet. With the overshoot commencing at 300 feet the aircraft reached 800 feet as it passed the estimated collision point; on both occasions when the overshoot started at 150 feet the aircraft's height was between 400 and 500 feet at the estimated point of collision. The AFISO who was on duty when the accident happened watched these trials from the control tower and later reported that the two overshoots from 150 feet most nearly matched her recollection of the climb profile of the Rallye prior to the collision.

1.17 **Additional information**

1.17.1 *Circuit procedures – general*

There are no official instructions which lay down precise joining and overshoot procedures. Over the years a number of procedures have become accepted as 'standard' practices and these are described in such instructional manuals as the Training Manual for the Private Pilot's Licence which is published by the Aircraft Owners and Pilots Association (AOPA). In practice variations to the basic procedures have been developed as a result of local conditions and personal experience. The following two paragraphs summarise the most common practices for joining a circuit and overshooting.

1.17.2 *Joining procedures*

The 'standard' joining procedure is to fly over the aerodrome at least two thousand feet above ground level and then proceed to the 'dead side' of the runway where a descending turn is carried out down to circuit height. Subsequently the aircraft is positioned so as to cross at right angles the upwind end of the runway or landing area. It then proceeds cross wind in order to join the downwind leg while maintaining adequate separation between aircraft. This procedure enables the pilot to examine the aerodrome before joining the circuit and it is still the recommended practice for non-radio aircraft and for any aircraft arriving at an unfamiliar aerodrome. However, the introduction of radio equipment and air traffic services has meant that pilots now receive all the circuit information while they are still some distance from the aerodrome. It has become common practice, therefore, to proceed straight into a let-down to circuit height on the 'dead side' of the runway without first flying overhead the aerodrome. When either a long runway is in use or there is a strong wind blowing, it is sometimes advocated that the landing area should be crossed from the 'dead side' in a more down wind position than normal so as to minimise the possibility of conflict with aircraft climbing away after take-off. Another variation from the full 'standard' procedure is to descend to circuit height away from the aerodrome and then join the circuit directly at the commencement of the down wind leg.

1.17.3 *Overshooting procedures*

In the case of general aviation aircraft it is normally recommended that, having commenced an overshoot, they should turn towards the 'dead side' of the runway and then fly parallel to it – so that the pilot can keep the take-off and landing area in sight. There are wide differences of opinion, however, about the next stage in the procedure, the repositioning into

the circuit. Some pilots believe that the turn onto the crosswind leg should be made whenever it is convenient while others advocate proceeding straight ahead to the normal crosswind position. Opinions also vary as to whether the aircraft should continue to climb directly to circuit height or whether the aircraft should level off at some intermediate height such as 500 feet aal and maintain that height at least until the upwind end of the runway has been passed.

Discussions with instructors who had flown with the Rallye pilot indicated that opinions amongst them varied as to the procedure which should be taught for repositioning an overshooting aircraft back into the circuit pattern.

1.17.4 *Biggin Hill Airport Rules*

The Biggin Hill Airport Rules current at the date of the accident included the following relevant items:

- (1) 'A sharp look-out for other aircraft is essential'
- (2) 'The village of Biggin Hill is not to be overflowed'.

1.17.5 *Civil Aviation Authority – Aeronautical Information Circulars (AICs) 81/1973 and 8/1978*

AIC 81/1973 was published following the occurrence of two mid-air circuit collisions involving light aircraft. The Circular warned pilots of the difficulties which can be experienced in seeing other aircraft in the circuit and mentioned the problems caused by 'blind spots' in the field of vision from all aircraft cockpits. It stressed the need for all pilots to maintain a high degree of circuit discipline and at the same time keep a good look-out, particularly when either joining a circuit or making an approach to land.

AIC 8/1978 gave notice and explained the purpose of changes in the ANO of 1976 which, with effect from 1 July 1978, eliminated unlicensed Air Traffic Control and introduced a licensed AFIS at certain aerodromes. The AIC went on to outline the type of service to be provided by an AFIS and the responsibilities of an AFISO. It included the following note:

'The AFISO may **not** give ATC instructions or advice to aircraft flying in the ATZ except for the purpose of averting a dangerous situation.'

1.17.6 *Extracts from the Rules of the Air and Traffic Control Regulations 1976*

Rule 17 (1) General

- (a) Notwithstanding that the flight is made with air traffic control clearance it shall remain the duty of the commander of an aircraft to take all possible measures to ensure that his aircraft does not collide with any other aircraft.

Rule 17 (2) Converging

- (b) Subject to the provisions of sub-paragraph (a) of this paragraph, when two aircraft are converging in the air at approximately the same altitude, the aircraft which has the other on its right shall give way.

Rule 17 (5) Landing

An aircraft while landing or on final approach to land shall have the right-of-way over other aircraft in flight or on the ground or water.

1.17.7 *Subsequent action in regard to Biggin Hill Aerodrome*

Shortly after the accident occurred the Civil Aviation Authority set up a working party to examine the operational conditions at Biggin Hill. Its report was far ranging but the main aspects on which it made recommendations were:

- (i) the introduction of 'standard' procedures for joining aircraft and also for those either taking-off, making touch and go landings or overshooting;
- (ii) restrictions on the number of aircraft in the circuit;
- (iii) encouragement in the use of landing lights in the circuit;
- (iv) an increase in the RTF facilities at the aerodrome.

Subsequent to the working party's activities all aircraft at Biggin Hill now have to observe set procedures when joining the circuit and also when either taking-off, carrying out a touch and go landing or when overshooting. A revised set of operating rules for Biggin Hill has been drawn up and is available for general distribution. Recording apparatus for RTF communications and an Aerodrome Terminal Information Service (ATIS) have been introduced at the aerodrome.

1.18 New investigation techniques

None

2. Analysis

2.1 General

The investigation has established that, immediately prior to the collision, the Cessna was flying straight and level towards the aerodrome from the south and the Rallye was on the south side of and flying parallel to runway 29. In all probability it was still climbing. Contact between the two aircraft removed a significant section of the Rallye's tail unit. The pilot, as a result, was no longer able to control the aircraft and its subsequent crash was inevitable. The Cessna, however, suffered little damage in the collision and its flying capabilities were not impaired.

There is no evidence of any pre-crash failure or malfunction in respect of either aircraft and neither aircraft was being flown in a deliberately hazardous manner nor was either carrying out any unusual manoeuvre. Neither pilot was found to be suffering from any medical condition which could have had a bearing on the accident. The weather was not considered to be a contributory factor except that the elevation of the sun was low enough for its glare to have restricted visibility towards the south.

The collision occurred while the aircraft were flying in a visual right hand circuit pattern without the benefit of positive air traffic control. Each pilot was, therefore, responsible for collision avoidance in accordance with the appropriate rules for avoiding aerial collisions. It is clear, however, that they both failed to see one another's aircraft until it was too late to prevent the collision.

2.2 Visibility considerations

Failure of either pilot to see the other aircraft does not necessarily mean there was a failure to keep a good look-out. It is not physically possible for any pilot to maintain a continuous look-out in every direction on a three dimensional basis. The limitations of his natural vision do not enable him to see backwards and his cone of vision sideways, upwards and downwards can only be increased by head movement to the extent that visual obstructions from the structure of his own aircraft permit. A low wing monoplane in a level turn allows good visibility in the direction of the turn but the raised wing partially obstructs the pilot's vision in the direction from which it is turning. The pilot of a high wing monoplane making a level turn has his vision partly obstructed by the lowered wing in the direction he is turning, while his visibility in the direction from which he is turning is enhanced by the raised wing. The visibility from an aircraft with a tandem seating arrangement is usually equal in quality to the right or to the left. However in the more common side-by-side seating arrangement where, except in helicopters, a solo pilot sits in the left hand seat, his visibility to the left is little different from that in a tandem seating arrangement, but to the right it is significantly obstructed by aircraft structure. In level flight the pilot can see comparatively little below the horizontal to the right of the aircraft's centreline. Manoeuvring the aircraft will increase his field of view within the limitations which apply to high or low wing monoplanes, as described above. On a bright sunny day an area round the sun represents an additional limitation of natural vision.

It is a characteristic of human eyesight that an object at some distance often becomes conspicuous only because of its relative movement. However, two aircraft on a collision course maintain a constant relative bearing and therefore are far more likely to remain undetected by their respective pilots, as was the case on this occasion, until immediately before the collision. The need for pilot vigilance, especially in areas of high traffic density such as aerodrome circuits, cannot be too strongly emphasised, and it is therefore recommended that CAA AIC 81/1973 on this subject be re-issued.

In many circumstances the use of anti-collision, high intensity strobe or landing lights may render aircraft more conspicuous; however, because this accident occurred in bright sunlight and excellent visibility – except when looking in the general direction of the sun – it is considered that the use of additional lighting would not have materially reduced the collision risk on this occasion.

2.3 The collision height

There is no direct technical evidence of the height at which the collision took place. The evidence of the Cessna pilot who survived the accident was that his aircraft was at the circuit height of 800 feet on the QFE when it crossed the aerodrome boundary and there is some eye-witness support of this statement. On the other hand, a number of eye-witnesses were of the opinion that the aircraft were below circuit height when they collided. In addition, the evidence of the AFISO, who had been on duty at the time of the accident and who viewed the test flight, suggests that the overshooting aircraft had not reached 500 feet aal by the time it had passed the estimated collision point. The conflicting eye-witness evidence only serves to confirm the known difficulty of estimating an aircraft's height from the ground.

2.4 Rules of the air

Rule 17(2)(b) which requires the aircraft which has the other on its right to give way is subject to the consideration that the two aircraft are converging at approximately the same altitude, however in this case the Rallye was climbing after overshooting from an approach to land. It is accepted that the Cessna was maintaining approximately a constant height whilst the two aircraft were converging. Whilst Rule 17(5) gives right of way to an aircraft landing or on final approach to land, the Rules are silent as regards aircraft taking-off or overshooting in which case it is considered that Rule 17(1)(a) which requires the commander of every aircraft to avoid collision and Rule 17(2)(b) apply. That the aircraft did in fact collide can only imply that they were at approximately the same altitude immediately before the collision in which case it was the duty of the commander of the Cessna to give way.

2.5 Operation of the Cessna

The Cessna pilot did not carry out the full, 'standard', joining procedure but his decision to join the circuit in level flight and, in view of the strong wind, to fly the crosswind leg across the mid-section of the runway was in accordance with generally accepted practice. Nevertheless, by so doing, he would appear to have contravened the local rule which, for noise abatement reasons, forbade overflying Biggin Hill village. At the time the Rallye became established on final approach the two aircraft were still over one and a half miles apart and the Cessna pilot would not have found it easy to see the Rallye because, being at a lower height, its very small image would have tended to merge with the landscape background. From this point onwards the Rallye's relative bearing from the Cessna remained very nearly constant, giving rise to the associated difficulty in sighting another aircraft on a collision course, already discussed. The various positions from which the Rallye's overshoot could have been initiated would have had only a minor effect on the relative bearings of the two aircraft, and the cockpit visibility diagram for the Cessna shows that the estimated position of the Rallye as the aircraft converged lay within the area obscured by the lower part of the Cessna's right hand front windscreen pillar. Therefore the Rallye would probably not have been visible to the Cessna pilot at least until after it had commenced its overshoot. Whether it would subsequently have come into sight as they converged would have depended on the exact heading and attitude of the Cessna at the time. Although these values could only be estimated approximately, the evidence suggests that the Rallye could have remained obscured by the Cessna's structure until shortly before the collision occurred. Naturally the pilot's view (from the left hand seat of the Cessna) out of the right side of the windscreen and right hand window is limited although no more so than from many other aircraft of similar size; thus in order to bring the other aircraft into view the Cessna pilot would have had to move his head or manoeuvre the aircraft. However, because he did not hear the Rallye pilot report that he was overshooting, he was not alerted to the fact that another aircraft was climbing towards him. Nonetheless he should have been aware that there were several aircraft in the circuit engaged in training flying and he should have taken into account the possibility of one of them carrying out a missed approach procedure involving a gain of height earlier than aircraft that were taking-off on runway 29. It would have been prudent therefore for the pilot of the Cessna to manoeuvre his aircraft from time to time as he approached the aerodrome to ensure that any aircraft that might be overshooting could be kept in view.

In the case of single pilot operations, a right hand circuit pattern makes the keeping of a good look-out to the right from the left hand seat more difficult, and therefore increase the risk of collision. This factor should be given due weight by those responsible for the choice of circuit pattern when assessing relative environment and safety considerations.

It is both possible and desirable for any right hand seat occupants to keep a good look-out, particularly in those sectors obscured from the pilot, but in this instance the pilot's son was too young and small to be of assistance.

2.6 Operation of the Rallye

The Rallye pilot probably decided to overshoot because he was too close to the preceding aircraft which was making a full stop landing on runway 29, by no means an uncommon event at a busy airfield.

The all-round view from the Rallye is exceptionally good and it is considered that the Cessna would have been within its field of vision from the commencement of the approach right up to the time of the collision. There were, however, several factors which could have affected the ability of its pilot to detect the other aircraft.

The overshoot procedure necessitated a period of comparatively high workload. The pilot had to adjust the power, continuously monitor the airspeed, turn left and then right to fly parallel to the active runway, and retract the flaps, amongst other tasks. In the case of a comparatively inexperienced pilot, pre-occupied with these actions, this would leave little time for keeping a good lookout however much its importance may have been emphasised during training. The Rallye pilot received no warning from the duty AFISO about the possibility of an impending conflict, and if he was well acquainted with the Biggin Hill Airport Rules, which he should have been, he had little reason to expect another aircraft to approach the aerodrome from the direction of Biggin Hill village over which aircraft were instructed not to fly.

In the event, the elevation of the sun was low enough to have affected the flight visibility to the south of the aerodrome. Although the Cessna was not flying directly out of the sun relative to the Rallye, the glare from the sun would have been sufficient to account for the Rallye pilot's inability to detect the Cessna while it was still some distance away. With a closing speed of 72 knots, the time interval between the point at which the increasing size of the Cessna made it conspicuous and the moment when the collision occurred was relatively short. In these few seconds the Rallye pilot's attention may easily have been focused either within the cockpit or upon some activity below him on the opposite, that is runway, side of the aircraft and thus he missed seeing the Cessna until it was too late to take avoiding action.

2.7 Circuit traffic

The local arrangement introduced at Biggin Hill aerodrome limiting the number of aircraft simultaneously engaged in circuit training to five appears to be a sensible one and compares favourably with other busy airfields. The number of aircraft arriving and departing the circuit was not restricted, hence the fact that shortly before the collision there were actually seven aircraft in the circuit.

An assessment of the disposition of the aircraft around the aerodrome confirms the Cessna pilot's impression that there was plenty of space for him to join downwind. It is considered, therefore, that the circuit was not congested at the time of the collision and that a number of aircraft and their movements were not factors material to the collision.

2.8 RTF communications

There was only one RTF frequency in use at Biggin Hill to deal with all the approach, tower and ground movement activities. As a result this channel became very congested at times and there have been reports of difficulties in radio communications. Whilst listening to a constant stream of RTF messages it is easy for a pilot to fail to recognise transmissions which are not directed to him but which nevertheless have a bearing on his own flight especially when a cockpit loud speaker is used rather than headphones. This could be the reason why

the Cessna pilot did not hear the Rallye's overshooting call. Had he heard it he would probably have been alerted to the situation and started to search for the other aircraft.

In order to reduce the RTF congestion, aircraft in the circuit were not required to make a 'downwind' call. The AFISOs were often so busy that they could pass to aircraft only the briefest details of aerodrome information, without any advice about circuit traffic. Thus pilots were sometimes deprived of information which could have helped them judge how best to conduct their own flights. The introduction of an ATIS at Biggin Hill since the accident should reduce this congestion and result in an improved level of safety. A further reduction in RTF congestion at busy airfields could perhaps be achieved by pilots exercising better RTF discipline.

2.9 Air traffic services

The AFIS was introduced to provide useful information, not ATC instructions, to pilots, as explained in AIC 8/78. The duty AFISO at Biggin Hill was therefore not responsible for providing separation between the Cessna and the Rallye and there is no evidence that any of the information she gave was incorrect or misleading. However it does appear that, although adequately promulgated at the time of introduction of the AFIS, the important distinction, mentioned above, between the two types of service is not always appreciated by those who use them.

It is the duty of an AFISO to take action whenever it is believed that a dangerous situation is developing. The Cessna pilot had reported his approach from the south at 1150 hrs but the pilot of the Rallye called 'overshooting' less than one minute before the collision occurred at 1202 hrs. Bearing in mind the amount of traffic in the circuit and the almost continuous RTF traffic involving the tower during this period, it is not reasonable to expect an AFISO to keep an accurate mental picture of conflicting traffic on a basis of a report made 11 minutes earlier. Furthermore since the Cessna was approaching the aerodrome from the direction of the sun, it is not surprising that the AFISO was unable to see the conflict until it was too late to warn either pilot.

2.10 Circuit procedures

The standard circuit procedures as outlined in paragraph 1.17.1 to 1.17.3 are often curtailed or varied to suit local conditions at aerodromes which contain a mixture of training, private and commercial aircraft. Although the full 'overhead' joining procedure is frequently omitted, most aircraft join the circuit by crossing the active runway at right angles. They normally cross at circuit height in order to avoid letting down into the 'live' part of the circuit. There is no general agreement as to whether overshooting aircraft should climb unrestricted back to circuit height or level off at some intermediate height. The joining aircraft and one overshooting can, therefore, be flying on converging courses without having the protection of height separation. This situation is also potentially dangerous because of the difficulty of detecting an aircraft which is climbing from below, as in this case. Furthermore, it cannot be conducive to flight safety that flying clubs at the same aerodrome may teach differing overshoot procedures. The measures recommended by the CAA working party should introduce a desirable degree of standardisation at Biggin Hill.

2.11 The flight of the Cessna after the collision

Post-crash examination of the Cessna revealed that it suffered no damage in the collision that would prejudice its airworthiness. The explanation of its stall after the collision most probably lies in the state of shock from which the pilot could well have been suffering after the traumatic experience of a mid-air collision. His recollection of the events is unclear but it is not unnatural that the pilot might have been suspicious of the airworthiness of his aircraft after the collision and after recovering from the stall decided to land at the earliest possible opportunity whilst he was still able to maintain control. The heavy landing which bent the right main gear leg and caused the nose gear leg to fail resulted in the aircraft coming to rest inverted.

2.12 RTF recordings

At the time of this accident there was no RTF recording apparatus in operation at Biggin Hill despite the recommendations that it should be installed in two previous accident reports, No 10/76 and 2/78. Since the accident occurred such recording apparatus has been installed. In order to avoid situations in which accident investigations have to be conducted without benefit of recorded RTF information in the future, consideration should be given to the installation of RTF recording apparatus at all other aerodromes in the UK which have a large volume of general aviation traffic.

The ATR was intended to provide useful information, not ATR instructions, to pilots as explained in ATR 78. The date ATR 78 was issued was therefore not responsible for the accident. The date ATR 78 was issued was therefore not responsible for the accident. The date ATR 78 was issued was therefore not responsible for the accident.

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3. Conclusions

(a) Findings

- (i) Both pilots were properly authorised and competent to carry out their flights. The Cessna pilot held a valid Private Pilot's Licence.
- (ii) There is no evidence that either pilot suffered from a medical condition which could have had a bearing on the accident.
- (iii) Both aircraft had been properly maintained and their documentation was in order.
- (iv) There is no evidence of any failure or malfunction of either aircraft prior to the collision.
- (v) The Aerodrome Flight Information Service in operation at Biggin Hill Aerodrome was not responsible for the maintenance of separation between aircraft in the circuit.
- (vi) It was the duty of the commander of the Cessna to give way to the Rallye.
- (vii) The commander of the Cessna did not see the Rallye until immediately before the collision because his view in the direction of the constant bearing on which it was approaching was obscured by the right hand windscreen pillar.
- (viii) The Rallye pilot's view of the Cessna was unobstructed, but the glare from the sun could have made it difficult for him to observe its approach from the direction of Biggin Hill village over which aircraft were instructed not to fly. His comparative inexperience could also have contributed to his difficulties in keeping a good look-out while performing the activities associated with an overshoot.
- (ix) Neither pilot saw the other aircraft in time to take evasive action to prevent a collision.
- (x) Circuit congestion was not a factor affecting the operation of either aircraft.
- (xi) The flying qualities of the Cessna were not affected by the collision but its subsequent stall and landing in a field probably resulted from the pilot suffering from some degree of shock.

(b) Cause

The collision resulted from the failure of the commander of the Cessna to see and give way to the Rallye which was on his right. His failure to manoeuvre the Cessna as he approached the busy circuit caused his field of view to be restricted by the windscreen pillar. The failure of the commander of the Rallye to keep a sufficient look-out to ensure that his aircraft did not collide with other aircraft was a contributory factor.

4. Safety Recommendations

It is recommended that:

- 4.1 Aerodrome circuit procedures in the UK be revised in a manner consistent with the procedure recommended by the CAA working party in respect of Biggin Hill in order to improve the separation between aircraft joining the circuit and those taking-off or overshooting.
- 4.2 Pilots be reminded by all appropriate means of the need for strict RTF discipline, particularly at busy airfields.
- 4.3 Aeronautical Information Circular 81/1973 be re-issued.
- 4.4 The requirements for the installation of RTF recording apparatus be extended to include all aerodromes which have a large volume of general aviation traffic.

W H Tench
Chief Inspector of Accidents

Accidents Investigation Branch
Department of Trade

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