

## **AIRPROX REPORT No 2014130**

Date/Time: 31 Jul 2014 1148Z

Position: 5301N 00032W  
(Cranwell Visual Circuit)

Airspace: Cranwell ATZ (Class: G)

Aircraft 1                      Aircraft 2

Type: Grob Tutor                      King Air BE20

Operator: HQ Air (Trg)                      HQ Air (Trg)

Alt/FL: 1000ft                      1000ft  
QFE (1004hPa)                      QFE  
(1009hPa)

Conditions: VMC                      VMC

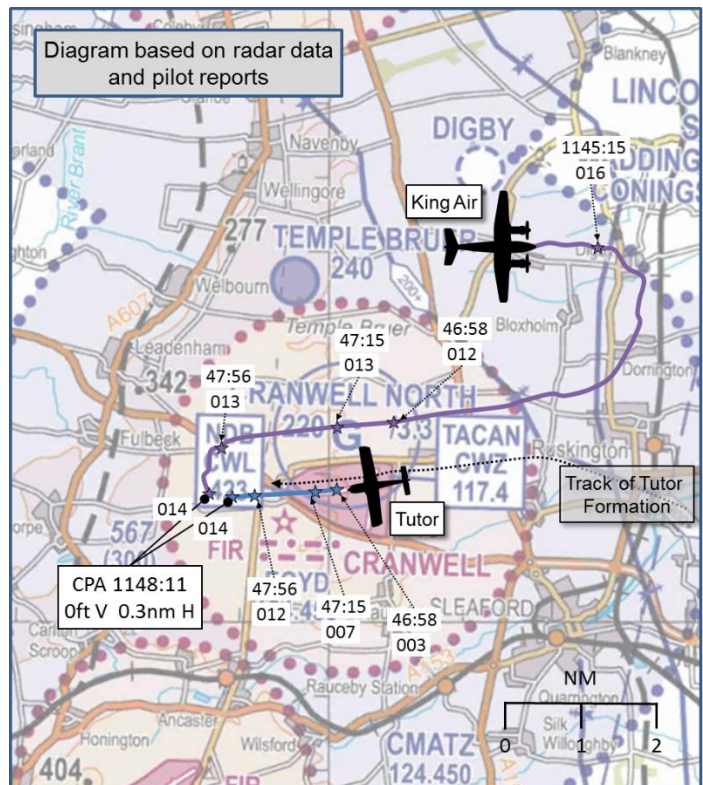
Visibility: 10km                      >10km

Reported Separation:

50ft V/50m H                      150ft V/50m H

Recorded Separation:

0ft V/0.3nm H



## **PART A: SUMMARY OF INFORMATION REPORTED TO UKAB**

**THE TUTOR PILOT** reports performing a SID<sup>1</sup> departure RW26, VFR, with white HISLs and navigation lights illuminated, transponder Modes 3/A, C and S selected and a TAS<sup>2</sup> operating. The student was flying under an IF visor, and changing from the Tower to the Director frequency, when the instructor became aware of a King Air displayed on the TAS joining through initial on the dead-side of RW26, around 200ft above them. The Tutor was departing traffic, consequently the instructor expected the King Air crew to avoid the Tutor as it was climbed through the King Air's height. The Tutor instructor saw the King Air turn crosswind immediately ahead of, and around 50ft above his aircraft, so he took control from the student, levelled-off at 950ft and immediately turned to the right to maintain separation.

He assessed the risk of collision as 'Low'.

**THE KING AIR PILOT** reports returning to the Cranwell visual circuit, in radio contact with Tower, with strobes and navigation lights illuminated, squawking transponder Modes 3/A, C and S, and with TCAS<sup>3</sup> operating. He was aware of a pair Tutors ahead, and another Tutor about to take-off; in order to allow sufficient separation from the pair of Tutors he positioned the King Air wide on the dead-side and extended upwind. Once he was comfortable that adequate separation from the formation existed, he 'dipped a wing' to look for the departing Tutor prior to initiating the upwind turn onto the downwind leg. The King Air crew received a Traffic Alert from the TCAS and saw the departing Tutor below their aircraft, in their 8 o'clock position, and converging with them; they immediate initiated a climb to 1500ft and, once they were clear of it, descended back to circuit height on the downwind leg whilst informing the Tower controller of their actions.

He assessed the risk of collision as 'High'.

<sup>1</sup> Standard Instrument Departure

<sup>2</sup> Traffic Alerting System

<sup>3</sup> Traffic and Collision Alerting System

**THE TOWER CONTROLLER** reports that the formation of two Tutors had called to join the visual circuit before the King Air called, on the same frequency, to join the visual circuit on recovery from RAF Waddington. The pilot and instructor in the single Tutor reported ready for departure and was given clearance to take off from RW26. When the formation leader reported at Initial, the Tower controller passed Traffic Information on the departing Tutor; shortly afterwards, the King Air's pilot reported at Initial and was given Traffic Information on the formation ahead on the dead-side, and the Tutor on the runway for departure. The controller recalled seeing the King Air positioning wide on the dead-side to deconflict with the formation, but he lost sight of the departing Tutor, as it travelled upwind, due to the aircraft colour against the clouds. The controller looked at the Hi-Brite<sup>4</sup> and saw that the Tutor was around 1nm up-wind. The controller saw the wing of the King Air dip prior to turning cross-wind, and he asked the pilot if he could see the Tutor; the King Air pilot replied that he could not, so the controller passed further Traffic Information using the data from the Hi-Brite. The King Air then appeared to execute a steep climb to avoid the Tutor. Once the King Air was re-established downwind, the aircraft descended to normal circuit height and the pilot stated that he had not been in visual contact with the Tutor. Although no Airprox was reported on frequency, the controller decided to note the occurrence and the information was passed to the Supervisor.

He perceived the severity of the incident as 'Medium'.

**THE CRANWELL SUPERVISOR** reports being in the Approach Control Room at the time of the occurrence, and so did not witness it; the Unit's and the controller's workloads were assessed as 'medium to low'.

### Factual Background

The weather at Cranwell at 1150 was recorded as:

METAR EGYD 311150Z 26011KT 9999 FEW036 OVC250 22/12 Q1012 BLU NOSIG

An excerpt from the RT transcript is reproduced below:

From	To	Time	
King Air	TWR	11:43:48	Cranwell Tower, [King Air C/S] request join tower to tower from Waddington
TWR	King Air	11:43:44	[King Air C/S] Cranwell Tower Join runway 26 QFE 1005 circuit clear
King Air	TWR	11:43:50	26, 1005, [King Air C/S]
Formation	Formation	11:44:33	[Formation C/S], Two
Formation	TWR	11:44:34	Tower, [Formation C/S] join with C
TWR	Formation	11:44:38	[Formation C/S] Cranwell Tower, join C correct one King Air joining from the north
Formation	TWR	11:44:43	[Formation C/S]
Tutor	TWR	11:45:23	Cranwell Tower, [Tutor C/S] ready for departure
TWR	Tutor	11:45:26	[Tutor C/S], Cranwell Tower cleared for take off surface wind 270 10 knots
Tutor	TWR	11:45:32	Cleared for take off [Tutor C/S]
Formation	TWR	11:45:53	[Formation C/S] Initials
TWR	Formation	11:45:56	[Formation C/S], one on for departure, wind 270 10
Formation	TWR	11:46:00	[Formation C/S]
King Air	TWR	11:46:07	and [King Air C/S] is initials sitting wide downwind for the formation, er wide deadside for the formation
TWR	King Air	11:46:12	[King Air C/S] roger, and there's one on for departure wind 270 9
Formation	TWR	11:46:21	[Formation C/S], for formations circuit we'll extend behind the King Air
TWR	Formation	11:46:26	[Formation C/S]
TWR	All Stns / Formation	11:47:10	Cranwell all stations, new QFE 1004, [Formation C/S]
Formation	TWR	11:47:15	[Formation C/S] 1004 set
TWR	King Air	11:47:17	[King Air C/S]
King Air	TWR	11:47:18	[King Air C/S] 1004 set

<sup>4</sup> Uncalibrated display of radar data-used for situational awareness not for issuing control instructions

TWR	Tutor	11:47:22	[Tutor C/S]
Tutor	TWR	11:47:23	[Tutor C/S] 1004 Set
TWR	Tutor	11:47:23	Roger
Tutor	TWR	11:47:44	[Tutor C/S] airborne Stud 3
TWR	Tutor	11:47:46	[Tutor C/S]
TWR	King Air	11:47:56	[King Air C/S] are you visual with the Tutor upwind?
King Air	TWR	11:48:03	[King Air C/S] negative
TWR	King Air	11:48:04	roger he's left 9 o'clock quarter of a mile, tracking east, 100ft below climbing
King Air	TWR	11:48:11	[King Air C/S] now visual
TWR	60K	11:48:12	roger
King Air	TWR	11:48:54	er [King Air C/S] we { <i>unintelligible transmission</i> } climbed for the traffic we're now descending back down, er downwind to land
TWR	King Air	11:49:01	[King Air C/S] roger

## Analysis and Investigation

### Military ATM

The radar recording at 1147:02 (Figure 1) shows the single Airprox Tutor getting airborne, and the King Air wide on the dead-side to overtake the Tutor formation.

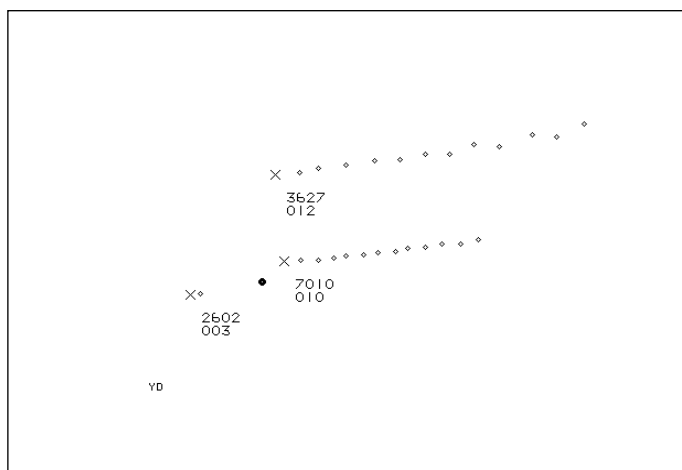


Figure 1: 1147:02  
(King Air squawk 3627; Tutor 2602; Tutor Formation 7010).

At 1147:44 (Figure 2), the Tutor had reported airborne and switching to the Director frequency.

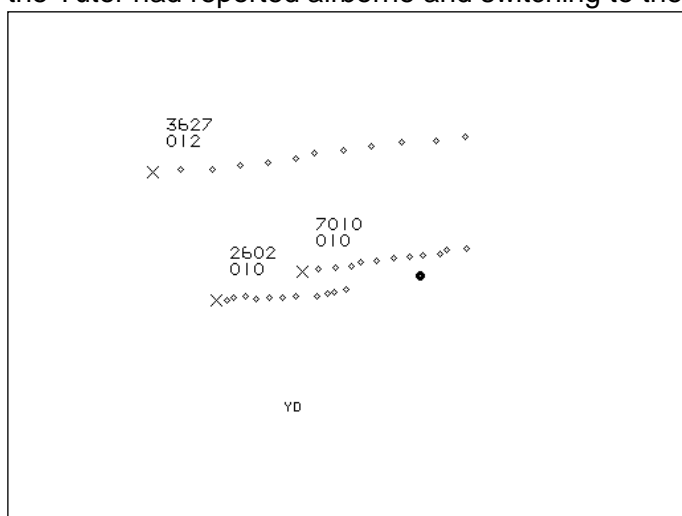


Figure 2:  
1147:44, the Tutor has called transferring from Tower to Director frequency.

At 1147:56, the Tower controller asked the King Air crew if they were visual with the departing Tutor (Figure 3).

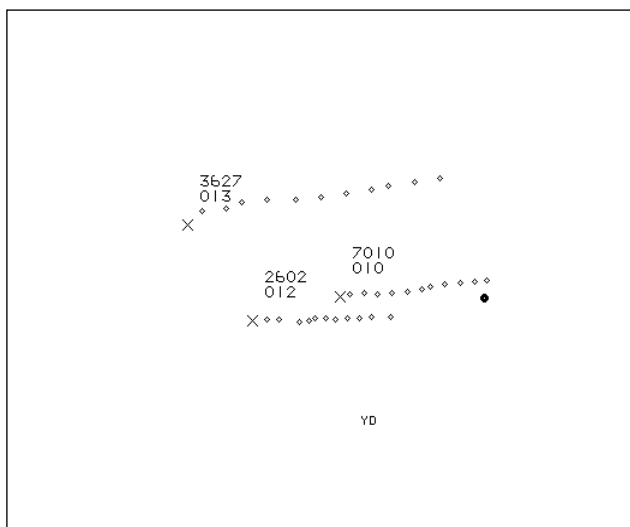


Figure 3: Geometry at 1147:56.

At 1148:04 (Figure 4), the Tower controller passed information, using the Hi-Brite, to the King Air: "left 9 o'clock quarter of a mile, tracking east, 100 feet below climbing."

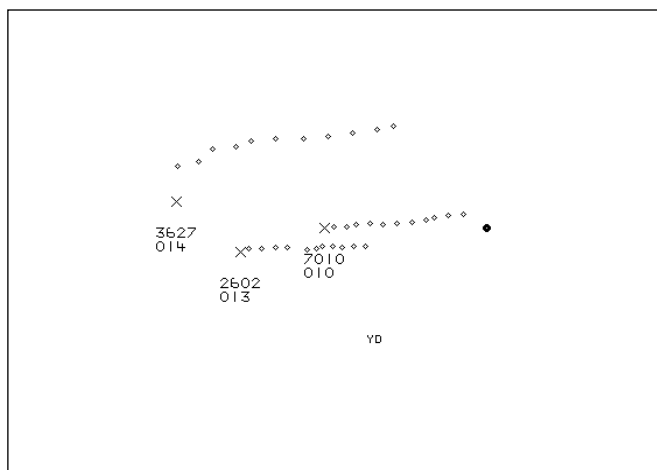


Figure 4: Geometry at 1148:04 Traffic Information.

The radar replay shows the CPA between 1148:10 to 1148:14 as 0ft V and 0.3nm H separation (Figure 5).

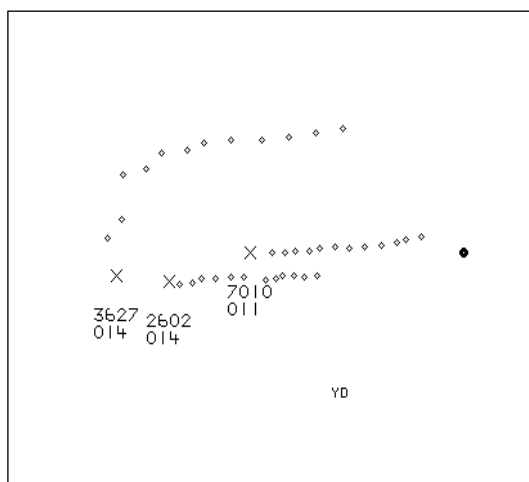


Figure 5: CPA taken at 1148:11.

The King Air pilot was aware of the Tutor formation joining and flew a modified circuit to deconflict from it. The Tutor formation was at initials first, but the King Air's greater speed (reported 140kt versus 80kt) meant that it would overtake the Tutors; circuit heights at Cranwell provide vertical separation between Tutors and King Airs (800 ft QFE and 1000 ft QFE respectively) but the King Air pilot was also using lateral separation. The King Air pilot flew a wider than normal and extended deadside/upwind leg of the visual circuit, and the profile of the aircraft meant that the aircraft wing needed to be tipped for him to be able to see the departing Tutor.

The Tutor crew were at an elementary phase of training, and the student was wearing an IF visor for the SID 1 departure (climb ahead on RW track to FL50); no climb-out restriction was in place. The instructor had an increased workload because he was responsible for the lookout and the instructional element of the departure. Traffic Information was available to the crew on the shared Tower frequency; as the Tutor switched to the radar frequency (Figure 2), indicating 1000ft on QNH 1014 hPa (QFE was 1005 hPa), the King Air pilot had not initiated the crosswind leg. TAS was used to good effect to increase awareness for the Tutor crew, and the instructor levelled off at 950ft and turned to the right to increase separation.

The controller had used standard RT for join calls and this was supplemented with Traffic Information on the departing Tutor. Having lost sight of the departing Tutor, the controller made good use of the Hi-Brite, and showed commendable awareness by asking the King Air crew if they were visual with the Tutor; further Traffic Information was passed several seconds prior to the CPA, which almost certainly aided visual acquisition.

The normal barriers to an Airprox in the visual circuit would be 'see and avoid', Traffic Information (visual or using Hi-Brite data), and safe procedures for separating traffic. Traffic Information was passed by the Aerodrome Controller; all elements were aware of the other aircraft in the circuit or getting airborne. TAS provided an alert for the Tutor crew; ACAS was fitted to the King Air and it indicated a TA but it is not clear how much assistance it provided in helping visual acquisition. The King Air crew modified their circuit slightly to deconflict with the Tutor formation on the deadside, and it was likely that the King Air was not in the usual position for turning crosswind and deconflicting with aircraft climbing out.

The pilots in the visual circuit were responsible for their own deconfliction and maintaining situational awareness. All parties were aware of their responsibilities, but certain limitations to 'see and avoid' were apparent:

(a) **Lookout.** The King Air crew had prioritised the lookout towards the Tutor formation until they were well ahead of it. Prior to the King Air crew beginning the crosswind turn, the departing Tutor would have been obscured approximately in the eight o'clock position, leading to an incomplete visual picture; the King Air crew's mental model of the normal position of departing aircraft may have become confused because of their extended circuit. The geometry meant that the Tutor crew would have had the King Air in their two o'clock position making it easier for them to see it.

(b) **Aircraft conspicuity.** As the King Air turned, the white Tutor was slightly below and may have been more difficult to spot if it was being viewed against the white clouds. The Tower controller lost sight of the Tutor for this reason and it's possible that the King Air crew were subject to the same effect.

(c) **Cockpit workload.** Both crews were in busy phases of flight and on instructional sorties. The Tutor was on an IF departure and the onus was on the instructor to balance the lookout with the other demands of an instructional sortie. The King Air crew were also under training, and having to modify a known circuit procedure would have placed greater demands on their attentional resources, and possibly their situational awareness became degraded.

(d) **Response times.** The Tutor crew was flying an IFR departure, but had received a TAS warning to supplement their lookout before they reported switching to Director's frequency at

around 700ft. Having turned crosswind the King Air crew had increased the rate of closure between the two aircraft and therefore reduced the response time available for avoiding action. A climb was initiated by the King Air but at CPA, the aircraft were co-height.

(e) **Threat recognition.** The Tutor pilot was content enough with the proceedings in the visual circuit to change frequency; the King Air pilot was always aware of the departing Tutor and the need to get visual with it because they needed to cross the climb-out lane.

The 'see and avoid' barrier was not as robust as it could have been in a visual circuit. The normal dead-side procedures were modified to increase separation with one formation but resulted in limited lookout and reduced separation with the departing Tutor.

### **UKAB Secretariat**

Both pilots had equal responsibility for avoiding collisions and for ensuring that they did not fly in to such proximity to other aircraft as to create a danger of collision.<sup>5</sup> The King Air pilot was required to conform to the pattern of traffic formed by other aircraft intending to land at the aerodrome or keep clear of the airspace in which the pattern was formed.<sup>6</sup>

## **Comments**

### **HQ Air Command**

The King Air pilot had responsibility to integrate into the visual circuit and avoid traffic already established (ie the formation of Tutors on recovery and the single Tutor on departure), so elected to fly wider on the deadside than would normally be the case to generate separation from the pair. However, having overtaken the pair, and being comfortable with the separation generated by also extending upwind, the radar trace suggests that he then commenced the crosswind turn without being visual with the departing Tutor and now in its climb-out area. Once the Tutor appeared on TCAS he reacted promptly to resolve the conflict, though by this time the instructor in the Tutor, who had been visual with the King Air throughout, had also taken positive measures to prevent the situation deteriorating further. The major lessons to be drawn from this incident are:

1. If in doubt about the position of circuit traffic, ask ATC
2. Having no contacts on TCAS does not mean that there are no aircraft there; and
3. When modifying the normal circuit pattern consider what the 2<sup>nd</sup> order effects might be (such as flying through the height band and likely location of departing traffic).

Ironically, had the King Air pilot flown a more normal ground track (and accepted direct overflight of the Tutor formation, with a separation of 200ft) then he would never have come into conflict with the departing aircraft. Furthermore, an early turn downwind (prior to having overtaken the formation) would also have kept him well away from the climb-out lane.

## **Summary**

An Airprox was reported in the Cranwell visual circuit, in VMC, between a King Air being flown on a visual recovery, through initials on the dead-side of the runway, and a Tutor being flown on an IFR departure. Both crews were in contact with Cranwell Tower, the King Air crew received Traffic Information, and both aircraft were equipped with TAS or TCAS.

<sup>5</sup> Rules of the Air 2007, Rule 8, Avoiding Aerial Collisions

<sup>6</sup> Rules of the Air 2007, Rule 12, Flight in the vicinity of an aerodrome, and Regulatory Article 2307(1) Para 15

## **PART B: SUMMARY OF THE BOARD'S DISCUSSIONS**

Information available included reports from the pilots of both aircraft, transcripts of the relevant RT frequencies, radar photographs/video recordings, reports from the air traffic controllers involved and reports from the appropriate ATC and operating authorities.

The Board was informed that normally in a military visual circuit the pilot joining the circuit has the responsibility to identify all of the traffic reported to him and ensure that he can see the other aircraft before turning onto the downwind leg; if there are any aircraft the pilot cannot see, then they are taught to extend up-wind, and if necessary request to go around and re-join the circuit. This is slightly different from normal practice in a civilian circuit, where it is more usual to fly an orbit to increase spacing or create more time to see other traffic.

There was considerable discussion amongst Board members about the differences between military and civilian visual circuit procedures. Some members observed that civilian controllers exercise greater control over the visual circuit and that this avoided the need for pilots to interpret (sometimes wrongly) what sequencing and join procedures were appropriate. Other members reflected that military pilots required greater flexibility in the circuit, especially when aircraft of greatly differing speeds and limited fuel reserves were present. They also opined that military pilots had to be able to operate in extreme conditions (for example: at night, overseas, at airfields with Force Protection constraints) and sometimes without the benefit of ATC, (or with limited ATC capability in war zones), and so needed to develop an ability to self-synchronise and marshal themselves accordingly. Notwithstanding, the Board noted that a recent previous Airprox in a military visual circuit had resulted in a recommendation that the MAA should review the provision of Aerodrome Control Service at military airfields to investigate whether there were procedures or lessons that could usefully be cross-fertilised. Turning to the actions of the controller in this specific case, members remarked that the Tower controller had very effectively used the Hi-Brite and his situational awareness to provide all pilots with accurate Traffic Information with which to make their decisions.

The Board noted that the King Air pilot had 4 viable options available: he could have turned downwind early (but this would have left him with a short downwind leg and increased workload); he could have turned normally (and accepted the 200ft vertical separation with the Tutor Formation); he could have elected to extend upwind until he could see the departing Tutor; or he could have cleared the circuit to the west and repositioned for initials. The Board members unanimously agreed that what he should not have done was to have commenced his turn until he had the Tutor in clear sight and it was agreed that the cause was therefore that the King Air pilot had turned in to conflict with the Tutor. Looking at the risk, it was noted that the Tutor pilot had been aware of the King Air from the point that it appeared on his TAS, and that he had taken effective and timely action of his own to avoid it; consequently, it was agreed that the degree of risk was Category C.

## **PART C: ASSESSMENT OF CAUSE AND RISK**

Cause: The King Air pilot turned in to conflict with the Tutor.

Degree of Risk: C.

ERC Score<sup>7</sup>: 2.

<sup>7</sup> Although the Event Risk Classification (ERC) trial had been formally terminated for future development at the time of the Board, for data continuity and consistency purposes, Director UKAB and the UKAB Secretariat provided a shadow assessment of ERC.