

Part 1.3 Narrative of Events

All Times Local (HAF Kastelli Zulu plus 2 hours)

BACKGROUND

1. **Introduction.** On 20 Mar 10, the Red Arrows deployed to Crete for the first phase of Ex SPRINGHAWK as part of the annual work-up for Public Display Authority (PDA). On 23 Mar 10, Hawk T Mk 1 XX233, callsign Red 6 and Hawk T Mk 1A XX253, callsign Red 7, departed Hellenic Air Force (HAF) Base, Kastelli, Crete at approximately 1330 hrs, as part of a 9-ship display practice. This was the third sortie of the day with the other two displays having been flown without incident. Weather conditions at the time were CAVOK¹, which allowed the first half of the display to be flown as planned. Shortly into the second half of the display as the Synchro Pair (Red 6 & Red 7) executed the initial low-level cross of the Opposition Barrel Roll (OBR), the 2 aircraft collided. Following contact, XX233 continued to fly toward the ground resulting in the pilot initiating ejection. The ejection was successful; however, the pilot sustained major injuries and was taken to Heraklion hospital by road ambulance. XX253 was flown away from the ground and the pilot subsequently diverted to HAF Heraklion Air Base. Post Crash Management (PCM) was initiated by Wg Cdr RAF Aerobatic Team (RAFAT), Red 11 and all appropriate items were quarantined.

Exhibit 1
Witness 4&5
Exhibit 2
Exhibit 3
Witness 4&5
Annex A
Witness 2
Witness 4
Witness 2
2. **Aircraft History.** XX233 and XX253 had completed the transit to Crete and 5 work-up sorties prior to the accident; no unserviceabilities had been raised against either aircraft. Furthermore, both pilots stated that there was nothing apparently wrong with their aircraft at the time of the accident. There were no reasons to suggest that there were any unserviceability issues with the aircraft.

Exhibit 4
Witness 4&5
3. **Pilot Background.** Prior to joining RAFAT both pilots had completed an instructional tour, followed by a second tour on the Tornado F3. A summary of their RAFAT experience follows:

Witness 4&5
Annex B

 - a. **Red 6.** Red 6 joined RAFAT in Aug 07 and had flown 2 complete seasons with the Team. In his first season he flew as Red 3 after which he was selected for Synchro. As is usual, this meant he flew as Red 7 in the 2009 Display Season (DS) before taking up the position of Red 6 for the 2010 DS. Therefore, he was the more experienced and lead pilot in the Synchro Pair. He was responsible for the training programme, supervision and, when not performing with Red 1, authorisation of the Synchro Pair. He had a total of 2368 hrs with 938 on the Hawk and was

Witness 5

¹Visibility 10km or more, no cloud below 5000ft above airfield level (or minimum sector altitude - whichever is higher), no cumulus or towering cumulus at any height and no significant weather

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rated as Above Average in his F5000².

Annex B

b. **Red 7.** Red 7 joined RAFAT in Aug 08 and in his first season flew in the Red 3 position. At the end of the 2009 DS, he was selected for Synchro duties ahead of 2 other RAFAT pilots. This selection was primarily based on his airmanship and ability to self-critique. He had a total of 2116 hrs with 1525 hrs on the Hawk and was rated as Above Average in his F5000.

Witness 4

Witness 5

Annex B

4. **Pre-Accident Events.** Despite a sustained period of inclement weather, which affected the whole of the UK in early Jan 10, progress with the work up for the 2010 DS was on track and the work tempo normal. Red 7 completed his individual work up on 5 Nov 09 and Synchro training commenced on the same day. As part of the display work up, the Team complete pre-season 9-ship display practices away from RAF Scampton. These are known as Out of Season Practices (OSP) and are aimed at giving the Team broader experience of conducting displays using different ground features. The OSPs, which were completed on 16 Mar 10, had all gone well with no significant safety errors noted. On completion of the OSPs, the Team completed a further 2 days training at RAF Scampton followed by a down day, before commencing the next phase of their work-up (Ex SPRINGHAWK).

Witness 1

Exhibit 5

Witness 1&5

Exhibit 6&7

Witness 1&5

5. **Previous 3 Days.** Ex SPRINGHAWK is an annual event designed to give the Team 'fair weather' training prior to PDA. It involves operating from 2 Mediterranean bases, the second of which is RAF Akrotiri. For 2010, the first stage involved a 2-week detachment of 10 aircraft to HAF Kastelli, Crete. The aircraft departed RAF Scampton on 20 Mar 10 and staged through France and Italy before arriving at Kastelli on 21 Mar 10. Despite minor frustrations as a result of a loose article, the transit sorties were uneventful and all 10 aircraft arrived on schedule. Display training commenced on 22 Mar 10.

Witness 1&3

Witness 1

Witness 3

Witness 1

6. **Previous 24 Hours.** On 22 Mar 10, the Team conducted a total of 3 display practices at HAF Kastelli. The first featured Reds 1-5 and was used to explore the effect of the altitude/terrain on the aircraft and identify local features. The second practice involved the Synchro Pair and was also flown as a familiarisation sortie. The final sortie was flown as a 9-ship. In all 3 sorties, no specific safety issues were raised. That evening both Red 6 and Red 7 went out for a meal with other members of the Team. During the course of the evening and whilst eating dinner, Red 6 consumed a total of 2 small beers, whilst Red 7 had only one. Both returned to their accommodation by 2200 hrs and reported having an uninterrupted night's sleep and waking well rested. On 23 Mar 10, the Team travelled to HAF Kastelli by road arriving in time for an 0800 hrs Met brief. This was followed by two 9-ship display practices. Both displays used a different datum³, with the first display having a more

Witness 1

Witness 5

Witness 1

Witness 3&6

Witness 4&5

Witness 5

² A pilot's record of service.

³ Datum is the central point of the crowd line.

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difficult 'off-runway' orientation. Both sorties were uneventful and both pilots had sufficient time for lunch prior to briefing for the 3rd sortie.

7. **Sortie Brief and Authorisation.** The accident occurred during the 3rd sortie of the day. The brief was for a Full⁴ display using a slightly different datum to the previous sortie. The display line was the edge of the runway furthest from the simulated crowd line. Red 6 briefed the Synchro Pair ahead of the main formation brief as is normal for the Team. No unusual issues were raised in either brief. The sortie was correctly authorised by Red 1 in accordance with RAFAT Display Directive & Standard Operating Procedures (DD & SOPs).

Witness 1

Witness 5

Exhibit 4&8

8. **Sortie Pre-Accident Events.** The first part of the display was flown as briefed with the weather conditions remaining CAVOK. The only point of note was the wind direction on take-off. The wind-socks at either end of the runway were pointing in opposite directions; accordingly, Red 1 requested an additional wind reading from Red 11, who was situated in ATC. Red 11 passed back a figure of 220/10; however, Red 1 elected to take-off on runway 02, as this runway had the benefit of a crash barrier. The first part of the display was completed as per normal. The second part of the display involves the Team splitting into 2 sections (callsigns Enid (Reds 1-5) and Gypo (Reds 6-9)). Having made an airborne assessment, Red 1 passed a wind of '1 right' meaning 5kts from Crowd Right (CR), which concurred with Red 6's assessment. This figure was then used to finesse the Synchro Pair's ground tracks and crossing points. Due to the presence of some cumulus clouds, Red 6 elected not to continue with the Full display and instead reverted to a Flat display. As a result, the 'Heart' manoeuvre⁷, which immediately precedes the OBR in the Full display, was replaced by the 'Vortex'.

Witness 1&5

Witness 1&2

Witness 1

Witness 5

ACCIDENT SEQUENCE

9. **Accident Events.** The 'Vortex' was executed without incident and the transition into the OBR appeared normal, although Red 7 had to correct his line-up as he initially rolled out slightly on-crowd. Red 6 called 'Threshold' which indicated that he was the first to reach a predetermined geographical feature, on line, visual with Red 7 and happy to proceed with the manoeuvre. Red 7 responded immediately with his 'Threshold' call, which confirmed that he was also on line, visual with Red 6 and happy to proceed with the manoeuvre. After approximately 2 secs, Red 6 called 'Roll go' having assessed that the aircraft were closer together than usual but sufficient distance remained to complete the manoeuvre safely. Red 6 commenced the next phase of the manoeuvre, which involved turning towards Red 7's flight path. On hearing the 'Roll go' and in order to break the collision, Red 7 should mirror this turn; however, he delayed fractionally. Realising that there may not be sufficient distance to complete the manoeuvre and not wanting to lose sight of Red 6, Red 7 attempted to avoid a collision by

Witness 4&5

Exhibit 3
Witness 4

⁴ There are three types of display depending on weather, Full, Rolling and Flat.

flying beneath Red 6. Immediately prior to the collision Red 6 eased off the bank and bunted to avoid Red 7; however, both pilots were unsuccessful in their attempts. The aircraft impact occurred on or about Red 7's initial flight path, at approximately 110ft above ground level (agl), slightly CR. Red 7's fin made contact with Red 6's windscreen and Red 7's starboard tip of the tailplane made contact with Red 6's starboard wing. Red 7 corrected the adverse downward pitch and climbed away from the ground. Due to the windscreen shattering and a conscious sense of a downward vector, Red 6 initiated his ejection just before XX233 impacted with the ground.

Witness 5

Annex C

Witness 5

10. **Ejection.** Analysis of Accident Data Recorder (ADR) data indicates that the impact occurred at approximately 110ft agl. After the collision, XX233 continued with a downwards vector; as a result, Red 6's ejection was close to the ground. From video evidence it appears that the parachute opened fully, though it may have collapsed slightly after the aircraft hit the ground and exploded. Red 6 ejected within the safe ejection envelope of the Martin Baker Type Mk10B ejection seat and all the escape systems functioned correctly.

Annex C

Exhibit 3

Annex A

11. **Aircraft Accident Site.** The aircraft impacted within the boundary of HAF Kastelli Airbase (AB) with the wreckage spread over a distance of approximately 1.3 km. The majority of the wreckage was on the grass between the runway and taxiway; however, some elements came to rest on the tarmaced surfaces. All the wreckage landed on the safe side of the crowd line, the closest part being the engine turbine section which came to rest on the taxiway.

Annex D

Exhibit 9

POST ACCIDENT EVENTS

12. **Red 6.** HAF emergency services were quickly on scene and the SAR helicopter was launched. Initial care was given to Red 6 by 2 Greek doctors. RAF personnel on-site assumed that Red 6 would be transferred to hospital in the SAR helicopter; however, the Base Cdr at Kastelli decided to use the ambulance. This decision was based on the fact that the helicopter could not land at the hospital and Red 6 would need to be transferred to another ambulance at Heraklion; accordingly, both journey times would be the same. The 35 min journey was traumatic and uncomfortable for Red 6, who was accompanied by Flight Sergeant (FS) RAFAT. On numerous occasions the driver was told to slow down as his driving style was causing Red 6 considerable pain. Red 6 was delivered to Heraklion hospital where he received post-trauma care.

Witness 2

Witness 2

Witness 14

13. **Red 7.** Red 7 called a 'Fly it through' to the rest of the formation to inform them of a problem. Red 11 (supervising on the ground) quickly called a 'Terminate' and then provided information on the crashed aircraft and Red 6's ejection. Once aware which aircraft had crashed, Red 1 dispatched Red 9 to carry out a visual inspection of Red 7 and, realising that the airfield at HAF Kastelli was 'black', organised a

Witness 4

Witness 2

Witness 1

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diversion of the remaining 8 aircraft to HAF Heraklion. After carrying out a Low Speed Handling Check (LSHC) over the sea, Red 7 configured the aircraft for landing and once he was safely on the ground, the remaining 7 aircraft landed without further incident.

Witness 4
Witness 1

DEGREE OF INJURY

14. **Service Personnel.** Red 6 sustained serious injuries; namely, a fracture/dislocation of his left shoulder, Annex A

but was conscious, able to sit up and remove his helmet. No other service personnel were injured.

15. **Civilian Personnel.** There were no injuries to civilian personnel.

DAMAGE TO AIRCRAFT, HOST NATION, PUBLIC AND CIVILIAN PROPERTY

16. **Aircraft.**

a. **XX233.** XX233 broke up into numerous parts when it impacted with the ground and was assessed as having suffered Category 5 (SCRAP) damage. The Net Book Value (NBV) of XX233 was £363,788.94. Annex E

b. **XX253.** In addition to the fin and tailplane, XX253 incurred damage to the right-hand Powered Control Unit mounting and frames 29 and 31. The aircraft was assessed as Category 4 (WORKS); however, the recommended repair was the replacement of the rear fuselage, which was deemed to be beyond economical repair. The NBV for XX253 was also £363,788.94. Annex F

17. **Host Nation Property.** Although the taxiway sustained minor damage, the HAF General Staff elected not to reclaim any financial compensation from the RAF. Annex D
Exhibit 9&10

18. **Public Property.** There was no damage to Public Property. Annex D

19. **Civilian Property.** There was no damage to Civilian Property. Annex D

INITIAL CONCLUSIONS

20. At this stage of the Inquiry the Panel concluded the following:

a. The sortie was properly briefed and authorised.

b. Both pilots were medically and physically fit.

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- c. Both pilots were current in display practice.
- d. There was no malicious intent.
- e. Both aircraft were serviceable and suitable for the duties of Synchro flying.
- f. Weather was suitable for the display.
- g. Both pilots were on duty.