SECTION 1.4.3 – SORTIE (ASTON 1)

1.4.3.1 The accident involved two aircraft from the same Sqn but different formations. Together, the formations numbered four aircraft and eight crewmembers. The actions of the eight crewmembers, interwoven with the maintenance and Flypro of the four aircraft create a complex picture. Further complication was added by personnel performing multiple supervisory duties due to half of the Sqn having deployed to Cyprus on exercise. The similarity of the formation callsigns, ASTON and ABBOT, can create confusion.

1.4.3.2 The crews were allocated as follows. The descriptors in the left hand column will be used to describe each crewmember throughout the report:

a. **ASTON 1 – ZD743**
   (1) Pilot: Student Pilot. (Deceased)
   (2) WSO: OC B Flight (Programming), Stand in OC XV(R) Sqn, Qualified Tactics Instructor (QTI). (Deceased)

b. **ASTON 2**
   (1) Pilot: Student Pilot.
   (2) WSO: Sqn WSO, QTI. Set the scenario for ASTON sortie.

c. **ABBOT 1**
   (1) FS Pilot: Student Pilot.
   (2) RS Pilot: Supernumerary Sqn Ldr on XV(R) Sqn, Qualified Weapons Instructor (QWI), was 1st Duty Authoriser, gave phase brief to student pilot before going flying.

d. **ABBOT 2 – ZD812**
   (1) FS Pilot: Student Pilot. (Deceased)
   (2) RS Pilot: STANEVAL(Synthetic). QWI. Led the plan for ABBOT sortie. (Survived)

Introduction

1.4.3.3 This section covers ASTON 1's sortie from Start Up, Taxi, Take Off (SUTTO) up to and including the descent over the North Sea into the Moray Firth environs. It is divided as follows:

a. ASTON 1 Sortie Events

b. ASTON 1 Air Weapons Range (AWR) Join

ASTON 1 Sortie Events

1.4.3.4 This sub-section is divided as follows:

a. Sortie Events

b. Regulation, Policy and Orders: IMC Flight, LL Abort and IMC Descent Over the Sea

c. Analysis of ASTON 1 Actions

d. Conclusions

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Sortie Events

1.4.3.5 **SUTTO.** The crew of ASTON 1 were driven to their aircraft at the hot pit[1] by ASTON 2 WSO in OC XV(R)'s service car; the service MT minibus and driver which normally support the Sqn had been reassigned to support Op OLYMPIC. This reduced the time it took the crew to get to the aircraft from the time they had allocated in the sortie plan to walk to the hot pit. The aircraft had already been refuelled under the supervision of the off going crew. The crew encountered no problems during the SUTTO and were able to complete the SUTTO in an unrushed, yet expeditious, manner. The WSO did not update the Mode S IFF to reflect his allocated callsign. It remained set as LOS 23, the previous sortie's callsign. The Pilot made a radio call to XV(R) Sqn Ops at 10:49 hrs just prior to taxi to check for updates to the late warnings. After a short hold for circuit traffic, ASTON 1 commenced the take off roll at 11:00 hrs, 14 mins earlier than planned. The Pilot verbalised selecting the HISLs[2] to the day setting of white prior to take off.

Witness 2
Witness 33
Exhibit 7
Witness 35
Exhibit 13
Exhibit 1
Exhibit 4
Exhibit 6
Exhibit 78
Witness 92
Witness 93
Witness 94
Exhibit 418

1.4.3.6 **Radar Conspicuity.** The TGRF Handbook directs crews to use the RHWR to detect radar emissions from radar equipped aircraft in order to aid situational awareness (SA) and avoidance of mid air collision. During the sortie ASTON 1 WSO verbalised setting up the Ground Mapping Radar (GMR) *"for conspicuity."* Approximately 32 mins into the sortie the WSO recycled the radar off and on when there was a fault, but later commented that the "*radar's up.*" [redacted] Operation of the GMR in this manner is directed in the TGRF Handbook. The RHWR was unserviceable; the fault description in the MoD F700 was *"Rear RF Head at fault. Due to time constraints rear RF head not replaced."* The crew did not verbalise any other issues relating to serviceability during the sortie and as such it is assumed that they identified no further problems with the GMR.

Exhibit 113
Exhibit 2
Exhibit 7

1.4.3.7 **SUTTO to 2nd Simulated Attack Profile (SAP).** The sortie was executed largely as planned. The WSO demonstrated good instructional technique, debriefed the student after significant events and was keen to maximise training benefit. The student Pilot had limited Low Level (LL) flying currency. His OCU training flights had concentrated on the Medium Level (ML) elements of the course and he had recorded only 40 mins of LL flight in the past 30 days; all of which had been achieved on the P SAP 1 sortie the preceding day. His lack of experience and currency at flying at LL was evident during the sortie: he descended below the 250 ft Minimum Separation Distance (MSD) causing the Radalt low height warning to sound, the WSO directed the pilot to *"check height"* as the Pilot made a switch selection, and on two further occasions the WSO directed the Pilot to strive to fly at 250 ft MSD as he was flying relatively high between 500–600 ft. The inconsistent profile of his LL flight describes a Pilot who has reduced experience, currency (and comfort) in the LL environment. Throughout this phase of the sortie the crew were professional and focussed.

Exhibit 6
Exhibit 7
Exhibit 22
Exhibit 120
Exhibit 215
Exhibit 78

1.4.3.8 **2nd SAP, 1st LL Abort and Return to LL.** The crew chose to cut short their planned route. An element they had planned to fly as part of a pair was no longer necessary when flying as a singleton. The purpose of that part of the route had been for the formation to rejoin after separating at the 2nd SAP. Shortening the route would save fuel which could be put to better use fulfilling the training needs of the Pilot. This decision and logic was articulated during in-cockpit discussion. ASTON 1 rerouted from 12 nm S of Stornoway,

Exhibit 78
Exhibit 6
Exhibit 3
Exhibit 7
Exhibit 225
Exhibit 226

[1] Hot pit is a colloquial term used to describe where engine running crew changes are performed. ZD743 was flown by another crew during the morning and then handed over to the accident crew iaw the TGRF Handbook and FCC.

[2] HISLs are explained in Section 1.4.1.19

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towards the E. They carried out an emergency LL abort[3] ivo Kylestrome due to poor weather. The WSO read out the Safety Altitude as 5300 ft. As the aircraft climbed through 2600 ft the WSO stated "*happy to take it from there.*" The Pilot commenced levelling the aircraft at an altitude of 3700 ft, reaching a maximum altitude of 5800 ft before descending again to 5300 ft. At this point, the crew had 100 kg over their planned fuel load and could afford to return to LL and still achieve all of their sortie objectives. The crew discussed the options to return to LL with the WSO stating "*aim for Helmsdale...gap in the 1230ish*" and then "*looks like you might get a gap left 11*" indicating suitable weather for a visual let down. Whilst still at ML, the WSO rechecked the fuel plan and initiated the Fence Checks which coincided with the boundary between enemy and friendly airspace within the tactical scenario of the sortie. Fence Checks are carried out on operations when an aircraft returns to friendly airspace, and on training sorties they are used to indicate the end of the sortie scenario. Training events often continue beyond the end of the scenario in a sortie. ASTON 1 descended visually into a gap and rejoined the planned track at 11:54 hrs, 17 mins earlier than planned. This would have resulted in a TOT of 12:02 hrs at Tain AWR versus their planned TOT of 12:19 hrs. At no time in the sortie did the crew comment on the amended FRA TOT.

1.4.3.9 **2nd LL Abort and Descent Over the Sea.** Once established at LL the crew immediately deviated towards the Helmsdale valley, 7 nm SW of their planned route in an attempt to maintain flight under Visual Flight Rules (VFR[4]). At this stage ASTON 1 was one minute away from underflying Advisory Route (ADR) N560D, colloquially referred to as an "advisory airway." The Pilot stated "*We just want a safe call before there, I suppose, for the airway.*[5]" Local orders and policy[6] require that crews treat the ADR akin to an actual airway for which a radar service is mandatory, and in the event of inadvertent entry would require an aircraft to emit an emergency IFF squawk and to contact an ATC agency. The WSO mentioned the possibility of turning left to avoid underflying the ADR but then shortly afterwards stated "*looks bright enough on your nose doesn't it? Which probably means Helmsdale's open as well.*" Just prior to underflying the ADR the Pilot stated "*don't think we are going to make it through here.*" The WSO directed the Pilot to "*keep coming*" and mentioned the option to turn right into lower ground rather than committing to the Helmsdale valley. The WSO then directed the Pilot once again to "*keep coming.*" Ten secs later and having flown 2 nm under the ADR the Pilot commenced a LL abort with the WSO stating "*let's go*" and the Pilot stating "*and going up*". The WSO stated "*and roll it off*" passing 2200 ft then "*yep, through 4000 ft*", the Pilot then commenced levelling by overbanking the aircraft to the left. The base of the ADR is the lower of 4000 ft AMSL or Flight Level 50 (FL 50). As the Pilot levelled the aircraft back to wings level at an altitude of 5700 ft the WSO then stated "*...Victor Mike, crossing at 90, I can't see anybody, just stay VMC on top...*" The WSO immediately informed the Pilot that "*... we'll try and get a Radalt descent inbound Tarbat Ness on Tain.*" The WSO immediately contacted Tain AWR on the Secondary radio frequency. The AWRC informed ASTON 1 that Tain AWR was active with traffic that had "*possibly 3 minutes left on range*". ASTON 1 did not request details of the traffic, nor was it offered. ASTON 1 agreed to remain outside of Tain AWR's airspace. Meanwhile the Pilot commenced a further climb and levelled at an altitude of 6500 ft. The WSO stated "*right just as soon as we coast out I'll be happy to take a Radalt descent*" followed by "*right that's us*

Exhibit 6
Exhibit 78
Exhibit 7
Exhibit 227
Exhibit 228
Exhibit 144
Witness 26
Exhibit 229
Exhibit 5
Exhibit 118

[3] An emergency LL abort for a Tornado GR4 is described in the TGRF Handbook as *"Simultaneously smoothly roll wings level, transfer to Head Down Display and positively rotate the aircraft into a 30° climb using a nominal 4g whilst selecting maximum reheat."*

[4] Flights by military pilots are required to be conducted under Instrument Flight Rules (IFR) or Visual Flight Rules (VFR)[4]. Visual Meteorological Conditions (VMC) and Instrument Meteorological Conditions (IMC) refer to the weather conditions encountered during flight. The terms IMC and VMC refer to actual weather conditions, as distinct from the flight rules under which flight is being conducted. VMC exist when the weather permits flight in accordance with the VFR; IMC exist when the weather conditions are below the minima for VFR flight.

[5] ASTON 1 Pilot had had an airspace infringement whilst at AFJT where he had exited LL away from his planned route and entered controlled airspace without being cleared – and subsequently had a complaint filed against him.

[6] RAF Lossiemouth FOB, Student Study Guide.

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coasting out happy to go down" as the aircraft crossed the coastline. ASTON 1 started their descent over the sea. A more detailed description of the weather through which they descended is provided later in Section 1.4.4. The Pilot stated that he could see the sea down to the right at the start of the descent. At a height of 1700 ft the WSO stated *"throw a 90 right in here and we'll just see what the weather is going to be like"* before stating *"it's going to be a little bit disorientating over the sea"* and later *"it's going to be on the deck."* The crew levelled at 700 ft Radalt and then orbited between Helmsdale and the Beatrice oil rigs.

Regulation, Policy and Orders: Instrument Meteorological Conditions (IMC) Flight, LL Abort and IMC Descent Over the Sea

1.4.3.10 **MRP RA 2307 Rules of the Air.** MRP RA 2307 states that: Exhibit 51

"The Aircraft Commander or handling pilot…shall take all possible measures to ensure that his aircraft does not collide with other aircraft irrespective of whether a flight is being made with air traffic control clearance."

MRP RA 2307 Guidance Material details that in order to reduce the risk of a collision, flight in IMC is only permitted in specific circumstances. This includes, but is not limited to: when in receipt of a radar or procedural service and where specific approval is given in Aviation Duty Holder and Commanders' Orders. The Guidance Material goes on to state that:

"In the event of unavoidable or inadvertent entry into cloud and when pilots are unable to achieve an immediate return to VMC, they will make every effort to obtain a radar service. If a radar service is unavailable, wherever possible pilots will avoid areas of known or expected airborne activity such as airfield approach and departure lanes, glider sites or areas of off-shore helicopter activity."

1.4.3.11 **Manual of Military Air Traffic Management (MMATM).** The MMATM states: Exhibit 230

"when descending over the sea more than 3 nm from the coast, aircraft may only descend below safety altitude in IMC to a minimum of 500 ft above authorized MSD in an attempt to achieve VMC below cloud. If cloud is not cleared by 500 ft above authorized MSD, or VMC cannot be achieved from this position, aircraft will climb to safety altitude and, if still IMC, climb until VMC is achieved or until above 3000 ft AMSL. Whenever possible, descents will be planned so that, if made in IMC, they will occur in areas clear of known airborne activity (for example, civil helicopter offshore operations) or where such activity can be determined and avoided."

1.4.3.12 **1 Gp Air Staff Orders (ASOs).** 1Gp ASOs contain orders relating to IMC descent over the sea and LL abort. 1Gp ASO 2330 states: Exhibit 231 Exhibit 180

"IMC Descent Over Sea. *IMC descent below safety altitude over the sea is permitted iaw the limits stated at Reference C* [MMATM] *provided the following conditions are met:*

a. *The aircraft's RAD ALT is serviceable.*

(1) *A positive fix of the aircraft position has been established prior to commencing descent.*

(2) *When within 30nms of the coast, descent is made either parallel to, or away from coastlines and man-made obstructions and not less than 5nms from the nearest coastline."*

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Tornado GR4 specific 1Gp ASOs include 1GpASO(4)2330:

*"**Areas of Known Aircraft Activity.** Descents in IMC to low level are not to be carried out in areas of known ac activity (ie airfields, glider sites, helicopter routes and oil rigs) without a Deconfliction service, Traffic service or Basic service from an ATC agency."*

1.4.3.13 **1 Gp ASOs continued.** 1Gp ASO 2330 also states: Exhibit 231

***Emergency Low Level Abort.** Should crews fly in to weather conditions below the required minima, an emergency low level abort is to be carried out using the approved techniques provided in the platform-specific SOPs.*

a. ***Climbout Remaining Clear of Controlled Airspace.** If the subsequent unpremeditated climbout will remain clear of controlled airspace but a priority radar service is required, crews are to call the appropriate Air Traffic Agency at a safe and appropriate opportunity.*

1.4.3.14 **RAF Lossiemouth FOB.** The RAF Lossiemouth FOB states: Exhibit 144 Exhibit 227

"...Inverness has the controlling authority for ac operating on the advisory routes ADR N560D and W6D below FL130 and will routinely descend ac inbound to heights around 6500ft when within 30nms of the airport...To reduce conflictions against civil traffic arriving or departing from Inverness Airport, the following local procedures are to be followed by all Stn-based ac:

*a. **ADR Crossing.** Stn-based ac intending to cross ADR N560D or W6D within 30 nms of Inverness Airport are to be in receipt of a radar service from either Lossiemouth, Inverness or Scottish before crossing the ADR.*

*b. **ADR Underflight**. Stn-based fast jet ac are to call Lossiemouth Approach on stud 4 or Inverness Radar on 122.6 for traffic information when under flying the track of either ADR N560D or W6D above 2000ft AGL within 30 nm of Inverness Airport. Furthermore, crews are to avoid deliberate under flight of these ADRs if there is any possibility that weather conditions may necessitate a low-level abort."*

1.4.3.15 **RAF Lossiemouth FOB continued.** The RAF Lossiemouth FOB contains a deconfliction order for "Flights over the Moray Firth". Figure 25 illustrates the Moray Firth airspace. The FOB states: Exhibit 143 Exhibit 144 Exhibit 229

"...all aircraft operating at low level West of ADR W4D, the ADR extending between Aberdeen and Wick airports or Helicopter Main Route X-RAY, are to contact Lossiemouth Approach. Approach will advise of helicopter traffic in the Firth, specifically those in transit from Banff to Beatrice A, those in Nigg Bay, and D Flt, 202 Sqn operations."

The order also identifies that:

"There is a danger of confliction between aircraft in transit between Lossiemouth, Tain AWR and LFA 14 North of Helmsdale."

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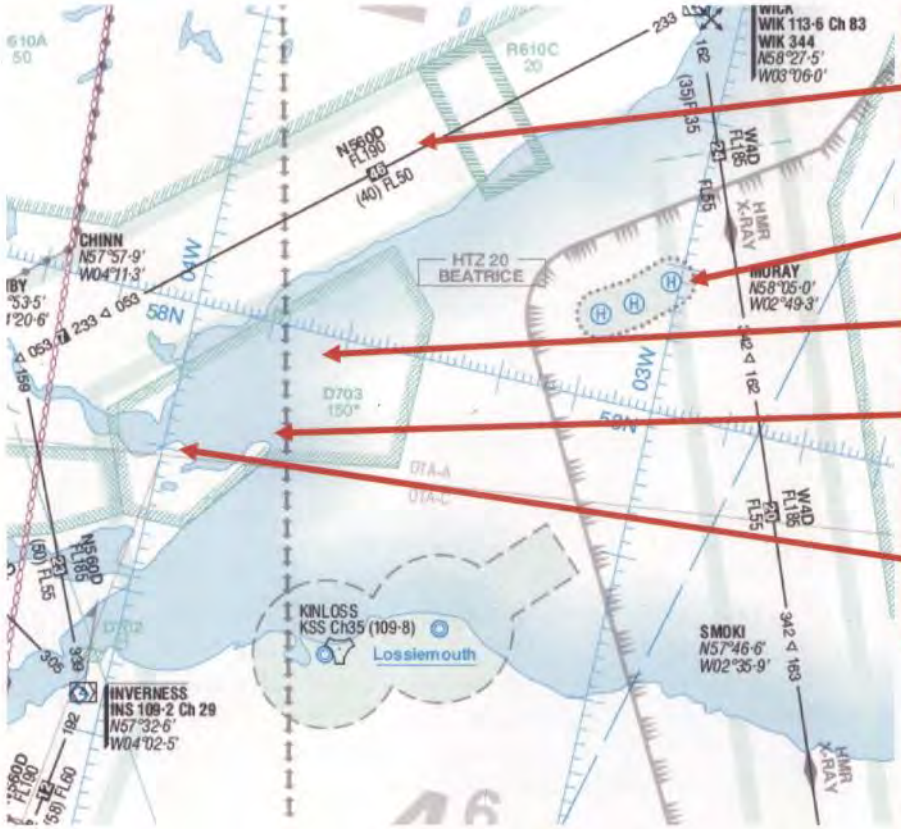

Figure 25. Moray Firth Environs Airspace.

1.4.3.16 **XV(R) Sqn Student Study Guide.** The Student Study Guide directs students that: Exhibit 228

*"Following a low-level abort into an Advisory Route, 1013mb is to be set and the correct quadrantal **above safety altitude** must be flown, even when VMC. If IMC, the correct quadrantal above SALT* [safety altitude] *must be flown and 7700 squawked. Scottish Military should be contacted on GUARD. The boundary of the Advisory Route should be left expeditiously at 90° if possible."*

Analysis of ASTON 1 Actions

1.4.3.17 **Rerouting Post 2nd SAP.** The crew's decision not to fly the formation rejoin and reroute to intercept the planned track was logical and reasonable because: Exhibit 3 Exhibit 7

a. ASTON 1 was now a singleton and the rejoin plan contained a prolonged over sea track, of limited training value.

b. by cutting short the route ASTON 1 would save fuel for later events.

c. given the Pilot's limited amount of LL flying in the past 30 days and his variable performance at maintaining 250 ft MSD during the sortie the rerouting would increase his exposure to overland LL in challenging weather.

1.4.3.18 **1st LL Abort.** The crew were forced to carry out a LL abort due to poor weather. Their actions in doing so are considered logical, normal, and compliant with orders. Exhibit 78

a. The actions verbalised by the crew during the start of the LL abort were in accordance with the TGRF Handbook. The Pilot stating *"low level abort, wings level"* Exhibit 6 Exhibit 7

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and the navigator replying *"safety altitude 5300ft."* Exhibit 225

b. Given the WSO's call of *"happy to take it from there"* passing an altitude of 2600 ft it is considered that the crew had achieved VFR flight before reaching Safety Altitude and the conditions were such that a further climb was unnecessary.

c. As the crew quickly achieved VFR and there being no controlled airspace or ADRs, a radar service was not required.

1.4.3.19 **Return to LL Following 1st LL Abort.** Following the LL abort, completion of fence checks and a review of the fuel plan, the crew decided to return to LL as soon as the weather conditions permitted. Exhibit 78 Exhibit 6 Exhibit 7 Exhibit 21 Exhibit 3 Exhibit 10 Exhibit 22

a. Completion of the fence checks and review of the fuel plan at ML was preferable to their conduct adding to a high cockpit workload at LL in marginal weather. The WSO had stated to the Community Psychiatric Nurse (CPN) that he would try to keep himself busy when not at LL, in order to avoid the onset of anxiety. Carrying out the fence checks at this time made a sensible contribution to the sortie as well as potentially aiding the WSO with his coping strategy.

b. The crew identified gaps in the cloud to return to LL. The crew were able to descend visually and there was no requirement for a radar service. Such descents are normal and compliant with orders.

c. Given suitable weather, their planned route would allow them a further 4 mins of overland low flying; they would have emerged by Tain AWR already established at LL for the FRA, which took the form of an operational profile requiring a LL entry. This would also allow time for Pre-Attack/Pre-Range Checks and Attack/Range Joining Checks.

d. Given the Pilot's limited amount of LL flying in the past 30 days and his variable performance at maintaining 250 ft MSD during the sortie, returning to LL would increase his exposure to overland flying in challenging weather.

e. They had sufficient fuel to return to LL and continue with the planned route.[7]

f. The weather was obviously challenging during this part of the route, but ASTON 1 had the fuel to return to LL and complete the route towards the AWR. ASTON 1 WSO would not have directed the Pilot to re-enter LL had there not been a VMC method to do so, or if visibility precluded it.

1.4.3.20 ASTON 2 carried out an alternative course of action to ASTON 1. Flying the same route as ASTON 1 approx 39 mins later, ASTON 2 climbed to FL135 following their 2nd SAP. At ML they contacted Scottish Air Traffic Control Centre (Military) (ScATCC(Mil)), completed the Pre Attack/Pre Range Checks, briefed the FRA and formulated a plan to contact RAF Lossiemouth Approach for a radar let down. Along with having less fuel, ASTON 2 followed this course of action because of the anticipated weather conditions which was reinforced by the weather presented to them at the time. Had ASTON 1 done as ASTON 2 and maintained altitude before a letdown into the Moray Firth for the FRA, they would have sacrificed a further 4 mins of low flying training but would have saved fuel. It

[7] At this time it was calculated that ASTON 1 was 200 kg (approx 3 mins of LL flight) above the minimum planned fuel to complete the route including the FRA and land at RAF Lossiemouth with 2000 kg. ASTON had made allowance for the ground track of the GCA recovery to RAF Lossiemouth on the TAMPA plan and aimed to land with 2000 kg. The diversion fuel was 1650 kg and therefore the TAMPA plan had a built in 350 kg fuel reserve.

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would have also allowed an opportunity for the crew to prepare for the FRA in a more benign weather/workload environment. The crew would have had time to obtain a radar service to cross the ADR which would also have helped facilitate their descent into the Moray Firth environs. This would have increased the radio workload but given that they were now a singleton and did not have to maintain an intra-formation radio frequency, they could have utilised both aircraft radios simultaneously with an ATC agency and Tain AWR.

1.4.3.21 The decision by ASTON 1 to return to LL did not provide a benign environment to brief and prepare for the FRA into Tain AWR. The return to LL flight in marginal weather conditions focussed the crew's attention on the weather limits and ground avoidance. The crew did not initiate the pre-range checks. Had the route allowed a LL ingress into the Moray Firth via the Helmsdale valley and remained on track, I t would have reduced the time available to complete the checks by approximately one minute, placing a high workload on the instructor WSO and student Pilot. ASTON 1 could, however, have extended their track once clear of the coast to allow for the checks prior to entry if the weather remained fit.

1.4.3.22 After the 1st LL abort, the options of returning to LL or remaining at ML were both viable for ASTON 1 to achieve the flying aims of the sortie.

1.4.3.23 **Why did ASTON 1 Return to LL after the 1st Abort?** The Panel believes that ASTON 1 returned to LL because:

Exhibit 6
Exhibit 78
Exhibit 21
Exhibit 22
Exhibit 233
Witness 34
Witness 38
Witness 39
Witness 13
Witness 37
Witness 16

a. It allowed the student Pilot to experience more LL flight, followed the planned route, and presented the earliest opportunity to achieve the entry parameters of the FRA (aircraft checks/speeds). The crew would not attempt to return to LL unless they had an expectation that the weather was suitable; and

b. the aircraft reached an altitude of 5800 ft during the abort, a flight regime that the WSO had not experienced since he presented with flying anxiety in Apr 12. He had stated to his psychiatric clinicians that ML flight triggered the anxiety and although he had admitted that LL flight also caused anxiety, he had stated that during his recent local, LL sorties that his levels of anxiety were reduced. The WSO had previously expressed his desire to restrict his flights to LL due to anxiety. This included asking ASTON 2 WSO, the night before the accident, to set the sortie scenario such that the sortie could be achieved entirely at LL. His desires met with the sortie objectives at this point.

1.4.3.24 **Decision Making Prior to Underflying the ADR.** As soon as they were re-established at LL, the weather proved to be more challenging than ASTON 1 had expected. They were forced to reroute immediately in order to maintain VMC and tracked towards the Helmsdale valley.

Exhibit 6
Exhibit 78
Exhibit 7
Exhibit 144
Exhibit 227
Exhibit 121
Witness 4
Witness 12

1.4.3.25 The Helmsdale valley can often provide a clear route from the N into the Moray Firth when other routes are closed by weather. It would not be unreasonable to have expected the valley to offer such an opportunity on this occasion; however, the crew's discussion of the weather and the WSO's comment of *"probably means Helmsdale's open"* indicated that the crew still had doubts prior to underflying the ADR as to their ability to maintain VMC. In the event of poor weather and any uncertainty of being able to maintain LL flight beneath the ADR the Lossiemouth FOB directs that crews are to avoid deliberate underflight of the ADR.

1.4.3.26 The crew decided not to perform a LL abort or controlled climbout in advance of crossing the ADR. This decision committed them to attempting to fly towards the Helmsdale valley at LL in challenging weather.

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1.4.3.27 The conversation between the WSO and Pilot indicated that the Pilot had considered the safety of proceeding under the ADR given the likelihood of having to perform an emergency LL abort into it. He stated that *"We just want a safe call before there, I suppose, for the airway"*. The WSO directed the Pilot to continue towards the Helmsdale valley and the Pilot did as he was instructed. Although the Pilot was the aircraft captain, he was heavily reliant on the WSO, a very experienced instructor, for guidance and instruction during the sortie and would have deferred some decision making to him.

1.4.3.28 Crews are generally encouraged to fly to the published weather limits and to be exposed to challenging flying regimes. Furthermore, the Pilot lacked confidence at LL, and was at a stage in his training where he might have needed encouragement to remain at LL, to increase confidence in his own ability and the procedure to make a safe exit. In these terms, the decision to press on is reasonable; however, the decision to continue was based on ASTON 1 WSO's assumption that the Helmsdale valley would probably allow exit. The RAF Lossiemouth FOB directs this course of action should only be taken where there is no "*possibility that weather conditions may necessitate a low-level abort.*" The WSO's desire to remain at LL, and thus avoid flying anxiety may have influenced the decision to remain at LL.

1.4.3.29 Potential factors considered by the Panel influencing this decision are:

a. **Lack of fuel.** The crew may have wanted to avoid unnecessary manoeuvres in order to preserve fuel. They might both have understood this, but not specifically spoken about it. The crew had very recently assessed that they had enough fuel and they had returned to LL as soon as possible following the first abort. This was discounted as a factor.

b. **Task Focus.** The crew may have been too focused on their task of achieving flight at LL, to the detriment of considering the orders and policy regarding underflight of the ADR and the weather conditions. The Pilot verbalised that a decision was required prior to the ADR, indicating he was aware of the ADR and was assessing the weather, but the WSO directed the Pilot to continue into the Helmsdale valley. As a student, the Pilot deferred to the WSO, his instructor, to make the airmanship/weather decision. This was discounted as the focus of the crew's attention was the weather and re-establishing LL flight; however the Pilot did discuss the ADR.

c. **Awareness of Orders and Policy.** It is possible that the crew were unaware of the orders and policy relating to the ADR. The WSO was an experienced instructor and had spent seven years at RAF Lossiemouth. He was expected to have had a good knowledge of the ADR orders, local policy, and the reasoning behind them. This was discounted as the Pilot verbalised that they needed to make a decision prior to the *"airway"* it was considered that both crew understood and were aware of the orders and policy.

d. **Understanding of Weather.** The crew may not have fully understood the weather conditions. The WSO received an abridged met brief at DA handover which may not have provided him with as clear a picture as he may have obtained in the formal Met/Ops brief. This may have led him to direct the Pilot to continue into the Helmsdale valley based upon an incomplete mental picture of the weather in that area and beyond, over the sea where he expected it to be clear. While both of the crew could have commenced the sortie with an incomplete understanding of the weather, they had both had exposure in the preceding LL segment to the weather. Any misconceptions they held about the actual weather would have been dispelled by this point. It was clear that at least the Pilot understood there was a reasonable chance that they would have to perform a LL abort under the ADR, having just performed an

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abort and returned to the same, if not deteriorating, weather conditions. This was discounted as a factor.

1.4.3.30 **Why Did ASTON 1 Continue Under the ADR in Marginal Weather?** Although the physical act of controlling the aircraft relies upon the pilot, either crewmember could direct an alternative course of action, either by instruction (WSO) or by altering course (Pilot). Both crewmembers will assess the weather conditions, airspace, hazards and operating tasks, and agree a course of action to ensure safe operation of the aircraft and to achieve the tactical objectives. Evidence indicates that ASTON 1 continued under the ADR in challenging weather, outwith the specific order *"to avoid deliberate under flight of these ADRs if there is any possibility that weather conditions may necessitate a low-level abort."* This could have been due to either of the reasons listed below:

Exhibit 144
Exhibit 227
Exhibit 7
Exhibit 21
Exhibit 22
Exhibit 233
Witness 34
Witness 38
Witness 39
Witness 13
Witness 37
Witness 16

a. The Pilot made airmanship comments prior to committing to underfly the ADR in good time to be able to action them. This is expected of a Pilot and the decision not to continue at LL in challenging weather could occur earlier for a student than an experienced instructor with greater experience and familiarity with the aircraft. The WSO believed that because of his experience, the Helmsdale valley would not be out of limits, he wanted to expose the student to more LL flying, and they had not reached the VMC minima for LL flying.

b. The WSO had just experienced a LL abort and had experienced ML flight for the first time since resuming flying following his flying anxiety presentation. The weather may have been challenging, but to him, LL flying was a more comfortable and known environment. Presented with the choice, the Panel concluded that ASTON 1 WSO would have chosen the challenging LL option over the ML option.

1.4.3.31 **2nd LL Abort.** The 2nd LL abort was initiated by the Pilot as the WSO said the words *"let's go"*. The Pilot interrupted the WSO with the words *"and going up"* as he initiated the abort. This indicates that both the WSO and the Pilot recognised the requirement to conduct an abort at that moment and vocalised that recognition. There is a possibility that in saying *"let's go"*, the WSO was content with the weather in the valley and wanted the Pilot to continue at LL. This was discounted given the reports of fog and low cloud along the Helmsdale Coastline; the Panel considered the weather must have been unsuitable for LL flight.

Exhibit 7
Exhibit 6
Exhibit 78
Exhibit 3
Exhibit 231
Exhibit 13
Exhibit 234

1.4.3.32 During the abort at an altitude of 2200 ft the WSO stated *"and roll it off"*. The crews' route map has a Safety Altitude of 5300 ft marked 1 cm away from their location when they conducted the LL abort. It is possible that the WSO had scanned the map for more localised terrain with consideration for avoiding the base of the ADR and then directed the Pilot to level off once they were passing 4000 ft, the base of the ADR. The highest terrain within 30 nm of ASTON 1 during the abort (the 1Gp ASOs requirement for Safety Altitude calculations) was 2317 ft, resulting in a Safety Altitude of 3400 ft. It is most likely that the crew had achieved visual references (although not necessarily VMC) at this stage, and similar to the 1st LL abort the WSO directed the Pilot to level off. The Pilot levelled initially at 5700 ft and then later climbed to 6500 ft. It was considered that this could have been due to either an attempt to maintain VMC or the Pilot not having trimmed the aircraft accurately.

1.4.3.33 ASTON 1 continued to climb upon reaching visual references, climbing from an initial altitude of 5700 ft to 6500 ft. This course of action, rather than an immediate descent out of the ADR, limiting exposure and negating the requirement for a radar service (the base of the ADR is 4000 ft AMSL), could indicate that the weather was not suitable to descend overland and maintain VMC. The use of the term *"Radalt descent"* in cockpit discussion also indicates that poor weather is going to be encountered.

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1.4.3.34 The WSO remarked that he had looked and did not see any traffic in the ADR. The closest traffic in the ADR was CAT 5 nm to the NE at FL100, which the crew did not see, however it indicates the airspace is utilised by CAT and a radar service would have either focused lookout or given SA. 1Gp ASO 2330 states that *"If the subsequent unpremeditated climbout will remain clear of controlled airspace but a priority radar service is required, crews are to call the appropriate Air Traffic Agency at a safe and appropriate opportunity."* The RAF Lossiemouth FOB requires that "*Stn-based ac intending to cross ADR N560D or W6D within 30 nms of Inverness Airport are to be in receipt of a radar service."* During the abort the crew remained 38 nm from Inverness and were therefore outside the 30 nm distance prescribed in the FOB. Given the local emphasis, RAF Lossiemouth aircrew consider it normal practise to obtain a radar service prior to entering the ADR; the requirement for a radar service following a LL abort would be considered a high priority due to the dynamic nature of the infringement. OC Standards, XV(R) Sqn stated that *"you don't go in to them IMC without some sort of a radar service…if you are VMC, it's still by exception you would go in without a radar service."* Exhibit 231 Exhibit 227 Witness 8 Witness 41 Witness 26 Witness 35 Witness 32 Witness 42 Witness 12

1.4.3.35 Possible reasons for the crew not seeking a radar service following the LL abort are:

a. **Benefit vs Time to Clear ADR.** The crew may have considered that by the time they had obtained a radar service they would have already exited or been close to exiting the ADR. From initiating the abort it took ASTON 1 a further 90 secs to exit the ADR. The crew may have considered that, if they had contacted RAF Lossiemouth, identification may have taken longer than usual as the SSR was on maintenance. 90 secs is sufficient for a crew to make contact, be identified by an air traffic controller and subsequently receive an ATS. In a Tornado 90 secs can equate to over 9 nm ground track, and so crews are taught to think ahead and anticipate options. Exhibit 6 Exhibit 78 Witness 20 Witness 21

b. **Delay to Joining Tain AWR.** The WSO formulated a plan to descend once inside the Tain AWR Danger Area. This would require that the crew contact Tain to obtain permission to enter the Danger Area. ASTON 1's routing had meant they coasted out 7 nm (one minute flying time) closer to the Tain AWR boundary than planned, thereby reducing the amount of time to organise the join. It is likely that by obtaining a radar service it would have delayed the join; the WSO was expeditious in contacting Tain AWR following the LL abort while still in the ADR. Exhibit 7 Exhibit 6 Exhibit 78

c. **Medical.** The aircraft reached an altitude of 6500 ft above an almost overcast layer of cloud. This would have provided little in the way of visual references and was the highest altitude the WSO had flown since he resumed flying and, whilst not particularly high, 6500 ft could be described towards the lower end of "Medium Level" (ML flight, with poor visual references and low workload was a trigger for his anxiety). The WSO's plan to descend in Tain AWR Danger Area could have presented an expeditious return to LL; it is considered that obtaining a radar service from RAF Lossiemouth would prolong the time spent at ML (although would also offer a distraction). It is recognised that during a busy time in a sortie it is the instructor's role to make decisions, provide direction and guidance to the student and to ensure the sortie aims are achieved in a safe and effective manner. The WSO's medical condition may have influenced his decision not to obtain a radar service in the ADR. Exhibit 21 Exhibit 6 Exhibit 78 Exhibit 7 Exhibit 10

1.4.3.36 **Why did ASTON 1 not obtain a Radar Service inside the ADR?** ASTON 1 crew would have known the implications of entering the ADR from an emergency LL abort, and, when questioned, all XV(R) Sqn aircrew interviewed were aware of how the ADR was regarded in both policy and procedure. Not obtaining a radar service was considered exceptional. There was no in-cockpit discussion regarding obtaining a radar service. There Witness 8 Witness 41 Witness 26

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was sufficient time to call an ATC agency, clear benefit to obtain a radar service and enough time remaining within the ADR to warrant it, but the pace of events driven by the WSO left the Pilot with no opportunity to voice an opinion. The Pilot was in the process of recovering the aircraft from the emergency LL abort when the WSO briefed him on his LL let down and communication plan. ASTON 1 did not gain a radar service within the ADR due to either: Witness 35 Witness 32 Witness 42 Witness 12 Exhibit 7 Exhibit 6 Exhibit 78 Exhibit 233

a. As the aircraft was closer to Tain AWR than originally planned, it was imperative to speak to the AWR to avoid a delay in entering and descending in the Danger Area. The plan to descend within the Tain AWR would have reduced the time available to achieve the parameters for the FRA but expedite the return to LL. The sanitised airspace of the Danger Area would help to facilitate a safe descent in IMC or intermittent IMC conditions without a radar service. The haste to initiate a descent took a higher priority than gaining a radar service (even though entry into the ADR had taken the form of an emergency LL abort).

b. The WSO had now experienced two unplanned episodes of ML flight from dynamic manoeuvres, which had not previously occurred during his return to flying duties after presenting with flying anxiety. The desire to return to a LL environment where he felt more comfortable could have influenced the decision to choose the most expeditious means to deliver it. This logic may not have even been a conscious one. The closest sanitised airspace which would not need a protracted identification process at ML was Tain AWR, and ASTON were planning to use the AWR anyway, which would make descending within it a reasonable Course of Action (COA). The WSO prioritised returning to LL as expeditiously as possible over other COAs, and accepted the compressed task schedule in order to enter the AWR to complete the FRA.

1.4.3.37 **Descent over the North Sea into the Moray Firth Environs.** Following the 2nd LL abort ASTON 1 descended to LL in the Moray Firth environs just outside the boundary of Tain AWR. The WSO's plan had been to descend to LL inside Tain AWR. If there was no other traffic using the AWR then this would have provided sanitised airspace in which ASTON 1 could descend. A descent within the AWR boundary followed immediately by the FRA would have been extremely demanding on the student Pilot and instructor WSO. The crew were yet to complete the Pre Attack/Pre Range Checks or the Attack/Range Joining Checks, they would have had to change radio frequencies to Tain Primary, achieve the 520 kt speed and 150 ft height entry parameters for the event and descend through challenging weather conditions. This would have meant descending 6350 ft in the 12 nm distance to the Initial Point of the FRA, increasing speed whilst carrying out checks and safely descending (possibly IMC) which, although not impossible, is a highly demanding profile for a Front Line Tornado GR4 crew. It is considered unlikely that ASTON 1 would have been prepared by the Initial Point to prosecute the FRA safely and effectively, without the need to extend the ground track or conduct a circling descent. Exhibit 6 Exhibit 78 Exhibit 7

1.4.3.38 On calling Tain AWR, the crew were informed that the AWR was active, although they were not informed of the other user's type or callsign. They were told that the traffic had *"possibly 3 minutes left on range."* ASTON 1 decided to descend remaining initially between 1-3 nm outside of the Tain AWR Danger Area. The crew were unaware of the other traffic's departure intentions and did not ask for them. It is common for RAF Lossiemouth traffic, the main user of Tain AWR, to exit the AWR via "The Cross." ASTON 1's join was planned via "The Cross." The crew may have descended anticipating that they would receive a clearance to enter the Danger Area following a short delay; ASTON 1 could then have completed their descent in the sanitised airspace of the Danger Area. Although they did not know the departure intentions of the other traffic they would have expected to receive the information from the AWRC to aid that deconfliction. Exhibit 5 Exhibit 7 Exhibit 3 Exhibit 6 Exhibit 78 Witness 1 Exhibit 146

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1.4.3.39 The descent was conducted iaw the MMATM and 1Gp ASO 2330 which detail IMC descent procedures over the sea. Although the crew descended immediately after coasting out rather than waiting until they were 5 nm clear of the coast, they did not descend below the "over the sea Safety Altitude" until 5 nm clear of the coast. Exhibit 230 Exhibit 231 Exhibit 78 Exhibit 6

1.4.3.40 Although it is believed that ASTON 1 began the descent in VMC, it is considered that they would have encountered cloud layers during the descent and possibly entered the fog bank that extended out from the Helmsdale coast. This would require them to adhere to the IFR procedures for descent over the sea. Even though they may have encountered periods during the descent where they were not completely in cloud and could use visual references, they would not have conformed strictly to VMC minima. Exhibit 10

1.4.3.41 1Gp ASO (4)2330 requires that descents in IMC to LL are not to be carried out in areas of known aircraft activity without a Deconfliction, Traffic or Basic Service from an ATC agency. It states oil rigs as an example of an area of known aircraft activity but does not specifically mention AWRs. AWRCs can provide a Basic Service to aircraft both inside and outside the AWR, however it was considered that as 1Gp ASO (4)2330 states *"ATC agency"* it is referring to a radar equipped agency. ASTON 1 WSO would have known that Tain AWR is not radar equipped. The RAF Lossiemouth FOB Moray Firth deconfliction order states "*There is a danger of confliction between aircraft in transit between Lossiemouth, Tain AWR and LFA 14 North of Helmsdale"* and that crews are to contact Lossiemouth Approach when operating at LL in the Moray Firth to be updated on helicopter traffic. To comply with this order, ASTON 1 could have contacted Lossiemouth Approach, regardless of their flight conditions (IMC or VMC) for an update on traffic information prior to descent to LL in the Moray Firth environs. This could have delayed their descent. Exhibit 180 Witness 43 Exhibit 143

1.4.3.42 The WSO commented that "*it's going to be a little bit disorientating over the sea*" and later "*it's going to be on the deck*" during the descent. It is assessed that he was referring to weather conditions over the sea in his comments and that at least part of the descent was conducted in IMC requiring the crew to follow the Radalt descent procedure. The crew levelled at 700 ft Radalt. Exhibit 7 Exhibit 6 Exhibit 78

1.4.3.43 The crew might not have sought a radar service for the letdown for the following reasons:

a. **Time Pressure.** The crew may have decided not to obtain a radar service due to the possible delay in joining the AWR with an increased workload over and above the Pre Attack/Pre Range Checks and Attack/Range Joining Checks. However, the crew had already been told that the AWR was active and therefore could expect a delayed clearance to enter the Danger Area. It was considered that the crew were not overly fuel or time limited. Indeed a descent and short hold at LL would use more fuel than maintaining altitude. There was sufficient time to obtain a radar service, descend to LL and maintain SA on AWR traffic whilst remaining outside the Danger Area. It was considered that as there was no overriding time pressure to descend to LL, this was not a factor in the decision not to obtain a radar service. Exhibit 7

b. **Predisposition.** The crew had already decided on a COA to descend whilst speaking to Tain AWR. Although the original decision had been to descend inside the Danger Area the crew may have been predisposed to continue with the descent once informed that the AWR was active. At 6500 ft the Pilot could see a clear area (Tain AWR) and the crew may have believed that they could remain in VMC during the descent stating *"I can see the sea down to the right"*. ASTON 1 WSO's comments referring to cloud and visibility suggest that this was not the case. ASTON 1 could have stopped their descent above Safety Altitude and reassessed their decision. Exhibit 7

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c. **Lack of Knowledge of Orders.** It is possible the crew did not know or understand the orders relating to the Moray Firth procedures. Given the experience of the WSO it was assessed that he would have known the orders. This is discounted as a factor in the decision. Exhibit 121

d. **Perception of Airspace Traffic Levels.** OC Standards, XV(R) Sqn stated that he believed the Moray Firth environs was congested airspace ten years ago but his overall impression today is that it is not congested, outwith the RAF Lossiemouth radar pattern. It is possible that ASTON 1 WSO had the same perception, which could have contributed to him not feeling there was a need to obtain a service for the descent. Witness 8

e. **Weather.** It is possible that the crew decided that the weather was not poor enough to warrant a radar service, as periods of IMC would be short lived. Prior to descent, the comment *"I can see the sea down to the right"* by the Pilot could indicate that the crew believed they could descend to their intended height without having to resort to IFR. This is unlikely to be the case with evidence of the cloud structure at that time, however it cannot be discounted. Exhibit 7

f. **Medical.** The WSO could have considered his exposure to ML would be prolonged by obtaining a radar service and therefore his medical condition could have influenced his decision making. Complying with the direction of a radar service would have likely prolonged ML flight as it would have taken time to have been identified by an air traffic controller. Identification may have required a track change away from the AWR. The WSO stated *"right just as soon as we coast out I'll be happy to take a Radalt descent"* followed 9 secs later as the aircraft crossed the coastline by *"right that's us coasting out happy to go down"*. It is recognised that during a busy time in a sortie it is the instructor's role to make decisions, and provide direction and guidance to the student. In this instance the compressed nature of the LL abort through to the descent over the sea was one of minimising ascent (height) and haste to return to LL. The COA taken does not represent a dynamic, instructor led demonstration of preparing the aircraft and crew for a successful FRA. It is highly probable that this COA would not have resulted in a successful and safe FRA. Exhibit 21 Exhibit 7

Why did ASTON 1 Not Get A Radar Service To Descend Into The Moray Firth?

1.4.3.44 It is considered that obtaining a radar service was a sensible option as they could no longer descend within the sanitised airspace. The Panel considered that ASTON 1 did not get a radar service to descend into the Moray Firth environs because:

a. ASTON 1 WSO had initiated an expeditious plan to return to LL where he was most comfortable. The requirement to return to LL was his priority, rather than making a more measured descent under a radar service. Exhibit 7

b. The Panel could not discount that ASTON 1 WSO had a belief that the Moray Firth airspace was significantly less busy due to his experience of the area. If this was the case, the WSO may have considered it appropriate to descend without a radar service regardless of the weather conditions. IMC descents below Safety Altitude, without a radar service, are not uncommon in remote regions where an ATS might be unavailable. The Moray Firth environs could not be classified as a remote region; however the experience of ASTON 1 WSO could have been a driver for his actions. Exhibit 121

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1.4.3.45 **How Could ASTON 1 have Obtained a Radar Service.** At 11:57 hrs, ASTON 1 was recovering from the emergency LL abort inside the ADR. ABBOT 2 was airborne and speaking to Lossiemouth Radar (Departures). If ASTON 1 had wanted a radar service they had three COAs available: Exhibit 6 Exhibit 78

a. **COA 1.** ASTON 1 could have contacted Inverness Radar for identification, traffic information and maintained a radar service for their descent. Inverness Radar had a serviceable SSR feed, and would have been able to identify ASTON 1 from their Mode 3 squawk (and Mode C height information) without a protracted identification process, and deconflict them within the ADR. This is the least likely option due to ASTON 1's intentions and predisposition to using Lossiemouth Radar. Exhibit 13

b. **COA 2.** ASTON 1 could have contacted ScATCC(Mil) as directed by the Student Study Guide. As ScATCC(Mil) had a serviceable SSR feed, they would have been able to identify ASTON 1 from their Mode 3 squawk (and Mode C height information) without a protracted identification process and deconflict them within the ADR. ScATCC(Mil) would have only been able to clear ASTON 1 to an altitude of 6500 ft, their area Safety Altitude. For a descent below 6500 ft ScATCC(Mil) would normally hand ASTON 1 over to Lossiemouth Radar. ASTON 1 could, however, descend below 6500 ft with responsibility for their own terrain clearance, with the possibility that traffic information could be degraded due to ScATCC (Mil)'s reduced radar coverage at lower altitudes. ASTON 1's intentions to descend to LL would require an agency with the best possible radar coverage to the lowest level, and it is likely they would not use ScATCC(Mil) for this. Exhibit 228 Exhibit 234 Exhibit 356 Exhibit 237 Exhibit 238

c. **COA 3.** ASTON 1 could have contacted Lossiemouth Radar. This would be the most expeditious[8] method of gaining immediate traffic information of any conflictions within the ADR and to allow an expeditious descent to with SA of LL traffic within the Moray Firth. Lossiemouth Radar can control traffic within the ADR; however with no SSR feed the identification process could have taken longer. Without SSR the controller could not have assigned a unique Mode 3 squawk to ASTON 1 and therefore a heading change (turn) could be required for identification. If ASTON 1 had been within 30 nm of the Kinloss TACAN, they could have passed their location relative to the TACAN to aid identification. It is not possible to determine if a descent to 1700 ft (the lowest level Lossiemouth Radar could clear ASTON 1 to) would have enabled ASTON 1 to regain visual references; for further descent the crew could have used Radalt descent procedures. This is most likely the option they would have chosen due to their familiarity with, and the fidelity of, the Lossiemouth Radar. Witness 20 Exhibit 239 Exhibit 239

1.4.3.46 **What Difference Would ASTON 1 Obtaining a Radar Service have made?** If ASTON 1 had contacted ScATCC(Mil) and been handed over to Lossiemouth Radar, it could have allowed coordination within Lossiemouth ATC and ABBOT 2 could have been informed of ASTON 1's position, height and intentions (as they were on Lossiemouth Radar (Departures frequency)). ScATCC(Mil) radar recordings show ABBOT 2's radar track until approx 90 secs before collision, which would have enabled ScATCC(Mil) controllers to give traffic information before a handover to Lossiemouth Radar would have become necessary. Exhibit 1 Exhibit 4 Exhibit 7 Exhibit 234

1.4.3.47 If ASTON 1 had contacted Lossiemouth Radar ASTON 1 and ABBOT 2 could have been informed of each other's position, height and intentions.

1.4.3.48 Section 1.4.4 discusses further the effect of the SSR being unavailable to ABBOT 2.

[8] The frequency would be "studded" within the aircraft radios, the crews would be familiar with the procedures, and the crews would be pre-disposed to using their home unit.

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Conclusions

1.4.3.49 The direction and control of ASTON 1's sortie was heavily influenced by the WSO as the senior supervisor and instructor. The flow of the sortie, from the decision to descend back into LL after the first LL abort to the descent into the Moray Firth environs, was controlled by the WSO. Although ASTON 1 Pilot was the aircraft captain, he deferred to the more experienced crewmember. Exhibit 7 Exhibit 21 Exhibit 121 Exhibit 122 Exhibit 123 Witness 65

1.4.3.50 Three of the WSO's airmanship decisions contravened orders and demonstrated poor airmanship for an experienced instructor WSO, graded *"above average"*. These decisions were: Witness 80 Witness 11

a. the decision to under fly the ADR in marginal weather;

b. the lack of radar service during/after the emergency LL abort into the ADR;

c. the decision to descend into the Moray Firth environs without a radar service.

1.4.3.51 The Panel concluded that:

a. the decision to initiate the 1st LL abort was logical, normal and compliant;

b. the decision to return to LL following the 1st LL abort was also logical, normal and compliant;

c. the WSO stated he was still affected by anxiety six days before the accident and had requested that the sortie on 3 Jul 12 be kept at LL. The Panel shares the view of the Head of Neurobiology and Mood Disorders (CAA consultant psychologist) who believes that the WSO would experience anxious symptoms if exposed to, or in anticipation of, ML flight;

d. the decision to under fly the ADR in marginal conditions was influenced by a mix of the WSO's experience (that the Helsmdale valley would allow clear passage) and a well documented medical imperative to avoid ML flight;

e. the 2nd LL abort was not carried out iaw local orders and procedures and although the weather conditions required the abort, the Panel could not rule out that the subsequent actions within the ADR were influenced by medical drivers to depart ML;

f. the decision to descend into the Moray Firth environs without a radar service precluded ASTON 1 from having an opportunity for coordination and deconfliction with ABBOT 2;

g. any aviator can make decisions during the dynamic pressures of FJ operations that can be questioned with hindsight. Students and experienced instructors regard these lessons positively, highlighting safety related issues and ensuring they are transparent and learned from. In isolation, decisions by ASTON 1 could be adopted as learning/safety points which could have been made by many crews;

h. the Panel considers that the WSO was an experienced, highly capable and *"above average"* instructor and that airmanship decisions were inconsistent with the character and esteem other operators held him in. The Panel could not rule out the

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influence of ASTON 1 WSO's medical condition on his actions, but concluded that the airmanship decisions of ASTON 1 which led to the descent into the Moray Firth environs without a radar service were a **contributory factor**.

ASTON 1 AWR Join

1.4.3.52 This sub-section is divided as follows:

a. Tain AWR Background to Events

b. ASTON 1 Joining Radio Call

c. ASTON 1 Timings

d. Regulation, Policy and Orders: AWR

e. Analysis

Tain AWR Background to Events

1.4.3.53 Tain AWR had two AWRC on duty referred to in this report as AWRC 1 and AWRC 2. The AWR was booked from 10:00 hrs to 12:00 hrs by [redacted] formation, comprising of two USAF F-15Es [redacted] arrived at Tain AWR just prior to 11:30 hrs. AWRC 1 manned both Tain Secondary and Tain Primary radio frequencies from the arrival of [redacted] until 11:43 hrs. At 11:43 hrs [redacted] departed due to low fuel leaving just [redacted] in the AWR pattern. AWRC 1 handed over the console to AWRC 2 and exited the visual control room to take photographs of the remaining F-15E from the outside gantry of the visual control room. AWRC 1 returned to the visual control room and sat at a desk across from the controllers' position at approximately 11:50 hrs. At 11:57 hrs, ASTON 1 contacted Tain AWR for the first time on Tain Secondary. AWRC 2 remained in dialogue with ASTON 1 and then informed [redacted] on Tain Primary that traffic was looking to enter and asked how many further passes he required; [redacted] requested one more pass. [redacted] believed that they had the AWR booked until 12:30 hrs. AWRC 1 was aware that ASTON 1 had contacted the AWR but was unaware of the specific dialogue. Following ABBOT 2's join call at 11:59 hrs and a brief discussion with AWRC 2, AWRC 1 assumed control of Tain Secondary, transmitting for the first time to ABBOT 2 at 12:00 hrs.

Witness 1
Witness 3
Exhibit 1
Exhibit 5
Exhibit 7

ASTON 1 Joining Radio Call

1.4.3.54 Table 3 below contains a transcript of the radio calls between ASTON 1 and AWRC 2.

Exhibit 1
Exhibit 5
Witness 1

ASTON 1 WSO	*Tain Range ASTON 1*
AWRC 2	*ASTON 1 Tain*
ASTON 1 WSO	*Just coming out of Helmsdale looking to join for a Brora Op 5 Target 1*
AWRC 2	*ASTON 1 roger be advised still got traffic on has probably 3 minutes left on range*
ASTON 1 WSO	*Roger that's copied. We will stay clear of the range just out of Helmsdale we've still got to get down to low level yet.*
AWRC 2	*ASTON 1 roger, just confirm you will be outside of D703?*
ASTON 1 WSO	*Affirm.*

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Table 3. Transcript of Radio Calls (ASTON 1 and AWRC 2)

1.4.3.55 AWRC 2 assumed that ASTON 1 had left Tain Secondary frequency to contact Lossiemouth for a letdown to LL. In fact ASTON 1 remained on Tain Secondary but made no further communication until 16 secs prior to collision.

ASTON 1 Timings

1.4.3.56 Tain AWR was expecting ASTON 1 for a TOT of 12:20 hrs, as this was the time they had entered on their Record of Flight. ASTON 1 actually planned to achieve a TOT of 12:19 hrs. ASTON 1 launched 14 mins earlier than planned. Following their rerouting after the 2nd SAP, ASTON 1 was 17 mins early. If ASTON 1 had been immediately cleared to join Tain AWR and prosecuted the FRA without delay they would have achieved a TOT of between 12:01-12:02 hrs owing to their further reroute from the planned track via the Helmsdale valley. Exhibit 3 Exhibit 6 Exhibit 78

Regulation, Policy and Orders: AWR

1.4.3.57 Regulation, Policy and Orders relating to AWR include JSP 403 Handbook of Defence Land Ranges Safety and Air Command Air Weapon and Electronic Warfare Range Orders (ACAWEWROs).

1.4.3.58 JSP 403 Handbook of Defence Land Ranges Safety contains both regulation and best practice measures for range safety. It requires that: Exhibit 235

> *"Squadron Commanders are to ensure that all aircrew taking part in air weapon sorties are fully conversant with the contents of JSP 403 Volume III and any additional operating authority orders... They are to ensure that aircrew sign as having read and understood the orders on the following occasions:*
>
> *a. On arrival at the unit.*
>
> *b. Immediately after the incorporation of an amendment.*
>
> *c. Annually"*

1.4.3.59 JSP 403 directs that an AWR join request should take the following format: Joining the range pattern, requested by aircraft captain, giving call-sign, number and type of ac, booked or bootleg, TOT, event and target.

1.4.3.60 ACAWEWROs state the following mandatory information should be passed by aircraft requesting joining clearance: Callsign of range, Callsign of ac, Number of ac, Persons On Board (POB), ETA (Slot time), target/s, line or sector of attack and event/s. Exhibit 142

1.4.3.61 ACAWEWROs state that FRA are to be booked as below: Exhibit 142

a. *"During another user's slot one FRA may be booked in each 15-min slot (unless the users who have booked the slot are content for additional FRAs to occur). The FRA must not exceed a maximum of 4 ac at a maximum of 30 seconds spacing. FRAs are not permitted during the first 3 or last 2 mins of each 15-min slot."*

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b. *"In order to maximise range utilisation aircrew may 'freecall' AIR CMD AWRs in advance to bootleg[9] un-booked or un-used range slots or to book FRAs. Bootleg FRAs may be accepted at the discretion of the AWRC following consultation with the lead crew of any booked traffic on the range. Although FRAs previously booked will have priority, in-flight bootleggers will be accommodated when possible."*

Analysis

1.4.3.62 It is unlikely that the crew of ASTON 1 had read JSP 403 recently, if at all. JSP 403 does not appear on the mandated and monitored reading list for aircrew. Only a small section of JSP 403 is relevant to fixed wing aircraft. In contrast, ACAWEWROs is on the mandated and monitored reading list and crews are expected to have a good knowledge of the document. The JSP 403 mandatory joining call information differs slightly from the ACAWEWROs mandatory joining call. There is no clear policy for aircrew to read JSP 403 but it holds policy on AWR procedures that conflict with ACAWEWROs. Exhibit 235 Exhibit 142 Exhibit 236 Exhibit 240

1.4.3.63 ASTON 1's join call did not comply with JSP 403 in that it did not contain the number and type of aircraft, booked or bootleg, or TOT. AWRC 2 would have known that ASTON 1 was a Tornado GR4 through familiarity with RAF Lossiemouth callsigns and the XV(R) Sqn Flypro and could infer by the use of the "1" in ASTON 1 that it was a singleton. Had the crew requested a bootleg FRA due to their timing change or passed a requested TOT this would have improved the SA of AWRC 2 to ASTON 1's intentions. Exhibit 7 Exhibit 236 Witness 3

1.4.3.64 ASTON 1's joining call did not comply with ACAWEWROs in that it did not contain: Number of ac, POB, ETA (Slot time), or Line or Sector of Attack. Use of the callsign ASTON 1, rather than ASTON, would again imply one aircraft. Tain AWRC's are familiar with the Tornado GR4 which is always operated by two crew, and *"Brora Op 5 target 1"* would indicate the flow of the event but does not specifically mention the final LOA. Had their ETA (or requested TOT) been passed this would have improved AWRC 2's SA of ASTON 1's intentions. Exhibit 7 Exhibit 142

1.4.3.65 ASTON 1 was, in effect, trying to bootleg an FRA as their timings differed significantly from their booked FRA. ASTON 1 attempted to conduct an FRA outwith ACAWEWROs: "*FRAs are not permitted during the first 3 or last 2 mins of each 15-min slot.*" It would appear that a degree of normalisation has occurred in this respect. OC Standards, XV(R) Sqn stated that *"since the reduction in flying…people have not stuck so rigidly to those procedures…and so as a result, the chances of an aircraft trying to join and being told to hold off because the slot is not available is that much less."* Exhibit 6 Exhibit 78 Witness 8 Exhibit 142

1.4.3.66 From ASTON 1's radio call AWRC 2 understood that ASTON 1 was in the Moray Firth trying to letdown to LL. AWRC 2 *"presumed he was with Lossie approach to do that because obviously we've got no facilities to do that."* AWRC 2 had made his own assumption that ASTON 1 would have to contact a radar equipped ATC agency for descent to LL. He believed that ASTON 1 had gone en route and would recall the AWR for their booked FRA at 12:20 hrs. The Panel considered that AWRC 2's assumption that ASTON 1 had left Tain Secondary was understandable given his previous experience of AWR users and the nature of ASTON 1's radio call "*we've still got to get down to low level yet.*" However, the Panel also considered that the lack of clarification of ASTON 1's intentions (informing AWRC 2 that they were remaining on frequency),or AWRC 2 (checking if they had left the frequency), facilitated a situation whereby AWRC 2 and ASTON 1 had different expectations. Witness 1

[9] ACAWEWROs definition: Bootleg is the use of a range without prior booking. Aircraft merely call the range on an opportunity basis. These aircraft are known as bootleggers.

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1.4.3.67 AWRC 1 stepped in to assist AWRC 2 following ABBOT 2's join call because AWRC 2 was managing both the departure of [redacted] and the arrival of ABBOT 2. AWRC 1 was unaware of the exact nature of the dialogue that ASTON 1 had had with AWRC 2. Furthermore, at this stage AWRC 1 and 2 were unaware of ASTON 1's position and intentions less that they would remain outside D703 (Tain AWR Danger Area). Both AWRC 1 and 2 were unaware that ASTON 1 had remained on Tain Secondary.

Witness 1
Witness 3
Exhibit 5
Exhibit 7

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