ACCIDENT

Aircraft Type and Registration:	Mudry Cap 10B, G-BXBU	
No & Type of Engines:	1 Lycoming AEIO-360-B2F piston engine	
Year of Manufacture:	1980 (Serial no: 103)	
Date & Time (UTC):	12 August 2021 at 0920 hrs	
Location:	Lower Colley Farm, Buckland St Mary, Somerset	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - 1
Injuries:	Crew - 1 (Fatal)	Passengers - 1 (Fatal)
Nature of Damage:	Aircraft destroyed	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	69 years	
Commander's Flying Experience:	1411 hours (of which 648 were on type) Last 90 days - 15 hours Last 28 days - 4 hours	
Information Source:	AAIB Field Investigation	

Synopsis

The pilot found himself stuck above cloud during a cross-country flight under Visual Flight Rules. After contacting the Distress & Diversion Cell for assistance he was transferred to the radar frequency of a nearby airport, at which the cloud base was below the minimum required for the approach offered. The pilot, who was not qualified to fly in cloud, lost control of the aircraft during the subsequent descent and the aircraft was destroyed when it hit a tree. Both occupants were fatally injured.

The investigation found that air traffic service providers did not obtain or exchange sufficient information about the aircraft and its pilot to enable adequate assistance to be provided. There was an absence of active decision making by those providers, and uncertainty between units about their respective roles and responsibilities.

Seven Safety Recommendations are made to address shortcomings identified in the provision of air traffic services in an emergency.

History of the flight

G-BXBU departed Watchford Farm in Somerset, which was the aircraft's home base, at 0704 hrs on 12 August 2021 with the pilot and one passenger on board. Their intention was to fly to St Mary's on the Isles of Scilly for a day trip before returning to Watchford Farm later that afternoon. At the time of departure, the local weather was described by witnesses as clear skies with good visibility.

After departure, the aircraft flew south-westerly as planned towards Cornwall. As the aircraft passed north of Culdrose, it began a descent to 1,000 ft over the sea before turning right to head east away from the planned destination. It continued in a north-easterly direction, passing to the north of Torquay then out over Lyme Bay. While over the sea, the aircraft reached a minimum of 320 ft momentarily before completing three 180º turns and two 360º orbits. It then began to fly north from Lyme Regis toward Watchford Farm climbing to a peak altitude of 8,200 ft amsl (Figure 1).

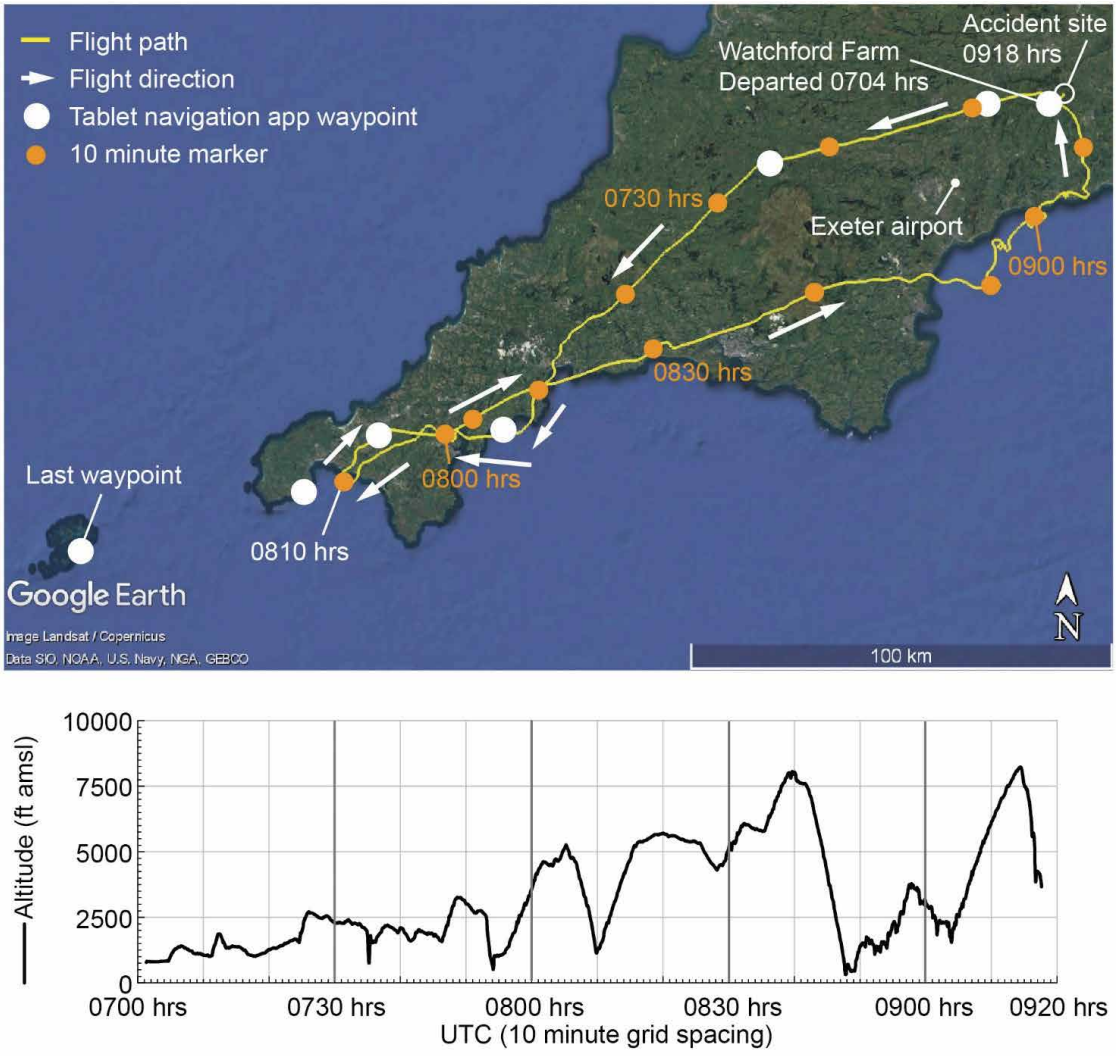

Figure 1

Aircraft planned route and flight path

At approximately 0905 hrs the pilot called Dunkeswell Radio, using the words “PAN, PAN, PAN” (indicating urgency), asking about the weather conditions at the airfield and stating that he was unable to land at Watchford Farm because he was stuck above cloud. The A/G operator at Dunkeswell replied that the weather at the airfield was poor – the cloud base was ‘on the deck’ and the visibility was 400 m. He suggested the pilot contact Exeter Radar or the Distress and Diversion (D&D) Cell on the emergency frequency 121.5 MHz.

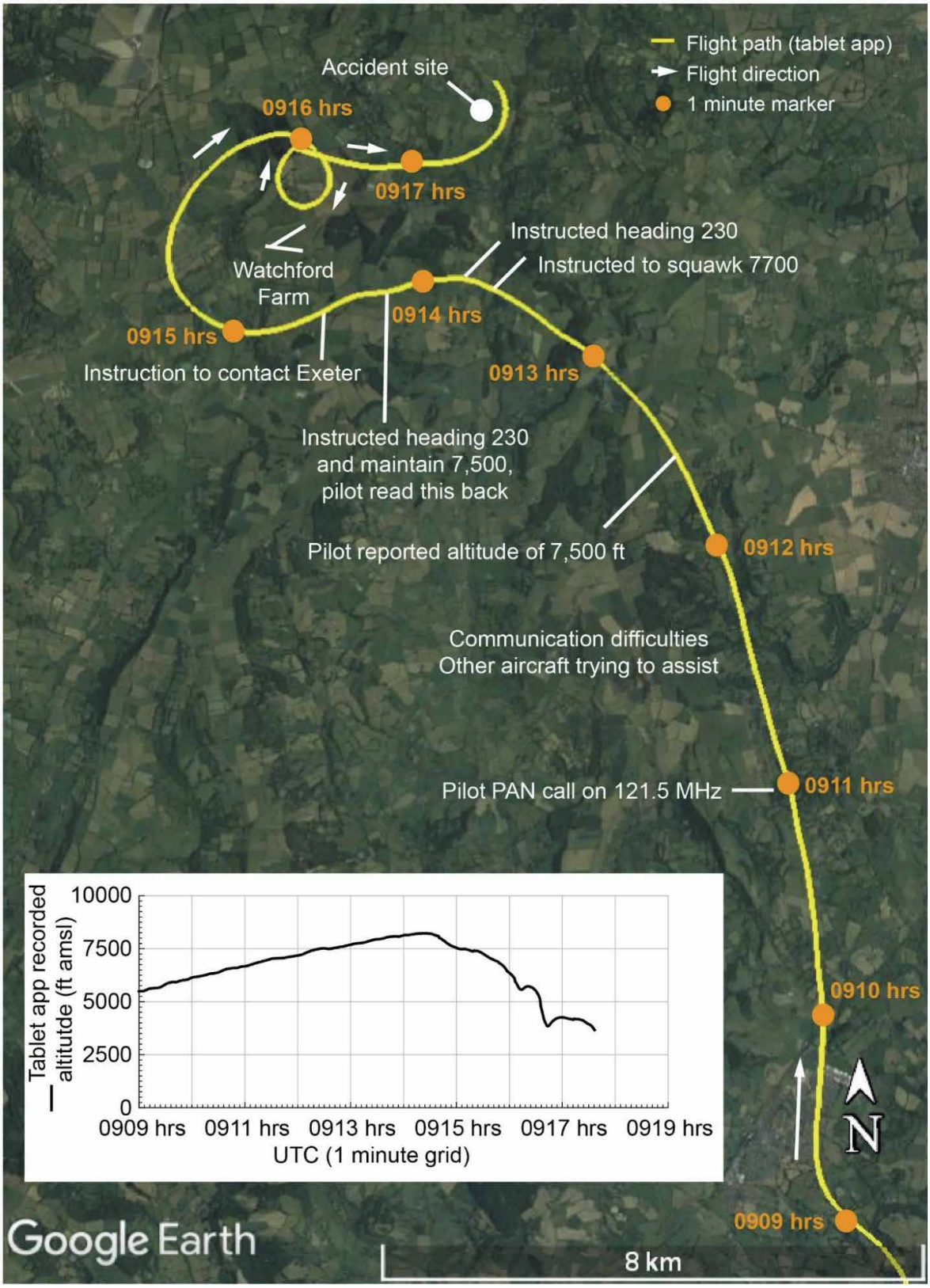

Figure 2

Flight path during D&D communications
(Note that this is not a comprehensive listing of the RT)

The pilot made another PAN call on 121.5 MHz at 0911 hrs, stating he was in "REAL TROUBLE" as he was stuck above thick cloud and he didn't know what to do (Appendix 2). He finished his radio transmission by stating "I NEED TO DIVERT TO SOMEWHERE ER CLOSE TO ME WHERE I CAN LAND". Several witnesses in other aircraft who heard the call described the pilot sounding anxious and stressed. The PAN call was initially acknowledged by two commercial aircraft in the vicinity prior to a response from the D&D controller who stated "... YOUR PAN IS ACKNOWLEDGED...". In response, the pilot stated his altitude was 7,500 ft and that he had a fuel endurance of 1.5 hours. The transponder on G-BXBU had not been used throughout the flight, but at the request of the D&D controller the pilot switched it on and set the emergency squawk of 7700.

At the time G-BXBU declared an emergency, there was a military jet holding in the vicinity of Exeter Airport where the jet had departed 28 minutes earlier. The aircraft had experienced a technical fault after takeoff which was subsequently resolved. The aircraft was holding to burn fuel and reduce its landing weight, prior to returning to land at Exeter. The military jet did not declare an emergency at any point. G-BXBU had been seen by controllers on Exeter's primary radar but there was no altitude information displayed as the transponder was not switched on. Exeter ATC were concerned about a potential conflict with the military jet, which was holding between 3,000 and 4,000 ft. The military jet was not moved clear of G-BXBU's primary return despite the lack of altitude information. However, altitude data recovered from the tablet from G-BXBU showed that the aircraft were sufficiently far apart to discount proximity as a factor in this investigation.

While G-BXBU's initial contact with the D&D controller was ongoing, a phone call between the Exeter Radar assistant and the D&D support controller took place between 0912 hrs and 0914 hrs (full transcript):

09:12:00 *D&D support*[1]*:* "D AND D SUPPORT"

09:12:01 *Exeter assistant:* "HELLO IT'S EXETER"

09:12:02 *D&D support:* "YEP"

09:12:03 *Exeter assistant:* "HI, HAS ANYONE UPDATED YOU FIRSTLY ABOUT THE [MILITARY JET]?"

09:12:07 *D&D support:* "ER, NO"

09:12:08 *Exeter assistant:* "OK ER JUST TO LET YOU KNOW THAT [MILITARY JET CALLSIGN] IS STILL INTENDING TO LAND AT EXETER, HE'S GOT A NORMAL UNDERCARRIAGE INDICATION NOW"

09:12:16 *D&D support:* "OK"

09:12:17 *Exeter assistant:* "AND ALSO, HAS A LIGHT AIRCRAFT CALLED YOU IN THE DUNKESWELL AREA?"

Footnote

[1] The 'D&D support' controller in this event provided support to D&D controllers equivalent to that provided by an air traffic control assistant (ATCA) to a civil controller when interacting with civil ATSU's. The D&D support controller was not permitted to conduct a radar handover.

09:12:21 *D&D support:* "YES, WE ARE CURRENTLY DEALING WITH THAT SITUATION"

09:12:23 *Exeter assistant:* "EXCELLENT, HE'S RIGHT IN THE WAY OF ER OF [MILITARY JET CALLSIGN] WOULD YOU, WHAT'S HE, WHAT'S HIS INTENTIONS AND HIS LEVEL?"

09:12:29 *D&D support:* "ER, DON'T KNOW HIS LEVEL BUT HE IS CURRENTLY ABOVE CLOUD AND WANTING TO DIVERT TO THE NEAREST AERODROME"

09:12:37 *Exeter assistant:* "WELL THAT WOULD BE US"

09:12:38 *D&D support:* "ER.."

09:12:40 *Exeter assistant:* "EXETER"

09:12:41 *D&D support:* "I THINK…"

09:12:44 *Exeter assistant:* "HE'S BASICALLY FLOWN ALL THE WAY UP THE COAST AND THEN ACROSS OUR EXTENDED CENTRELINE TWICE IN FRONT OF ER, A [MILITARY JET]"

09:12:49 *D&D support:* "YES"

09:12:50 *Exeter assistant:* "ER.. DO YOU WANT TO PUT HIM OVER TO US?"

09:12:54 *D&D support talking to D&D controller offline:* "EXETER ARE ASKING IF ER, MAYBE WE WANT TO, SHE ASKED TO PUT IT OVER TO THEM?..... THEY ARE WONDERING IF ER… THEY WANT TO TAKE OVER."

09:13:14 *D&D support:* "STANDBY, WE ARE JUST TALKING TO THE AIRCRAFT"

09:13:15 *Exeter assistant:* "OH OK, ALRIGHT" *(offline)*: "HE'S WORKING D AND D THAT AIRCRAFT"

09:13:21 *D&D support (offline):* "EXETER ARE WILLING TO TAKE THE AIRCRAFT"

09:13:22 *Exeter assistant:* [UNINTELLIGIBLE]

09:13:48 *D&D support:* "EXE.. ER WE ARE PUTTING HIM ON AN EMERGENCY SQUAWK, IS THERE A FREQUENCY THAT WE CAN PUT HIM ON TO?"

09:13:52 *Exeter assistant:* "ER... ONE.. ONE.. HANG ON"

09:13:55 *Exeter assistant (offline):* "WHICH ONE OF YOU WANTS TO WORK THIS AIRCRAFT INBOUND, DO YOU WANT TO [NAME] OR SHALL [NAME] TAKE IT? THE INBOUND. FOR WEATHER. THE ONE THAT'S BEEN IN THE WAY FOR THE LAST TEN MINUTES. YEAH. YEAH?"

09:14:10 *Exeter assistant:* "YEAH, IF YOU PUT IT THROUGH ONE TWO THREE FIVE EIGHT ZERO"

09:14:14 *D&D support:* "ONE TWO THREE FIVE EIGHT ZERO"

09:14:17 *Exeter assistant:* "AND WHAT'S HIS CALLSIGN?"

09:14:18 *D&D support:* "ER, CALLSIGN IS…"

09:14:21 *Exeter assistant:* "OH WE'VE GOT IT, WE'VE GOT IT IT'S OK."

09:14:23 *D&D support:* "YOU'VE GOT..."

09:14:25 *Exeter assistant:* "YEP, ALRIGHT THEN."

09:14:26 *D&D support:* "ALRIGHT THEN, BYE."

09:14:27 *Exeter assistant:* "THANKS CHEERS, BYE."

The D&D controller understood the D&D support controller to mean that the Exeter Air Traffic Service Unit (ATSU) had assessed that aerodrome as suitable for a diversion by the pilot of G-BXBU. He believed Exeter heard the 'PAN PAN' call on 121.5 MHz and that the reason for Exeter's phone call was solely to offer help to G-BXBU. He was not aware of their concern of a potential conflict with the military jet, nor that the D&D support controller was speaking to an assistant. When the D&D support controller told the D&D controller that Exeter was willing to take G-BXBU, the D&D controller advised the pilot of this one second later (Appendix 2). The location of the D&D controller and the D&D support controller was such that the controller could not overhear the conversation with the Exeter assistant directly. The Exeter assistant did not identify herself as such during the phone call, contrary to operating procedures[2].

The D&D controller informed the pilot of G-BXBU that his aircraft was identified on radar and operating under a deconfliction service.

CAP 1434 states that a deconfliction service is,

> *'only available to IFR flights in Class G airspace. An ATCO will use radar to provide you with detailed traffic information on specific conflicting aircraft and advice on how to avoid that aircraft. However, the pilot retains responsibility for collision avoidance; you can opt not to follow the ATCO's advice*[3].'

Although the emergency squawk of 7700 was visible on the radar controller's screen, G-BXBU was transferred to Exeter before anyone with controlling authority at that aerodrome had been made aware the aircraft was diverting in an emergency. There was no formal radar handover[4] from the D&D controller and the suitability of Exeter, in particular the weather conditions at the airfield, were not discussed at any point by either the Exeter assistant, D&D support controller or the D&D controller.

Footnote

[2] Manual of Air Traffic Services Part 2 (Exeter Airport) states '*When ATCOs [controllers] use the mediator or direct lines they shall identify themselves as "Exeter Radar" or "Exeter Tower", ATCAs [assistants] add the suffix "Assistant".*

[3] Civil Aviation Publication (CAP) 1434 - *'UK Flight Information Services'.*

[4] A radar handover is designed to ensure the safe transfer of responsibility of aircraft between ATSU. RA 3233 contains the details required to be included in a radar handover from controller to controller. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/974521/RA3233_Issue_3.pdf [accessed April 2023].

The Radar South controller at Exeter, who had come on duty at 0900 hrs but was not yet on frequency, agreed to accept G-BXBU on a separate frequency. At the time, Exeter Radar North was active and had only the military jet on frequency. There was no discussion as to the nature of the diversion in the context of the weather conditions at the airport, nor was consideration of the pilot or aircraft capability expressed.

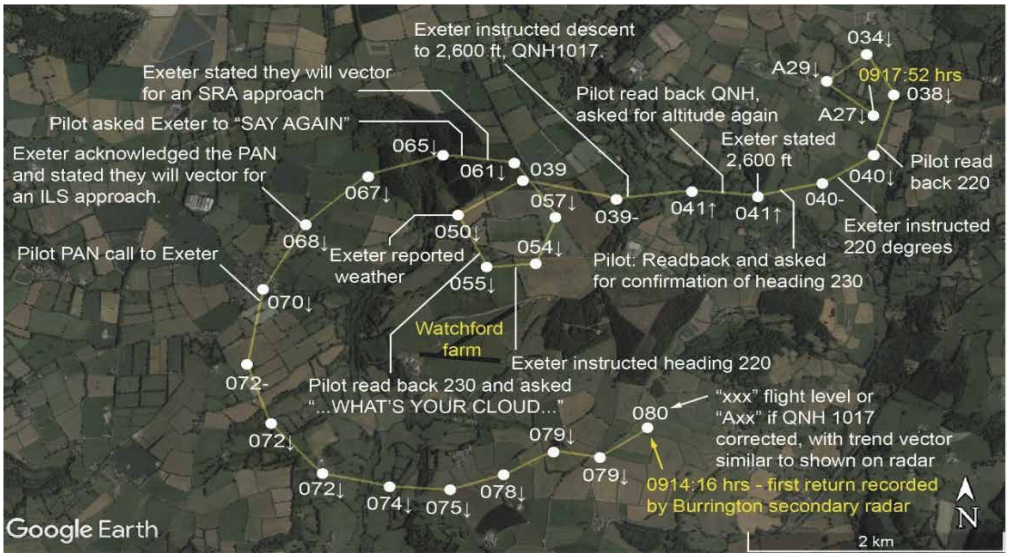

Figure 3

Flight path and flight level / altitude radar during Exeter communications
(Note that this is not a comprehensive listing of the RT)

When the pilot of G-BXBU made initial contact with the Exeter controller he confirmed his emergency 'PAN' status and stated, "HAVE BEEN DIVERTED". The controller initially advised she would give him vectors for an ILS approach for Runway 26 at Exeter. The pilot asked her to repeat her transmission and in her response the controller advised she would give vectors for a Surveillance Radar Approach (SRA), instructing him to fly a radar heading of 220°. The controller recalled that this change in clearance was prompted by input from a colleague who was in the room and witnessed her communications with G-BXBU. The pilot asked her to confirm the cloud base at Exeter, to which she replied the visibility was 6 km and the cloud was broken at 500 ft. The controller commented that she was surprised to be asked about the weather conditions at this point, as she would have expected the pilot to have this information before diverting.

At 0914 hrs the controller observed the aircraft descending and not maintaining the assigned heading. At 0916 hrs the radar track showed the aircraft levelling briefly around 4,000 ft. Without having noticed this, the controller instructed G-BXBU to descend to 2,600 ft, which was the minimum safe altitude[5], aiming to prevent the aircraft descending below that.

Footnote

[5] The minimum safe altitude in this sector was 2,600 ft.

The last radio transmission from the pilot was "DESCENDING TWO THOUSAND SIX HUNDRED, YOU WANT ME ON TWO THREE ZERO?". The last radar return was at 0917 hrs and showed the aircraft at 2,700 ft.

Several ear witnesses nearby described a loud engine noise prior to an impact.

At 0920 hrs, Devon and Cornwall Police received a report of an aircraft accident. First responders found that both occupants had been fatally injured.

Accident site

The accident site was a field approximately 1.2 km north-west of Buckland St Mary in Somerset. The aircraft struck the boughs of an oak tree and then the ground in the northern end of the field (Figure 4). Around the tree and from the ground impact there were large amounts of debris scattered on a southerly path. Running east-west midway across the field was a concrete single track road bounded on both sides by a single strand, wire fence supported on wooden posts. The wire had been broken and a piece of wire was caught in the tail wheel. The engine, cockpit instrument panels and rear fuselage were approximately 40 m to the south of the roadway and had been arrested by the wire fence. The left landing gear wheel was found in a sunken stream at the southern end of the field, approximately 235 m from the tree.

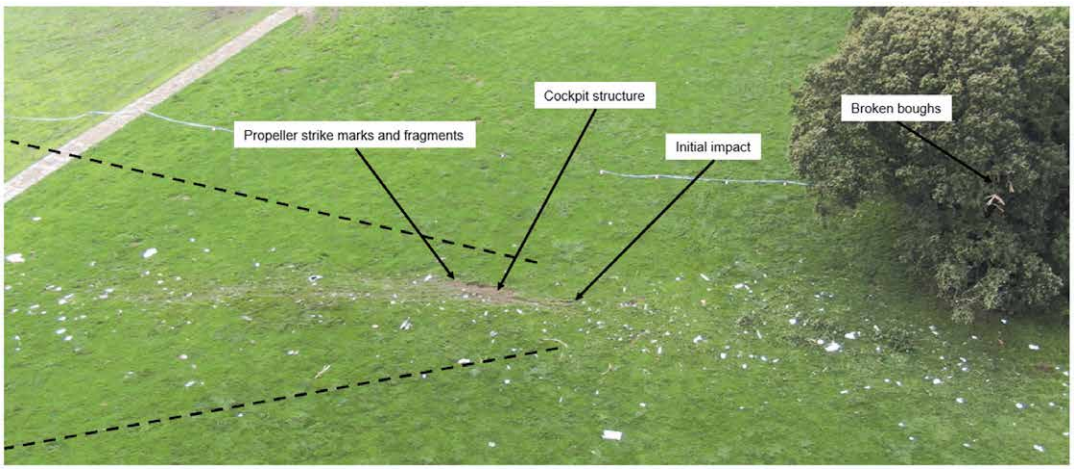

Figure 4

Ground impact marks

The oak tree at the northern end of the accident site was approximately 20 – 25 m tall with a large swathe cut through it at about 15 m from ground level. Several large boughs had been broken and some pieces of wreckage were lodged in the tree. The ground to the south and east contained broken branches and further wreckage, including wing and fuselage structure, shards of clear plastic from the canopy, and fragments of the propeller (Figure 5).

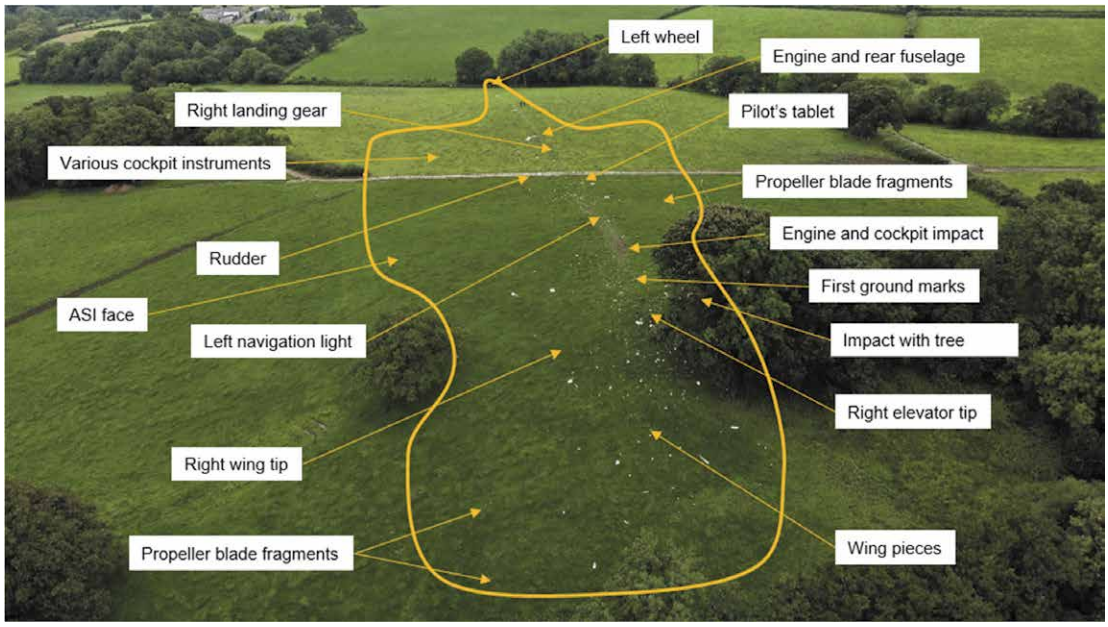

Figure 5

Accident site looking from the north showing wreckage distribution and boundary

To the south of the concrete roadway was the engine and rear fuselage (Figure 6). The engine was attached to the cockpit instrument panels and rear fuselage by flight control and electrical cables. The primary fuel tank had ruptured and was empty whereas the auxiliary fuel tank was intact and still contained a small quantity of fuel.

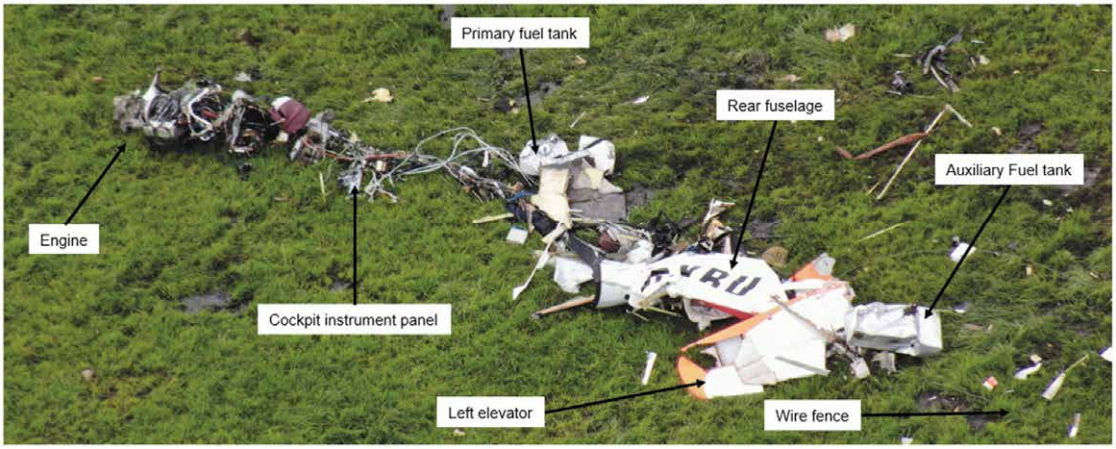

Figure 6

Engine and rear fuselage

Inspection of the seat belts revealed they were still done up and that all the structural attachments had either failed in overload or become detached from the structure so that they were no longer capable of restraining the occupants. The right landing gear leg was found close to the rear fuselage section and was complete including a small section of wing spar (Figure 7).

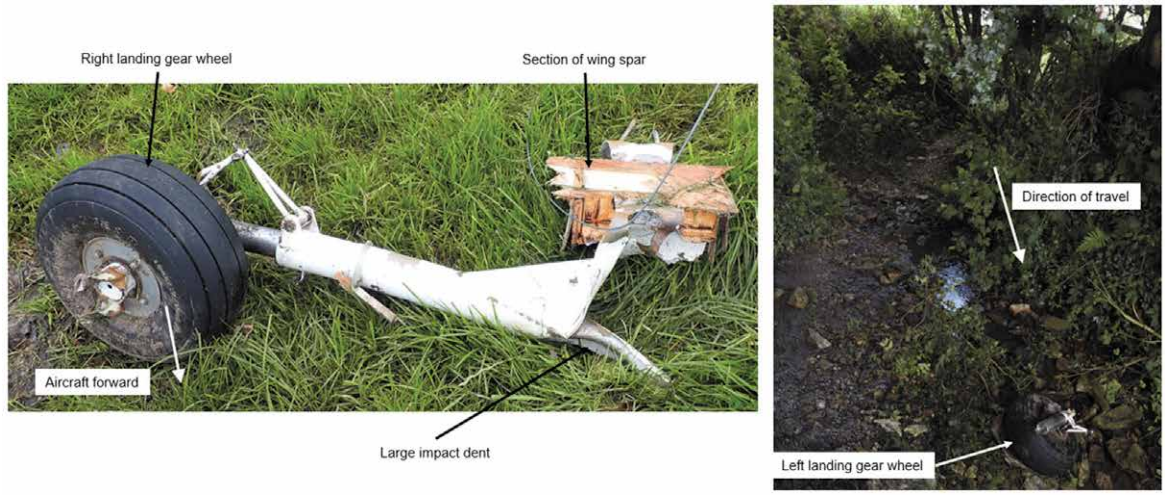

Figure 7

Main landing gear wheels

Recorded information

The aircraft's avionics did not have any recording capability.

A mobile phone was recovered from the accident site by the police and passed to the AAIB. The contents indicated that it was not used to check for weather and not used in flight. There was a change of one of its internal settings recorded at 0917:57 hrs, likely associated with the time of the accident.

A heavily damaged tablet device was recovered from the aircraft. The main logic board had become twisted with a part of it ripped off. Some of the integrated circuits had been damaged and some detached. Damage was largely focused on one end of the board and included a distorted circuit board with the left narrow part detached, a detached chip and a cracked chip (Figure 8). Despite the damage, a specialist organisation was able to recover data from the item.

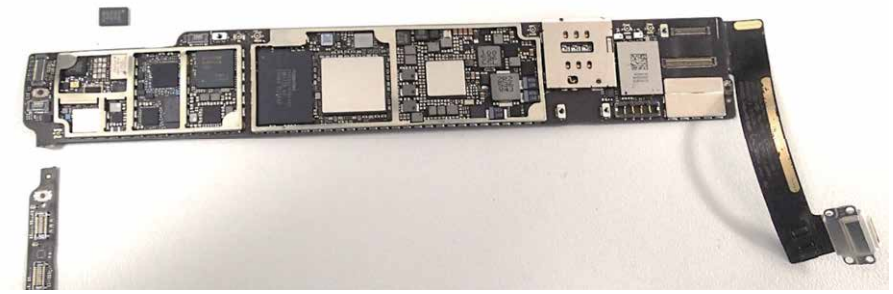

Figure 8

Tablet logic board

The tablet contained an aviation navigation application ("app"), from which route information, flight path and app settings were recovered. The waypoints and path are shown in Figure 1.

A function enabling the app to access the internet in flight was selected OFF. Therefore, there was no access to the latest weather information from within the app once airborne.

The weather information was last updated the day before the accident. The NOTAM information was last updated approximately 17 minutes before the end of the accident flight. Given that internet access was off, preventing an update, this indicates that the pilot had changed which NOTAMs were hidden or unhidden.

The recorded track of the aircraft stopped an estimated 27 seconds before the final impact. This was during the start of a turn to the left, close to the accident site. The recorded file showed that tracking was not stopped due to user input. The app company stated that there was no explanation for the loss of this period associated with the app itself. However, it also stated that any buffering delays of the underlying tablet operating system were not known.

The data from the tablet was reviewed for other relevant activity outside of the use of the app. It showed that at 0519 hrs on the day of the accident, weather information for St Mary's (Isles of Scilly), Sidmouth, Bodmin and Exeter was checked on a BBC website. The tablet contained a screenshot of the weather information for Exeter taken at 0519 hrs (Figure 9). As the information is not intended for aviation use, it provided insufficient cloud information for aviation use, summarising the weather as "*Light cloud and a moderate breeze*".

Figure 9

Screenshot from the tablet – (times are UTC +1)

Radar

Primary radar data from airfield installations along the flown route were provided by the respective airfield ATC units. The operator of enroute radar facilities found primary radar tracks for large parts of the flight path, aiding the investigation early on and corroborating track data later recovered from the navigation app.

The aircraft was fitted with an ATC transponder but was not detected by secondary radar until the D&D Cell asked the pilot to switch the transponder on. The secondary radar recordings from Clee Hill and Burrington radar facilities were provided. Burrington radar provided the most complete recording of the end of the flight but stopped approximately 2,000 ft above the accident site. Figure 10 shows the data for the duration of the secondary radar recording and data from the navigation app over the same period.

Burrington's radar antennas swept the area every 8 seconds. The next sweep after the last recorded radar return did not detect the aircraft, either because the transponder antenna was obscured by an unusual aircraft attitude, or because the aircraft had rapidly descended below the line of sight of the radar. Such a descent would have required a loss of approximately 1,700 ft in 8 seconds, equating to a descent rate in excess of 12,750 ft/min.

Radio transmissions

RT recordings were obtained from the NATS Swanwick facility where the D&D Cell is located and from Exeter ATC. The recordings included telephone conversations between the two facilities associated with the aircraft, pertinent extracts of which are provided in the *History of the flight* section of this report.

Aerodrome logs and recordings showed no communication with the aircraft other than those described in the *History of the flight* section.

CCTV

CCTV from a local farm did not show the aircraft but provided evidence of the visual conditions before, during and after the accident (Figure 11). The times shown compensate for errors in the embedded timestamps.

The tree line that is about 360 m from the camera was clearly visible in the recorded image an hour before the accident but was no longer visible in the period leading up to and after the accident. Trees about 170 m from the camera also became hazy at about the time of the accident. Ground level visibility significantly improved over the next hour.

The CCTV camera recordings included audio. Audio from one of the cameras captured the sound of the aircraft propellor intermittently for about 90 seconds before the aircraft contacted the ground. The pitch of the audio varied in this period, reflecting a combination of a higher propellor speed due to airspeed or throttle changes, and distortion of the pitch by travelling towards or away from the audio recording device.

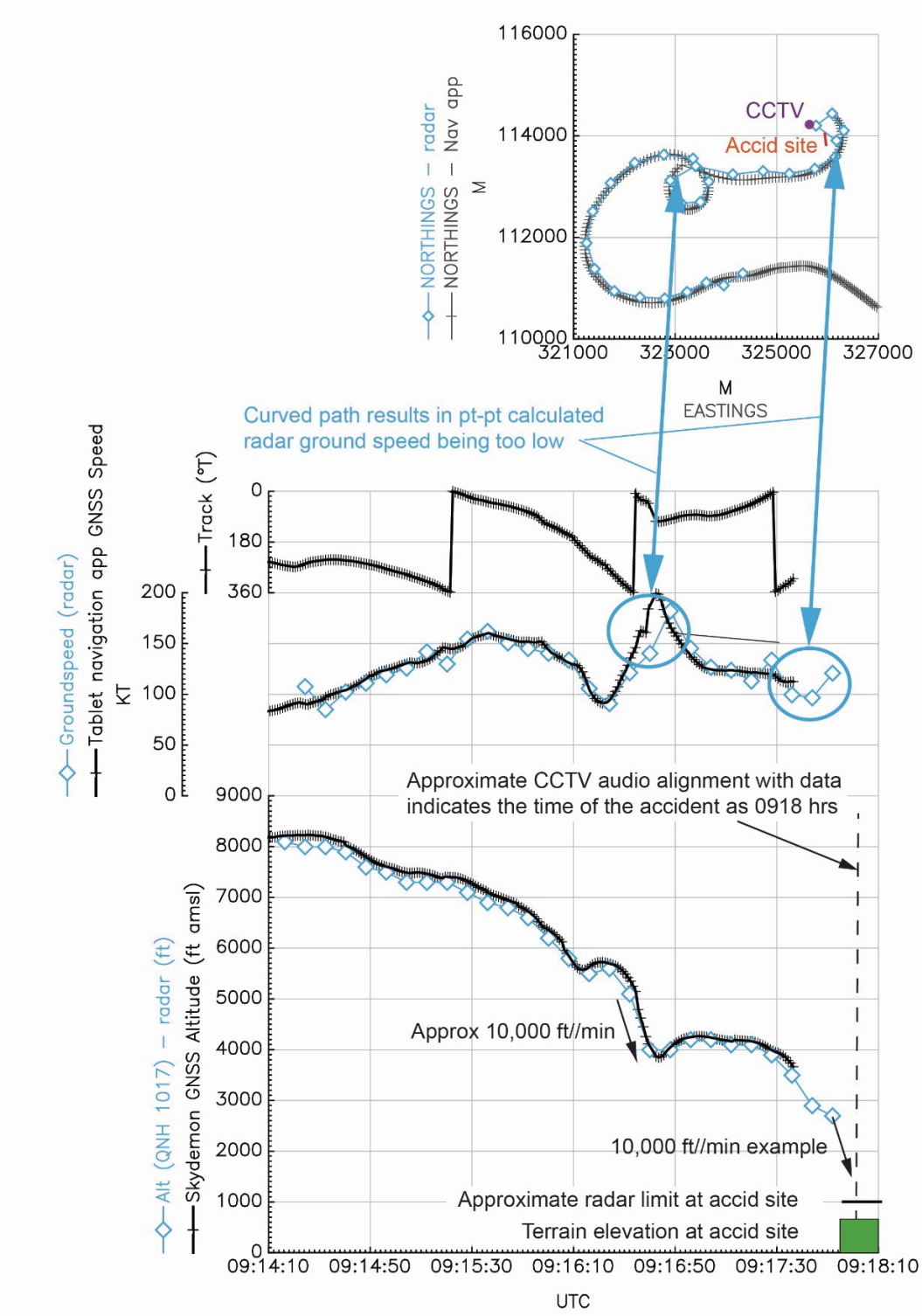

Figure 10

End-of-flight radar, navigation app data and CCTV audio signature data

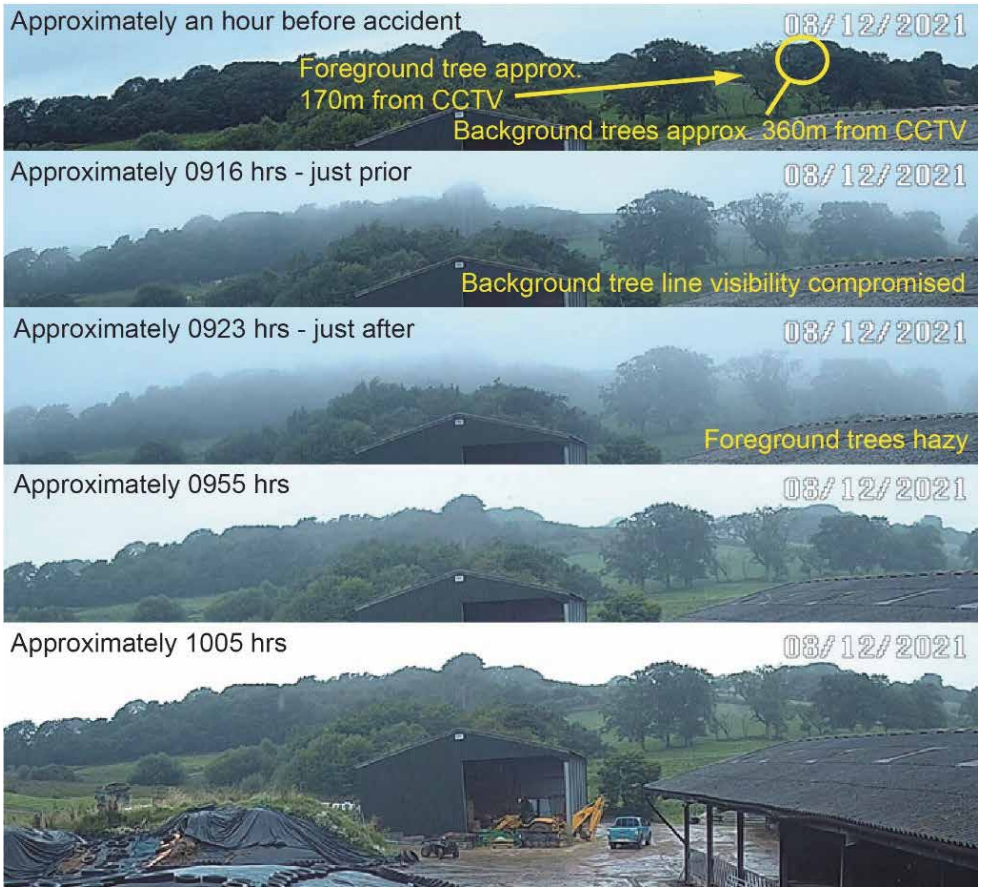

Figure 11

Cropped snapshots from one of the CCTV cameras on a local farm showing changing visibility in the area

Final descent

The audio characteristics, proximity of the first left turn to the accident site, the altitude above the terrain and the expected radar line of sight capability in the area, indicate that the aircraft flew another tight left turn after the end of the radar recording. If there were no significant changes to throttle settings, the audio indicates that the final turn was associated with higher speeds than the previous 10,000 ft/min / 200 kt descent, followed by a brief reduction in speed before impact with the terrain.

Other traffic

There was military jet activity east of Exeter during the later stages of G-BXBU's flight. Comparison of the recorded aircraft paths showed that this traffic was not close enough laterally or vertically to have influenced the accident aircraft directly. The recorded radio communications with the accident pilot did not suggest the traffic had interacted in any way that had affected the controllability of G-BXBU.

Aircraft information

The Mudry Cap 10B is a low wing aerobatic aircraft predominantly constructed from wood and powered by a Lycoming AEIO-360 four-cylinder engine with a fixed pitch, wooden propeller. The pilot and passenger sit side-by-side and it is certified for flight under VFR only.

The wing is a single piece with a main spar of spruce and birchwood. It is covered with 2 mm thick plywood and fabric. The fuselage is a spruce lattice structure covered with fabric with the vertical fin an integral part.

There were two fuel tanks, each having a capacity of 20 gallons, located within the fuselage. The primary tank was forward of the instrument panel and behind the engine firewall. The auxiliary tank was under the baggage compartment to the rear of the cockpit. The tanks were constructed from thin gauge aluminium sheet and secured to the aircraft structure by steel straps.

Each seat was fitted with a five-point harness which was attached the aircraft structure; the lower fixings to the main spar and the shoulder straps to the upper cockpit structure. In addition, a secondary lap strap belt was also provided which was secured to the main spar.

Aircraft examination

The aircraft was recovered to the AAIB facilities where it was laid out to confirm that all the aircraft had been at the accident site. No significant items were missing. Along with the identifiable structural items, the flight control systems were also laid out and examined to verify continuity (Table 1).

System	Components	Breaks	Comments
Ailerons	Cables, push pull rods, bell cranks	Yes	Push pull rods broken through bending
Elevator	Cables, push pull rod	Yes	Push pull rod broken through bending
Elevator trim	Cable	No	
Rudder	Cables	Yes	Cables cut during aircraft recovery
Flaps	Push pull rods, bell cranks	Yes	Push pull rods broken through bending

Table 1

Flight control continuity

The AAIB determined that the damage to the engine was probably sustained during the impact and no evidence was found of any anomalies that would have prevented normal operation.

Meteorology

METAR and TAF information is shown in Appendix 1. A TAF was available for St Mary's from 0629 but not all relevant en route or alternative aerodromes had begun reporting for the day. However, the pilot lived 35 minutes from Watchford Farm and while some weather forecasts for relevant aerodromes had become available by the time the flight departed, it may not have been practical for the pilot to access them after he left home. There was a weather forecast for below 10,000 ft published at 0312 hrs by the Met Office (Figure 12). Although this forecast was valid at 1200 hrs, it was available before G-BXBU departed and indicated the weather conditions which were expected along the planned route.

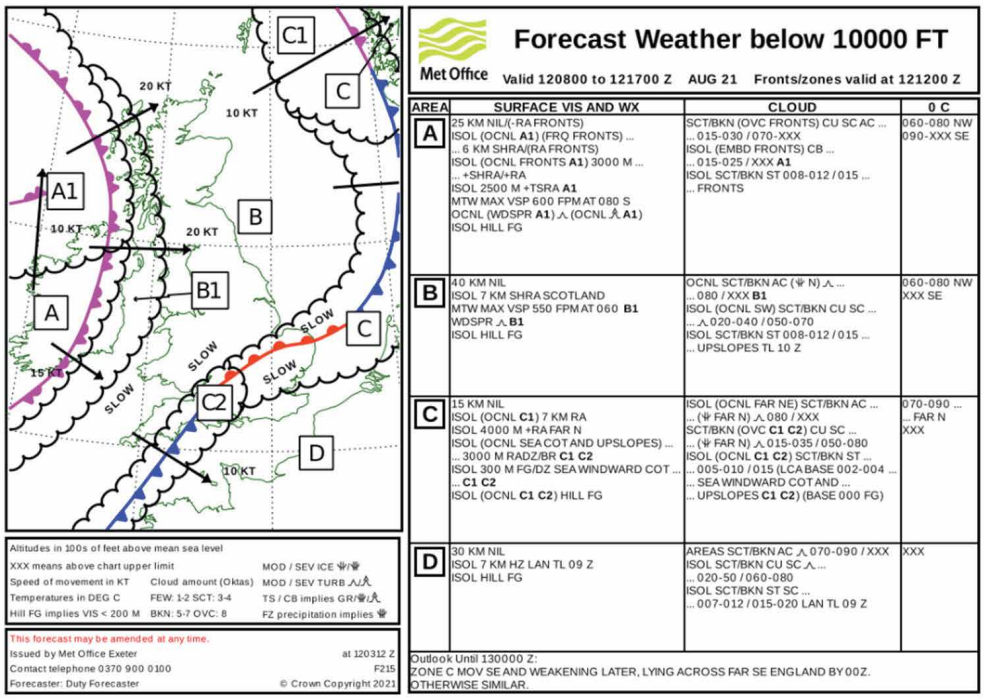

Figure 12

Met Office forecast for below 10,000 ft

During the investigation the Met Office provided the following interpretation of forecast conditions in south-west England:

> *'Conditions [in area C2] were expected to be generally 15KM visibilities* [sic]*, but occasional areas of rain with 7000 m visibilities, isolated (occasional for upslopes) areas of rain and drizzle or mist with visibilities of 3000 m, and occasional areas of hill fog. There were expected to be isolated areas of scattered/broken altocumulus with bases of 8000 ft and tops of 10000 ft or above, overcast cumulus or stratocumulus cloud with bases 1500-3000 ft and tops of 5000-8000 ft, occasional areas of scattered or broken stratus with bases 500-100 ft and tops 1500 ft, locally bases of 200-400 ft on upslopes and at the surface in the hill fog. The freezing level was expected to be at or above 10,000FT.'*

Approximately 30 minutes before the aircraft departed from Watchford Farm, several METAR's and TAF's relevant to the planned route to St Mary's were published, indicating a deterioration in weather conditions, locally and at the planned destination.

The navigation app used for flight planning the previous evening displayed the then most recently published METAR and TAF weather information for the airfields along the planned route. There was no evidence the app was used to assess the weather on the day of the accident flight. The screenshot of Exeter weather which was accessed through the news website indicated cloudy conditions, with the temperature increasing throughout the day.

It was not possible to reproduce exactly what weather would have been presented on the app at a particular time. However, it probably generated weather for Yeovilton Naval Air Base, Exeter Airport, Newquay Airport, Culdrose Naval Air Base, Land's End Airport and St. Mary's Airport. The actual and forecast conditions for these aerodromes available at 0600 hrs, 0630 hrs and 0900 hrs are available in Appendix 1. These weather reports show a marked deterioration in the conditions as the morning progressed; the extent of the poor weather was not evident in the early morning reports.

Witnesses who were flying locally at the time of the accident described the weather conditions as 'intermittent IMC' with areas of VMC between 3,000 ft and 4,000 ft. Figures 13 and 14 shows satellite imagery of the cloud cover along the south coast.

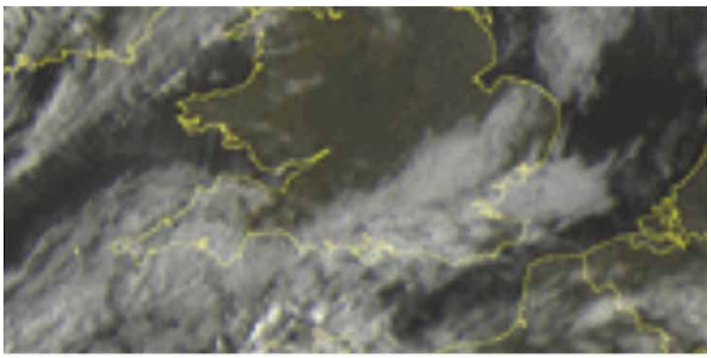

Figure 13

Satellite image at 0700 hrs

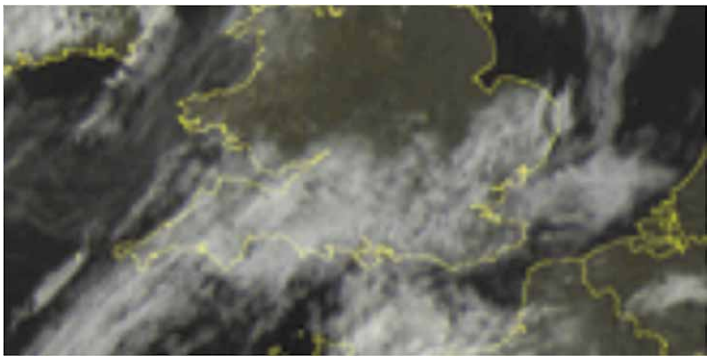

Figure 14

Satellite image at 0915 hrs

Both Birmingham Airport and Gloucestershire Airport were within 90-minutes flying time of the aircraft's position during the emergency. Both reported 1-2 octas of cloud and good visibility; conditions that were suitable for flying a visual approach.

Aids to navigation

Although not required for the planned flight, G-BXBU was fitted with a pressure altitude reporting Secondary Surveillance Radar (SSR) transponder. The transponder was not switched on during the flight until requested by the D&D controller, after the pilot had declared an emergency.

The UK Aeronautical Information Publication (AIP) states that, where fitted, pilots shall operate the transponder to the full extent of its capabilities. The retention by the UK of the relevant EU Regulations means that the Standardised European Rules of the Air (SERA) apply to aircraft operating in UK airspace. SERA.13001[6] states:

> *'1. When an aircraft carries a serviceable SSR transponder, the pilot shall operate the transponder at all times during flight, regardless of whether the aircraft is within or outside airspace where SSR is used for ATS purposes.*
>
> *2. Pilots shall not operate the IDENT feature unless requested by ATS.*
>
> *3. Except for flight in airspace designated by the competent authority for mandatory operation of transponder, aircraft without sufficient electrical power supply are exempted from the requirement to operate the transponder at all times.'*

Aerodrome information

Watchford Farm has two grass strips, 08/26 and 04/22, both of which are 400 m long and 20 m wide. The airfield elevation is 840 ft amsl.

Exeter Airport is an international airport with one runway, 08/26. The landing distance available on Runway 26 is 2,036 m. The airport has regular commercial traffic and has various instrument approaches available for both runways.

Personnel

Background

The pilot had a total flight time of just over 1,400 hrs. He held a valid PPL(A) with a valid Single Engine Piston (SEP) rating issued by the CAA, and his medical was in date. He had completed a total of 1.5 hrs of instrument flying during his initial PPL training 21 years earlier.

Footnote

[6] The retention by the UK of the relevant EU Regulations means that the SERA apply to aircraft operating in UK airspace *'Standardised European Rules of the Air'* Annex: Rules of the Air Section 13, available at https://www.easa.europa.eu/en/document-library/easy-access-rules,https://www.easa.europa.eu/en/document-library/easy-access-rules/online-publications/easy-access-rules-standardised-european?page=20 accessed 1 November 2022.

The pilot had owned G-BXBU since 2014 and it had been hangered at Watchford Farm since 2015. He was described by flying acquaintances as a 'fair weather' flyer. It was reported that he did not routinely request an ATC service, nor did he operate the aircraft's transponder.

The passenger had no flying experience but was known to have flown previously as a passenger in G-BXBU.

Pre-flight planning

The day before the accident, the pilot contacted St. Mary's Airport by telephone to make a prior permission request for his flight the following day. During that call, the pilot indicated that he intended to land at Bodmin Airfield should the weather at St. Mary's not be suitable.

Air traffic control

Air traffic control assistants

Air traffic controllers may delegate some of their responsibilities, including duties which are closely associated with the safety of aircraft (such as phone calls regarding flight data), to adequately trained support staff such as air traffic control assistants (ATCAs). The responsibilities which can be delegated must not require an air traffic control licence. The Exeter assistant and D&D support controller were not licenced to make decisions concerning the diversion of G-BXBU.

Management of emergencies

The Manual of Air Traffic Services (MATS) Part 1 contains procedures, instructions and information intended to form the basis of air traffic services in the United Kingdom. Section 5 *'Emergencies'* states that pilots should contact an ATSU as soon as it becomes apparent that an emergency situation exists[7], to allow the ATSU to provide the necessary priority and assistance as appropriate to the emergency. There are two states of emergency which are classified and declared as follows:

> *'Distress: defined as a condition of being threatened by serious and/or imminent danger and of requiring immediate assistance. Distress is indicated by the words "MAYDAY MAYDAY MAYDAY" being spoken on the RTF.*
>
> *Urgency: defined as a condition concerning the safety of an aircraft or other vehicle, or of some person on board or within sight, but does not require immediate assistance. Urgency is indicated by the words "PAN PAN, PAN PAN, PAN PAN" being spoken on the RTF.'*

Annex 10 to the International Civil Aviation Convention (Annex 10) Volume V states that the emergency channel 121.5 MHz shall only be used for genuine emergency purposes

Footnote

[7] 'Manual of Air Traffic Services (MATS) - Part 1' Section 5 Chapter 1 4.1 – Civil Aviation Publication (CAP) 493.

and when normal channels are being utilised by other aircraft, although the UK has filed a difference for the purpose of pilots conducting practice PAN radio calls.

Annex 10 Volume II states that aeronautical stations shall guard and maintain a continuous listening watch on the emergency channel 121.5 MHz during the hours of service of the units at which it is installed[8]. Civil Aviation Publication (CAP) 413[9] states that this ICAO requirement is not applied in the UK. ICAO Annex 10 Vol II further states that the station addressed by an aircraft in an urgency or distress condition will normally be that station communicating with the aircraft or in whose area of responsibility the aircraft is operating, until it is considered better assistance can be provided elsewhere.

MATS Part 1 states:

> *'controllers **shall** offer as much assistance as possible to any aircraft that is considered to be in an emergency situation, including weather information, availability of aerodromes and associated approach aids'. It further states that 'before transferring an aircraft, controllers should obtain sufficient information from the pilot to be convinced that the aircraft will receive more assistance from another unit.'*

The United Kingdom AIP states that distress and urgency communications within the UK Search and Rescue Region (SRR) are in accordance with standard international procedures[10]. It also states that the D&D Cell exercises 'executive control' over emergencies in the London and Scottish FIRs, which encompasses the airspace covering England, Scotland, Wales and Northern Ireland.

The Distress and Diversion Cell

General

The D&D Cell is a military air traffic unit based at the London Area Control Centre at Swanwick. The service the D&D Cell provides is a collaboration between military operators and civil providers – the unit is exclusively operated by Royal Air Force personnel who use equipment owned by a civil air navigation service provider (ANSP). The service provided is described in CAP 413 as unique to the UK.[11]

The minimum requirement to be a D&D controller is to hold a valid area control endorsement (AC EMerg), meaning they are qualified to control air traffic in an area environment. Prior practical experience is not a requirement to become a D&D controller. The D&D Cell commonly receives 'practice PAN' calls and the general aviation community is encouraged to practice these calls during training. Pilots have reported comparatively higher levels of transmission on 121.5 MHz in UK airspace than in other jurisdictions, primarily involving 'practice PAN' calls.

Footnote

[8] 'International Civil Aviation Organisation' (ICAO) Annex 10, Vol II 5.2.2.1.3 & Vol II 5.3.1.5, Vol V 4.1.3.1.1.
[9] CAP 413 – *'Radiotelephony Manual'.*
[10] 'UK AIP' - GEN 3.6.6.1 Search and Rescue, accessed at https://www.aurora.nats.co.uk/htmlAIP/Publications/2021-12-02-AIRAC/html/index-en-GB.html on 2 December 2021.
[11] CAP 413 – *'Radiotelephony Manual'*, Chapter 8.7.

The role of the D&D Cell is to provide military and civil pilots with emergency communication and aid, a position fix service, and a search and rescue alerting service[12] within the Scottish and London FIRs. It achieves this in part by providing pilots with the weather and operational status of an aerodrome, selecting a suitable aerodrome, and providing a steer toward that aerodrome. D&D utilises two boards to display all current military aerodrome weather 'colour codes'[13] across the UK in order to select a suitable diversion. It also has access to a limited number of electronic weather reports from civil aerodromes around the UK; it stated that 51 of the 558 civil airfields are potentially able to provide electronic weather. Details from the other 507 are obtained by calling the aerodrome or farm strips on a landline. The unit may be contacted by civil pilots on the VHF emergency frequency 121.5 MHz and by military pilots on UHF frequency 243.0 MHz, all day and every day.

The D&D Cell has the facility to detect emergency SSR squawks automatically. It can also locate an aircraft's position using VHF Direction Finding[14] (VDF), subject to the aircraft's position and altitude. The service uses the callsign 'London Centre' and the AIP states that it provides coverage over the greater part of the UK above 3,000 ft[15].

According to the structure in place at the time of the accident, when the D&D Cell receives an emergency call directly on 121.5 MHz, it automatically assumes executive control and operational control of the emergency. MATS Part 1 states:

> *'Once D&D hand the aircraft to another unit they pass-over Operational Control but retain Executive Control. This means that D&D do not give up all responsibility for an emergency once the aircraft is working another unit. They retain responsibility for overall management until the emergency ends.'*[16].

Operational control is control by an ATSU directly issuing instructions and support to the emergency aircraft, which should be consistent with the executive control objectives determined by the D&D Cell. The D&D Cell transfers operational control when it completes a handover of the traffic to another ATSU. Guidance for D&D controllers states they are to '*verify before handing Operational Control to another agency, that the receiving controller has been given all the details'*.

If pilots experiencing an emergency are already in communication with a military or civil ATSU, they should request assistance directly from them. Air traffic controllers should inform the D&D Cell of an aircraft emergency[17], at which point the D&D controller assumes executive control. The D&D controller normally delegates operational control back to the ATSU, but this may depend on the circumstances of the event. MATS Part 1 also provides controllers with guidance on selecting the most appropriate controlling agency for managing

Footnote

[12] CAP 413 – *'Radiotelephony Manual'*, Chapter 8.5.
[13] Military METAR reports also display a colour state according to cloud base and visibility.
[14] VDF provides information on the position from which a VHF transmission was made.
[15] 'UK AIP' GEN 3.4 Section 3.2.5 – *Emergency Telecommunications Services*, accessed at https://www.aurora.nats.co.uk/htmlAIP/Publications/2021-12-02-AIRAC/html/index-en-GB.html [accessed December 2022].
[16] CAP 493 – *'MATS - Part 1'* Section 5 Chapter 1 9.1.
[17] CAP 493 – *'MATS - Part 1'* Section 5 Chapter 1 2.5.

an emergency aircraft[18]. The executive control and associated responsibility for managing the aircraft held by the D&D Cell persists until the emergency ends[19].

MATS Part 1 section 5, 9.2 states:

> *'D&D controllers have a detailed knowledge of minor aerodrome availability within their area as well as a comprehensive database that enables rapid communication with aerodromes, Aircraft Operators, ATSUs, and the SAR organisation including Police Air Support Units and the regional emergency services. The D&D Cell can assist a pilot of an aircraft in an emergency and the civil ATSU to select the most suitable diversion aerodrome.'*

MATS Part 1 also states that the D&D Cell do not have detailed knowledge of the local airspace, terrain or obstacles surrounding aerodromes, and may seek guidance on local minimum safe altitudes to serve emergency aircraft. MATS Part 1 further states that ATSUs should not transmit on 121.5 MHz without the authorisation of the D&D Cell, unless the pilot in distress calls a specific local ATSU, or if it is apparent that the D&D Cell is not responding to an emergency transmission.

Responsibility and oversight

The Department for Transport is responsible for the overall provision of the national aeronautical search and rescue (SAR) operations. The initial response to and coordination of aeronautical SAR is integrated with maritime response and is fulfilled by HM Coastguard.

Before 2016, SAR helicopters were operated by the military and organisationally the D&D Cell sat within the military SAR operation. In 2016, SAR operations were transferred to HM Coastguard and since then the Aeronautical Rescue Coordination Centre based at the National Maritime Operations Centre in Fareham coordinates all helicopter and fixed wing SAR assets. These aircraft are operated by civilian contractors.

The responsibilities held by the D&D Cell remained following this transfer of SAR provision from the military to HM Coastguard. The AAIB was not provided with evidence of any agreement documenting the responsibilities with which the D&D Cell was tasked under these new arrangements.

MATS Part 1 is a CAA publication which contains several references to the D&D Cell. However, as a military unit, the D&D Cell is not subject to oversight from the CAA, despite providing a service to the civil aviation community in the UK. The responsibility to ensure the D&D Cell is providing the required level of service, detailed in ICAO Standards and Recommended Practices, is delegated by the Department for Transport to the Ministry of Defence. The D&D Cell is therefore subject to operational oversight by the Military Aviation Authority (MAA).

Footnote

[18] CAP 493 – *'MATS - Part 1'* Section 5 Chapter 1 8.1.
[19] CAP 493 – *'MATS - Part 1'* Section 5 Chapter 1 9.1.

The MAA issues Regulatory Articles (RA's), which provide the framework of policy, rules, directives, standards, and processes; and the associated direction, advice and guidance that govern military aviation activity and against which air safety is assessed. RA 3311[20] details the actions expected of a controller once an aircraft has declared an emergency:

> *'Regulatory Article RA 3311 (1) Controllers Emergency Actions Rationale: Air Systems with emergencies need to be afforded special attention by controllers RA 3311(1) Controllers **shall** offer as much assistance as possible to any Air System that is considered to be in an emergency situation.*
>
> *AMC 3311 (1) On notification that an Air System is suffering an emergency, controllers **should**:*
>
> *a. Inform the pilot of the most suitable aerodrome, considering weather conditions (including winds), terrain and obstructions. The pilot can be offered navigational assistance.*
>
> *b. Coordinate actions with Distress and Diversion and other Air Traffic Control (ATC) units as required and alert crash and rescue facilities.*
>
> *c. Advise other Air Systems of the emergency in progress and, where possible, keep them off the frequency being used by the Air System in distress. If possible, avoid changing the frequency of the Air System in distress once suitable contact is established'.*

In contrast to the description of executive control in MATS Part 1, the D&D Cell has described its executive control as 'administrative'.

Civil Air Navigation Service providers

Responsibility

Although the D&D Cell assumes executive control of all emergencies declared in the London and Scottish FIR's, some aerodromes can also offer civil pilots an effective emergency communications and aid service on 121.5[21]. These airports are listed in ICAO European Air Navigation Plan, Volume I Part II. Exeter Airport is included on this list.

ICAO guidance for air traffic management states that when an emergency is declared by an aircraft, the ATSU should take appropriate and relevant action[22], including:

> *'Take all necessary steps to ascertain aircraft identification and type, the type of emergency, the intentions of the flight crew as well as the position and level of the aircraft; …*

Footnote

[20] 'Regulatory Article (RA) 3311': controllers emergency actions accessed at https://www.gov.uk/government/publications/regulatory-article-ra-3311-controllers-emergency-actions on 2 December 2021.

[21] 'UK AIP' – GEN 3.6.5, accessed at https://www.aurora.nats.co.uk/htmlAIP/Publications/2021-12-02-AIRAC/html/index-en-GB.html on 3 December 2021.

[22] Doc 4444 '(16th ed) – *'Procedures for Air Navigation Services - Air Traffic Management'* (PANS-ATM) Chapter 15.1.1.2.

… 'Decide upon the most appropriate type of assistance which can be rendered'…

…. 'Provide the flight crew with any information requested as well as any additional relevant information, such as details on suitable aerodromes, minimum safe altitudes, weather information;' …

The CAA defines abnormal and emergency situations (ABES) as situations, including degraded situations, which are not routinely or commonly experienced and for which automatic skills have not been developed, and serious and dangerous situations requiring immediate actions. ABES training is included in refresher training programme for ATCOs and should include dealing with aircraft emergencies[23]. Training to prepare controllers to react to ABES events are outlined in CAP 584 – '*Air Traffic Controllers – Training'*.

Exeter Airport did not have a procedure specifically for dealing with VFR traffic stuck above cloud, but the *'Emergencies: general'* aid memoire was available to controllers (Figure 15).

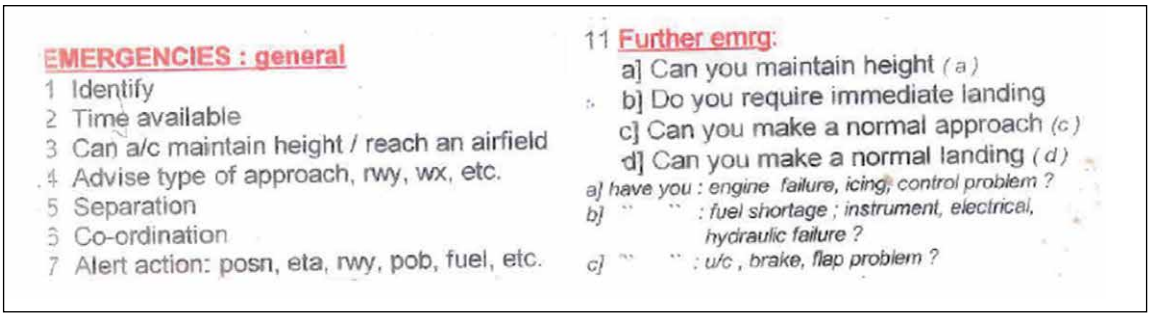

Figure 15

Exeter Airport *'Emergencies: general'* and *'Further emergency'* procedures

The controller on Radar South did not utilise a specific ABES procedure or checklist prior to accepting G-BXBU or during her transmissions with the pilot. She referred to G-BXBU as a 'weather diversion' on several occasions, not as an aircraft that had declared an emergency. Although the controller stated she knew the aircraft had been in radio contact with the D&D Cell, and the emergency squawk of 7700 was visible on her screen, the status of G-BXBU's emergency was not interrogated and no handover from the D&D controller was sought. There was no verbal acknowledgement that its pilot might require additional assistance to that of a routine arrival to Exeter.

Exeter Airport follows a unit training plan which details the training and assessment requirements for controllers.

Footnote

[23] CAP 584 – '*Air Traffic Controllers – Training'*.

Section 3 of the unit training specifies the required training for ABES. It states:

> *'Staff must be able to establish some basic information as early as possible. When appropriate ascertain:*
>
> *Nature of the problem*
>
> *Intentions of personnel (e.g. aircraft crew or emergency services)*
>
> *Time available*
>
> *Additional information'*

It advises that ATC staff should be aware that aircraft emergencies are not always announced as such, and that staff should be prepared to act in response to events if it is thought an emergency is developing, even without a 'PAN PAN' or 'MAYDAY' call.

Controllers are periodically assessed on a variety of emergency scenarios described in the unit training plan. In one scenario described in the *'Aerodrome'*, *'Approach control'* and *'Approach control surveillance'* sections of the plan, '*a pilot makes a PAN or MAYDAY call, or other information indicates an emergency situation'*, indicating this is a scenario which controllers would be expected to manage effectively.

Instrument approaches

The controller initially told the pilot to expect an ILS approach, followed very shortly by a change of plan to an SRA approach, both of which are instrument approaches. To fly an instrument approach the aircraft must have appropriate instrumentation, and the pilot must be trained to fly in IMC and hold a valid instrument rating. The pilot of G-BXBU was not licenced to fly in IMC and the aircraft was not equipped to carry out an ILS approach.

An SRA is an instrument approach flown by the pilot according to ATC heading and rate of descent instructions. The controller assesses the aircraft position and height on radar and, when required, issues corrective headings and descent rates to regain the desired approach path. The minimum obstacle clearance height for a category A aircraft on an SRA approach to Runway 26 at Exeter is 788 ft.[24]

SRA approaches are not part of the PPL syllabus and are not commonly flown by pilots outside a training environment.

MATS Part 2 contains local operating procedures specific to each ATC unit. MATS Part 2 for Exeter Airport states:

> *'Unless otherwise stated inbounds receiving a radar service are to be offered vectors for an ILS approach. The pilot will request if an alternative type of approach is required, including positioning themselves to the ILS.'*

It is not clear how this applies to VFR traffic.

Footnote

[24] Doc 8168 (5TH Ed) – *'Procedures for Air Navigation Services - Aircraft Operations Volume I'*, Flight Procedures-Section 4 Chapter 1.

Visual Flight Rules

Flights conducted under VFR are permitted in VMC by day outside Class A airspace in the UK. The pilot of G-BXBU ordinarily flew in uncontrolled Class G airspace. He did not routinely file a flight plan with ATC and he had not done so for the accident flight. There is no requirement for VFR flights in Class G airspace to file a flight plan. Aircraft operating in uncontrolled airspace may request an air traffic service[25]. VFR flights in Class G airspace are entitled to request a Basic or Traffic Service. IFR flights in Class G airspace are entitled to request a Basic, Traffic, Deconfliction or Procedural Service. The pilot in G-BXBU retained responsibility for avoiding collisions and terrain.

The meteorological conditions in which aircraft are permitted to operate under VFR, are determined by the class of airspace, altitude and airspeed. The applicable VMC minima while operating outside controlled airspace are described in Table 2 (G-BXBU was flying at less than 140 kt).

Below FL 100	Below 3,000 ft
5 km visibility 1500 m horizontal separation from cloud 1000 ft vertical separation from cloud	As per below FL 100. ***or*** 5 km flight visibility, clear of cloud, insight of the surface ***or (if operating at less than 140 kt)*** 1500 m visibility, clear of cloud, in sight of the surface

Table 2

VFR Weather Minima outside controlled airspace

The airspace around Exeter Airport is an Air Traffic Zone (ATZ) with a radius of 2.5 nm centred on the airport, rising to an altitude of 2,102 ft. An ATZ conforms to the class of airspace in which it is situated, so the Exeter ATZ is considered Class G airspace. However, a pilot must obtain permission from the ATSU at the aerodrome to fly, take off or land within an ATZ[26].

Instrument flying

Training

The CAA PPL syllabus includes one flight exercise in which students are introduced to basic instrument flying. The PPL skills test includes simulated entry into IMC, following which the student must complete a 180° turn. The student must also demonstrate consideration of the relevant safety factors. The biennial SEP revalidation flight test does not require any additional training on inadvertent entry into IMC or for pilots to demonstrate recovery from a simulated entry to IMC.

Footnote

[25] CAP 1434 – '*UK Flight Information Services'.*

[26] ''*Guide to Visual Flight Rules (VFR) in the UK*', Civil Aviation Authority, available at https://www.bfgc.co.uk/VFR_Guide.pdf [accessed April 2023].

Instruments

G-BXBU was not certified to fly in IMC or icing conditions. It did however have some instruments installed which would aid IMC flight, such as an attitude indicator (AI). The AI on G-BXBU was a Horizon Bendix J-8 model (Figure 16), featuring yellow markings on an entirely black background. In more modern AI's the symbolic sky and ground have representative colourings that are more instinctive in helping pilots to determine the attitude of the aircraft without outside visual reference (Figure 17).

Figure 16
Horizon Bendix J-8 Model

Figure 17
Example of modern AI design

Spatial disorientation

A pilot's spatial orientation, although supported by other senses, relies heavily on external visual references. An obscured visual horizon, false horizons from cloud tops or ground lights, or featureless terrain coupled with conflicting information from other senses such as vestibular and proprioceptive, can lead to spatial disorientation in flight.

There are five primary contributory factors which may lead to a pilot experiencing spatial disorientation:

Environment – cloud/ poor visibility resulting in little or no horizon

Manoeuvres – turns and spins which disturb the vestibular system

Pilot – training and practice in instrument flying, workload and distraction

Aircraft – AI size, colour and ease of interpretation

Health – congestion and other physiological factors affect proper function of the vestibular system

There are two classifications of disorientation – unrecognised (Type I) and recognised (Type II). Pilots recognising they have become disorientated should transfer to flying on instruments and believe them. In an unrecognised event, the pilot will feel normal until

seeing the ground in the wrong place, understanding that the instruments look 'wrong', or until ground impact. In both cases, the pilot requires skill to maintain or recover the aircraft to a safe attitude until the required visual reference can be established.

Human performance

Decision making and workload management

The pilot of G-BXBU was making decisions under increasingly uncertain conditions as he ruled out his planned destination, home airfield and a chosen diversion airfield due to bad weather. This led to him seeking external assistance, in this case contacting the D&D Cell with the intention of finding a suitable diversion airfield.

A person's ability to make effective decisions is limited by, amongst other things, knowledge, skill and the ability to process information. Everyone will reach a point where there is too much information to process, or too many tasks to complete, for them to do so effectively – known as 'cognitive saturation'. An increase in workload to the point where mental capacity is reached, results in a degradation in the ability to process information. This weighs subsequent decision making towards using prior knowledge or experience rather than assessing the current circumstances and solving a novel problem with a novel solution. A pilot with reduced capacity may choose to land or divert to an airfield with which they are familiar, even if it has comparably poor weather conditions or with comparably complex approaches available. When there is limited cognitive space to analyse all options, this previous success and familiarity become important factors in the decision-making process.

Instrument flying is considered a more difficult cognitive task than flying visually. Research on pilot mental workload in flight showed that pilots who do not routinely fly on instruments reported higher levels of estimated mental workload when flying on instruments than when landing or taking off[27]. Inadvertent or unplanned flight into IMC will add further stress to a pilot who is not prepared to do so and is likely to consume the attention of the pilot to the point were making decisions beyond the immediate task of flying becomes more challenging. Anything that adds to the pilot's workload, such as communication from ATC or preparing for an unfamiliar approach, will increase the likelihood of the pilot reaching cognitive saturation.

Communication

Effective communication is necessary to achieve safe outcomes. Without normal bodylanguage cues ordinarily available to assist in the transfer of information, the standardisation of verbal communications has long been recognised as an effective way to avoid or mitigate potential ambiguity or misunderstandings in communications. This includes the phonetic alphabet and standard phraseology[28] which are well accepted norms within the industry. Although often considered in the context of pilot-to-controller or pilot-to-pilot

Footnote

[27] '*An Analysis of Mental Workload in Pilots During Flight Using Multiple Psychophysiological Measures*', Glenn F. Wilson in The International Journal of Aviation Psychology 12:1, pp 3-18, 2002.

[28] Doc 9432 – *'ICAO Manual of Radiotelephony'.*

interaction, the premise is relevant for all communication containing safety critical content – including between controllers and assistants.

CAP 584 – '*Air Traffic Controllers – Training'* states that effective communication in normal and emergency scenarios, and human factors training, shall be assessed as part of controller refresher training[29]. CAP 737 – *'Flight Crew Human Factors Handbook'* states that although UK ANSP's '*tend to have different views on HF training, but in the main the concept of CRM and human factors has transferred across to Air Traffic Control'*[30]. CAP 737 also suggests that exposure of pilots and controllers to each other's operational environment can be beneficial, although it is not a requirement for initial or refresher training for pilots or controller's. In the past, controllers in the UK received some flight training, but this is no longer the case.

The Exeter Airport human factors refresher training plan for the unit included team resource management, fatigue management and stress management. Eurocontrol[31] suggests that a breakdown in teamwork makes it more difficult for an individual or team to identify and correct weaknesses in monitoring pilot actions, communication between ATC personnel (including handovers) and between controllers and pilots[32] .

Further guidance for controllers can be found in CAP 745 *'Aircraft emergencies – Controller considerations'*, which provides guidance for controllers to understand the challenges which may be faced by flight crew during an emergency. It is primarily focused on commercial multicrew operations.

There is no training or guidance for controllers on stress responses that a general aviation single-pilot might experience during an emergency, how this may manifest and mitigation strategies which could be employed.

Checklists

Following checklists is a simple and well-established process, particularly when dealing with abnormal events. They provide an additional safety barrier where personnel are often operating outside their normal routines and with elevated levels of stress. Checklists can be used to ensure critical actions are completed, or that critical information required to inform the decision-making process is obtained. Their use can free mental capacity to create novel plans whilst ensuring those critical tasks are not missed. While the use of checklists is embedded in most aircraft operations, this concept has not transferred to ATC to the same degree.

Footnote

[29] CAP 584 – *'Air Traffic Controllers – Training'* - Chapter 12 pp 52.
[30] CAP 737 – '*Flight Crew Human Factors Handbook'.*
[31] Eurocontrol is a pan-European organisation that provides technical and civil-military expertise in air traffic management.
[32] Team Resource Management, Guidelines for the Implementation and Enhancement of TRM, Eurocontrol, 2021.

There is no reference to checklists in MATS Part 1 and ATSU's are not required to use them in emergency and abnormal events. Exeter Airport did have a list of procedures and aide-memoire's[33], including *'Emergencies: general'*. This aide-memoire was available at controller stations but not used routinely. The D&D Cell similarly stated they did not follow mandatory checklists in response to abnormal or emergency events.

Analysis

The accident

There was no evidence of any aircraft defects before impact that might have affected its controllability. It was not possible to determine the speed at impact with the large tree but the spread of wreckage and distance travelled by some of the larger pieces indicate it was probably greatly in excess of normal landing speed.

Decision to fly

When the pilot checked the weather information online at 0519 hrs, it indicated that at Exeter there would be light south-westly winds throughout the morning with less than 20% chance of rain. Weather forecasts for aerodromes along the planned route deteriorated throughout the morning and the extent of the poor weather was not reflected in the weather information available at 0600 hrs.

It was not possible to establish the extent of any additional weather planning the pilot carried out before departure. The forecasts available when he left home differed significantly from those that became available before G-BXBU took off.

In the absence of sufficient weather reports earlier in the day, the pilot could have delayed the flight until all relevant forecasts were available. There was an indication of poor weather enroute in the Newquay forecast available at 0600 hrs. There were no reports for the destination until the METAR at 0620 hrs and forecast at 0629 hrs, the latter showing that low cloud was expected at the time of arrival and, although the forecast conditions may have been sufficient to operate under VFR, it indicated the weather might deteriorate close to VFR limits. The conditions were sufficiently poor to merit reconsidering the flight or having a diversion plan to mitigate the risk posed by the low cloud base if the flight went ahead.

There were clear skies when the flight departed, which may have reinforced the pilot's belief the conditions were suitable for the intended flight. Nevertheless, there was sufficient ambiguity or indication of poor weather to suggest conditions might not be suitable for VFR flying.

In-flight decision making

It is likely the marked deterioration in the weather as the flight proceeded towards St Mary's prompted the pilot not to continue to his planned destination. His stated intention to divert to

Footnote

[33] An aide memoire in this context has the same function and purpose as a checklist.

Bodmin demonstrates a degree of contingency planning, but it is not possible to know if he considered an enroute diversion, because he was not communicating with air traffic control.

It is difficult to create novel plans while under pressure and, in the absence of an obvious alternative option, it was logical the pilot attempted to return to his home airfield where he was familiar with the local flying environment and where skies were clear when he departed.

The investigation determined that at the time of the accident there were at least two aerodromes available with weather conditions suitable for G-BXBU to conduct a visual approach, offering the possibility of a safe outcome had the conditions been checked.

Instrument flying skills

The pilot had logged the minimum instrument flight training required by the PPL syllabus at the time of his initial training. It is unlikely this training enabled him to deal with this event as it was limited in scope and completed more than 20 years ago, and there is no requirement for pilots to revisit the basics of instrument flying in subsequent licence revalidation checks. It is possible the pilot had not even discussed the topic of inadvertent flight into cloud in a training setting since his initial skills test, where executing a level 180° turn is demonstrated.

Planning the response to an abnormal or emergency situation in advance increases the chance of success, saving time and mental capacity when dealing with the emergency in flight. Without a plan, experience or recent training to flying in IMC, there was a high risk that the pilot would become spatially disorientated when trying to conduct an instrument recovery to a diversion airfield. The simple AI display probably increased the challenge.

Pilots will be better prepared to deal with these factors if they are more aware of them. The following recommendation is therefore made:

Safety Recommendation 2023-011

It is recommended that the Civil Aviation Authority publish guidance for general aviation pilots on responding to unexpected weather deterioration, highlighting the factors affecting their performance and the benefits of planning before the flight how they will respond.

Transponder

The pilot did not comply with regulations requiring the use of transponders when fitted. Had the transponder been operating throughout the flight, it would probably have enhanced Exeter ATC's situational awareness when concern arose about a potential conflict between G-BXBU and the military jet which was holding in the vicinity. It is not possible to know what effect this would have had on the outcome of the accident flight. It is not known if the pilot monitored the relevant frequencies and if Exeter could have contacted him earlier. When the pilot did contact the D&D Cell, he turned on his transponder and both the D&D Cell and Exeter could then see his altitude on secondary radar.

Communication

The pilot's first contact with the Dunkeswell A/G operator was pivotal because the pilot, who rarely communicated with ATC, began to request, and accept external influence in the decision-making process for the flight.

On making first contact with the D&D Cell, the pilot immediately declared an emergency and requested assistance, explaining that he was stuck above cloud and needed to divert to somewhere nearby. In response to a request by the controller, he confirmed he was currently above cloud and had 1.5 hrs fuel endurance. This provided sufficient information to indicate there was no immediate pressure to provide the pilot with a solution. Despite the potentially very stressful situation, the pilot succeeded in asking for help when it is likely his ability to solve the problem himself had diminished.

It is not possible to know why the pilot made a 'PAN' call in preference to 'MAYDAY' when he declared an emergency on 121.5 MHz but, given his 90-minute fuel endurance, he may not have considered he was in immediate danger. Whether a PAN or MAYDAY call was made, it should not have affected the response by ATC to support G-BXBU. Guidance to controllers considers both states to be an emergency, the response to which (the application of the ATC emergency procedure) is the same. The CAA definitions distinguish between PAN and MAYDAY based on the immediacy of the emergency, not on the nature of support required. When the D&D controller advised that Exeter was willing to accept the aircraft, it is unlikely the pilot had the knowledge or mental capacity to question this plan, particularly as he had declared an emergency and shared relevant information about his problem with the D&D controller. In his transmission to Exeter ATC the pilot said, *"I've been diverted",* a passive phrase that suggests it was not something he chose to do himself.

The D&D controller does not appear to have considered what options were available to the pilot. In order to select viable diversion aerodromes, a controller would need to know at least the capabilities of the aircraft and pilot to fly in the conditions likely to be encountered.

To provide effective assistance controllers must provide practical guidance that can be understood by pilots in distress, and an intervention is more likely to be successful if the controller recognises when a pilot has a reduced capacity to respond.

Pilots might assume that agencies providing emergency assistance to aircraft will check the weather of potential diversion aerodromes. In this event, controllers do not appear to have considered whether the pilot and aircraft were capable of diverting to Exeter, and there was no obvious attempt to match the style of communication to the circumstances. (For example, whilst not incorrect, phrases such as "deconfliction service" and "ILS approach" may not have been useful or reassuring to a pilot with his experience or qualifications.) In part this may be because controllers are not sufficiently aware of the factors influencing human behaviour under stress, or how to address them.

CAP 745 aims to provide controllers with a flight crew's perspective on ATC communications in an emergency and is phrased in a manner that may make it more applicable to professional pilots. Pilots of light aircraft often operate in a less formal environment and

with less frequency, and much of the information in CAP 745 may not transfer to the general aviation environment. MATS Part 1 states that 'calm and coordinated actions are essential' when dealing with emergencies but does not specifically address pilot stress reactions and the assistance which might be provided to account for it. Accordingly, the following Safety Recommendation is made:

Safety Recommendation 2023-012

It is recommended that the Civil Aviation Authority require air traffic controllers to receive training regarding the human performance characteristics and limitations associated with stress. This should include the verbal cues that may indicate that a pilot is operating under high stress, and mitigation strategies to help controllers deal with such events.

The D&D controller stated that he made assumptions based on the phone call received by the D&D support controller from the Exeter assistant. The Exeter assistant, who was not a controller qualified to make decisions about air traffic, did not identify herself as such on the phone, and the D&D support controller did not check her status when this information was omitted. The first assumption made by the D&D controller was that the Exeter assistant was a controller; the second, that the phone call had been instigated because an Exeter controller had heard G-BXBU make a 'PAN' call on the emergency frequency and intended to offer assistance. However, the practical application of D&D's executive control is that the D&D controller would take the lead in making an assessment, then contact an aerodrome which they deemed suitable, not the other way round.

The D&D controller advised the pilot that Exeter was willing to accept the aircraft, within seconds of the D&D support controller telling him this (Appendix 2), leaving no time to assess the suitability or practicality of this suggestion.

The D&D controller did not independently check the weather conditions at Exeter and a handover between controllers did not take place. The D&D controller stated he did not want to delay the transfer of G-BXBU to Exeter, based on the understanding that his support controller was speaking directly to a controller. However, as the aircraft had a stated fuel endurance of 1 hour and 30 minutes, there was no need to expedite the transfer at the expense of a full handover.

The phone call to the D&D Cell was made by the Exeter assistant regarding the military jet holding locally; it was not for the purpose of assisting an aircraft experiencing an emergency. Whereas the assistant's interaction with the D&D Cell ultimately resulted in the diversion of G-BXBU to Exeter, there was no active or informed decision to that effect. It is possible this was seen by the Exeter assistant as the most efficient way to remove a potential conflict with the military jet. However, it appears there was no attempt to resolve this potential conflict by moving the military jet away from G-BXBU, which was more readily achieved given the two-way radio contact between Exeter Radar (north) and the jet. The assistant did not receive or request information about G-BXBU or its pilot's capacity to carry out an approach in the prevailing conditions.

These misunderstandings appear to have misled the D&D controller to believe that Exeter had a more detailed awareness of the nature of the emergency and, significantly, that a controller there had determined that Exeter was an appropriate diversionary aerodrome.

The Exeter assistant described G-BXBU as a "weather diversion" and, in the absence of information normally included in a radar handover, the Exeter controller may not have known the seriousness of the situation its pilot faced. She commented that to her knowledge there were no other VFR flights operating in the area, which she believed was due to the weather conditions. She may therefore have expected that aircraft locally would have some IFR capability. These cues may have acted to confirm the controller's belief that the aircraft could make an approach in the prevailing weather conditions, and may explain why she did not consider she was dealing with an aircraft in difficulty. There were several contrary cues: G-BXBU had been in contact with the D&D Cell, the controller had heard a 'PAN PAN' call on 121.5 MHz earlier, and G-BXBU's emergency squawk of 7700 was visible on her radar screen. Whereas the D&D Cell has executive control in these circumstances, the normal responsibilities of a civil controller still apply. The Exeter controller was entitled to request a full radar handover from the D&D controller in order to understand the reason for the aircraft's diversion, and the ambiguity around the inbound aircraft was sufficient to indicate more information was required.

The Exeter controller advised the pilot of G-BXBU that he could expect vectors for the ILS approach for Runway 26. This indicates she did not appreciate the nature of the emergency the pilot was experiencing or his ability to carry out an approach in IMC. When the pilot said 'SORRY I CAN'T, CAN YOU SAY AGAIN?', she was prompted by a colleague to instead offer an SRA approach, which she did without further discussion. An SRA approach did not require onboard equipment but did require the pilot to be appropriately trained and qualified. The SRA decision point[34] was above the reported cloud base and therefore was unlikely to have been successful.

The ATC units involved do not appear to have considered what options were available to the pilot or to have communicated them effectively to each other. In order to select viable diversion aerodromes, a controller would need to know at least the aircraft type and the ability of the pilot to fly in the conditions likely to be encountered. The following Safety Recommendation is therefore made:

Safety Recommendation 2023-013

It is recommended that the Civil Aviation Authority specify the types of information that air traffic controllers will obtain and record when responding to aircraft in an emergency to ensure that pilots' needs are met and reported correctly if communicated to other air traffic control units.

Footnote

[34] The 'decision point' is the point at which an instrument approach must be discontinued and a go-around flown if the required visual contact is not obtained.

It is not possible to know why the pilot began his descent before being transferred to Exeter Radar. It is possible he was distracted by his interactions with the D&D Cell; and by trying to act on their requests to select an emergency squawk, maintain height and heading, and transfer radio frequency; and that he inadvertently descended into cloud. It is also possible that, given his proximity to Watchford Farm, he was attempting to establish visual contact with the ground in the hope of conducting an approach to his home base. Alternatively, he may have begun the descent intentionally: the aircraft had reached an altitude of 8,200 ft and was approximately 16 nm from Exeter Airport. Assuming a direct path from there to the runway flown at 90 kt, the aircraft would have needed to begin its descent and maintain a rate of descent of approximately 750 ft/min to land. If the pilot was attempting to divert to Exeter, he would have needed to begin a descent at this point.

It is likely, based on the D&D Cell's transmission to the pilot at 09:13:22, and the pilot's comment to Exeter that he had "been diverted", that the pilot thought there was a plan for him to divert to Exeter. If he had reached cognitive saturation, he may have felt his only option was to follow that plan. Controllers did not appear to understand that the pilot must descend into cloud to continue with the planned diversion to Exeter, or that he was not equipped to do so. Consequently, he had the undesirable options of complying with the apparent plan or questioning its suitability. Given the D&D Cell's publicised expertise and responsibilities for providing emergency assistance, and the absence of clear alternatives in a high stress situation, it is understandable that he would not question their plan.

It is also not possible to know what would have happened if the pilot had maintained altitude and followed the controller's instruction to follow a heading. Although there is no evidence of a considered plan to help the pilot, delaying the descent into cloud and additional communication between the pilot and Exeter ATC might have revealed Exeter's unsuitability as a diversion aerodrome. In the event, the worst of the weather had passed before the aircraft's fuel would have been exhausted, and remaining clear of cloud until then, might have enabled visual approaches to Watchford Farm, Dunkeswell or Exeter. There was no need for an immediate descent.

At the time the descent began, G-BXBU was in Class G airspace and, as a VFR flight, the aircraft did not require ATC clearance to descend. However, the D&D controller provided a deconfliction service to G-BXBU, which is only available to IFR traffic in Class G airspace. The confusion may have been compounded by the Exeter controller's initial intention to issue vectors initially for an ILS, followed by an SRA approach. These instructions suggest she believed she was controlling IFR traffic, which would ordinarily require descent clearance from ATC when carrying out an IFR approach. Although offering an ILS approach accords with local procedures, in this case doing so demonstrated a gap in understanding the pilot's circumstances.

Witness reports from pilots flying in the area at the time G-BXBU levelled off at 4,300 ft indicate the pilot may have been attempting to fly the aircraft in a gap between cloud layers. Shortly afterwards, at 09:16:49 hrs, G-BXBU was instructed to descend to 2,600 ft. Whilst this was intended to prevent the aircraft from descending below the minimum safe altitude in the area, it is likely to have introduced further confusion.

Checklists

The D&D Cell and Exeter ATC had checklists or procedures for dealing with emergencies, although neither controller used a checklist in this event. The use of an appropriate checklist in this event could have prompted an effective handover and ensured the transfer of critical information. The reported tendency to use procedures, checklists, and aide memoirs as guidance rather than formally, may have given rise to the impression that some or all of their contents could be disregarded.

Checklists make it easier to carry out routine or emergency procedures or create novel plans in foreseeable circumstances, and there is no evidence they are less effective in the air traffic control environment.

Therefore, the following Safety Recommendation is made:

Safety Recommendation 2023-014

It is recommended that the Civil Aviation Authority encourage the use of checklists in air traffic management operations when dealing with abnormal and emergency situations.

Emergency air traffic service provision

As a military unit, the operation of the D&D Cell differs from that of civilian ATSUs, which do not operate under a military structure. For example, the D&D Cell has a board providing an immediate visual guide for airfield data, including weather conditions, at all military aerodromes in the UK. There is no equivalent display for civil aerodromes. Exeter ATC was monitoring 121.5 MHz and was aware a 'PAN PAN' call had been made. However, its controllers were not familiar with the detail of the emergency and did not consider what assistance they could provide the aircraft. As MATS Part 1 restricts an ATSU from responding to a call on 121.5 MHz, except in limited circumstances, it is understandable that ATSU's do not actively monitor the emergency frequency for the purpose of responding to an emergency.

When declaring an emergency, if not already in receipt of a service from an ATSU, a pilot should do so on 121.5MHz. The transfer of operational control takes place when the aircraft in difficulty is handed over from D&D to the best-placed ATSU. It is unclear if the transfer of operational control took place during this event as there was no conversation between the D&D and Exeter controllers (as distinct from their assistants), but G-BXBU was transferred by D&D to the Exeter Radar frequency.

If an aircraft declares an emergency on a civil ATSU frequency, the ATSU will then contact D&D to give pertinent details of the emergency via landline. D&D will then give the ATSU operational control, although it is not clear who has the authority should the ATSU and D&D disagree on the best course of action to support the aircraft.

The AAIB investigation has received differing interpretations of D&D's executive control.

Although MATS Part 1 does provide guidance, there is no published equivalent interpretation from the D&D Cell, adding to the potential for misunderstanding between ATSUs. MATS Part 1 provides inconsistent guidance: one section stating that controllers should consider the most appropriate ATSU to manage an emergency and are empowered to transfer operational control to another ATSU; another that controllers should advise the D&D Cell of all emergencies, transferring executive control to D&D who then have the authority to delegate operational to control where they see fit. In informing the D&D Cell, this may remove the civil ATSU from the decision-making process. The D&D Cell is not necessarily the best placed unit to make decisions regarding an aircraft in difficulty, but having executive control creates an authority gradient in the decision-making process when working with civil ATSUs. This may cause inefficiencies, and distances controllers with local knowledge from the decision-making process without objective benefit. Whether the D&D Cell's executive control is solely 'administrative', or has the result that it holds 'responsibility for the overall management of the emergency' it is important the definition of these terms is clear to all ATCOs who are routinely interacting with the D&D Cell, to avoid any misunderstanding or misinterpretation. The positions expressed by the D&D Cell and the CAA are not consistent with the guidance in MATS Part 1, and currently the situation is not settled. Therefore, the following Safety Recommendation is made:

Safety Recommendation 2023-015

It is recommended that the Civil Aviation Authority determine the effect the D&D Cell's executive control has on civil ATCOs and inform civil ATCOs of any differences in their responsibilities whilst executive control is exercised.

In this event, Exeter controllers would have been aware that the weather at Exeter Airport was not suitable for a pilot and aircraft not equipped for flight in IMC, and could have acted accordingly had they received the initial 'PAN' call themselves. The complexity of communication between multiple personnel at both ATC units meant no controller or assistant had all the available information at any moment as the event unfolded.

The UK AIP states '*Distress and Urgency communications within the UK SRR are in accordance with standard international procedures*'[35]. ICAO Annex 10 states that the emergency frequency should only be used when normal channels are not available, and that it should only be used for genuine emergencies. It also states that ATSUs shall monitor 121.5 MHz and that an aircraft reporting a distress or urgent condition shall normally address the station already communicating with the aircraft, or in whose area of responsibility the aircraft is operating. Aircraft are required to monitor 121.5 MHz if possible.

The provision of a nationwide service on 121.5 MHz, including for aircraft practicing emergencies, is unique to the D&D Cell and can lead to volumes of communication on the frequency that discourage some pilots from monitoring it.

Footnote

[35] 'UK AIP' – GEN 3.6 Paragraph 6.3.1.

The involvement of the D&D Cell in this process increased the opportunity for misunderstanding and did not assist in achieving a safe outcome. Therefore, the following Safety Recommendation is made:

Safety Recommendation 2023-016

It is recommended that the Department for Transport review the current provision of emergency communications in the UK to determine if the involvement of a dedicated emergency air traffic service unit is the most effective way to assist civil aircraft in an emergency, and publish its findings.

There is no formal agreement between the Department for Transport and the Ministry of Defence defining the responsibilities of the D&D Cell. This may be a result of the D&D Cell continuing to provide a service to both the military and civilian aviation after the provision of civil SAR ceased to be a military operation in 2016. As the D&D Cell were associated with the military provision of SAR, it is possible their responsibilities were previously defined in this context. If the D&D Cell continues to provide emergency support to civil aircraft its responsibilities should be set out clearly. Therefore, the following Safety Recommendation is made:

Safety Recommendation 2023-017

It is recommended that the Department for Transport specify and publish details of the emergency air traffic service it requires the D&D Cell to provide.

Military-civil ATC interaction

Operations with a solely military purpose are outside the scope of this investigation. However, the AAIB has considered the service provided by the D&D Cell to the civil aviation community on behalf of the State, and four Safety Recommendations are made to the Civil Aviation Authority in areas that should also be addressed by the MAA. Accordingly, the MAA has stated that it intends to address the intent of Safety Recommendation 2023-012, 2023-013, 2023-014, and 2023-015 made to the CAA.

Conclusion

The aircraft collided with terrain because the weather conditions deteriorated beyond the capabilities of the pilot who was not trained or qualified to operate in poor weather. The forecasts available when the pilot assessed the weather did not accurately reflect the extent of the poor weather.

The pilot found himself stuck above cloud. When the pilot requested assistance in finding an appropriate aerodrome to land, the level of ATC support from the D&D Cell and Exeter ATC was not sufficient to provide the assistance required by the pilot, who was in a state of distress. A breakdown in communication and teamwork occurred between the D&D Cell, Exeter ATC and the pilot, which led to miscommunication, incorrect assumptions and omission of critical information.

Following published procedures would likely have allowed either the D&D Cell or Exeter Airport ATC to establish the unsuitability of Exeter Airport as a diversion aerodrome.

The investigation identified shortcomings in the system in place in the UK to provide emergency support to aircraft in distress.

Seven Safety Recommendations are made.

Safety Recommendations

Safety Recommendation 2023-011: It is recommended that the Civil Aviation Authority publish guidance for general aviation pilots on responding to unexpected weather deterioration, highlighting the factors affecting their performance and the benefits of planning before the flight how they will respond.

Safety Recommendation 2023-012: It is recommended that the Civil Aviation Authority require air traffic controllers to receive training regarding the human performance characteristics and limitations associated with stress. This should include the verbal cues that may indicate that a pilot is operating under high stress, and mitigation strategies to help controllers deal with such events.

Safety Recommendation 2023-013: It is recommended that the Civil Aviation Authority specify the types of information that air traffic controllers will obtain and record when responding to aircraft in an emergency to ensure that pilots' needs are met and reported correctly if communicated to other air traffic control units.

Safety Recommendation 2023-014: It is recommended that the Civil Aviation Authority encourage the use of checklists in air traffic management operations when dealing with abnormal and emergency situations.

Safety Recommendation 2023-015: It is recommended that the Civil Aviation Authority determine the effect the D&D Cell's executive control has on civil ATCOs and inform civil ATCOs of any differences in their responsibilities whilst executive control is exercised.

Safety Recommendation 2023-016: It is recommended that the Department for Transport review the current provision of emergency communications in the UK to determine if the involvement of a dedicated emergency air traffic service unit is the most effective way to assist civil aircraft in an emergency, and publish its findings.

Safety Recommendation 2023-017: It is recommended that the Department for Transport specify and publish details of the emergency air traffic service it requires the D&D Cell to provide.

Published: 27 April 2023.

Appendix 1 – Meteorological reports

Available airfield weather at 0600 hrs		
	METAR	TAF
Yeovilton	Not available	Not available
Exeter	Not available	Not available
Newquay	At 0550: light south-east **broken cloud at 1,200 ft**	Between 0600 and 1500: light south-easterly wind, good visibility, **scattered cloud at 4,000 ft** Temporarily between 0600 and 1200 (30% chance): 8,00 0 m visibility, **broken cloud 1,200 ft**
Culdrose	At 0550: light south-easterly wind, good visibility, scattered cloud at 300 ft	Not available
Land's End	Not available	Not available
St. Mary's	Not available	Not available

Table A1

Available METAR and TAF information at 0600 hrs

Available airfield weather at 0630 hrs		
	METAR	TAF
Yeovilton	Not available	Not available
Exeter	Not available	Not available
Newquay	At 0620: light southerly wind, 9000 m visibility, **broken cloud at 600 ft**	Between 0600 and 1500: light south-easterly wind, good visibility, **scattered cloud at 4,000 ft** Temporarily between 0600 and 1200: 8,000 m visibility, broken cloud 1,200 ft. Temporarily between 0600 and 1200 (30% chance): **broken cloud at 600 ft**
Culdrose	At 0550: light south-easterly wind, good visibility, **scattered cloud at 300 ft**	Not available
Land's End	Not available	Not available
St. Mary's	At 0620: light south-westerly wind, good visibility, **broken cloud at 1,100 ft**	Between 0600 and 1500: south-westerly wind, good visibility, **few cloud at 1,500 ft** Temporarily between 0600 and 0900: **broken cloud at 1,200 ft** Temporarily between 0600 and 0900 (30% chance): 7,000 m visibility, **broken cloud at 800 ft** Between 0900 and 1200: wind gusting to 25 kts

Table A2

Available METAR and TAF information at 0630 hrs

Appendix 1 – Meteorological reports cont

Available airfield weather at 0900 hrs		
	METAR	TAF
Yeovilton	Not available	Not available
Exeter	At 0850: - light southerly wind, 6000 m visibility, broken cloud at 500 ft	Between 0900 and 1700: light southerly wind, good visibility, scattered cloud at 1, 000 ft. Temporarily between 0900 and 1400: 6,000 m visibility, moderate rain and drizzle, broken cloud 700 ft. Between 0600 and 1200 (30% chance): temporarily 2,000 m visibility, mist, broken cloud 400 ft
Newquay	At 0850: light south-westerly wind, good visibility, **broken cloud at 300 ft**	Between 0900 and 1800: Wind becoming easterly Temporarily between 0900 and1200: visibility 800 m, **broken at 1,200 ft** Temporarily between 0900 and1200 (30% chance): 1,400 m visibility, mist, broken cloud at **200 ft**
Culdrose	At 0850: light south-westerly wind, 250 m visibility, fog, **scattered cloud at 0 ft, overcast cloud at 200 ft**	Between 0900 and 1800: light variable winds, good visibility, few clouds at 900 ft, scattered cloud at 2,000 ft Temporarily between 0900 and 1000 (30% chance): 500 m visibility, fog, scattered cloud at 100 ft
Land's End	At 0850: light south-westerly wind, good visibility, **few cloud at 500 ft, scattered cloud at 3,000 ft**	Between 0900 and 1800: south-westerly wind, good visibility, **scattered cloud at 1,500 ft** Temporarily between 0900 and 1200: **broken cloud at 1,200 ft** Temporarily between 0900 and 1200 (30% chance): 7000 m visibility, **broken cloud at 600 ft**
St. Mary's	At 0850: light south-westerly wind, good visibility, **few cloud at 800 ft, scattered cloud at 2,300 ft**	Between 0900 and 1800:south-easterly wind, good visibility, scattered cloud at 2,500 ft Temporarily between 0900 and 1100: broken cloud at 1,200 ft Temporarily between 0900 and 1100 (30% chance): 7,000 m visibility, broken cloud at 800 ft

Table A3

Available METAR and TAF information at 0900 hrs

Appendix 2 - Communication transcript

Colour key	
G-BXBU	
D&D Controller	D&D Support (DDS)
Exeter Controller	Exeter Assistant (ATCA)
Other aircraft on frequency	

Time	G-BXBU Radio communication with the D&D Cell 121.5 MHz and Exeter Radar 123.580 MHz	Mediator line – communication between Exeter assistant and D&D support
09:10:59	G-BXBU: Emergency frequency PAN PAN PAN this is Golf Bravo Xray Bravo Uniform	
09:11:17	D&D Controller (broken): Bravo Xray Bravo Uniform, London Centre, PAN acknowledged, pass your details when ready	
	Commercial aircraft 1: Golf Bravo Xray Bravo Uniform, it's [callsign] [unintelligible] ...go ahead	
09:11:21	G-BXBU: Er say again	
09:11:23	*Commercial aircraft 1: Golf Bravo Xray Bravo Uniform, this is [callsign] go ahead we heard the PAN PAN call*	
09:11:29	G-BXBU: Yeah, er I am er, I've got a, I've got in real trouble, I am a, it's a cap ten, two P O B, I am about eight miles, er east of Exeter, er and there is very thick cloud and I am above it and can't get below it, er according to Dunkeswell it is on the deck. I don't know what to do. I need to divert somewhere er close to me where I can land	
09:11:54	*Commercial aircraft 2: Golf Bravo Xray Bravo Uniform er this is [callsign] and we will contact London*	
09:12:00		DDS: D&D support
09:12:01	G-BXBU: Sorry can you please speak slower	
09:12:01		ATCA: Hello it's Exeter
09:12:02		DDS: Yep
09:12:03		ATCA: Hi, has anyone updated you firstly about the [military jet]?
09:12:04	*Commercial aircraft 2: Er Golf Bravo Xray Bravo Uniform this is [callsign], we copy what you are saying I'll call London for you*	
09:12:07		DDS: Er, no
09:12:08		ATCA: OK er, just to let you know that that [callsign] is still intending to land at Exeter, he's got a normal undercarriage indication now

Appendix 2 - Communication transcript cont

09:12:14	G-BXBU: Er thank you Bravo Uniform	
09:12:16		DDS: OK
09:12:16	D&D Controller: … Xray Uniform this is London Centre on one two one decimal five. Your PAN is acknowledged, your position is approximately four miles to the west of Chard. What is your altitude?	
09:12:17		ATCA: And also, has a light aircraft called you in the Dunkeswell area?
09:12:21		DDS: Yes, we are currently dealing with that situation
09:12:23		ATCA: Excellent, he's right in the way of er, of red five, would you, what's he, what's his intentions and his level?
09:12:27	G-BXBU: Altitude is currently seven thousand five hundred, and that is the cloud base	
09:12:29		DDS: Er, don't know his level but he is currently above cloud and er wanting to divert to the nearest aerodrome
09:12:35	D&D Controller: Golf Bravo Xray Bravo Uniform confirm you are above cloud	
09:12:37		ATCA: Well, that would be us
09:12:38		DDS: Er….
09:12:40		ATCA: Exeter
09:12:41	G-BXBU: I confirm I am above cloud at seven thousand five hundred. Er I've called Dunkeswell they say it is on the deck there. I am really quite anxious and don't know what to do	DDS: I think...
09:12:44		ATCA: He's basically flown all the way up the coast and then across our extended centre line twice in front of er, a [military jet]
09:12:49		DDS: Yes
09:12:50		ATCA: Er.. do you want to put him over to us?
09:12:50	D&D Controller: Golf Bravo Uniform roger. Golf Bravo Uniform what is your endurance?	
09:12:54		DDS (Offline discussion): Exeter are asking if er, maybe we want to, she asked to put it over to them…
09:12:55	G-BXBU: Er one and a half hours	
09:12:59	D&D Controller: Golf Bravo Uniform roger. Golf Bravo Uniform standby.	
09:13:03	G-BXBU: Standing by.	

Appendix 2 - Communication transcript cont

09:13:04		DDS (Offline discussion): They are wondering if er, they want to take over
09:13:05	D&D Controller: Golf Bravo Uniform	
09:13:06	*Commercial aircraft 2: Er London [callsign] are you happy if we come off frequency now.*	
09:13:11	D&D Controller: [callsign], affirm we have the aircraft position and [unintelligible] identified we will carry on and thank you for your help	
09:13:14		DDS: Standby we are just talking to the aircraft
09:13:15		ATCA: Oh OK, alright (offline: He's working D and D that aircraft)
09:13:18	*Commercial aircraft 2: OK copied, good luck*	
09:13:21		DDS offline: Exeter are willing to take the aircraft
09:13:22	D&D Controller: Golf Bravo Uniform roger. Exeter are willing to take you and standby your steer for Exeter is two three zero range sixteen nautical miles	
		ATCA: [unintelligible]
09:13:33	G-BXBU: What's the Exeter radio?	
09:13:35	D&D Controller: Golf Bravo Uniform, we will hand you over. Golf Bravo Uniform squawk seven seven zero zero	
09:13:41	G-BXBU: Squawking seven seven zero zero	
09:13:46	D&D Controller: Golf Bravo Uniform, make your heading two three zero report steady	
09:13:48		DDS: Exe.. er we are putting on emergency squawk, is there a frequency that we can put him on to?
09:13:52		ATCA: Er.. one.. one.. hang on
09:13:52	G-BXBU: Ah, can you hold the line	
09:13:55		ATCA (offline discussion): Which one of you wants to work this aircraft inbound, do you want to [name] or shall [name] take it? The inbound. For weather. The one that's been in the way for the last ten minutes. Yeah. Yeah?
09:14:06	G-BXBU: Er, squawking, er Golf Bravo Uniform, squawking seven seven zero zero. Can you say again next instruction?	
09:14:10		ATCA: Yeah, if you put it through one two three five eight zero
09:14:14		DDS: One two three five eight zero

Appendix 2 - Communication transcript cont

09:14:14	D&D Controller: Golf Bravo Uniform roger. Head, make your heading two three zero, maintain seven thousand five hundred feet	
09:14:17		ATCA: And what's his call sign?
09:14:18		DDS: Er call sign is…
09:14:21		ATCA: Oh we've got it, we've got it it's OK
09:14:22	G-BXBU: Two three zero, maintaining er seven thousand five hundred	
09:14:23		DDS: You've got
09:14:25		ATCA: Yep, alright then
09:14:26		DDS: alright then bye
09:14:26	D&D Controller: Golf Bravo Uniform identified on radar, deconfliction service	
09:14:27		ATCA: Thanks, cheers bye
09:14:35	G-BXBU: Sorry, say again	
09:14:36	D&D Controller: Golf Bravo Uniform you're identified on radar, in a deconfliction service, Exeter have you iden…, have you on their radar, contact Exeter frequency one two three decimal five eight zero	
09:14:52	G-BXBU: One two, one two three decimal five eight zero	
09:14:57	D&D Controller: Golf Bravo, Golf Bravo Xray Bravo Uniform, that is correct	
09:15:05	D&D Controller: Golf Bravo Uniform if no contact on that frequency return to this frequency one two one decimal five	
09:15:12		*Ringing*
	123.58	
09:15:27	G-BXBU: Er Exeter, er Golf Bravo Xray Bravo Uniform, have been PAN PAN PAN, have been diverted	
09:15:30		ATCA: Exeter
09:15:32		DDS: It's D&D support, we've just passed him over to you, has he come up?
09:15:34		ATCA: Yes I think he's called us now. Yes he has
09:15:36	Exeter: Golf Bravo Xray Bravo Uniform, Exeter Radar, roger the er PAN call, and we'll be vectoring you for the er ILS approach for runway two six for Exeter	

Appendix 2 - Communication transcript cont

09:15:37		DDS: Oh OK perfect.
09:15:40		ATCA: OK
09:15:41		DDS: Will you er let us know when he's landed?
09:15:42		ATCA: Yes will do
09:15:43		DDS: Thank you
09:15:44		ATCA: Cheers
09:15:44		DDS: Bye
09:15:54	G-BXBU: Sorry I can't, can you say again?	
09:15:57	Exeter: Golf Bravo Uniform I'll be vectoring you for the SRA Approach for runway two six at Exeter. Fly heading two two zero degrees	
09:16:21	Exeter: Golf Bravo Uniform fly heading two two zero degrees	
09:16:26	G-BXBU: Bravo Uniform, heading two three zero. What's your cloud base?	
09:16:32	Exeter: Golf Bravo Uniform the weather at Exeter we've got six kilometres visibility and the cloud is broken at five hundred feet	
09:16:49	Exeter: Golf Bravo Uniform, descend to altitude two thousand six hundred feet, QNH one zero one seven	
09:17:00	G-BXBU: One zero one seven, you er you require me to descend to what altitude?	
09:17:04	Exeter: Two thousand six hundred feet	
09:17:07	G-BXBU: Descending two thousand six hundred, you want me on two three zero?	
09:17:14	Exeter: Affirm, when you are able, fly heading two two zero degrees	
09:17:21	G-BXBU: Two two zero	
09:18:12	Exeter: Golf Bravo Uniform stop descent and maintain altitude two thousand six hundred feet	