Frythens Farm, St. Erth, Cornwall
Archaeological excavation of a WW2 Spitfire crash site

Cornwall Archaeological Unit

Report No: 2017R051

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The views and recommendations expressed in this report are those of Cornwall Archaeological Unit and are presented in good faith on the basis of professional judgement and on information currently available.

Freedom of Information Act

As Cornwall Council is a public authority it is subject to the terms of the Freedom of Information Act 2000, which came into effect from 1st January 2005.

Cornwall Archaeological Unit is a Registered Organisation with the Chartered Institute for Archaeologists

Cover illustration

Archaeologist Guy Salkeld of the Defence Infrastructure Organisation and Adam Sharpe of CAU excavating in the lower section of the impact crater at Frythens Farm, St. Erth.

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Abbreviations

AHB-2B	Air Historical Branch (RAF)
CAU	Cornwall Archaeological Unit
CIfA	Chartered Institute for Archaeologists
HER	Cornwall and the Isles of Scilly Historic Environment Record
JCCC	Joint Casualty and Compassionate Centre, Service Personnel and Veterans Agency, Ministry of Defence
MOD	The Ministry of Defence
NGR	National Grid Reference
OD	Ordnance Datum – height above mean sea level at Newlyn
OS	Ordnance Survey

1 Summary

On the evening of 24th March 1942, Squadron Leader Daniel Cremin DFC RAF and Sergeant William Norman RAAF of No 66 Squadron, then based at RAF Portreath, Cornwall, were flying Spitfire Mk Vcs during a night flying exercise. Their planes were involved in a mid-air collision over west Cornwall and crashed into adjacent fields on Frythens Farm, St. Erth. S/L Cremin's plane had lost a wing in the incident and spun in, whilst Sgt. Norman's plane nose-dived into the ground. Both aircraft subsequently caught fire.

The pilots were killed on impact and their badly damaged bodies were retrieved from the wreckage for burial. An RAF recovery crew salvaged what remained of the aircraft and the crash sites were returned to agriculture.

In 2013 a metal detectorist located and investigated one of the crash sites, illegally removing some aircraft parts. In 2017 another amateur researcher identified the second crash site and began to investigate it, again without an MoD licence. On finding human bones at the wreck site he reported his discovery to the local police.

The matter was passed to the Cornwall Coroner who requested that Cornwall Archaeological Unit (CAU) undertake an excavation at the crash site to recover any surviving human remains. This work was undertaken under a licence issued by the JCCC at the MoD, and was observed by a Defence Infrastructure Organisation Archaeologist. The primary aim of the work was to recover any human remains surviving on site. Parts of a human pelvis, femur and ulna were recovered from the site and were passed to the Cornwall Coroner via the Devon and Cornwall Police. No unique identification codes were found on any surviving aircraft components, and the identity of the pilot has been determined by DNA matching with samples donated by one of their living relatives.

The crash site was archaeologically excavated by professional archaeologists from CAU. All surviving artefacts were recovered from the impact crater for subsequent analysis; the surrounding area was checked for unexploded ordnance (UXO) – none was found.

The archaeological investigation carried out at the site suggested that a low angle ground impact had taken place, this being consistent with the account of S/L Cremin's plane spinning in. The absence on site of the aircraft's engine block, wings, armament, landing gear and the rear section of the fuselage, together with many cockpit components indicated that the aircraft had broken up catastrophically on impact; the relatively shallow impact crater contained only a small part of its cockpit - this had been smashed beyond recognition during its violent burial in the impact crater.

A report on the findings of the investigation was prepared for the Coroner; copies were also supplied to the JCCC and the Defence Infrastructure Organisation Archaeologist.

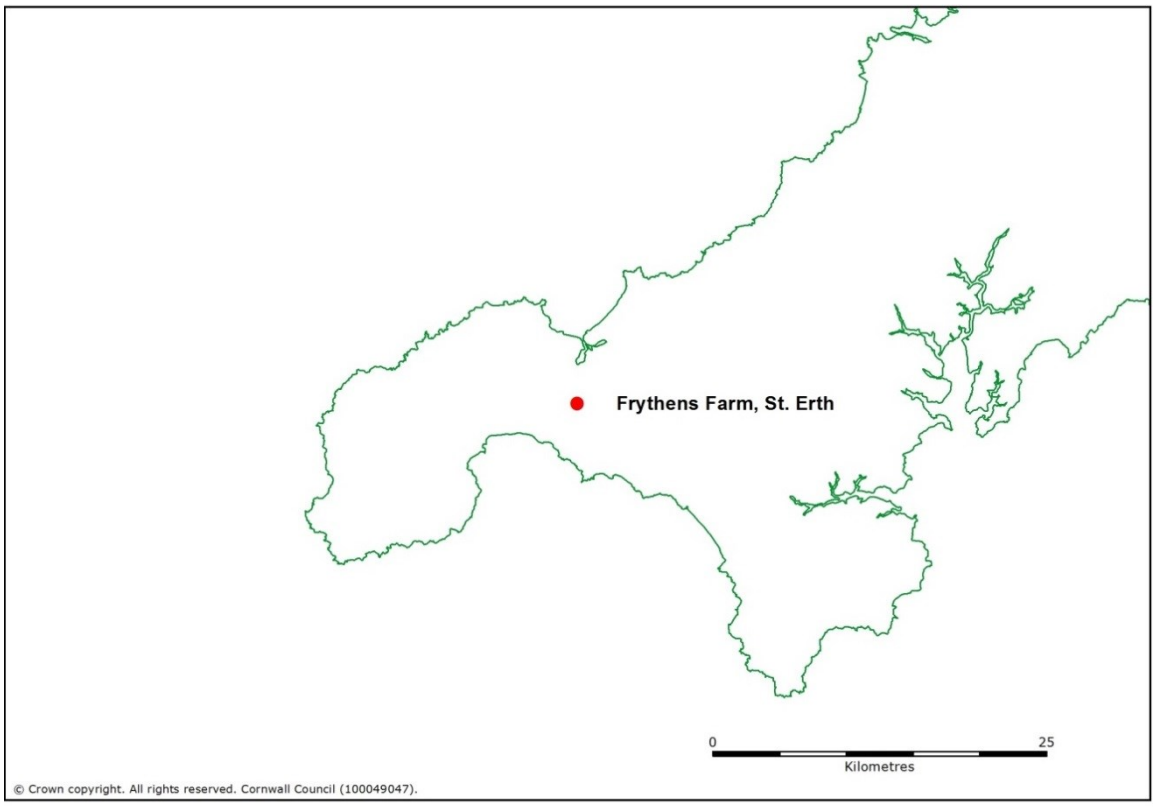

Fig 1. The location of Frythens Farm, St. Erth, Cornwall.

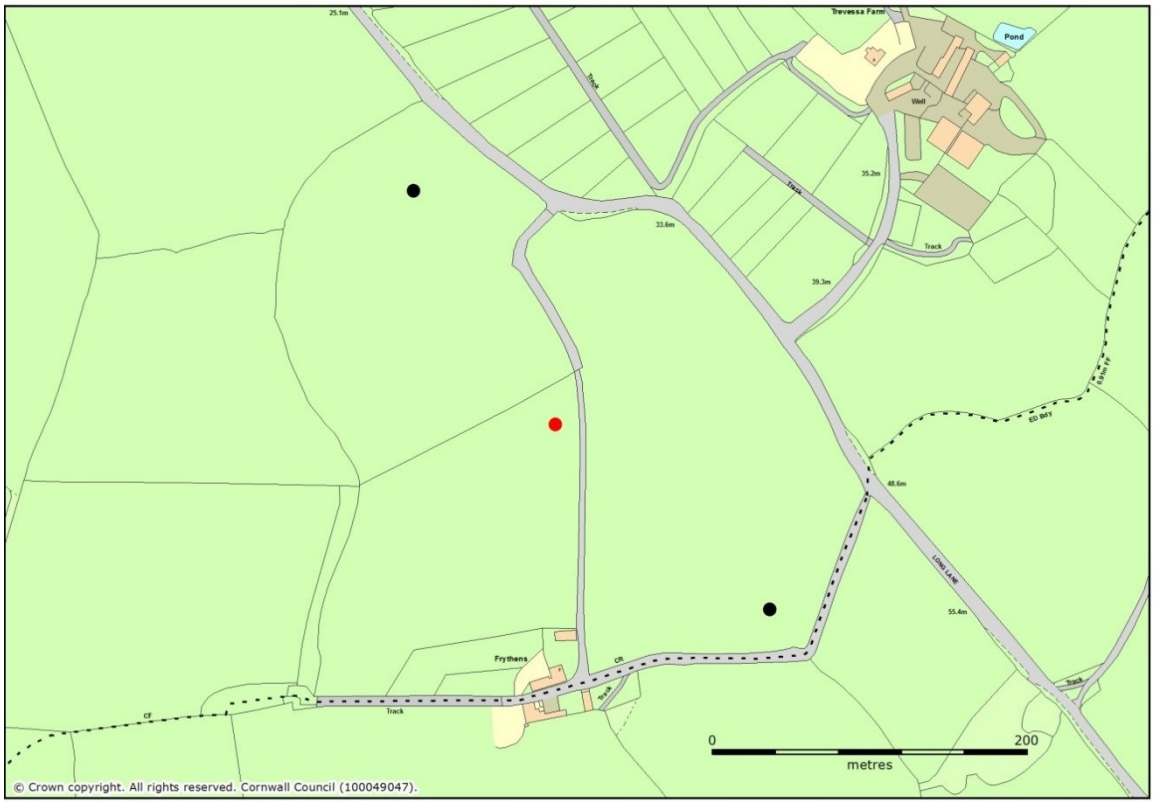

Fig 2. The location of the Spitfire excavation at Frythens Farm (red dot). The black dots represent the crash sites recorded by Mr. Strick. The southern location has apparently been partially excavated and produced Spitfire components.

2 Introduction

2.1 Project background

On the evening of 24th March 1942, Squadron Leader Daniel Cremin RAF and Sergeant William Norman RAAF of No 66 Squadron, then based at RAF Portreath, Cornwall, were flying Spitfire Mk Vcs during a night flying exercise. The two planes were involved in a mid-air collision over west Cornwall and crashed into adjacent fields on Frythens Farm, St. Erth. S/L Cremin's plane had lost a wing in the incident and had spun in, whilst Sgt. Norman's plane had nose-dived into the ground. Both crashed aircraft subsequently caught fire.

Both pilots were killed on impact and their badly damaged bodies were retrieved from the wreckage for burial. An RAF recovery crew salvaged what remained of the aircraft and the crash sites were returned to agriculture.

In 2013 a metal detectorist located and investigated one of the crash sites, illegally removing some aircraft parts. In 2017 another amateur researcher identified the second crash site and began to investigate it, again without an MoD licence. On finding human bones at the wreck site he reported his discovery to the local police.

The matter was passed to the Cornwall Coroner who requested that Cornwall Archaeological Unit (CAU) undertake an excavation at the crash site to recover any surviving human remains. This work was undertaken under a licence issued by the JCCC at the MoD, and was observed by a Defence Infrastructure Organisation Archaeologist.

2.2 Aims

The primary aim of the work was to recover any human remains surviving on site, to pass these to the Cornwall Coroner, and to produce a report on the findings of the excavation. An entry to the Historic England/ADS OASIS online database of archaeological investigations was prepared.

2.3 Methods

2.3.1 Preliminary

A licence to excavate the southern Spitfire crash site at Frythens Farm was applied for from the JCCC in the name of Laura Ratcliffe. This was granted on 17 July 2017.

2.3.2 Desk–based assessment

A brief desk-based assessment was undertaken using on-line archives in order to obtain information about the history of the air crash incident and the personnel involved in it; access to MoD archives and liaison with the Australian Government archives was undertaken by Lynsey Shaw Cobham, Air Historical Branch (RAF), who shared with CAU the findings of her investigations. Further relevant material was shared with CAU by Guy Salkeld, Defence Infrastructure Organisation Archaeologist. An e-publication produced by Strick (one of the metal detectorists who has investigated sites at Frythens Farm, Strick 2013) proved useful in indicating what had already been removed from one of the military aircraft wreck site in the way of artefacts.

2.3.3 Fieldwork

All fieldwork was carried out in accordance with the methodologies set out in the CAU Written Scheme of Investigation (WSI, see Appendix) utilising a combination of machine and hand excavation. The fieldwork was undertaken on 27 July 2017 by Laura Ratcliffe and Adam Sharpe (CAU) with the assistance of Guy Salkeld (Defence Infrastructure Organisation Archaeologist). The Devon and Cornwall Police ensured that the local Explosive Ordnance (EOD) Team were informed of the possible presence of UXO which might need to be made safe and were on standby to come to site.

2.3.4 Post-fieldwork

The human remains recovered from the crash site were handed over to the Devon and Cornwall Police on the 27th July 2017 for transfer to the Cornwall Coroner.

All recovered artefacts were washed using a low-pressure water supply and a sieve to remove loose soil and stones and were allowed to dry naturally. They were subsequently sorted and bagged by material type. All bags and boxes are labelled with the site code (FF17).

3 Location and setting

Frythens Farm is located to the south-west of St. Erth, west Cornwall (Fig 1). The crash site investigated is at SW 54563 33413, immediately to the north of the northern access lane to Frythens Farm (Fig 2).

4 Designations

4.1 National

The crash site is protected under the *Protection of Military Remains Act 1986*.

Interference with the sites of crashed military aircraft without a licence issued by the JCCC is an offence under the Protection of Military Remains Act 1986 (1986 c. 35). Military aircraft are automatically protected under this Act, and it is illegal to undertake investigative activity on them without a licence from the JCCC. It is JCCC policy not to grant licences in circumstances where human remains or unexploded ordnance are likely to be present. In applying for a licence an investigator must have thoroughly researched the aircraft and the fate of its crew and have the permission of the landowner. All recovered material remains the property of the MoD. The MoD reserves the right to witness all excavations.

5 Incident history

During March 1942, 66 Squadron, based at RAF Portreath since February 1942, were converting from Spitfire Mk IIs to Spitfire Mk Vcs prior to re-deployment to RAF Ibsley in the April of that year. During their short time at Portreath they were engaged in training exercises and routine convoy patrols. On 24 March 1942, the Operations Record Book noted that the pilots were also involved in 'Army cooperation flights, air to ground firing and cine gun practice'. Later that day, Squadron Leader Cremin RAF in Spitfire AB462 and Sergeant Pilot Norman RAAF in Spitfire AB496 were engaged in dusk landing practice. They took off again at 21.20 hours on a clear, moonlit evening and headed south-west with the intention of carrying out night flying practice. Both planes would have been fully armed with 20mm cannon rounds and .303 machine gun ammunition.

Local Police diary entry 1100 notes that '*Supt. Rowlands reports that at 21.55 hrs on 24.3.42, a British Spitfire aircraft crashed into fields at Trevessa Farm, 1 ¼ miles SW St. Erth. Machine badly smashed and burnt out. One occupant dead. Machine from RAF Stn. Portreath No AB496. Police guard. RAF informed.*

The following entry in the logbook (1101) noted: *Supt. Rowlands reports that at 21.55 hrs on 24.3.42 a British Spitfire aircraft crashed in fields at Frythens Farm, 1 ½ miles SW St. Erth. Machine badly smashed and burnt out. One occupant dead. Machine from RAF Stn. Portreath No WAE631. Police guard. RAF informed.*

The identification of the second plane was incorrect – this was Squadron Leader Cremin's AB462. Clearly there had been a catastrophic mid-air collision which had resulted in the loss of both planes and their aircrew less than 40 minutes after their take-off from Portreath earlier that evening.

Edna Hocking, interviewed in November 2005 about her wartime experiences stated: *In 1941/2 I lived on Tregethes Farm, St. Erth. At 10.30 one night we heard the collision of*

two planes. Two Spitfires had crashed and fallen into the field of the next farm called Frythens. I've no idea how this crash occurred. Both pilots were killed and their bodies put in the barn overnight. It was awful and the police were out in the dark looking for parts of the bodies.

Neither the Operations Record Book nor the Casualty File detailed the process of the recovery of the bodies, or contained any descriptions of the human remains recovered from the crash sites.

The Casualty File states that a Court of Enquiry was ordered to assemble on 27 March 1942 at RAF Portreath to fully investigate the accident. Unfortunately all copies of the results of the Enquiry held in British archives were routinely destroyed at the end of the War. However, given that Sgt. Norman was a member of the RAAF a copy was lodged with the Australian Government. Although a copy of the full report has not been made available, extracts posted in an on-line article and a summary provided by Ms Shaw Cobden state that '*the weather had been clear, with moonlight … the aircraft had collided in mid air … AB462 had spun in minus its starboard wing and AB496 had dived vertically into the ground. No chutes were used and both pilots were killed'.* The Court of Enquiry had found that '*AB496 had misjudged the distance between itself and AB462, and it collided with the starboard side of the fuselage and main plane of AB462.'*

The conclusion of the Court of Enquiry was that the aircraft piloted by the less experienced Sgt. Norman had struck the forward end of the plane piloted by Squadron Leader Cremin, causing it to lose its starboard wing. The impact would also have resulted in significant damage to Norman's aircraft, almost certainly significantly damaging its propeller and forward end. Both planes would have become immediately uncontrollable. The height at which the aircraft were flying at the time of the incident is not recorded, but given that they crashed into adjacent fields it seems likely that it would have been no more than a few hundred feet above this part of West Cornwall. If the suggested crash site locations are correct, they lie 345m from one another. If, as suspected, they were flying at a few hundred feet up, the pilots would have had neither the time nor the height to have bailed out, even had their aircraft been sufficiently controllable to allow them to open their canopies and get clear of the planes. Both would have died instantaneously on impact with the ground.

The remains of Squadron Leader Cremin were buried in the Wardour (Roman Catholic) Cemetery, Wiltshire, whilst those of Sgt. Norman were buried at Illogan churchyard, close to RAF Portreath.

Both men were Australian by birth. 36128 Daniel Edward Cremin had been born in Sydney in 1917 and had enlisted in the Royal Australian Air Force in 1936, and was given a short service commission in the RAF in February 1938. After training he had qualified as a flying instructor and was employed as such in the Middle East Command from November 1938 during the Syria campaign, flying with 127 Squadron. He was promoted to Flying Officer in August 1939, and to Flight Lieutenant in January 1940. In October 1941 was awarded the Distinguished Flying Cross (DFC) '*for gallantry and devotion to duty in the execution of air operations*'. On the 5th July he had been shot down in Hurricane P3731 but had survived the incident. Shortly before his death at the age of 25 he was promoted to Squadron Leader (temporary).

Being a non-commissioned officer, no equivalent level of detail is available for 404315 William David Norman, who was probably born in Brisbane, and was also 25 years old at the time of his death.

An RAF recovery team (No 67 Maintenance Unit) based in Truro was deployed to West Cornwall to recover what they could of the crashed aircraft, both of which were described as 'Cat E: Burnt'. Unfortunately the records of this unit do not detail what was salvaged from the downed planes.

Both crash sites lay on farmland, and their impact craters appear to have been backfilled and the affected areas of the fields returned to agricultural use shortly thereafter – RAF stereo aerial photographs taken only four years later show no evidence for the 1942 crash sites, whose locations seem to have been forgotten about for many years.

However a local WW2 researcher and metal detectorist (Mr. Strick) who had a particular interest in investigating the sites of WW2 military aircraft remains appears to have located at least one of the March 1942 Spitfire crash sites in 2012, and undertook a small-scale excavation on it, digging a hole one metre deep at SW 5470 3330 (note that this relates to the probable location of the southern crash site), recovering material from what he identified as Spitfire AB462 (LZ-W), including a substantial amount of Perspex from its cockpit canopy, an empty 20mm cannon cartridge, pieces of Bakelite, copper cabling and copper-alloy objects, a collection of corroded ferrous fragments, a high pressure pipe coupling, pieces of twisted Duralumin, hose couplings, buckles, pieces of corroded aluminium alloy and electrical capacitors. He also recovered a burnt penny which he assumed had derived from the pilot's pockets.

At Trevessa Farm (the alleged site of the second crash) he recovered a piece of aluminium plate at SW 5448 3358 (note that this is not currently thought to be one of the March 24th 1942 crash sites, lying to the north of the site investigated by CAU; it is also on Frythens Farm, not Trevessa Farm). During an interview with a former member of the Home Guard he was informed that the engine from this crashed aircraft had been found at surface 10m to the north of the find spot. It is understood that Mr. Strick donated his finds from both sites to the wartime museum at the former RAF Davidstow, Camelford, Cornwall.

Subsequent to this in 2017 a second WW2 researcher (Mr. Palmer) appears to have identified the northern aircraft wreck site on Frythens Farm. However, in digging an investigative hole at the site he came upon human bone, and reported this to the Police, who informed the Cornwall Coroner. It is not clear whether Mr. Palmer recovered any artefacts from the crash site prior to this.

6 Archaeological investigation by CAU

Prior to its controlled excavation the crash site at Frythens Farm was marked by the sub-triangular hole thought to have been excavated earlier in 2017 by Mr. Palmer. The hole was a maximum of 1.25m deep, having a shallow sloping face to the south-west and vertical to overhanging edges to the north-west, north-east and south-east. It is assumed to have been excavated over an area showing significant responses on a metal detector. A low spoil heap containing corroded aluminium fragments was located to the west of the hole. The topsoil could be seen to slope down to the north-east at an angle of around 30 degrees from the horizontal, overlying a compact, tan-coloured clay-sand subsoil with almost no stony inclusions. The topsoil also contained abundant fragments of corroded aluminium. At the base of the hole, a piece of small-bore copper pipe protruded from the unexcavated material; adjacent to this was the ball joint of a human femur. During a preliminary site visit on 27th June 2017 by ADI Green of the Devon and Cornwall Police, Laura Ratcliffe of CAU and Mr Palmer the presence of human remains bone had been confirmed; the exposed femur had been temporarily covered over with large stones to prevent further interference to it.

The excavation of the southern crash site at Frythens Farm was undertaken by CAU staff on Thursday 27th July 2017. The work was observed (and assisted) by Guy Salkeld, Defence Infrastructure Organisation Archaeologist.

A check of the area surrounding the existing excavation was undertaken using a metal detector in order to identify in advance any areas where strong magnetic responses might indicate the presence of buried clusters of ordnance or large ferrous objects. None were found. The exposed soils within the trial hole (assumed to be the location of the former cockpit) were checked using a calibrated Geiger counter given the potential

for high levels of radiation to be present deriving from radium paint from the cockpit dials. The levels were uniformly low and the excavation site was judged to be safe to work on.

Nevertheless, in response to the guidelines set down in the CAU Risk Assessment, archaeologists conducting the excavation wore disposable coveralls and gloves, safety boots and hard hats. Dust masks were available for use should they be required, as were washing facilities; repeated checks were made with the metal detector and Geiger counter as the excavation progressed.

A 4m x 4m area focussed on the original trial digging was opened up using a wheeled mechanical excavator utilising a toothless (grading) bucket. The machine at all times worked under the direction of the site archaeologists. The excavation area was reduced in depth in 100mm spits, clearly defining the extent and shape of the impact crater, which had been cut through the topsoil into the underlying subsoil to a maximum depth of 1.7m and which had become backfilled with topsoil containing abundant artefacts. The crater was treated as a single context, as was the infill. After each spit had been reduced and the arisings checked for stray artefacts the infill of the crater was hand excavated and all artefacts recovered with the exception of the very large number of fragments of cast aluminium found throughout, as these had become highly corroded through oxidation, and as a result had a powdery consistency without any diagnostic forms or structural coherence. These were assumed to be the broken up remains of the cast aluminium fuselage frames. Digital record photographs were taken at intervals during the excavation.

Two areas containing human bone were identified: these consisted of fragmentary sections of a pelvis and the associated (but disarticulated) upper part of a femur in the northern part of the impact crater (Fig 6) and the heat-affected upper half of an ulna 400mm to the south-east of this at more or less the same level. Both areas were carefully excavated and the bones were boxed up on site.

The size of the impact crater reduced significantly in depth. At 0.6m from surface, it measured approximately 2.0m by 2.0m in plan. Below this depth its south-western edge steepened from 30 degrees below the horizontal to 60 degrees below horizontal and it reduced in size to around 1.25m x 1.25m in plan. Its north-eastern edge remained more or less vertical, whilst its north-western and south-western edges sloped in at a steep angle. A clearly-defined narrow U-shaped extension on the south-eastern side of the impact crater was visible between 1.0m from surface and 1.35m from surface (Fig 7).

At 1.7m from surface the impact crater bottomed out as a small, poorly-defined south-west – north-east aligned v-shaped hollow; clean, undisturbed subsoil was shown to form the base of the whole of the excavation trench below this depth. No further human remains were recovered other than those described above.

The area at the western end of the original trench was machine excavated to test the extent and profile of this edge of the impact crater; this proved the overall crater to have been approximately 3.0m in diameter; no additional artefacts were recovered during this exercise. Once excavation was complete the excavation trench was backfilled in layers, each being machine compacted before the next was replaced. The backfill within the excavated area was left slightly proud to allow for settlement.

7 Interpretation of excavation findings

As mentioned above, all identifiable artefacts were recovered from the impact crater. It should be noted that some artefacts were removed from the southern crash site at Frythens Farm by Mr. Strick in 2012, and some may also have been removed from the crash site investigated by CAU during Mr. Palmer's previous investigations.

Following the preliminary cleaning of the artefacts recovered by CAU from the impact crater an assessment was made of their types (see below) in order to better

understand from where within the aircraft they might have originated. An assessment was also made of those Spitfire components which were not found at the site. Finally, taking into account the distinctive form of the impact crater, a consideration was made as to how this might have been created, and as a result which parts of the aircraft might have become buried on site and which might have been salvaged.

As CAU were unable to retrieve any components bearing unique part numbers which might have helped in identifying which of the two aircraft this was, and thus which pilot's remains were recovered, DNA testing was resorted to by the JCCC to achieve the required identification. Nevertheless the archaeological evidence can throw some light on what is likely to have happened to the aircraft which crashed near the northern entrance track to Frythens Farm on 24th March 1942.

7.1 Artefacts recovered from the Frythens Farm site

A range of artefacts and components were recovered from the Frythens Farm crash site. It is unfortunate that those recovered by Mr. Strick from the other crash site at Frythens Farm are not readily available for inspection and they do not appear to have recorded and catalogued at a level of detail which would allow his assemblage to be considered to see whether they might assist in identifying the aircraft from which they derived. The following is based on an assessment of those components recovered by CAU (Figs 9 to 43).

- Broken sections of Perspex (Fig 10). Some have indications of having been fire damaged but they are insufficient to represent more than a small fraction of the canopy. It may be that the majority of it was destroyed by burning following the crash.
- Small fragments of armoured glass from the front screen (Fig 9). Again, only a small proportion of the front window of the cockpit was found on site.
- Sections of small bore copper alloy hydraulic pipework identified as being part of the aircraft's landing control gear system (Figs 18 and 19). This includes a two safety wired pipe junction blocks (Fig 18).
- A few sections of small-bore steel pipe (Fig 40), function unknown, though possibly sections of oil lines.
- A number of glass-bodied electrical fuses, most badly heat-damaged (Fig 21). The fuse box was low down beside the pilot's seat on the port side.
- Some badly damaged electrical components (for example Figs 12 and 23).
- Sections of woven copper tubing originally the sheaths of armoured cables (Figs 16).
- Steel Jubilee clips (Fig 39) and pipe clips made from copper alloy and duralumin (Fig 37).
- A number of buckles (Fig 20). A section of 1½" wide black webbing (Fig 38) and an eyelet retaining fragments of a coarse open weave material may derive from other cockpit straps, as may some of the copper alloy buckles.
- A copper alloy button, probably from the pilot's trousers (Fig 20).
- Various small Duralumin plates and larger components (Figs 36 and 37), some possibly originally inspection covers as they have holes for attachments in their corners, others were clearly brackets. Many are badly twisted. Also made of duralumin were a heavy duty latch and a slightly twisted component of distinctive form with a 1" central eye (Fig 37).
- One large diameter (1½") aluminium/duralumin pipe joiner (Fig 37).
- Two sections of flattened originally large diameter (1½"?) copper tubing, one having an end flange, the other over 12" long (Fig 35). Short sections of occasionally perforated 5/8" wide copper alloy strip (Fig 17).
- Rubber joiners for 2½" pipes (Fig 26).
- Woven copper filters (Fig 31).
- A section of machined wood with two closely-set holes (Fig 30).
- Part of a machined wooden component (Fig 30).
- The remains of one of the aircraft's batteries including two terminal posts (Fig 34).

- Broken parts of various Bakelite control knobs and wheels (Fig 11).
- A small electrical coil.
- The probable remains of the IFF Destructor button unit (Fig 28).
- Miscellaneous copper alloy objects including half a contactor arm, buckle pins, half of a plain bearing shell, a flange coupler for a 1½" pipe, small sections of perforated strip, washers, two small triangular plates, etc. (Figs 17, 24).
- Two short sections of large diameter woven copper tube, probably originally about 1"in diameter (Fig 16).
- Small scraps of unidentifiable fabric, leather, cardboard and mica (Fig 38).
- Small unidentifiable pieces of carbonised material, possibly burnt Perspex, but perhaps incorporating small carbonised bone fragments.
- Samples of heavily corroded aluminium components (Fig 33).
- Miscellaneous and currently unidentifiable corroded ferrous objects (Fig 41, 42), including two pieces of probable former steel pipe incorporating woven copper alloy filters (Fig 31) and four pieces incorporating rubber hose connectors (Fig 29). Some of these might be better understood following X-raying.
- One small (10mm diameter) hemispherical glass button, dark green in colour.
- Probable instrument dial face. **NB this gave a higher reading on the Geiger counter than the background soils at the crash site and may retain dangerous amounts of radium paint on its surface** (Fig 13).
- Two fire-damaged cannon shell cartridges and one corroded 20mm cannon shell projectile, probably High Explosive (Fig 32).

The majority of Mr. Strick's collection of artefacts from one of the sites at Frythens Farm investigated by him in 2012 (now thought likely to be that near the southern entrance to the farm, and not the site investigated by CAU) are depicted in his e-book but are mostly not readily identifiable, though include:

- Perspex fragments.
- Possibly live cannon shell projectile; 20mm Hispano cannon cartridge case.
- Copper alloy buckle.
- Capacitors.
- Aluminium bracket stamped 225 S5.
- Two 691 Mica A 0.01 micro-farad condensers made by Dubilier originating from the aircraft's MF-HF radio transceiver.
- Corroded fragmentary ferrous objects; fragmentary copper-alloy objects.
- High pressure pipe coupling labelled AVIMO Patent 4657424.
- Pieces of twisted duralumin plate.
- Various fragmentary aluminium components.
- Various ferrous objects.
- Various copper alloy components.
- Piece of machined wood with two drilled holes similar to that recovered by CAU.
- Heat-affected one penny piece.

7.2 Aircraft parts not found at the Frythens Farm site

In understanding the nature of the aircraft crash at Frythens Farm, it is also instructive to consider which aircraft components were not found at the crash site. These include:

- The engine, propeller, constant speed gearbox, engine bay firewall, other engine bay components.
- The wings, landing gear, armament, under-wing and under-body coolant radiators.
- The tail, tailwheel, main radio set, oxygen bottles, rear fuel tank.

The absence of these components or component groups suggest that during the impact the entire engine bay, the wings and the section of the plane aft of the cockpit became detached and were subsequently removed from site by the recovery unit.

The finds listed in the section above appear to derive almost wholly from the cockpit area. However, not all of the components which would originally have been present

within this part of the aircraft were found. Notably absent were the gunsight, compass, flight instruments, flying controls and linkages, radio channel selector box, throttle, undercarriage control, IFF remote contactor, emergency crowbar, landing light controls, seat armour, canopy locking mechanism, cockpit door locking mechanism and most of the Perspex cockpit canopy.

The absence of these components tends to suggest that what was recovered in 2017 represents items from a relatively small part of the cockpit, possibly predominantly its lower port side (given that this was the location of the fusebox).

7.3 A hypothetical interpretation of the crash sequence derived from the archaeological evidence

See Figures 35 to 48. Please note that the squadron and aircraft identification numbers shown are not those of either of the aircraft which crashed at Frythens Farm in 1942.

The impact crater found at Frythens Farm had a distinctive asymmetric profile, and indicates that the aircraft struck the ground when travelling from the south-west. The upper section of the south-western side of the crater was at an angle of 30 degrees from the horizontal and was cut down through the topsoil and subsoil to a depth of 700mm for just under 2.0m from the crater's western lip. At this point the south-western crater edge steepened to 60 degrees from the horizontal and remained at this angle to its base at 1.7m from surface. The north-western, north-eastern and south-eastern edges of the crater were more or less vertical.

Given the very small size of the crater, it seems certain that the wings had sheared off prior to or on impact, though the elongated u-shaped hollowed area on its upper south-eastern edge may suggest that the stub of one wing remained attached to the fuselage at the time of impact, producing this feature. If this is so it is not clear whether this was the port or the starboard wing as the aircraft might have been inverted at the time of impact. If this were Cremin's aircraft, the evidence would be consistent with the loss of (most of) his starboard wing, suggesting that the plane impacted when in normal orientation.

The forward end of the aircraft containing the engine as far back as the cockpit firewall (frame 5) almost certainly sheared off on impact, whilst the forward fuel tank and cockpit instrument panel (back to frame 8) probably also became detached at the time. This part of the impact event probably also destroyed substantial parts of the forward section of the cockpit, as none of its components were found in the impact crater. The archaeological evidence suggests that the engine did not become buried in the impact crater, and is thus likely to have stayed at or close the surface, possibly ploughing on eastwards at surface for some distance, something documented in other crash incidents where the angle of impact was not acute.

However, immediately following the impact the remainder of the aircraft body would seem to have been forced downwards at a steeper angle than that occurring in the original ground impact, possibly as a result of colliding with the rear of the engine block. It is likely that the cockpit area, at the front end of what by then remained of the aircraft, would have been very badly damaged as it was violently thrust into the ground; the suddenly steepened change of angle would also have thrown the mid and aft sections of the plane forward over what remained of the cockpit, possibly detaching them. As no evidence for the seat armour was found it seems likely that this (and the seat (attached to frame 11) together with most of the pilot, who probably remained strapped in at the time of impact) remained attached to the central and aft sections of the plane at this point during the crash. The impetus of the impact would have meant that this element of the plane may have continued eastwards for a short distance (possibly inverted by this point in the crash sequence), and would have probably broken up and become scattered on the ground surface. The fate of the wings remains unknown. If they were still in place at the time of the crash, the sudden deceleration on impact would have sheared them off, quite possibly together with those parts of the fuselage to which they were attached. In such a scenario they would have ended up on the surface in the crash zone, though probably not far away from the point of impact as

at least one was certainly affected by the ensuing fire, as is evidenced by the heat-affected cannon shell cases found on the edges of the crater.

The impact site would have been a chaotic mess following the crash, with partially burnt debris likely to have been scattered over a fairly large area on top of and to the east of the impact crater. The impact crater itself was not very large or deep, and following little more than a cursory examination by the recovery team may have been backfilled. From what remained at surface it would have been evident that there was relatively little of the aircraft buried there, and it is unlikely that anyone would have suspected that some parts of the pilot's body remained within the buried debris.

8 Conclusions/discussion

It is known that S/L Cremin's plane lost its starboard wing during the mid-air collision. This would have found its way to earth some distance from the other remains of his aircraft. It is also stated that his plane spun in before crashing, consistent with what was archaeologically excavated at Frythens Farm, the evidence suggesting a plane which struck the ground at a relatively shallow angle. The forward end of Sgt. Norman's plane would have also been badly damaged in the collision, and it is reported that this nose-dived into the ground. It is not felt that the crater shape found at Frythens Farm is consistent with a nose-diving aircraft, as it would be expected that the heavy engine block would have become deeply buried as a result of a near-vertical impact. It seems most likely, therefore, that the crash site investigated at Frythens Farm is that of Squadron Leader Cremin's plane. This was subsequently confirmed by DNA matching with his son.

9 Recommendations

The core of the crash site adjoining the northern entrance to Frythens Farm, St. Erth, Cornwall has been excavated down to unaltered subsoil and so can now be considered as being archaeologically sterile. However no excavation or investigation has taken place within the surrounding area of the field, where further buried aircraft components may survive. The wider crash site could therefore continue to fall under the remit of the *Protection of Military Remains Act 1986*.

A preliminary identification of the crash site of the second aircraft involved in the mid-air collision has been made by at least one of the amateur archaeologists responsible for the unlicensed digging at Frythens Farm, and some illegal excavation seems to have taken place there (the site lies upslope in the field to the south of that investigated by CAU and seems probable to be that from which the artefacts illustrated in Strick 2013 derive). It is not known whether significant buried military aircraft remains survive at this location but the tenant farmer has been advised that he should not sanction any further investigation of this site in the absence of a JCCC licence to undertake such work. Given that it remains unclear whether all of the pilot's body was recovered from the second site following the 1942 crash and the probability that unfired ammunition will survive there, it is unlikely that any such licence would be granted.

10 References

10.1 Primary sources

Ordnance Survey, MasterMap

Police logbooks relating to military incidents dating to March 1942 (Camborne Division)

Shaw Cobden, Dr. L. 2017, *Report on potential identity of human remains recovered at Frythen Farm, nr. St. Erth, Cornwall*,

Aircraft Casualty File Ref: P367116/42

Operations Record Book (Form 540) for No 66 Squadron (Ref: AIR 27/599)

Royal Air Force Casualty Cards (Air Historical Branch Collection) AM Forms 1582

10.2 Publications

Strick, S. 2013, *History of World War 2 West Penwith Cornwall Uncovering the evidence with a metal detector*, e-publication

English Heritage 2002, *Military aircraft crash sites: archaeological guidance on the significance and future management*

Osgood, R. nd., *Exercise Tally Ho! Archaeological project report for the recovery of Spitfire P9503 at Lidbury, near Upavon Wiltshire under the Protection of Military Remains Act (1986)*, Defence Infrastructure Organisation

Service Personnel and Veterans Agency (Joint Casualty and Compassionate Centre) 2011, *Crashed military aircraft of historical interest: licencing of excavations in the UK, notes for guidance of recovery groups*, *MOD*

10.3 Websites

http://www.heritagegateway.org.uk/gateway/ Online database of Sites and Monuments Records, and Listed Buildings

https://en.wikipedia.org/wiki/Protection_of_Military_Remains_Act_1986

www.bbc.co.uk/history/ww2peopleswar/stories/41/a7069241.shtml

http://www.rafjever.org/spitfirepictures.htm

www.spitfire.dk/

11 Project archive

The CAU project number is **146705**

The project's documentary, digital, photographic and drawn archive is maintained by Cornwall Archaeological Unit

Electronic data is stored in the following locations:

Project admin: \\Sites S\St Erth Frythens Farm Spitfire crash site\

Digital photographs: \\Historic Environment (Images)\Sites Q-T\Sites S\St Erth Spitfire crash\

Historic England/ADS OASIS online reference: cornwall2-292297

The location at which the physical archive is to be deposited is to be discussed with the MoD but it is likely to be the Cornwall Aviation Heritage Centre, St. Mawgan.

12 Appendix: Frythens Farm, St Erth, Written Scheme of Investigation for the archaeological recovery of the remains of a Spitfire pilot.

Client:	Cornwall Coroner
Client contact:	DS Nigel Green, D&C Police
Client tel:	01209 611352

Project background

On 27 June 2017, Detective Sergeant Green of Devon and Cornwall Police contacted CAU on behalf of the Cornwall Coroner with a request for a method statement and costs for recovering the remains of the pilot of a Spitfire which had crashed in a field at Frythens Farm, St. Eth in 1942 as the result of a mid-air collision. The crash site had been identified by a metal detectorist, who had excavated down in the area of the aircraft's cockpit, but had encountered human bone and had stopped work and reported what he had found to the police.

Discussions between the JCCC at the MoD, DS Green and DS Sarah Price at Camborne police station and CAU established that as the Cornwall Coroner was taking on the responsibility for paying for the recovery of the remaining pilot's body parts, CAU could undertake the work, subject to the submission of an acceptable method statement (this document) and cost schedule. CAU has applied to the JCCC for a licence to excavate at the crash site to recover the remains of the pilot. This was granted on 17 July 2017.

CAU also discussed the requirements of the excavation with Guy Salkeld, Defence Infrastructure Archaeologist, as well as the potential for the crash site to be further investigated by Operation Nightingale.

Frythens Farm is located just to the west of Long Lane, St. Erth; the crash site is just to the south of the farm track at SW 54079 33240 near the edge of a field. It seems likely that any above ground wreckage was removed by an RAF recovery crew. Some body parts were recovered by local farmers from the surrounding area.

Site history

In 1942, Britain was at war. The Battle of Britain was over, but airfields across the country were on a state of readiness. 66 Squadron had transferred to RAF Portreath in December 1941, carrying out cross-channel raids, providing bomber escorts and undertaking coastal patrols. In the early months of 1942 they had just taken delivery of Mk Vc Spitfires to replace their ageing Mk 2 models.

At 21.20 hrs on the 24th March 1942, Squadron Leader Daniel Cremin DFC and Sgt William Norman (RAAF) took off from Portreath for some night flying practice over west Cornwall. The skies were clear with good moonlight. The planes may have been flying fairly low during the practice.

The exact details of what was to happen 45 minutes later that evening are unclear, but an online extract from the air accident report suggests that at 22.05hrs Sgt Norman, flying Spitfire AB496 veered into Spitfire AB462 flown by S/L Cremin, striking his plane amidships on the starboard side. With its starboard wing torn off Cremin's plane spun in to the ground uncontrollably, broke up and caught fire. Cremin almost certainly died on impact. Norman's plane nose-dived into the ground, crashing in an adjoining field. His plane also broke up and burned. Both Cremin and Norman died in the crash. Farmers, hearing the mid-air collision, scoured the local fields, but found only body parts, which they took back to a farm barn for subsequent recovery. No record of which body parts were subsequently interred survives.

An RAF team went to both sites to recover what they could of the crashed planes, but given that what is thought to be S/L Cremin's plane had struck the ground in a at a relatively shallow angle, its nose section as far back as the rear of the cockpit remained

buried in a crater, which had become backfilled with the topsoil thrown up during the impact. As a result, at least one (and possibly both) of his legs remained deeply buried in the wreckage.

About ten years ago, a local metal detectorist identified the crash site of what is thought to be S/L Cremin's plane and began to excavate it. He had not applied for an JCCC licence. Around 1.5m from surface, amidst corroded fragments of aluminium aircraft components mixed with loose topsoil he uncovered the head of a human femur. Stopping work at this point, he reported his findings to the local police.

What happened to the other plane (Sgt. Norman's) is unknown. Its exact crash site is not recorded though it appears to have been a short distance to the south f S/L Cremin's. As this nose-dived into the ground it is likely that much of it would have become telescoped and buried in a relatively small diameter crater. Information from the Air Historical Branch of the RAF state that both planes were assessed as being 'Cat E: Burnt', but were marked for salvage by No 67 Maintenance Unit based at Truro.

An analysis of the information relating to the incident available from MoD archives has been undertaken by Dr. Lynsey Shaw Cobden of the RAF Air Historical Branch. The report concludes that there is currently '*insufficient clear and convincing official evidence available to identify the aircraft [at Frythens Farm] as Spitfire Vc AB496. For this reason, the human remains uncovered at the excavation site cannot be positively identified as Sgt William David Norman at this stage*.' It has subsequently been concluded that the remains are most likely to be those of S/L Cremin.

As a footnote, Frythens Farm seems to have been a particularly unlucky place for the RAF in 1942, as on the day following the mid-air collision a Lancaster bomber crash-landed in the farm's fields.

Project extent

The excavation will be limited to the area immediately within and surrounding the cockpit of the aircraft, which is documented as having struck the ground having spun in, and which appears from a preliminary site inspection to be reasonably readily capable of delineation. A maximum 4m x 3m area will be opened up, focussed on the cockpit.

Aims and objectives

The principal aim of the study is to recover the remains of the Spitfire pilot, this being likely to consist of his legs. Personal effects within the excavated area of the cockpit will also be recovered.

The project objectives are to hand over the pilot's remains to the Cornwall Coroner any personal effects to the JCCC at the MoD and any detached aircraft components to the Defence Infrastructure Organisation Archaeologist. A report on the findings of the excavation will be provided to the Coroner; copies will be provided to the JCCC and the Cornwall and Scilly HER and subject to permission from the Coroner and JCCC, to national archives. An entry to the Historic England/ADS OASIS national database of archaeological projects will be produced.

Working methods

All recording work will be undertaken according to the Chartered Institute for Archaeologists *Standards and Guidance for Archaeological Investigation and Recording.* Staff will follow the CIfA *Code of Conduct* and *Code of Approved Practice for the Regulation of Contractual Arrangements in Archaeology.* The Chartered Institute for Archaeologists is the professional body for archaeologists working in the UK.

Desk-based assessment

An outline desk-based assessment will be carried out to inform the fieldwork stage. This will comprise:

- Material made available from MoD archives including the air accident and other relevant reports (if available).

- RAF 1946 aerial photographs of the site.
- On-line material relating to the air collision incident and the pilots involved.
- GIS data sets available to CAU.

Excavation

The principal aim of the excavation is the recovery of all remaining body parts within (and possibly also surrounding) the cockpit of the crashed Spitfire at Frythens Farm, St. Erth, and the recovery of any personal effects remaining within the cockpit area.

It is intended that superficial soil deposits surrounding the remains of the aircraft fuselage will be lowered down over an area notionally measuring 4m x 3m (centred on the forward end of the cockpit area) in shallow spits using a mechanical excavator equipped with a grading bucket; all work will be undertaken under the direct supervision of the site archaeologist. Each spit will be cleared, cleaned and inspected to determine the nature and distribution of any debris scatters, and to better clarify the location of the fuselage. Any significant aircraft fragments will be photographically recorded and located before removal. A metal detector will be run across each spit once it has been stripped. Should significant scatters of unfired ammunition (which may consist of .303 machine gun rounds and 20mm cannon shells) be revealed during this process, all ground lowering activities external to the cockpit will cease at this level. The Police will be informed immediately and the ammunition temporarily covered up with soil.

The intention of the ground lowering work is to reduce ground pressure within the area of the cockpit, which will be the principal focus of the excavation work; the lowering of ground levels external to the cockpit should reduce the risk of ground collapse within the cockpit excavation. As there is a possibility that an MoD team may subsequently excavate and retrieve the remains of this aircraft wreck, it is important that as little damage as possible results to it during the current excavation.

Parts of the cockpit area have already been excavated in a rather haphazard way by an amateur archaeologist/metal detectorist. Some areas of the sides of this excavation are currently overhanging, and will need to be collapsed in a controlled fashion before the existing excavation trench can be safely entered.

The cockpit area of a Spitfire is a relatively confined space. Although it is reported that the aluminium skin of the aircraft has substantially disintegrated, the profile of the fuselage is discernible. The forward section of the cockpit was a cramped space and originally contained the seat base, the joystick and links, magnetic compass, rudder pedals and links, the instrument panel, gunsight, undercarriage control, elevator trim wheel, throttle control, radio channel selector, signalling switchbox, IFF switchgear, radio controls, rudder trim wheel, gun camera indicator, emergency crowbar, remote contactor box and floodlight. As well as these, there were numerous cables, hydraulic and d pneumatic pipes. Sections of the Perspex hood and the armoured glass front screen may also be present. In a high speed nose-first crash, some of the fuselage and its contents may have been telescoped forward whilst the engine block is likely to have been pushed back into the cockpit, as may the engine coolant tanks.

The situation on the ground is thus likely to be highly complex. Whilst some components of the cockpit ad engine bay may be in their original positions, many will have become dislodged, damaged through impact or fire, or will have succumbed to the effects of time and burial in acidic soils. It is also unclear what degree of disturbance resulted from the excavation undertaken by the amateur archaeologist and whether any items have already been removed from the site.

It is proposed that, once the shape of the fuselage is identified, the archaeologist will excavate within it, proceeding downwards towards the foot pedals, recovering human body parts (bones) and any personal effects as the work proceeds. It is possible that soil conditions may have allowed the pilot's flying boots to survive. If this is the case these will contain the bones of the pilot's feet and it is recommended that the boots are bagged *in situ* for subsequent micro-excavation.

Given the complexity of the lower cockpit, and the likelihood that many of the components within this area will have been badly damaged by the impact, providing that the archaeologist is satisfied that all body components have been recovered, it is not proposed that the remainder of the cockpit is fully excavated. In view of the almost certain presence of live, probably heat-damaged ammunition formerly stored within the wing magazines, excavation of areas likely to contain ammunition will be avoided.

The Air Historical Branch has suggested that the identity of the human remains found at Frythens Farm cannot be identified with any degree of certainty on the basis of surviving official records. Although DNA matching of material taken from the bone found on site and supplied by surviving relatives would identify the pilot, it has been suggested that CAU should keep an eye out for any aircraft parts marked with serial numbers AB496 or AB462. It was also suggested that if there engine were to be recovered, since the serial numbers of the two Spitfires involved in the collision are known, identifying the engine number would identify the pilot. It is, however, considered that such an operation is beyond the remit of the brief provided to CAU on this occasion.

Excavation: description

Recording - general

A local site grid will be set up within the 3m x 3m excavation area. Significant finds will be dimensionally recorded in relation to this grid and plotted at a scale of 1:20 on a site plan. Within the cockpit area it is proposed that a 1m x 1m area will be marked out using coloured plastic pegs. High resolution digital photographs will be taken from as close to the vertical axis as is possible at stages in the excavation to record the features revealed at each stage. As the space within the cockpit is likely to be relatively confined and shaded from direct sunlight an LED floodlight will be use to illuminate the images. Trials will be conducted at an early stage in the excavation to find the best location for the floodlight and the best exposure compensation levels to ensure that an archive quality record is produced. A chalkboard or similar should be included in each frame to indicate north and the depth from a pre-determined reference height at which each record image is taken. The pegs will probably need to be relocated as the excavation deepens. The photographs should be accompanied by one or more scaled plans of the cockpit area as the excavation proceeds.

Site drawings (plans, locations of finds) will be made by pencil (4H) on drafting film; the site grid and 3m x 3m trench area will be linked to the Ordnance Survey Landline (electronic) map; all drawings will include standard information: site details, personnel, date, scale, north-point and location.

All features and finds will be accurately located at an appropriate scale. All archaeological contexts will be described to a standard format linked to a continuous numbering sequence.

Human remains

Human remains are known to be present on site. All recording will conform to best practice and legal requirements. The human remains will be excavated with due reverence and will not at any time be exposed to public view. They will be boxed or bagged on site, the container will be labelled with the site code and it will be removed from the site on the day of their excavation to be temporarily stored at the CAU offices pending handing over to the Cornwall Coroner. Whilst loose dirt may be removed from the bones using a soft brush, they should not be washed in anything but a gentle stream of clean water, as it may be necessary for DNA testing to be carried out on them.

Treatment of finds

The archaeological fieldwork may produce artefactual material.

Any personal effects such as those formerly in the pilot's trouser pockets will be collected and bagged for handing over to the JCCC.

Detached aircraft components (other than fragments of its aluminium airframe and skin) should be photographed *in situ*, and bagged to be potentially handed over to the Defence Infrastructure Organisation Archaeologist. Some may bear serial numbers which may help to identify the plane involved in the crash, and hence the pilot whose remains are to be recovered from the crash site.

All finds will be collected in sealable plastic bags which will be labelled immediately with the context number or other identifier.

Fieldwork: photographic recording

CAU follows Historic England's guidance on digital image capture and file storage (2015).

Photography: high resolution digital photography using a digital SLR with a resolution of at least 10Mp will be used as the main record medium; selected images will subsequently be copied onto archive quality film. Colour digital images will also be used for illustrative purposes and will include both general site views. All archive photographs will include a scale whilst photographs of detail will include a north arrow.

Drawings and photographs will be recorded in a register giving details of feature number and location.

The methodology for the archive standard photography is set out as follows:

- Photographs of details will be taken with lenses of appropriate focal length;
- A tripod will be used to take advantage of natural light and slower exposures;
- Difficulties of back-lighting will be dealt with where necessary by balancing the lighting by the use of flash or by the use of a portable floodlight;
- A metric scale will be included in all views, except where health and safety considerations make this impractical.

Creation of site archive

To include:

- Digital colour photographs (stored according to HER guidelines; copies of images will be made available to the client).
- Preparation of finished drawings.
- Completion of the Historic England/ADS OASIS online archive index.

Archive report

A written report will include:

- Summary
- Project background
- Aims and objectives, methodologies
- Location and setting, designations
- Incident history
- Archaeological results including any evidence which would assist in the identification of the aircraft and pilot
- Significance of the results
- Recommendations (for instance for further excavation, treatment of UXO, etc.
- References
- Project archive index
- Colour digital images taken as part of the site archive will be professionally copied onto black and white negative film and added to the site archive.

- Supporting illustrations: location map, historic and other photographs and drawings, excavation, photographs

A digital (PDF) copy of the report, illustrations and any other files will be held in the Cornwall HER. Further copies of the report will be distributed to the client, to the JCCC and Air Historical Branch (RAF) and the Defence Infrastructure Organisation Archaeologist; hard copies of the report will be sent to local archives and national archaeological record centres unless this is embargoed by the MoD on the grounds of sensitivity.

Archive deposition

An index to the site archive will be created and the archive contents prepared for long term storage, in accordance with CAU standards.

The archiving will comprise the following:

1. All correspondence relating to the project, the WSI, a single paper copy of the report together with an electronic copy on CD, stored in an archive standard (acid-free) documentation box.
2. A2 drawn archive storage (plastic wallets for the annotated record drawings).
3. The project archive will be deposited initially at ReStore PLC, Liskeard and in due course (when space permits) at Cornwall Record Office.
4. Digital data will be stored on the Cornwall Council network which is regularly and frequently backed up.

CAU uses the following relevant file formats for stored digital data:

DOCX Word processed documents

PDF Exports of completed documents/reports/graphics

JPG Site graphics and scanned information

DNG or TIF Digital photographs

Timetable

The study is anticipated to be commenced during July 2017. The archive report will be completed within 3 months of the end of the fieldwork. The deposition of the archive will be completed within 3 months of the completion of the archive report.

References

Historic England 2015. *Guidance note on Digital Image Capture and File Storage. Historic England*, Swindon

Service Personnel & Veterans Agency 2011, *Crashed military aircraft of historical interest, licencing of excavations in the UK: notes for guidance of recovery groups*

Shaw Cobden, Dr. L. 2017, *Report on potential identity of human remains recovered at Frythens Farm, nr. St Erth, Cornwall*, Air Historical Branch (RAF) report

Cornwall Archaeological Unit

Cornwall Archaeological Unit is part of Cornwall Council. CAU employs 20 project staff with a broad range of expertise, undertaking around 120 projects each year.

CAU is committed to conserving and enhancing the distinctiveness of the historic environment and heritage of Cornwall and the Isles of Scilly by providing clients with a number of services including:

- Conservation works to sites and monuments
- Conservation surveys and management plans

- Historic landscape characterisation
- Town surveys for conservation and regeneration
- Historic building surveys and analysis
- Maritime and coastal zone assessments
- Air photo mapping
- Excavations and watching briefs
- Assessments and evaluations
- Post-excavation analysis and publication
- Outreach: exhibitions, publication, presentations

Standards

CAU is a Registered Organisation with the Chartered Institute for Archaeologists and follows their Standards and Code of Conduct.

http://www.archaeologists.net/codes/ifa

Terms and conditions

Contract

CAU is part of Cornwall Council. If accepted, the contract for this work will be between the client and Cornwall Council.

The views and recommendations expressed will be those of CAU and will be presented in good faith on the basis of professional judgement and on information currently available.

Project staff

The project will be managed by a nominated Archaeology Projects Officer (Adam Sharpe BA MCIfA) who will:

- Discuss and agree the detailed objectives and programme of each stage of the project with the client and the field officers, including arrangements for health and safety.
- Monitor progress and results for each stage.
- Edit the project report.
- Liaise with the client regarding the budget and related issues.

Work will be carried out by CAU field staff. The project team is expected to include:

Project manager: Adam Sharpe BA MCIfA

Projects Archaeologist specialising in the recording, interpretation and conservation management of industrial buildings, sites and landscapes, having worked with CAU and its predecessors since 1984 and has published guidance on the conservation of mine buildings. Major projects during the past two and a half decades have included the Bodmin Moor and West Penwith Projects, the St. Just survey and all of the related National Trust and Objective One conservation projects, the Minions Survey, most elements of the Mineral Tramways Project and the recent conservation of Trewavas

mine. Adam has been closely involved with the development of Geevor into a major heritage site since its closure in 1991 and managed the data collection and boundary identification stages of the successful Cornish Mining World Heritage Site Bid. Member of the CIfA Buildings Group. Holder of CSCS Card.

Adam will organise the day to day management of the project at CAU, will assist with the excavation and will write the project report.

Principal excavator: Laura Ratcliffe, BSC, MCIFA, ACR

Archaeologist Laura Ratcliffe has worked on a variety of projects with the Cornwall Archaeological Unit over a number of years. Projects she has undertaken have included supervising excavations at the multi-period prehistoric site at TEDC, Truro and Victoria. She also an accredited archaeological conservator and an experienced finds person. Holder of CSCS card.

Laura will undertake the majority of the excavation at Frythens Fam under the management of Adam Sharpe. Laura will help the project manager produce the archive report, collate the project archives and complete the OASIS record.

Report distribution

Copies of the report will be distributed to the client, to the JCCC, the Defence Infrastructure Organisation Archaeologist, local archives and national archaeological record centres (in the case of the latter two, unless this is embargoed by the JCCC on the grounds of the potential sensitivity of the site).

A digital copy of the report, illustrations and any other files will be held in the Cornwall HER and also supplied to the client on CD or other suitable media.

Copyright

Copyright of all material gathered as a result of the project will be reserved to Cornwall Archaeological Unit, Cornwall Council. Existing copyrights of external sources will be acknowledged where required.

Use of the material will be granted to the client.

Freedom of Information Act

As Cornwall Council is a public authority it is subject to the terms of the Freedom of Information Act 2000, which came into effect from 1st January 2005.

CAU will ensure that all information arising from the project shall be held in strict confidence to the extent permitted under the Act. However, the Act permits information to be released under a public right of access (a "Request"). If such a Request is received CAU may need to disclose any information it holds, unless it is excluded from disclosure under the Act.

Health and safety statement

CAU follows Cornwall Council's *Statement of Safety Policy*.

Prior to carrying out on-site work CAU will carry out a Risk Assessment.

Insurance

CAU is covered by Cornwall Council's Public and Employers Liability Insurance, with a policy value of £50m. The Council also has Professional Negligence insurance with a policy value of £10m.

Adam Sharpe BA MCIfA
Archaeology Projects Officer
17 July 2017

Cornwall Archaeological Unit
Cornwall Council

Fal Building, County Hall,
Treyew Road,
Truro, Cornwall. TR1 3AY
Tel: 07968 92146
Email: asharpe@cau.org.uk

Cornwall Archaeological Unit
Health and Safety Risk Assessment Record

Project No: **Site: Frythens Farm Spitfire crash site**

Persons affected (tick as appropriate)

Category	Under 10	Over 10	None	Worker classification	
Employees	✓			Experienced	✓
Other staff	✓			Inexperienced	x
Volunteer	x			Disabled	x
Work experience	x				

Identify ALL hazards. Tick ✓ if hazard present/requires control.

Physical Injury Hazards		Physical Agents		Manual Handling	
Buried services	x	Radioactive materials	✓	Lifting and moving objects	?
Gases/fuels	x	Lasers	x	**Electrical**	
Unstable ground	✓	Ultraviolet light	x	Buried cables	x
Unstable structures	x	Very hot/cold objects	x	Overhead cables	x
Demolition	x	Noise	x	**Miscellaneous**	
Access equipment	x	Vibration	x	Poor/absent welfare facilities	✓
Slips, trips or falls	✓	Arc welding	x	Lone working	✓
Vegetation conditions	x	**Hazardous substances**		Stress	✓
Boggy ground, etc.	x	COSHH substances	?	People	x
Drowning	x	Soil contamination	?	Animals	x
Projecting objects	✓	Human remains	✓	Severe weather	?
Mobile plant	✓	Animal remains	x	Restricted access	x
Dust	✓	Sewage/effluent	x	Confined spaces	✓
Moving machine parts	x	Micro-organisms	x	Equipment/tools	x
Unstable trenches	✓	Vermin/Weils disease	x		
Falls from heights	x	Stings, bites etc.	?	Traffic	x
Fire explosion	x	Explosive substances	✓		
Portable tools	x				

Risk evaluation (see above checklist and enter appropriate score)

Risk	A: Likelihood of harm			B: Severity of injury			Risk total
Score	Unlikely 1	Possible 2	Likely 3	Slight 1	Serious 2	Major 3	Multiply Columns A x B

Physical injury		✓			✓		4
Physical agents		✓				✓	6
Hazardous substances		✓				✓	6
Manual handling	✓			1			1
Electrical	✓			1			1
Miscellaneous		2		1			2

Significant risks identified (high risk evaluations scores)

The normal range of hazards present on any excavation site are likely to be present on site, though exacerbated by the work undertaken by the previous excavator. The space to be excavated is also relatively confined.

The preliminary soil stripping will involve working with a mechanical excavator.

Two unusual hazards are present on this site: the first is the possible presence of un-fired ammunition which may have been destabilised by the effects of heating following the crash landing. These could be initiated by the weight of the mechanical digger pressing down on them or through the operation of its blade.

The second concerns the presence of radioactive radium paint on the dials of the cockpit instruments. If the glass faces of the instruments have been broken, radium dust could well be present in the soil to be excavated, or may still be within the broken instruments, and could be inhaled, or could get onto the skin. Both can cause very serious injuries, including cancers.

Protective and preventative measures to be taken

Care must be taken to ensure that the working conditions within the area to be excavated are safe. A certain amount of ground reduction around the remains of the aircraft fuselage will be undertaken to reduce the differential in the heights between the prevailing ground surface and the base of the trench within the cockpit. This may, however, expose sections of the structure of the crashed aircraft which we are not remitted to deal with and may potentially increase the risk of exposing unfired ammunition.

This stage of the work will involve working with a mechanical excavator under the supervision of the site archaeologist. The archaeologist should position themselves so that they are at all times clear of he extended reach of the boom arm and in full view of the plant operator. The trench area should not be entered at any time whilst the machine is in operation. A re-arranged set of hand signals should be agreed with the plant operator to indicate that the archaeologist wishes to enter the trench area and that the driver should cease operations, or that a hazardous item has been uncovered.

The excavation of the cockpit area will necessitate working within a confined space. Although the excavation area is theoretically enclosed within an aluminium structure, in practice this is likely to have lost most of its structural competency through the effects of time and the effects of acid soils and the trench wall conditions should be periodically checked for any signs of instability. Should this be found the soil in the trench sides will need to be battered back to a safe angle before any further excavation is attempted.

The presence of unfired ammunition is a possibility, though it may have been recovered by the RAF in 1942. This cannot be assumed to have been the case. If

ordnance is set off during machining operations it would be wise for the archaeologist to be as far away as possible from the machining operations as is practicably possible. The machine driver should be reasonably protected by the metalwork of his vehicle. If any unfired ammunition is exposed it is recommended that all machining operations in that area cease immediately and the police are informed. They will contact the UXO removal team to deal with the problem.
In relation to protection against contamination by the radium paint, the site archaeologist will wear robust disposable gloves to prevent against skin contamination, a disposable coverall and a disposable particulate mask when working within or adjacent to the cockpit area. No areas of skin should be exposed. If the coverall becomes torn it should be immediately bagged up securely and replaced. All PPE items of this type should be securely disposed of at lunchtime and the end of each working day. When on site (and particularly when the machine is operating the archaeologist must wear a hard hat, high vis tabard and safety boots. The use of a hard hat within the cockpit excavation area is optional but recommended.

Fuels, coolants, hydraulic oils and other liquids may have contaminated the soils within the cockpit area, together with the residues of burned rubber and early plastics, whilst broken incendiary and tracer bullets may have leaked phosphorous compounds. Skin contact with soil within and around the aircraft should be avoided.

The site archaeologist should ensure that they take with them to the site a suitable supply of washing water and hand soap so that they can remove any skin contamination before leaving the site. It would also be advisable to wash potentially contaminated earth from the soles of boots before leaving the site.

It should be recognised that any items retrieved from the cockpit area (including human remains) may potentially be contaminated with small amounts of radium. Skin contact with such items should be kept to a minimum until this can be shown not to be the case, and the items should be kept in sealed bags or boxes clearly labelled as potential radiation hazards. This problem will be exacerbated if such items dry out and any attached soil turns to dust, making it possible for it to be inhaled. It is recommended that items are wetted down periodically until they can be shown to be safe.

Site First Aider (name): TBA
Site telephone No/Mobile No: 07779 502286
Draft safety plan completed: 05.07.2017
Safety plan reviewed (initials/dates): AS 27 Jul 2017

Useful contact names and numbers (Hospital, Air Ambulance, Doctor, Coastguard, etc.):

CAU Office/Admin	01872 323603 01872 322057
CAU lone working mobile	07973 813566
Accident & Emergency departments:	
Royal Cornwall Hospital, Treliske, Truro TR1 3LJ	01872 250000
Minor injuries units at community hospitals:	
Camborne/Redruth Community Hospital, Barncoose Terrace, Redruth TR15	01209 18000
St Ives Edward Hain Memorial Hospital, Albany Terrace, St Ives TR26 2BS	01736 571300
Helston Community Hospital, Meneage Road, Helston TR13 8DR	01326 430200
Launceston Hospital, Launceston PL15 9JD	01566 761000
Stennack Surgery, The Old Stennack School, St Ives TR26 1RU	01736 793333
West Cornwall Hospital (Penzance), St Clare Street, Penzance TR18 2PF	01736 874000

Compiled by: Adam Sharpe BA MCIfA Date: 05 July 2017

Fig 3. Looking north-east into the hole excavated by Mr. Palmer on the site of the Frythens Farm Spitfire crash site. Note the white-coloured corroded aluminium fragments in the side of the trench. The stones at the base of the pit had been placed there to temporarily protect the human bones which had been revealed at its base.

Fig 4. The early stages of topsoil stripping over the crash site at a depth of 300mm from surface. The exposed corroded aluminium (right) is in an area corresponding to the southern edge of the crater at this elevation.

Fig 5. The excavation trench at 700mm from surface. The edges of the eastern section of the backfilled impact crater in the subsoil are clearly evident in this image.

Fig 6. The head of a human femur (left) exposed at 1.0m from surface in the eastern part of the excavation trench. Note also the abundant corroded aluminium fragments in the crater backfill and the section of copper alloy hydraulic pipe exposed in the section (top right, just to the left of the large aluminium fragment).

Fig 7. Looking south-east across the trench when its base was 1.4m from surface. Note how small the impact crater was at this depth. The edges of the crater on its south-western edge extended to the edges of the excavation trench.

Fig 8. The fully excavated impact crater. The trench was lowered by a further 300mm from surface to expose clean subsoil across the whole of the trench base.

Fig 9. Fragments of the armoured glass cockpit windscreen.

Fig 10. Fragments of the Perspex cockpit hood, some heat-affected.

Fig 11. Broken Bakelite components, including parts of at least two control wheels.

Fig 12. An unidentifiable, probably electrical component.

Fig 13. The face of one of the cockpit instruments.

Fig 14. Part of the identification label from an unidentifiable component.

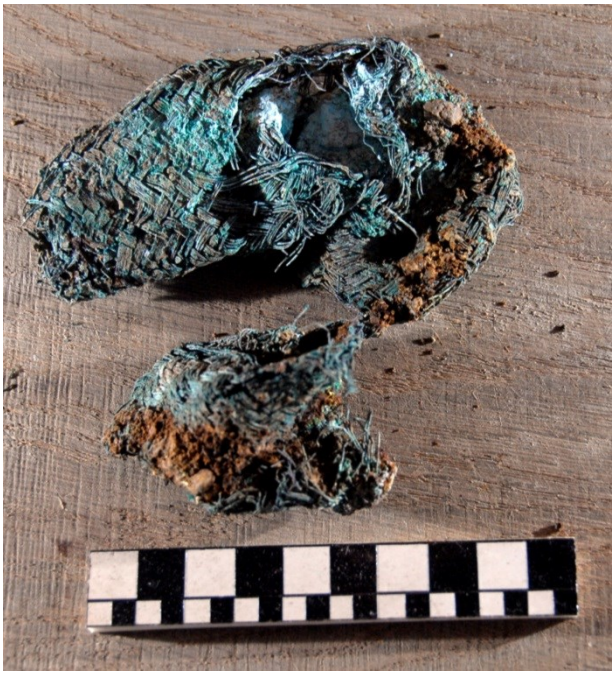

Fig 15. Two sections of large diameter woven copper sheathing, probably from the electrical loom.

Fig 16. Smaller diameter sections of woven armoured cable sheathing.

Fig 17. Examples of the small copper alloy components recovered from the crash site.

Fig 18. Sections of copper alloy pipework of various bores, including two safety wired connector units.

Fig 19. Sections of copper alloy hydraulic pipes associated with the undercarriage control system.

Fig 20. Three copper alloy buckles, a trouser button and an eyelet retaining fragments of canvas webbing.

Fig 21. The remain of electrical fuses, the surviving glass in one being severely heat affected.

Fig 22. A small, badly corroded steel spring.

Fig 23. An electrical component consisting of two coils in a thin metal box.

Fig 24. A one inch internal diameter copper alloy pipe connector.

Fig 25. Probably the badly corroded throttle lever.

Fig 26. Two large diameter rubber pipe couplers.

Fig 27. A distorted copper alloy object corroded onto a ferrous buckle and strap.

Fig 28. Possibly the remains of the twin button Identification Friend or Foe (IFF) destructor unit.

Fig 29. Badly decayed rubber pipe connectors.

Fig 30. Various wooden components.

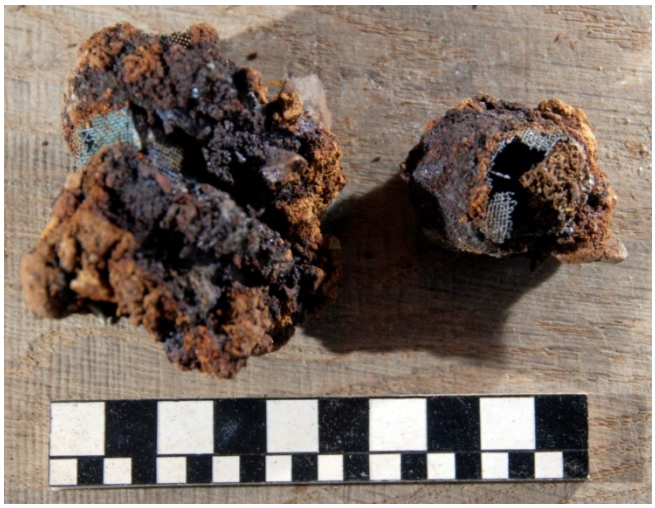

Fig 31. Two ferrous objects incorporating woven copper mesh filters.

Fig 32. Two fire damaged 20mm cannon cartridge cases and a corroded possibly HE cannon shell projectile.

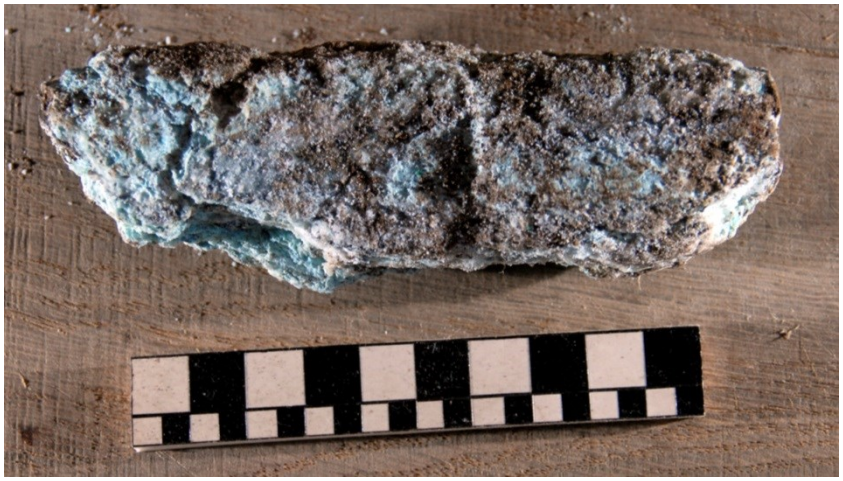

Fig 33. An example of the heavily corroded aluminium fragments found on site, probably part of one of the fuselage frames.

Fig 34. Fragments of the aircraft battery, including its casing, a terminal post, lead plates and separators.

Fig 35. Two sections of flattened large diameter copper alloy pipe.

Fig 36. Pieces of Duralumin sheet from the skin of the fuselage.

Fig 37. A large diameter aluminium pipe joiner, two Duralumin pipe clamps, a locking handle and a distinctively-shaped piece of Duralumin with a central eye.

Fig 38. Pieces of thin plastic, a piece of high density cardboard a fragment of fabric and a small length of black webbing.

Fig 39. Several very corroded Jubilee clips.

Fig 40. Short sections of small-bore steel pipe.

Fig 41. Pieces of corroded ferrous components.

Fig 42. Various corroded ferrous components, some of distinctive form.

Fig 43. A large piece of badly corroded ferrous sheet, found at the base of the impact crater.

Fig 44. A twisted mass of Duralumin aircraft skin and corroded ferrous material.

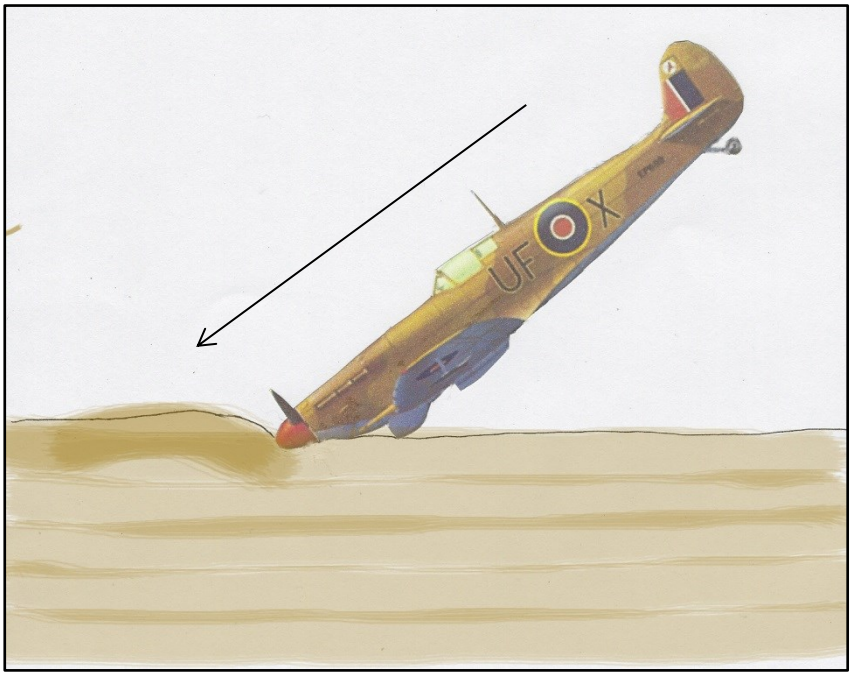

Fig 45. Crash stage 1. The Spitfire hits the ground at an angle of 30^0, its wings shear off and the body begins to telescope into the rear of the engine block.

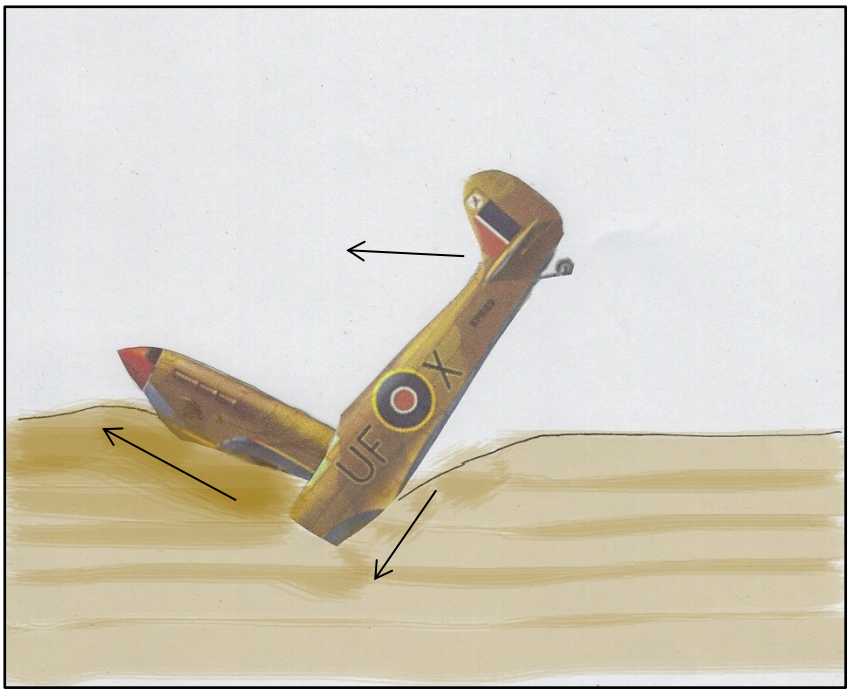

Fig 46. Crash stage 2. Engine block shears off at firewall; the remainder of fuselage impacts the rear of the engine block and the fuselage burial angle changes to 60^0. The cockpit area begins to crush and fragment.

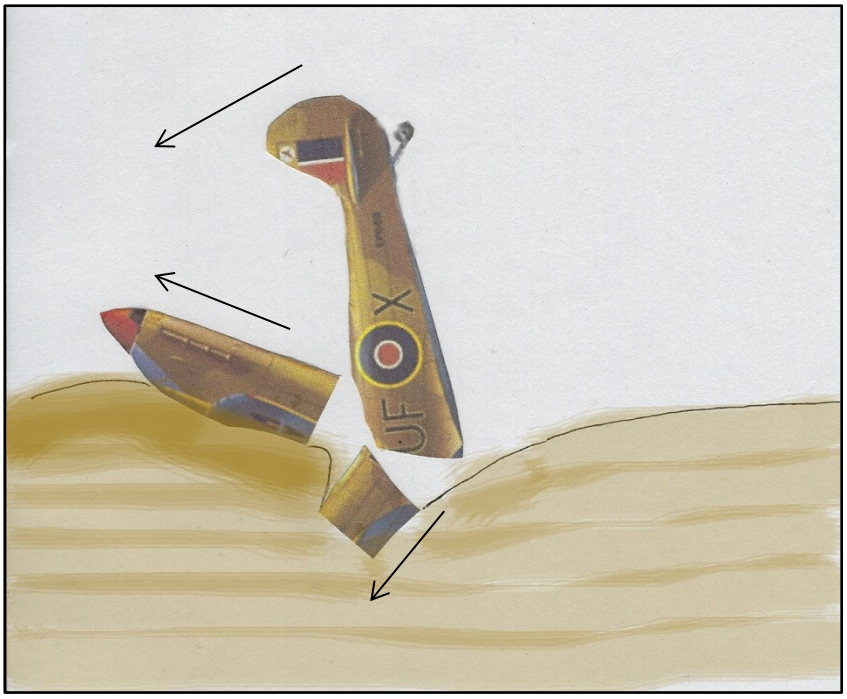

Fig 47. Crash stage 3. The engine block continues to move away from the crater; the crushed remains of the centre part of the cockpit is buried in the crater; the mid fuselage and tailplane shears off and is carried forwards in the direction of impact.

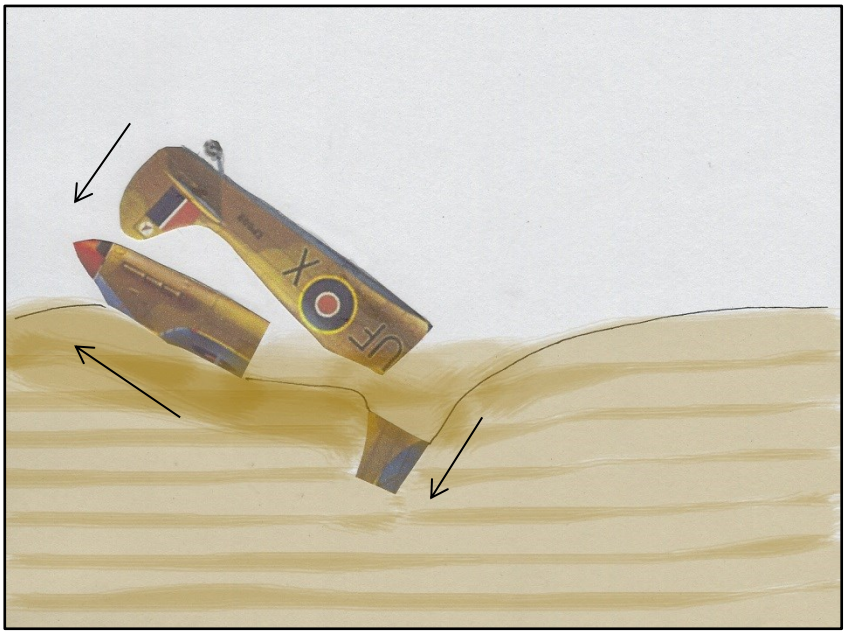

Fig 48. Crash stage 4. The engine block comes to rest (probably further on than shown here); the mid and tail section of fuselage may have ended up ahead of the impact crater as shown here, or standing more or less vertically on top of the crater as shown above; the fragmented remains of the mid cockpit area become buried at the base of the crater. Some above-ground parts of the aircraft wreckage are affected by fire. Above ground wreckage subsequently salvaged by the RAF maintenance unit team. The crater is partly backfilled.

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