WRECK OF A MIDGET SUBMARINE AT ABERLADY BAY, EAST LOTHIAN

(Lat. 56° 01.362' Long. 02° 52.866' Map Datum WGS 84)

Summary of Original Report for the Nautical Archaeology Society

INTRODUCTION

Out on the sands of Aberlady Bay, East Lothian, lies the remains of two WW II midget submarines. The bay is a designated nature reserve with salt marshes, mudflats and a large flat beach of compacted sand. It is only at low tides that the wrecks of these two midget submarines become visible at the southern end of the beach. Both wrecks are badly deteriorated and partially buried in the sand. The wrecks have been described as X –Craft, either of the type XT (Royal Navy Submarine Museum, Gosport) or possible X-20, X-21 or X-25 (NAS, International Journal of Nautical Archaeology, 24, 1995, 219). A survey of hulks in Aberlady Bay carried out by Connect Archaeology of the University of St Andrews in 2002 (Groome and Oxley, 2002; 23) states that the wrecks could be XT or X20 type craft.

XT-Craft known as Wreck A in this report

The site was visited by the RCAHMS in 2003, and the results of a basic survey (RCAHMS database - NMRS Number NT48SE 8008), is that no positive identification of the type of craft could be made.

I became aware of the existence of these wrecks in 2005 whilst looking for a suitable subject for my Nautical Archaeological Society Part II Report. Initially the aim was to carry out a survey on part of the better preserved wreck (Wreck A), but as the project progressed and more research was carried out it became possible to identify the craft as an XT-Craft. Sadly it has not yet been possible to identify the serial number of the craft.

WORK UNDERTAKEN

Archive research was carried out during several visits to the Royal Navy Submarine Museum Archives at Gosport, Hampshire. References in this report made to archive material listed in the Bibliography will have the prefix 'RNSM'.

Several site visits were made to survey and photograph Wreck A between December 2004 and July 2005. Basic dimensional measurements were taken along the line of the deck in order to establish the relative position and size of the major features such as the forward step, 'wet and dry' or escape hatch, periscope dome and 'water tight' hatch. From this it was possible to establish that the wreck was an X-Craft of some type. Subsequent site visits were used to take further photographs and carry out more detailed surveys of the front step, 'wet and dry' or escape hatch and periscope dome. An area of hull on the starboard side, which contained the remains of a lifting lug and an array of small external fixtures, was sketched using a 1m square frame. The results of these surveys were compared to plans and elevations of an XT-Craft found in the Royal Navy Submarine Archives and in the Archives of the National Maritime Museum, Greenwich, and to information from 'Midget Submarines of the Second World War' (Kemp, 2003).

HISTORY OF THE X-CRAFT

The history of the X-Craft is well documented and further reading can be found in 'Midget Submarines of the Second World War' (Kemp, 2003). X-Craft midget submarines were designed and built during the Second World War for attacking targets in defended harbours. They were extremely successful and are best remembered for their part in the attack on the battleship Tirpitz in September 1943 known as Operation Source. They went on to play an important part in the D-Day landings, by carrying out beach reconnaissance and acting as navigational beacons. The two prototypes were given the identification numbers X3 and X4, and the operational craft were given the identification numbers of X5 to X10 (built by Vickers in 1942 -1943) and X20 to X25 (built by Broadbents of Huddersfield during the same period)

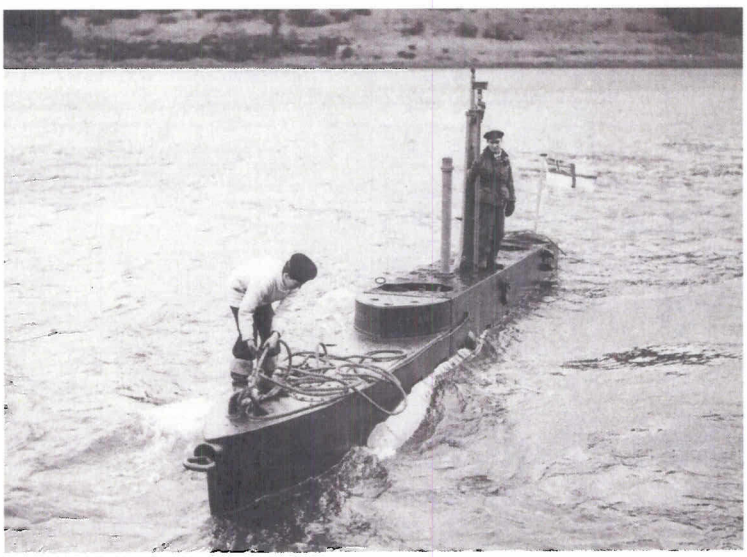
The design of the X-Craft was subsequently modified for operation in the Far East as the XE-Craft. 12 XE-Craft were built; XE1 to 6 by Vickers (1945) and XE7 to 12 by Broadbent (1945 - 1952).

XT5 – Photograph courtesy of the Royal Navy Submarine Photographic Archive

The XT-Craft were simplified versions of X-Craft, used for training in air to sea exercises. The miniature submarines were excellent substitutes for full sized submarines as hunting craft, with the obvious advantage of economy of scale and manpower (RNSM 1). In May 1943 an order for 6 XT-Craft was placed with Vickers. The XT-Craft were similar in construction to X-Craft except that the following equipment was not fitted (RNSM 2):

1. Side cargoes and associated release gear
2. Gyro Compass
3. Automatic Steering
4. Patent Log and Log Tank
5. Taut Wire Gear
6. Night Periscope
7. Magnetic Target Indicator

In addition, the movable periscope was not required and instead had a more simplified periscope fixed in the up position. Also the 'wet and dry' forward hatch was converted into an ordinary escape compartment with the flooding and draining connections from the compartment to the No 2 main ballast tank not being fitted.



XT1 – Photograph Courtesy of the Royal Navy Submarine Photographic Archive

According to the Royal Navy Submarine Museum, the 6 XT-Craft were named:

XT1 - Extant
XT2 - Sandra
XT3 - Helen
XT4 - Excelsior
XT5 - Extended
XT6 - Xantho

DESCRIPTION OF WRECK A

Photo-mosaic of Wreck A

Wreck A (Lat. 56° 01.362' Long. 02° 52.866' Map Datum WGS 84) lies close to the low water mark in a deep scour pool in the compacted sands of the beach. The orientation of the wreck is bows pointing out to sea on a bearing of 310°. The wreck is upright, but listing at 30° from the vertical to port. Approximately half of the lower part of the hull is sunk in the sand, and what can be seen above the sand is badly deteriorated. The outer skin is missing, and about three quarters of the inner skin has gone, leaving the ribs exposed.

The bows are mostly covered by sand and water, and may be in better condition that the rest of the wreck. The forward towing cleat was observed on one site visit, but has since disappeared under sand on subsequent visits. Moving aft, the frame of the 'front step' up to the main deck of the craft is visible. Next is the slightly opened hatch of the 'wet and dry' compartment.

Front Step and Wet and Dry Hatch of Wreck A

Aft of the 'wet and dry' hatch, and below the level of the main deck, is the remains of a pipe connection; possibly coming down from the deck to below. This may be the remains of the fixed projector compass. Further deck structures are missing until the bulge of the periscope housing with a distinctive 'eye' feature (the remains of the periscope) on top. This was inspected inside during the second site visit and found to be completely empty.

Remains of the Periscope Housing of Wreck A

Moving further back the remains of the main 'water tight' hatch has no lid and a large tear down the starboard side of the hatch tube shows signs of being blown open from within. Aft and starboard of this hatch is an upright tube (560mm in height and external diameter (measured at the top) of 140mm.) This may be the remains of the signal ejector tube.

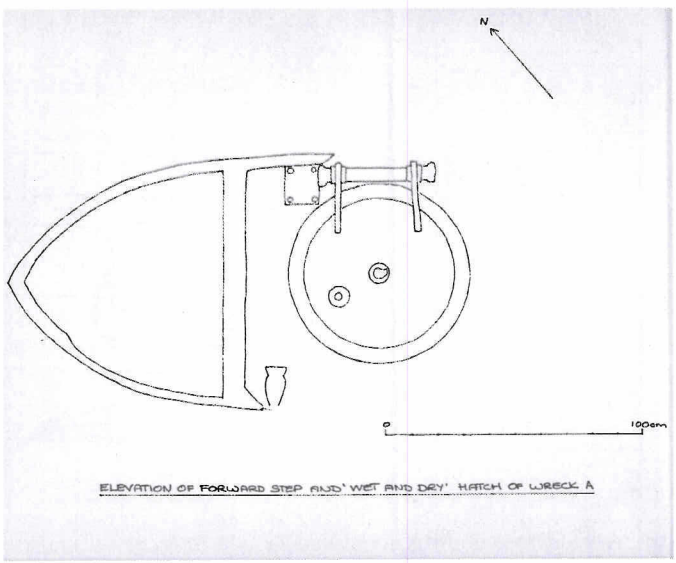
Water Tight Hatch of Wreck A

Moving aft, the ribs of the wreck are missing allowing access into the wreck and a view of the remains of the diesel engine and electric engine. At the stern, the propeller is missing and so is the vertical rudder. Part of the starboard hydroplane, with linkage mechanism still attached on the starboard side, is lying in the scour pool directly behind the vessel. The top linkage mechanism for the vertical rubber is still attached to the main body of the hull, and hangs over to the port side.

Stern View of Wreck

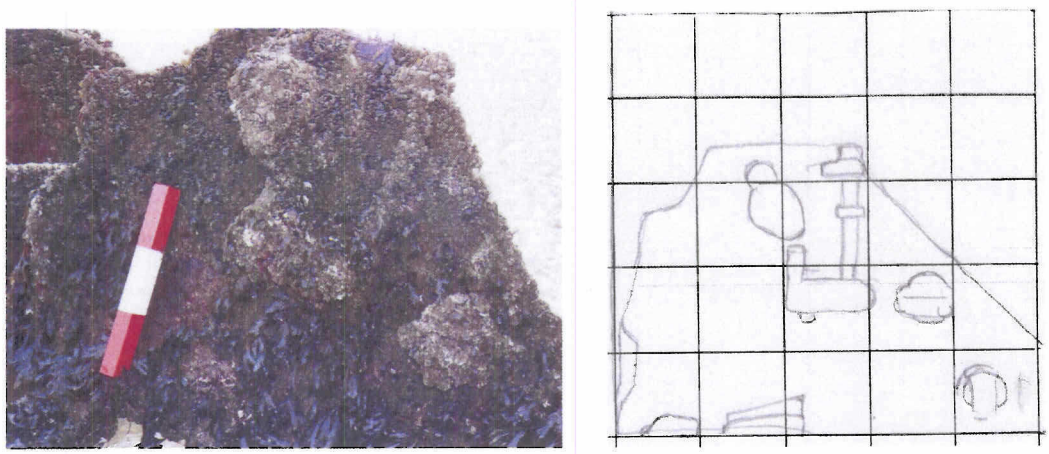
RESULTS

From the site measurements, several survey drawings were made showing the layout of the forward deck step, 'wet and dry' or escape hatch and periscope dome as if the vessel were upright and viewed from above. This allowed the position of the major features as measured on Wreck A to be compared to the position of the same features as determined from the sketch/side elevation of an XT-Craft from the Royal Navy Submarine Archives. The overall length of the vessel was also taken as this was used to eliminate Wreck A from being XT5 as XT-5 was slightly longer in length to the other XT craft.



Resulting drawing of the 'wet and dry' or escape hatch from site measurements

An area around the starboard lifting lug was sketched using a planning frame which was then compared to photographs of the same area on an XT-Craft.



Area around the starboard lifting lug ad the resulting sketch using a planning frame

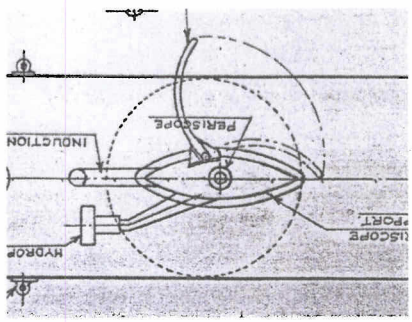
DISCUSSION OF RESULTS

A report issued by the Naval Construction Research Establishment, Rosyth, Report No. NCRE/R.7 (RNSM 3) describes the trials carried out by aircraft using 20mm cannon on two X-Craft moored in Aberlady Bay during May 1946. The report does not indicate which particular type of X-Craft was used or give individual identification numbers. However, the drawings attached to the report, showing the damage inflicted on the vessels during the trials, refer to the forward compartment as an 'escape' compartment rather than a 'wet and dry' compartment. This is the first indication that the craft are XT-Craft as this is one of the design differences given in RNSM 2.

A visual examination of Wreck A shows that the craft has a distinctive step up on the deck, forward of the first hatch. XE-Craft had this characteristic step removed to give the craft a flatter silhouette in the water (Kemp, 2003; 93) and so Wreck A can not be a XE-Craft.

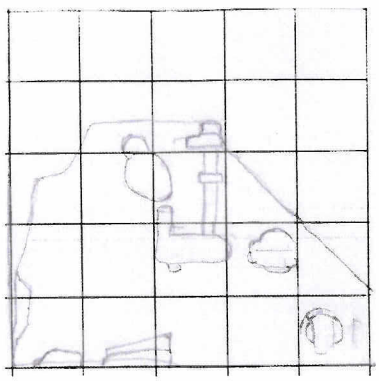
The 'wet and dry' compartment was originally placed in the centre of the craft (Kemp 2003; 90), midway between the engine room and the control room. This arrangement proved unsatisfactory, and in X5 and all subsequent craft the 'wet and dry' compartment was placed forward of the control room. Again a visual examination of Wreck A places the 'wet and dry' compartment forward of the periscope dome and therefore of the control room. This means that Wreck A is neither of the two prototype X-Craft, X3 or X4.

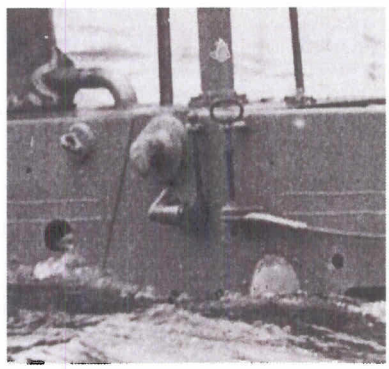
Apart from the change to the 'wet and dry' compartment, the other main design difference between the X-Craft and the XT-Craft is the simplified periscope. Photographs and drawings supplied by the Royal Navy Submarine Photographic Archives shows XT-Craft to have a much larger fixed periscope in the shape of a 'flattened tapered cone', rather than the retractable attack periscope and a smaller night periscope of the X-Craft. This change in the design of the periscope is probably the most distinctive difference between the X and XT-Craft and the most useful feature in determining if Wreck A is an XT-Craft. An examination of the 'eye' feature on the top of the periscope dome of Wreck A showed the outline of the flange to fit well with the design of the tapered cone. Also there is no evidence on the periscope dome of Wreck A of an aperture for a night periscope. Both these findings support Wreck A being an XT-Craft.



The 'eye' feature on the top of the periscope dome of Wreck A compared to a drawing

The area on the starboard side of the outer hull, which was sketched using the planning frame, was looked at and compared to photographs of XT Craft. The actual items on the wreck are almost unidentifiable, but the top feature is probably a lifting lug. However the item's size, shape and layout are distinctive and can easily be recognised from a photograph of XT5. The layout of this area appears to be particular to the XT-Craft as plans for X5-10 and X20-25 show a slightly different configuration. Although this particular piece of evidence on it's own does not prove that Wreck A is an XT-Craft, it positively supports the findings of the periscope design.

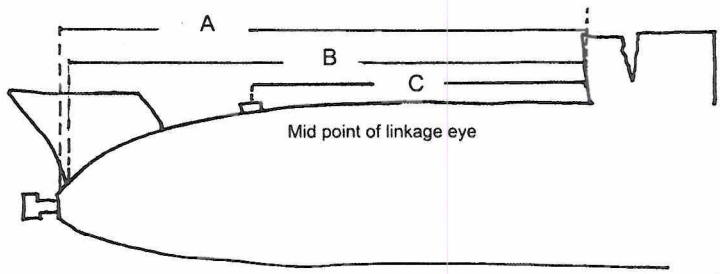




The sketched area on the starboard side of the hull compared to photographs of XT Craft.

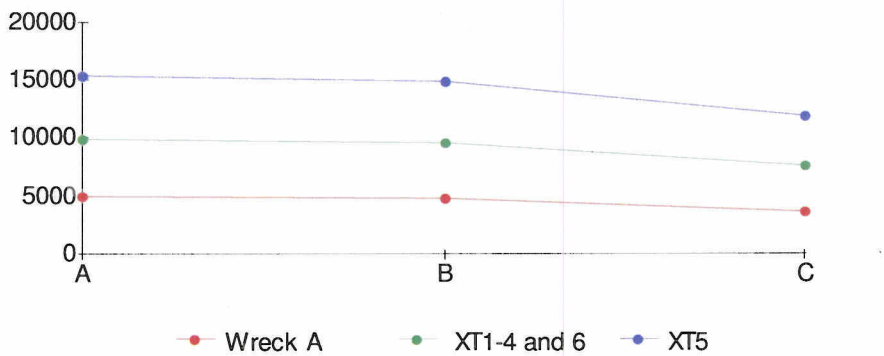
A visual examination of the second wreck in the bay, although extremely badly deteriorated, found that the periscope dome had the same 'eye' feature, and it is therefore likely that this is also an XT-Craft.

Finally, from a detailed set of plans from the builders of the XT craft, Vickers-Armstrong Ltd., for XT1-4 and 6, and XT5 (from the National Maritime Museum Archives at the Royal Arsenal, London), it was confirmed that XT5 had been modified and was 1½ foot longer at the stern than any of the other XT-craft. This was to allow the main motor and diesel to be mounted on a common sound-insulated bed in an effort to reduce the running noise of the craft (Kemp, 2003, 91). From the length measurements taken from the wreck site, Wreck A is more likely to be one of XT1-4 or XT6 rather than XT5.



Measurement	Wreck A	XT1-4 and 6	XT5
A	4920	5029	5486
B	4850	4792	5249
C	3540	3889	4316

All measurements in mm



ARCHIVE RESEARCH

Two visits to the Royal Navy Submarine Museum Archives were made in order to try to seek further information on the X-craft in Aberlady Bay. The information in the files is not complete and is hindered by the fact that the prefix 'X', 'XT', 'X Type" and 'XE' have been used in an inconsistent fashion. However from the archive files it has been possible to piece together the following information.

- All six XT-Craft were scrapped in June 1945 and sent to the Royal Naval Construction Research Establishment (NCRE) in Rosyth along with the two prototypes X3 and X4.

- A report of the 'Ships Target Trials Committee' (RNSM 4) proposed a programme of trials for the 1946 financial year, which include three trials using X-Craft from NCRE. These trials were;

Trail series No.	Description of Trail	No of X-Craft Required
5/B	Submerge to collapsing depth.	1
2/F	Trials of 20 mm shell against midget submarines. Forth Area.	1
1/C	Damage by underwater non-contact charges.(Rupture Trials)	6

- From this information it appears that all six XT-Craft and X3 and X4 were allocated to trials during 1946-47.

- Trail 2/F (20 mm cannon shell attack) took place on the 1st and 6th May 1946 in Aberlady Bay. The report on the trials (RNSM 3) gives no hint as to the type or serial number of the X-Craft used. However two X-craft were used which is in contradiction to the proposals made in the 'Ships Target Trials Committee' (RNSM 4).

- The first of the rupture trials (1/C) took place on the 8th November 1946. A short report on the trial describes the craft used as only 'of the type X1-4' (RNSM 5). Since there was no X1 or X2, this must have been an error, and should probably have been reported as XT1-4.

- Trail 5/B (Submerge to collapsing depth) took place on the 26th November 1946. The report on the trial (RNSM 6) described the craft as an XT type, but does not give it a serial number.

- A second rupture trial (1/C) took place between the 5th and 12th March 1947. The report on the trail (RNSM 7) states that the craft used was of 'type XT'.

- The third rupture trial (1/C) took place on the 8th May 1947. The preliminary report (RNSM 8) states that the craft used was 'of the type X4'. However due to the previous reporting uncertainties, this may have been either X4 or XT4.

From this information it is impossible to be sure which X and XT craft were used for each trial and therefore which XT-craft is Wreck A in Aberlady Bay. However it does confirm that it is an XT craft, as the possibility of it being an early prototype (X3 or X4) has been dismissed due to the position of Wreck A's 'wet and dry' compartment and the periscope design.

CONCLUSIONS

Having carried out the survey work on Wreck A and compared the observations and resulting surveys to known data, plans and photographs of XT-Craft and X-Craft, the evidence appears to be in favour of Wreck A, and the second wreck, being XT-Craft for the following reasons:

1. The Report by the Navel Construction Establishment on the 20mm Cannon shell attack (RNSM 3) refers to the craft as X-Craft with the front hatch as an escape hatch and not a wet and dry hatch.

2. The remains of the periscope dome with its 'eye' feature compares well with drawings and photographs of XT-Craft. There is also no sign of an aperture for a night periscope.

3. The detail around the lifting lug on the starboard side of Wreck A matches the photograph of XT5, but does not compare favourably with the plans of X5-10 and X20-25.

4. From research carried out in the Royal Navy Archives, all six XT craft were sent to the Royal Naval Construction Research Establishment (NCRE) in Rosyth and allocated for use in the ships target trials in 1946- 47. One of these trials was the attack using 20 mm shell against midget submarines carried out in Aberlady Bay.

5. From measurements taken of the length of Wreck A, it is unlikely to be XT5.

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RNSM 2. A Preliminary copy of X and XT Craft History by C E Clews RCNC, Navel Construction Department. Archives File A1978/22/008

RNSM 3. X-Craft – 20mm Cannon Shell Attack, Navel Construction Research Establishment Rosyth Report No NCRE/R.7. Archives File A1942/3

RNSM 4. Ships Target Trials Committee, First Interim Report Covering the Trials Proposed for the 1946 Financial Year. Ref; STTC/A/Z/6. Archives File A1946/1.

RNSM 5. Ships Target Trials Committee Sub-committee 1 (STT 1/C). Archives File A1942/3.

RNSM 6. Damage to XT craft after being submerged to 540 ft. Archives File A1942/3.

RNSM 7. Explosive trials against a 2nd X-craft (STT 1/C). Archives File A1942/3.

RNSM 8. Explosive trail against 3rd X-craft (STT 1/C). Archives File A1942/3.

RNSM 9. Build information for X and XT-Craft. Archive File A1942/3.

National Monuments Record of Scotland

RCAHMS database - NMRS Number NT48SE 8008. X-Craft Aberlady Bay, Firth of Forth.