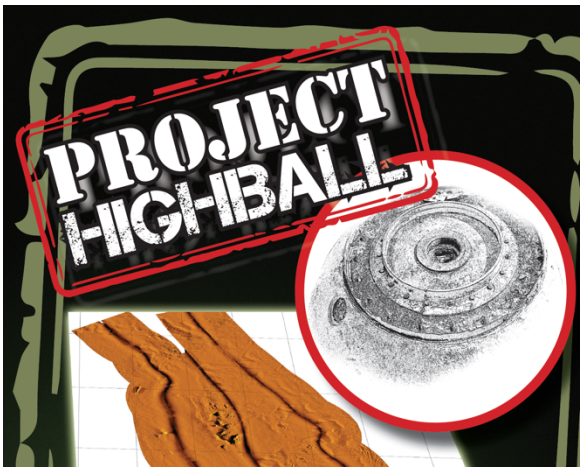

EAST CHESHIRE SUB AQUA CLUB

HIGHBALL PHOTOGRAMMETRY PROJECT

SUPORTED BY THE BSAC JUBILEE TRUST

EXPEDITION DATES

JUNE 2018 & JULY 2019

Report Authors

Kevin Phillips
Diving Officer – East Cheshire Sub Aqua Club
Expedition Leader (Trip 1)

Mike Dennison
Expedition Leader (Trip 2)

Report Date - October 2019

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Introduction

In 2017 East Cheshire Sub Aqua Club (ECSAC) led a project to survey, locate and ultimately raise two Highball Bombs from Loch Striven in Argyll and Bute, Scotland.

With the support of the BSAC Jubilee Trust, ECSAC put together two expedition teams to revisit the site of the bombs and complete a photographic survey of the target area and specifically create a 3D Photogrammetry Model of a highball bomb so that it could be shared with the diving community as well as the two museums that currently have the highball bombs we raised.

See http://www.ecsac.org.uk/?page_id=1102 for details of the original Highball project.

Projects background

Having documented and published details of a dive trail for Project Highball we aimed to produce detailed 3d Photogrammetry models of a number of items as they lie on the bottom of Loch Striven with two primary aims:

1. To provide an opportunity to develop capability and build skills within the club in the use and application of Photogrammetry.

2. To produce three detailed 3D Photogrammetry models of key targets on the Dive Trail. (in order of priority)

    1. A Highball Bomb (possibly two)
    2. The X-Craft Side Charge
    3. The Bruce Anchor and some of the chain

These models will enable the dive trail to be “visited” by non-divers and provide a resource that will augment the Highball displays at Brooklands and The De-Havilland Museums when the Highballs go on display in 2018.

The project assembled a dive team, boat and required equipment to visit Loch Striven and photograph the artefacts in-situ on the bottom of the Loch. The diving was planned to take place during a single 2 day trip and will involve transport of two boats and associated equipment to Largs then launch and recovery of the boats will be made from there in order to transit to Loch Striven to the pre-defined coordinates of the Dive Trail

The first trip to Loch Striven (in 2018) proved problematic as the visibility in the Loch was very poor and precluded us from producing any usable models.

A second trip was therefore arranged in July 2019, (with the agreement of the Jubilee Trust) to obtain more usable imagery and this report covers the outputs of both of these expeditions.

Expeditions overview

Expedition 1 – 2018.

The expedition team were assembled from across the club, with a good mix of experienced and less experienced team members. A number of detailed briefing sessions were arranged as we some pre-expedition outings to training venues to develop the capabilities needed across the team.

Two boats were taken up to Largs to provide the dive platform for the weekend. Launching from Largs Lifeboat Ramp we were able to transit over to Loch Striven in about an hour.

The dive plan for the initial dives was as below:

Dive Teams:

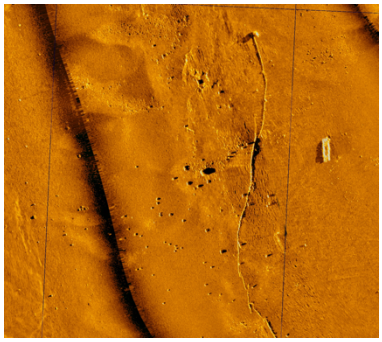
Team 1 : Kevin & Steve - Site setup
Team 2 : Alex & Michelle - Photography on Sidecharge
Team 3 : Nicole & Vesta - Survey Photograph Anchor
Team 4 : Mike & Joanne - Survey Photograph Anchor
Team 5 : Dave & Simon - Survey Photograph Highball
Team 6: Alison & Clive - Survey Photograph Highball

PLAN

Thursday 7th – Evening – prep boats, make the final call on the trip subject to weather forecast.

Saturday 9th:
Arrive Largs for launch of 2 boats.

Kit loaded onto boats, assemble team and briefing + dive plans to be discussed.



Weather permitting make the crossing to Loch Striven (45 mins to 1hr) (fall back- dive around Cumbrae – lots of Wrecks and Reefs to choose from).

In Loch Striven – arrive at dive site and shot the Side-Charge.. Using the mapping and GPS coordinates obtained in the original 2017 expedition.

Dive Team 1 - Shot to be placed near to side charge – then dive team 1 to drop in and put a distance line in from Shot to side charge (minimise silt). DSMB Sent up to indicate ready.

Dive Team 2 – (Alex and Michelle) deployed to side charge for phase 1 of Photography.

Dive Team 1 – proceed to anchor chain and run a distance line from the side charge to the chain.

Dive Team 1 – proceed north along anchor chain and locate the anchor. Deploy DSMB from the anchor chain (5 meters from the anchor – with an arrow pointing to the Anchor).

Upon appearance of the Anchor DSMB on the surface (likely 15-20 mins from Team 1 – going in).

Dive team 3 & 4 – Drop in on Anchor DSMB and survey/photograph the Anchor.

Upon Completion of the Sidecharge Photography – Team 2 send up DSMB from the Side-Charge (Expected 30 mins) and surface via DSMB.

Dive Team 5 & 6 – drop in on the Shotline and proceed to the Side Charge, follow lines to Anchor Chain, at chain turn south and survey/photograph Highball(s).

Subject to the results of the above survey/photography work, we may need to return to the site on Sunday for which a similar plan will be created.

Boats may need to be recovered on Saturday night depending on available moorings.
Air fills are available in Largs.

Sunday 10th – dive operations to be completed by 1pm and then recover boats, and drive back to Macclesfield to wash and stow the boats.

Post weekend work will be to collate the data and photographs, produce Photogrammetry models and complete report. Suggest a Wednesday evening meeting (13th June) at the club to compare notes and review/agree outputs.

The actual dives differed from the plan as we had to adapt to the conditions.

Here is an account from a team member:

After team 1 dropped the shot it was up to Kev and Steve Welton to descend into the depths of the Loch to locate and then set a distance line up from the shot to the side charge.

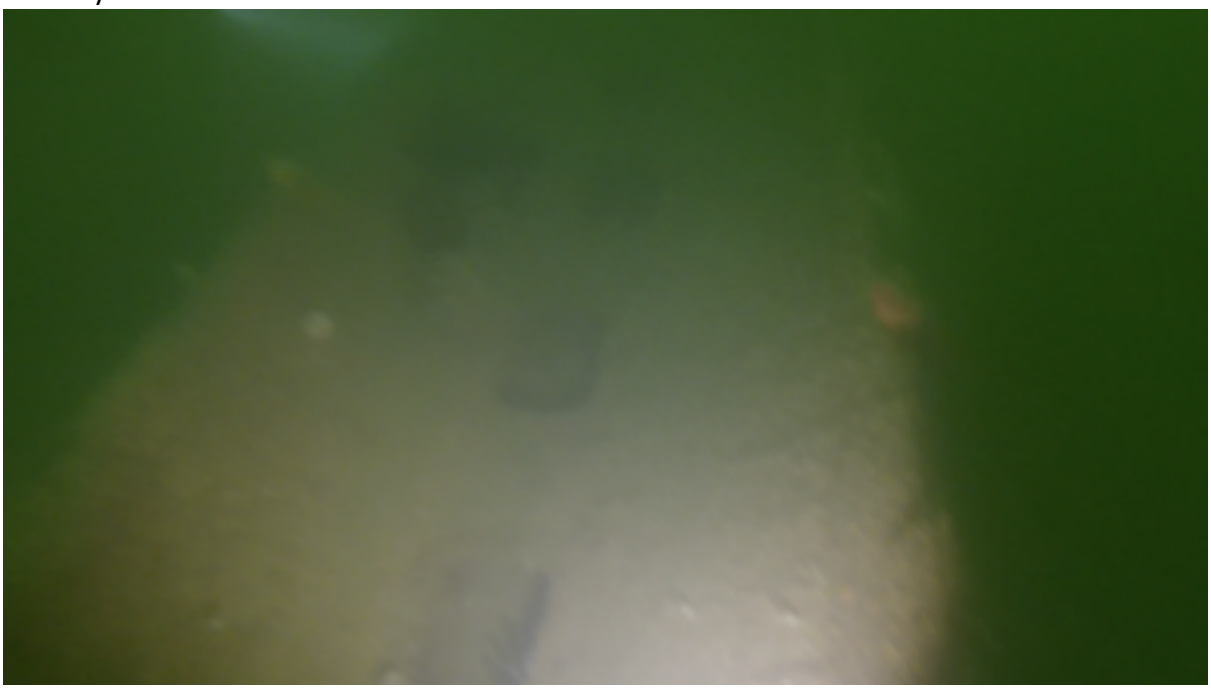
We attempted to shot near to – but not on top of the Side-Charge as we have never been assured that it was not actually "Live"!

A few minutes passed and we thought the dark depths had got to Steve and Kev as their bubbles kept going round and round in circles. It wasn't until they surfaced that we realised the visibility was so poor they had to set up a circular search pattern to locate the side charge. But it was a success and lines were now in so everyone could easily locate the start of the dive trail.

Next in went Alex and Michelle. Their original job was to dive the bombs for Alex to take the photographs for the photogrammetry portion of our mission. Alas, as visibility was so poor they had to settle for part of a side charge.

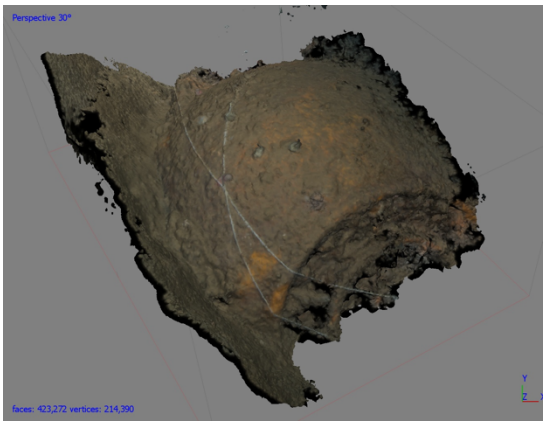
Expedition 1 – Outcomes.

After attempts were made to photograph the Side Charge it was apparent that the scale of the side charge was such that it was not going to be practical to model it in such low visibility.



A decision was taken to attempt to locate a suitable highball and photograph that for the purposes of 3D modelling. This was achieved, with a number of photographs being taken that would ultimately produce a partial model.

Partial model of a Highball.



Sadly the visibility impacted the quality of the photographs and the model we had desired was not practical to produce. We managed to create a partial model but this was not sufficient for sharing with the museums.

Expedition 2 – 2019.

Following the disappointing results in 2018 it was decided to run a second trip in July 2019. The intervening 12 months had given us the opportunity to assess the reasons for the problems encountered on the first trip and to undertake the necessary planning and training needed to obtain more positive results. This included further photogrammetry training and a recognition of the desirability to conduct diving operations during the flood tide (and after better weather) in order to increase visibility.

A new team was assembled to revisit Loch Striven and detailed plans were worked up for the team.

Thursday 4th July – Planning briefing

A planning briefing was conducted in the training room which was attended by all team members, with the following plan being agreed upon.

Drop a shot line close to the side charge.

Jon G & Jon S: Run a temporary line from the side charge to the anchor chain via the Highball we knew to lie in between. Attach a DSMB to the anchor chain both to inform us they had completed their task and to provide an additional datum for later teams.

Drop a shot line to the anchor.

Alex & Michelle: Follow the line laid by the previous team and photograph the Highball for photogrammetry purposes.

Simon & Dave: Follow the chain from the anchor to a further known Highball and photograph for photogrammetry purposes. (Also act as a reserve line laying team should the first team be unsuccessful).

Ensure all these teams have completed their photography before deploying further divers in order to protect visibility.

Vesta & Peter: Survey the anchor and build experience for subsequent trips.

Jo & Helen: Survey the side charge and build experience for subsequent trips.

Mike & Alison: Measure the temporary line laid by Jon G & Jon S in preparation for laying a permanent line.

Timings for a further 2 dives were planned but it was decided to leave tasking details until the results of the first dive were known, with the exception of Jon G & Jon S who were to replace the temporary line with a permanent one.

Thursday 11th July
Travelled to Largs and berthed both boats in Largs Marina.

Friday 12th July
As we were not planning on diving the Highball site until the afternoon in order to have a favourable tide it was decided that the less experienced members of the team would conduct a check dive on a shallow site close to the Marina, with Dave & Jon G providing boat cover.
In the meantime Mike, Jon S & Simon travelled to the Highball site in the second boat to drop a shot line close to the side charge. This proved to be beneficial as it took a considerable length of time to locate which would have significantly disrupted the afternoon's dive plan.

On arrival at the Highball site in the afternoon the diving ran as follows:

As per the plan Jon G & Jon S ran a line from the side charge to the chain, then released a DSMB from the chain. On the surface however, this had come up nowhere near where it was expected so a decision was taken to postpone further dives until the pair surfaced in order to assess the situation.
It later transpired that they had missed the intended Highball but had found an alternative, accounting for the unexpected DSMB location. They reported good visibility for the site.

Alex & Michelle followed the line to the alternative Highball and conducted photography, releasing a DSMB when completed.

Vesta & Peter followed the shot line that had been placed on the anchor. Unfortunately this had missed it's target and despite following a search pattern they were unable to locate anything of interest.

Simon & Dave modified their plan due to the missed anchor shot and dived to the side charge, locating a Highball to photograph from there. They were, however, thwarted by a camera casing failure early on. They did manage to travel the length of the chain and release a DSMB on the anchor in place of the missed shot.

Jo & Helen conducted a successful survey dive on the side charge and adjacent Highball. Mike & Alison successfully surveyed the temporary side charge line and planned the permanent line for installation the following day. It was decided that due to the route being different to that planned there was only enough line available to mark from the side charge to a Highball.

Saturday 12th July

Due to the sea state looking less favourable than the previous day the decision was taken to abandon the morning dive and travel to the Highball site earlier than planned in order to compensate for the increased crossing time. This meant dives would be undertaken during the ebb tide with a potential impact on visibility, yet it was felt this was the best option. In the event visibility seemed unaffected.

Alex & Michelle dived on the anchor in order to collect data for a second Highball model.

Simon & Dave attempted a repeat of the previous day's dive but sadly further camera problems prevented them from collecting any useful data.

Vesta & Peter successfully followed the trail from the side charge, collecting useful information for subsequent trips.

Jo & Helen successfully surveyed the anchor.

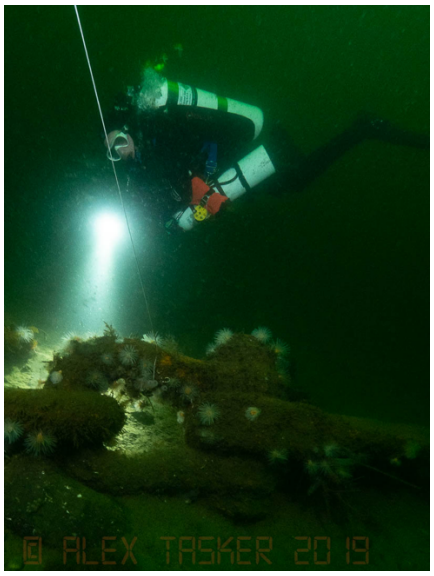
Mike & Alison collected video footage from the anchor and a Highball just off the anchor chain.

Jon G & Jon S made an attempt at replacing the temporary side charge line with a permanent one. This inevitably resulted in disturbance of the silt, unfortunately causing them to become separated, meaning the attempt had be abandoned.

Sunday 14th July

Arrival at the Highball site was to be as early as possible due to the long journey back to base later in the day. A delay in getting fills was compensated for by exceptionally flat sea conditions.

As Alex & Michelle had already collected enough data for two Highball models it was decided they should survey the anchor using a newly developed modelling technique. Results are not yet available but if successful it should result in more data being gathered than is currently possible.



Jon G & Jon S made a further attempt at installing the permanent line and this time were successful. Sadly there are no photographs of it in situ but they report it hangs approximately 1m above the silt and the orange colour makes it highly visible. This will undoubtably be of huge benefit to subsequent trips.

It was then decided that no further useful data could be gathered with the time and equipment available. The remaining members of the team conducted a very enjoyable dive on the nearby wreck of the SS Wallacchia.

Expedition 2 – Outcomes

Following a huge amount of processing work by Alex the expedition has produced workable models of two Highballs. There is still further work to be done but it can be assumed at this stage that the final results will not differ significantly from what is currently available. Both models are now publicly available and can be viewed on the Sketchfab website using the following links (no login is required):

https://sketchfab.com/3d-models/highball-bomb-02-draft1-b3eac9f4d68a48c793681d1f67771e02

https://sketchfab.com/3d-models/highball-bomb-03-draft1-be2db84f7b3947a9a0fe0b750749242d
These models are in lower resolution than we have on our main modelling software. Bu give a good idea of the broad quality of the models and the nature of the 3D rendering.

Although the visibility for 2019 was significantly
better than 2018, the very nature of the site with its lack of light and silty bottom make it incredibly challenging for photogrammetry and it is testament to the skill of the team that these results have been obtained. The remoteness of the site also makes it a logistical challenge but this likely why it was chosen as a testing site for the bombs in the first place.

The laying of the permanent line between the side charge and the three highballs will be of great benefit to future expeditions, and the laying of further lines has been discussed.

It was noted on the 2019 expedition that the side charge, an artefact of significant historical interest, is decaying at an alarming rate. There is notable degradation from the condition noted in 2018. With this in mind it would be desirable to attempt to produce a photogrammetry model of the side charge before it is lost completely, which we intend to plan over the next few dive seasons.

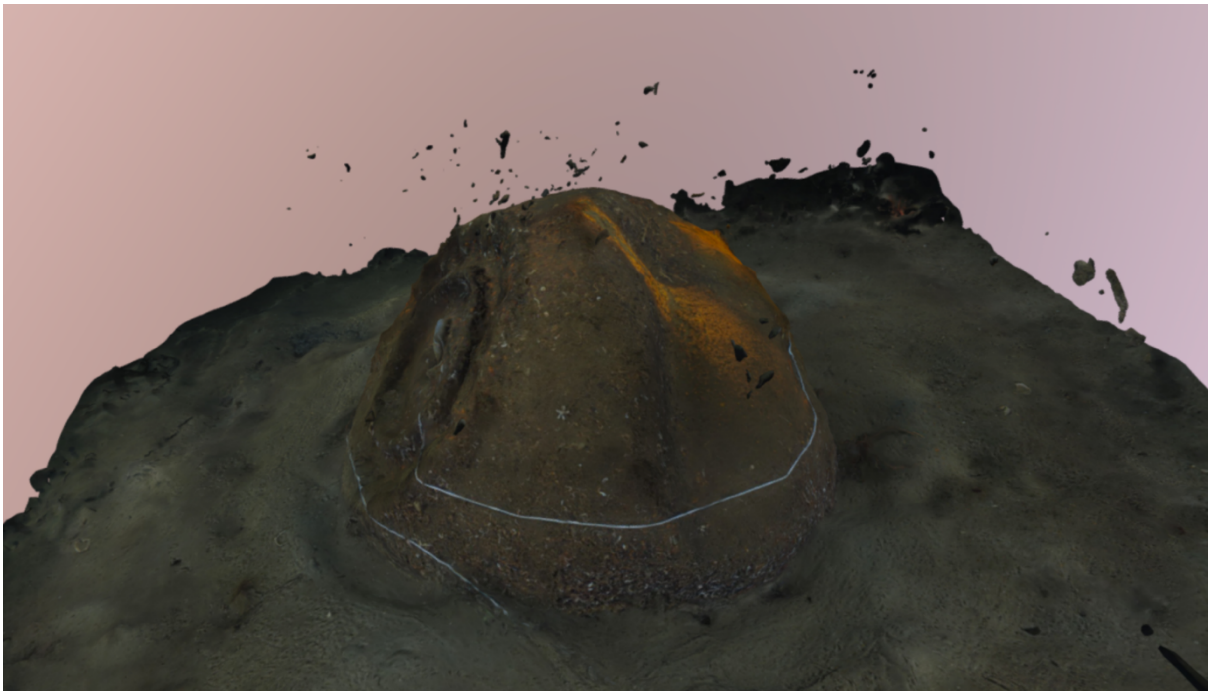
Expedition Outputs

We produced 3D models of two different highball bombs. These are now publicly available online (at the listed locations). They can also be loaded in higher resolution into a VR Headset and explored and moved around real-time as if you were in the water with them.

The equipment shown above was loaned from the Nautical Archaeology Society in order to gain an insight into how it functioned.

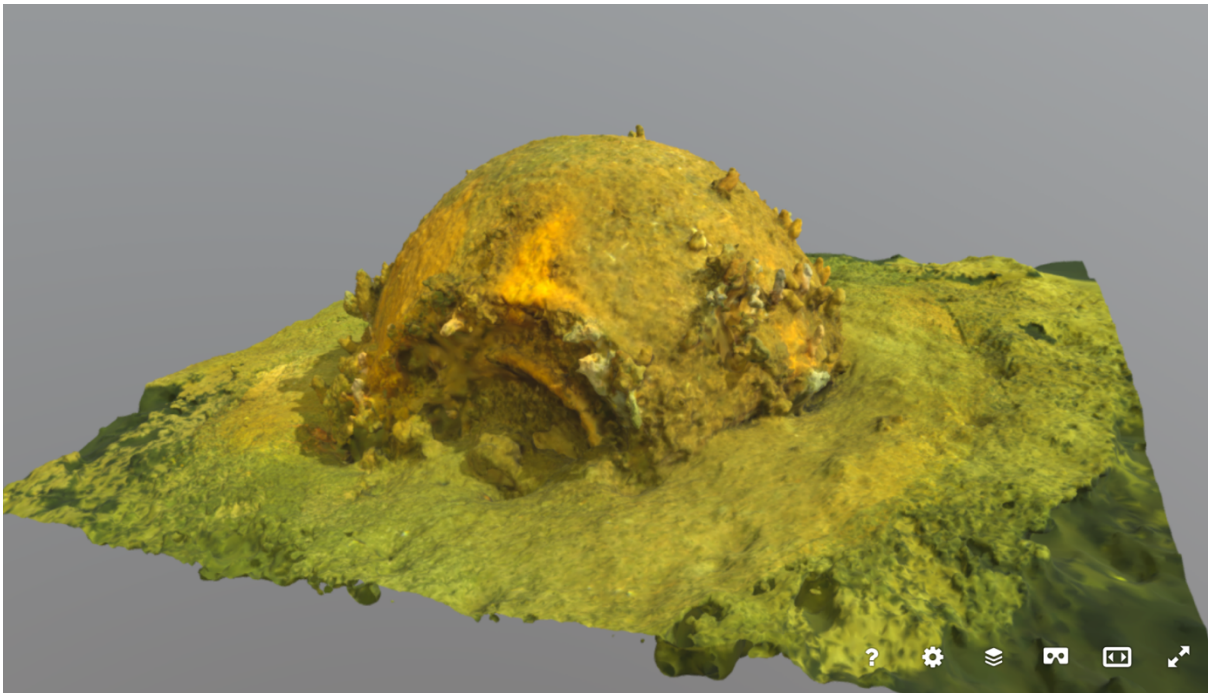
It is our intention to share these models with the two Highball museums and ideally provide them with some VR Headsets to use next to the bomb exhibits. We intend to raise money to source the equipment necessary to show these models at our own club and trial the VR experience as well as make them available to other local clubs. At present the models are freely available on the internet via Sketchfab and we have notified the museums of their availability.

3D Highball Model 1.



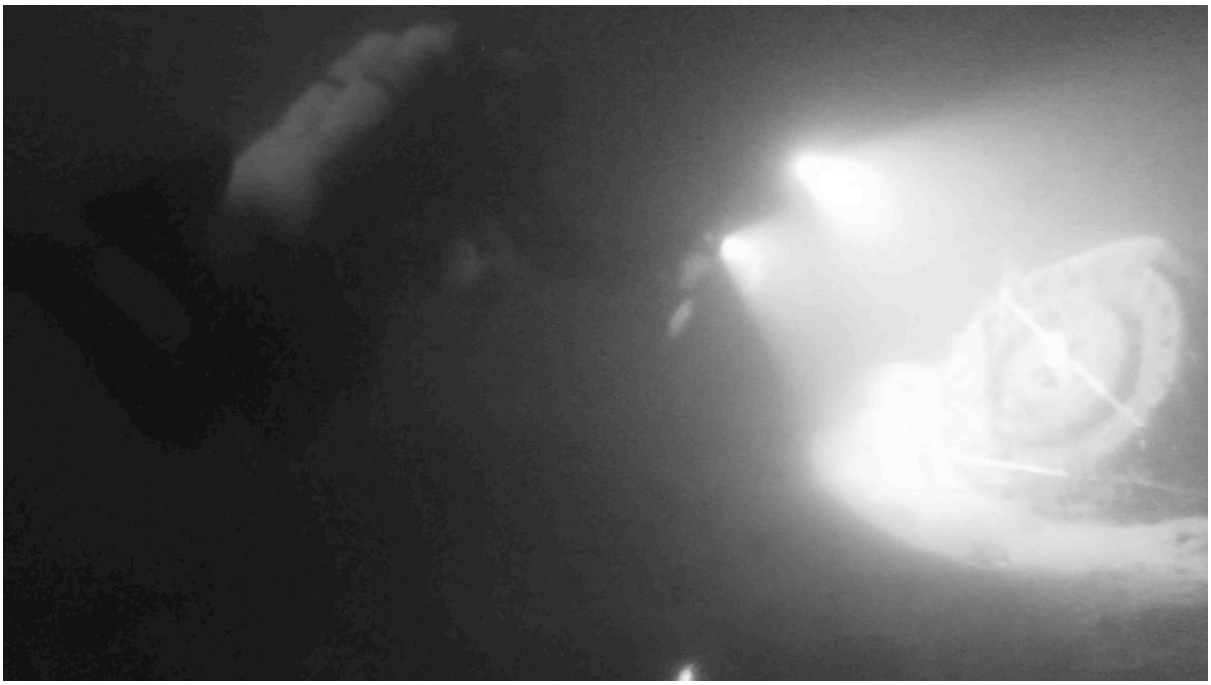
The damage to this bomb can be clearly seen (the dent on the right hand side).

3D Highball Model 2.



This one was in a slightly shallower area and shows the algae on the seabed as well as some higher light levels. It also shows the depth of the silt into which the bomb has sunk.

We have also obtained a number of detailed photographs of the bombs which will act as a permanent record (and baseline) of the state of the bombs in the loch.



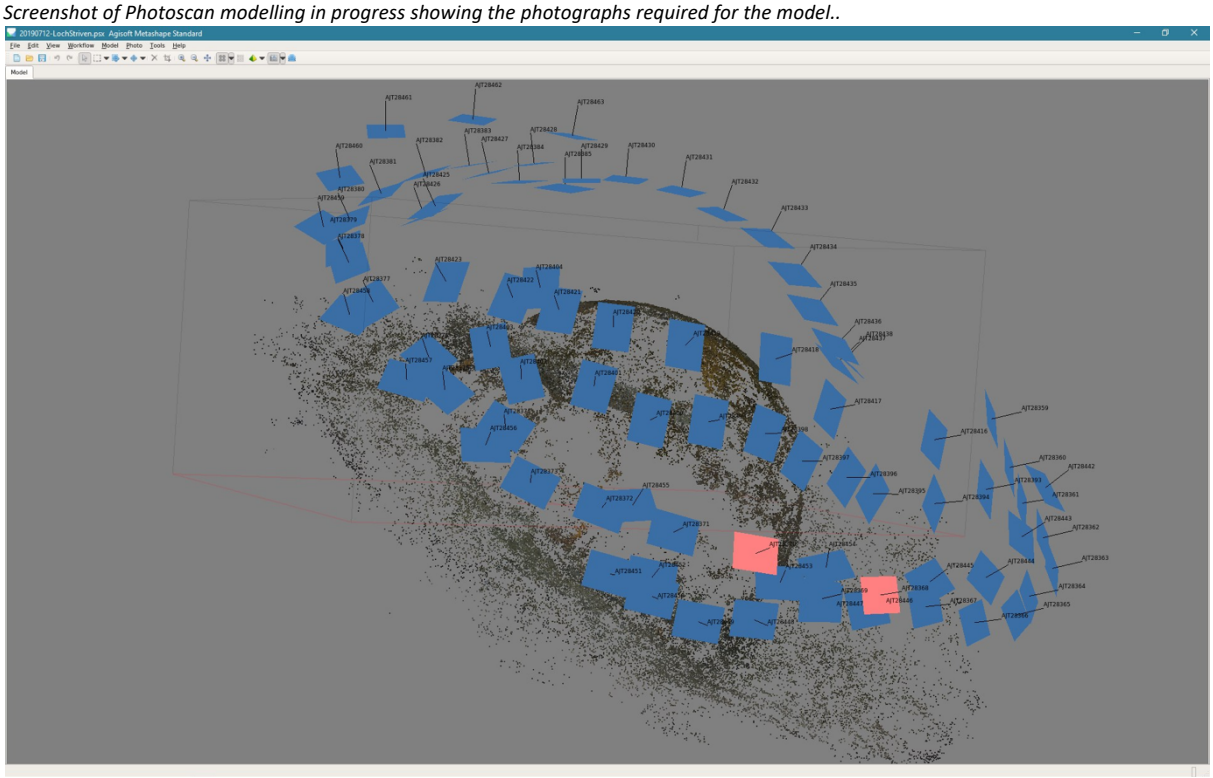
This photo shows the main photography in progress for model 1. It also gives an impression of the low light levels and the challenges with the visibility

Gallery of photos for background.

Photo of Bomb 1 in situ.

Photo of Bomb 2 in situ.

Screenshot of Photoscan modelling in progress showing the photographs required for the model..



Photoscan hi-resolution model prior to export to Sketchfab.

This would be the resolution available in the VR Headset once we obtain one.