VOC-ship Amsterdam Monitoring Report 2017

Gawronski, J.; Jayasena, R.; Gijswijt, G.; Vastenhoud, C.

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Content

Content .................................................................................................................................................... 3  
Introduction ............................................................................................................................................. 5  

1  Goals and methods .......................................................................................................................... 7
2  Activities and results ........................................................................................................................8
  2.1  Datum points and wood degradation ....................................................................................... 8 
  2.2  Control of set of datum bolts for degradation monitoring ....................................................... 8 
  2.3  Site and ship structure plan ..................................................................................................... 9 
  2.4  Overall site plan 1984-2017 .................................................................................................. 9 
  2.5  Photography .......................................................................................................................... 13 
  2.6  Webcam monitoring .............................................................................................................. 14 

3  Conclusions .................................................................................................................................... 15 

4  References ..................................................................................................................................... 16 

Appendix 1 Participants survey 2017 ....................................................................................................... 17 
Appendix 2 Survey data .......................................................................................................................... 18 
Appendix 3 Web cam stills of low tides 2017 ........................................................................................... 19
Cover photo: the site of the *Amsterdam* at low tide, 26th May, 2017
Introduction

Since 2009 the Stichting VOC-schip Amsterdam (VOC-ship Amsterdam Foundation: VOCAF) organises a continuous monitoring programme of the site of the Dutch East Indiaman Amsterdam (1749) at Bulverhythe (Hastings) (fig. 1). The goal of this programme is to gather information on on-site processes in relation to the state of conservation of this historical shipwreck. The core of the programme consists of regular webcam recordings of the site at low tide. In addition to the webcam recordings, once in a year one or two day on-site surveys during low tide are executed. Surveys were conducted in 2009, 2011, 2013, 2016 and 2017.

The 2017 campaign took place during four consecutive low spring tide periods of approximately two hours each on Thursday 25th, Friday 26th and Saturday 27th of May. The survey team consisted of Dutch and English participants belonging to the Office for Monuments and Archaeology, city of Amsterdam (MenA) and the working group Archaeology / Hastings of VOCAF (Appendix 1). The project operated under a survey licence that was granted by the United Kingdom’s Department for Culture, Media and Sport.

Fig. 1 Georeferenced site plan projected on aerial photograph of 2013 (source public geodata of Channel Coastal Observatory (http://www.channelcoast.org/))
Fig. 2 Cleaning the bow section of the wreck for photographic recording, May 2017

Fig. 3 Interior view of the bow section of the wreck, May 2017
1 Goals and methods

In 2009 the VOCAF developed a non-destructive monitoring programme of the site of the East Indiaman Amsterdam at Hastings (Gawronski, Jayasena, Vastenhoud, 2009). The main objective was to establish a dataset for long-term assessment of the site formation processes in relation to the ship’s remains. The monitoring programme of 2017 was directed to the following issues:

- Recording of separate sections of the hull and the exposed timbers to extend the integral plan of the site and the exposed wreck structure.
- Inspection of the condition of the site and the wreck, focusing on wood degradation and the stability of ship’s timbers, particularly in the upper part of the wreck which is exposed at low tide.
- The progress and state of sedimentation processes on the site in relation to the condition of the ship structure.
- Installation of a set of additional bolts for monitoring the degradation of the ships’ timbers.
- Photography of the structure.
- Installation of a new webcam.

Fig. 4 VOC-ship Amsterdam exposed during low tide, May 27, 2017
2 Activities and results

2.1 Datum points and wood degradation

The 2009 datum points, consisting of 10 durable stainless steel screws with stainless steel horizontal tags (M1-M10), remained largely in place in the period 2013-2017 (Seinen, 2009). Nevertheless, some datum points showed progressing decay, such as M6. Some of the tags were not anymore in a horizontal position: originally they were touching the surface of the wood, but because of erosion and water movement, their position became unstable. As usual elevations with a level were taken of the tag and the surface of the wood to gather data on the extent of wood degradation (Appendix 2, table 1). In 2009 the datum points were driven into the wood up to the base plate underneath the tag. Consequently, the base plate, that in 2009 was at the surface of the timber structures, is the reference point for measuring degradation of the wood (Seinen, 2009, 20). The distance between the base plate and the tag is 22 mm. Table 2 shows the direct measurements, taken with a folding ruler, from the tag to the wood and from the base plate to the wood. Leaving out M6, where erosion is exceptional, the average erosion measures 2.42 cm for a period of 8 years. Consequently, on a yearly base there is an average erosion of 0.3025 cm (Appendix 2, table 2).

2.2 Control of set of datum bolts for degradation monitoring

In 2016 nine inox bolts were positioned in a number of exposed timbers (B1-9, figs 5, 6) in order to have an additional check on the monitoring of the degradation process of the ship’s structure apart from the M1-M10 datum points. These 2 inch bolts had a flat pentagonal head which was screwed in completely flush with the surface. The rate of wood degradation could be assessed by the distance which would occur between the underside of the bolt head and the wood surface. The location of the bolts (B1-9) has been surveyed and added to the site plan (fig.9)

Fig. 5. Inox bolts to monitor degradation of the wood: left, B1 mounted on the planking behind the bow; right, B4 near datum point M7
In May 2017 the wreck structure less exposed than in 2016 (figs 4, 7, 8, see also Gawronski et al. 2017). On average the end of the frames protruded 30 to 40 cm above the 2017 beach level, whereas in 2016 these values were 70 to 80 cm (Appendix 2, table 2). Nonetheless, the overall site plan could be extended. At the starboard side sections between M4 and M10 and M10 and M6 were mapped in detail. All the exposed areas of the ship were mapped at scale 1:20. Each map included two of the 2009 datum points.

Post-survey work included digitizing the analogue plans using AutoCAD. The individual maps were projected on the overall site plan, which had been produced by processing the measurements in DSM and exporting to a dxf file to allow further processing in AutoCAD. The measurements of 2017 were added to the survey plan of the bow section of 2009, 2011, 2013 and 2016 (fig. 9).

The ship’s structure mapped in 2017 was integrated in the overall site plan which was initiated in 2013 (Gawronski et al., 2014: 5, 9). The basic overall site plan consists of a combination of the survey data of the 1984-1986 excavations (Gawronski et al., 1985; Gawronski, 1986; 1987) and the low tide surveys in 2009-2013 (fig. 9). The overall site plan, which shows almost the complete outline of the wreck, was extended with the more detailed measurements of 2017 on the bow section. The site plan was georeferenced on an aerial photograph of 2013 (fig. 10), making use of ArcGIS PRO and the public geodata of Channel Coastal Observatory (http://www.channelcoast.org). The projection used is the British National Grid (EPSG:27700).

More work is needed on the remaining ship structure on portside and starboard between 13 B and M10 and the surveyed timbers of the 1980s excavation (fig. 9). These sections generally remain underwater even during low spring tide and are therefore in general not accessible during the monitoring operations so far. Progress in completion of the low tide survey plan depends entirely of the tidal situation and the exposure of the wreck.
Fig. 7 The bow section of the wreck seen in south-westerly direction, May 26, 2017

Fig. 8 The bow section of the wreck seen in south-westerly direction, March 13, 2016
Fig. 9 Integrated site plan of the 1984-2017 archaeological survey of the hull structure of the Amsterdam. In purple the sections mapped during the 2017 survey.
Fig. 10 Integrated site plan projected on the British National Grid (EPSG:27700)
2.5 Photography

In addition to the site mapping, different timbers and parts of the ship, which were visually accessible, were photographed in detail. Specifically sections on the starboard side could be recorded photographically, as they were well exposed and not covered with sand or grown over with seaweed or mussels.

In total four lead drain pipes between the frames of the starboard hull structure between M2 and M10 were fully exposed this time and have been added to the site plan. Three lead drain pipes on starboard side were photographed for the purpose of 3D model generation (fig. 11). These structures were photographed from every possible angle and subsequently processed using photogrammetry software to produce the 3D model. The ability to manipulate models, which a 3D digital environment offers, are a helpful tool for the analysis of structural details. 3D techniques not only allow the movement of the model on screen, but also the application of lighting variations and even on-screen measurement of elements. The initial results of the 3D photogrammetry show the technology provides a useful addition to the recording and monitoring of this resource. Plans are being developed to further incorporate photogrammetry into the project.

Fig. 11: 3D model of three lead drain pipes on starboard side section between M2 and M10 and (below) their location
2.6 Webcam monitoring

In addition to the yearly monitoring visit, the site is monitored constantly by means of the webcam which was installed by the survey team in 2009. The webcam was used from 2009 to 2017 for structural recording of still pictures and video footage of the wreck site at all the exceptional low tides with sufficient daylight. The time lapse recordings (12 second intervals) also show all activities on and around the site at low tide. The camera monitoring was stopped in the November 2016, due to a change in the network settings at Hastings Diesels, where the camera is located.

The systematic recording sessions have produced a substantial and concrete dataset on the nature and extent of the on-going site’s dynamic sedimentation processes. The sequence of images over the years shows rapid seasonal changes in the sand deposit levels with a range of almost a meter, causing the wreck being covered and other times being greatly exposed, leading to erosion of (parts of) the wreck structure.

During the 2017 monitoring visit the old camera was replaced by a new HD camera. The new camera has significantly improved image quality, both optical and digital (cf fig. 12) (see for stills 2017: Appendix 3).
3 Conclusions

The May 2017 survey had a threefold goal:

- Monitoring the beach situation with regard to sedimentation levels and wreck timber exposure and related erosion.
- Survey parts of the wreck structure for extending the overall site plan.
- Installation of a new webcam.

In general the wreck was well exposed in May 2017, but there was considerably more sedimentation than in March 2016. Elevation measurements of the frame ends in relation to the beach level showed that on average the frames were exposed above the sand for 30 to 40 cm (Appendix 2, table 1), compared to 70 to 80 cm in 2016 (figs 7 and 8, and Gawronski et al, 2017, 18). To assess the extent of wood degradation elevations were taken of some datum points and the wood surface underneath the tag (Appendix 2, table 1 and 2). These proved that the overall condition of the site had deteriorated compared to 2009. At the datum points a degradation of, on average, 3.6 cm was measured. Leaving out M6, where erosion is exceptional, the average erosion measures 2.42 cm for a period of 8 years. Consequently, on a yearly base there is an average erosion of 0.3025 cm (Appendix 2, table 2). As a measure to continue further degradation monitoring, in 2016 a set of new datum points – consisting of sturdy inox bolts – was installed to replace some of the eroded 2009 reference points. Here an average degradation of 0.5 cm was measured (Appendix 2, table 2).

The well exposed state of the timbers allowed detailed mapping of sections that had been (partly) covered by sediment during the previous campaigns. The 2017 survey provided more data on the starboard side between M4 and M10 (fig. 9). The 2017 survey data was integrated in an overall site plan, consisting of both the 2009-2017 survey data and the 1984-1986 excavations (fig. 9). More work is needed on the remaining ship structure on portside and starboard between 13 B and M10 respectively and the surveyed timbers of the 1980s excavations. These sections are more difficult to map during the monitoring campaigns as they generally remain underwater even during low spring tide. Progress depends entirely of the tidal situation and the exposure of the wreck.

The webcam, which had been in use since 2009 and had stopped recording in November 2016, was replaced by a new HD camera, resulting in significantly improved image quality (Appendix 3).
4 References


Appendix 1 Participants survey 2017

Adrian Barak (working group Archaeology / Hastings, VOCAF)
Jerzy Gawronski PhD (archaeologist, working group Archaeology / Hastings VOCAF / MenA)
Ranjith Jayasena MA (archaeologist, working group Archaeology / Hastings VOCAF / MenA)
Chris Vastenhoud (Licensee, working group Archaeology / Hastings VOCAF)
## Appendix 2 Survey data

### OD measurements (m)

<table>
<thead>
<tr>
<th>Datum point</th>
<th>Bow wood</th>
<th>Wood</th>
<th>Sand level beach</th>
<th>Sand level inside</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M2</td>
<td>-0.45</td>
<td>-0.5</td>
<td>-0.78</td>
<td>0.05</td>
<td></td>
</tr>
<tr>
<td>M3</td>
<td>-0.42</td>
<td>-0.45</td>
<td>-0.75</td>
<td>0.03</td>
<td></td>
</tr>
<tr>
<td>M4</td>
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<td>-0.49</td>
<td>-0.82</td>
<td>0.05</td>
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</tr>
<tr>
<td>M5</td>
<td>-0.52</td>
<td>-0.56</td>
<td>-0.85</td>
<td>0.04</td>
<td></td>
</tr>
<tr>
<td>M6</td>
<td>-0.65</td>
<td>-0.79</td>
<td>-1.59</td>
<td>0.14</td>
<td></td>
</tr>
<tr>
<td>M7</td>
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<td>-0.67</td>
<td>-1.07</td>
<td>0.07</td>
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</tr>
<tr>
<td>M8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M10</td>
<td>-0.6</td>
<td>-0.67</td>
<td>-1.07</td>
<td>0.07</td>
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</tr>
<tr>
<td>Upper part ship</td>
<td></td>
<td></td>
<td></td>
<td>0.75</td>
<td></td>
</tr>
<tr>
<td>Central part ship</td>
<td></td>
<td></td>
<td></td>
<td>-1.19</td>
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</tr>
</tbody>
</table>

Table 1: Elevations of timbers, datum points and sand levels (in relation to elevation reference datum point M1 on the bow)

### Direct measurements of wood surface in relation to datum point tags and datum point baseplate

<table>
<thead>
<tr>
<th>Datum point</th>
<th>Tag-wood (cm)</th>
<th>Base plate -wood (cm)</th>
<th>Erosion bolt-wood</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1</td>
<td>3.5</td>
<td>1.3</td>
<td></td>
</tr>
<tr>
<td>M2</td>
<td>4</td>
<td>1.8</td>
<td></td>
</tr>
<tr>
<td>M3</td>
<td>3.5</td>
<td>1.3</td>
<td></td>
</tr>
<tr>
<td>M4</td>
<td>6.4</td>
<td>4.2</td>
<td></td>
</tr>
<tr>
<td>M5</td>
<td>4</td>
<td>1.8</td>
<td></td>
</tr>
<tr>
<td>M6</td>
<td>14</td>
<td>11.8</td>
<td></td>
</tr>
<tr>
<td>M7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M8</td>
<td>4</td>
<td>1.8</td>
<td></td>
</tr>
<tr>
<td>M10</td>
<td>7</td>
<td>4.8</td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>5.8</td>
<td>3.6</td>
<td>0.51</td>
</tr>
<tr>
<td>Erosion bolt B5</td>
<td></td>
<td></td>
<td>0.5</td>
</tr>
<tr>
<td>Erosion bolt B9</td>
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<td></td>
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</tr>
<tr>
<td>Erosion bolt B4</td>
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<td></td>
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</tr>
<tr>
<td>Erosion bolt B1</td>
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<td></td>
<td>0.35</td>
</tr>
</tbody>
</table>

Table 2: Direct measurements of wood surface in relation to datum point tags and datum point baseplate
Appendix 3 Web cam stills of low tides 2017

Overview of low tides 2017. See also http://cam.voschip-amsterdam.org/download.php