



Wrecks of HMS Erebus and HMS Terror
National Historic Site of Canada

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HMS Terror Underwater Archaeological Survey April 2017



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WRECKS OF HMS EREBUS AND HMS TERROR
NATIONAL HISTORIC SITE OF CANADA

HMS TERROR UNDERWATER ARCHAEOLOGICAL SURVEY
APRIL 2017

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SUMMARY

This report describes archaeological activities carried out by Parks Canada's Underwater Archaeology Team (UAT) in April 2017 at HMS *Terror*, in Terror Bay, Nunavut. The inspection work was achieved using a remotely operated vehicle (ROV) deployed through an ice hole positioned over the wreck. The general goal was to document the HMS *Terror* wreck and its debris field as a means to evaluate the site's archaeological potential and integrity. It aimed more specifically to achieve complete exterior video and photo documentation of the wreck, as well as sector-scanning sonar recording of selected features. The exterior of the wreck of HMS *Terror* was thoroughly documented using video and photo cameras, with the exception of the starboard side of the vessel. Sector-scanning sonar was used to position and map a ship's boat on the seafloor. The data collected thus far from HMS *Terror* now provides a benchmark for planning further archaeological research; it also demonstrates the amazing state of preservation of the wreck.

SOMMAIRE

Ce rapport rend compte des opérations archéologiques effectuées par l'Équipe d'archéologie subaquatique (EAS) de Parcs Canada en avril 2017 sur HMS *Terror*, dans la baie de Terror, Nunavut. Le travail d'inspection a été réalisé à l'aide d'un véhicule sous-marin téléguidé (VTG) opéré depuis la surface et au travers d'un trou pratiqué dans la glace au-dessus de l'épave. L'objectif global du projet était de documenter l'épave de HMS *Terror* et le champ de débris qui l'entoure de manière à évaluer le potentiel archéologique et l'intégrité du site. Il visait plus spécifiquement à réaliser une couverture complète de l'extérieur de l'épave à l'aide de caméras vidéo et photo, de même que l'enregistrement de quelques éléments avec un sonar à balayage par secteur. L'extérieur de l'épave du HMS *Terror* a été documentée systématiquement par enregistrements vidéo et photos, à l'exception de son côté tribord. Finalement, grâce au sonar à balayage par secteur, il a été possible de localiser et de cartographier l'une des embarcations du navire qui se trouve sur le fond marin.

Les informations recueillies jusqu'à présent sur HMS *Terror* fournissent de bonnes données de référence, celles nécessaires à la planification des travaux archéologiques à venir. Elles démontrent également l'extraordinaire degré de conservation de l'épave.

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ACKNOWLEDGEMENTS

The Underwater Archaeology Team acknowledges first and foremost project team members from Gjoa Haven: John Nahalolik, Gavin Nahalolik and Bob Cahill (CAP Enterprises Ltd.), and Colin Putuguk, Johnnie Tavalok, Dennis Qirqqut, Johannissee Angel Ukkuktunnaq, and Louie Kammimalik (Kitikmeot Hunters and Trappers Association, Gjoa Haven section). Our thanks also go to Douglas Stenton (Government of Nunavut), a long-standing research partner on the Franklin Project, as well as the following organisations:

(HTA), Hamlet of Gjoa Haven, Kitikmeot Inuit Association (KIA), Government of Nunavut, Kenn Borek Air and the Franklin Interim Advisory Committee (FIAC) board members. Finally, a special thanks to our many colleagues and friends within the Parks Canada Agency, often operating behind the scenes, in particular Tamara Tarasoff, Bronwyn Pavey, Jarred Picher, and Leanna Ellsworth. Matthew Betts kindly read a draft of this report and made a number of very useful comments and corrections.



Figure: Project Team. From left to right: Ryan Harris, Thierry Boyer, Gavin Nahalolik, John Nahalolik, Johannissee Angel Ukkuktunnaq, Dennis Qirqqut, Jonathan Moore, Johnnie Tavalok, Colin Putuguk, Charles Dagneau, Douglas Stenton (Photo: T. Boyer, Parks Canada; 90M1909EF).

LIST OF ABBREVIATIONS

3D	three-dimensional
GN	Government of Nunavut
HD	high-definition
HMS	Her Majesty's Ship
HTA	Hunters and Trappers Association
MBES	Multi-beam echosounder
ROV	remotely operated vehicle
UAT	Underwater Archaeology Team
USBL	ultra-short baseline

1. PROJECT DESCRIPTION

1.1 OBJECTIVES

This short, six-day project was carried out from an ice camp established on the ice over the *Terror* wreck site in April 2017. It aimed to thoroughly record the wreck exterior and its debris field using remotely operated vehicle (ROV) inspection dives. The inspection was planned as a rapid means to evaluate the site's archaeological integrity and potential. It was also intended to provide a benchmark for further archaeological research planned for the summer of 2018.

The main field objectives were as follows:

1. Video and photo documentation of the hull and surrounding debris field;
2. Sector-scanning sonar recording of selected shipwreck components; and

3. Photogrammetry coverage of *Terror*'s port side and upper deck.

1.2 DEFINITION OF STUDY AREA

HMS *Terror* is located in 24 m of water in the middle of Terror Bay, on the southwest shore of King William Island, Nunavut. It is located approximately 130 km from Gjoa Haven and 250 km from Cambridge Bay, the two nearest communities in Nunavut. Furthermore, it is some 70 km north of the wreck of HMS *Erebus* (Figures 1.2.1 and 1.2.2).

The Wrecks of HMS *Erebus* and HMS *Terror* National Historic Site of Canada originally consisted of a single 10 by 10 km protected area around the *Erebus* wreck site. Following the discovery of Sir John Franklin's second vessel, it has been amended under the National Parks Act to include a second, 5.5 by 10.5 km protected area occupying most of Terror Bay. That being said, the 2017 fieldwork on HMS *Terror* focused on the wreck and its immediate surroundings.



Figure 1.2.1: Locations of the wrecks of HMS *Erebus* and HMS *Terror*, Kitikmeot Region, Nunavut (Map: C. Dagneau, Parks Canada; Imagery: Esri World Imagery / Earthstar Geographics, TerraColor).

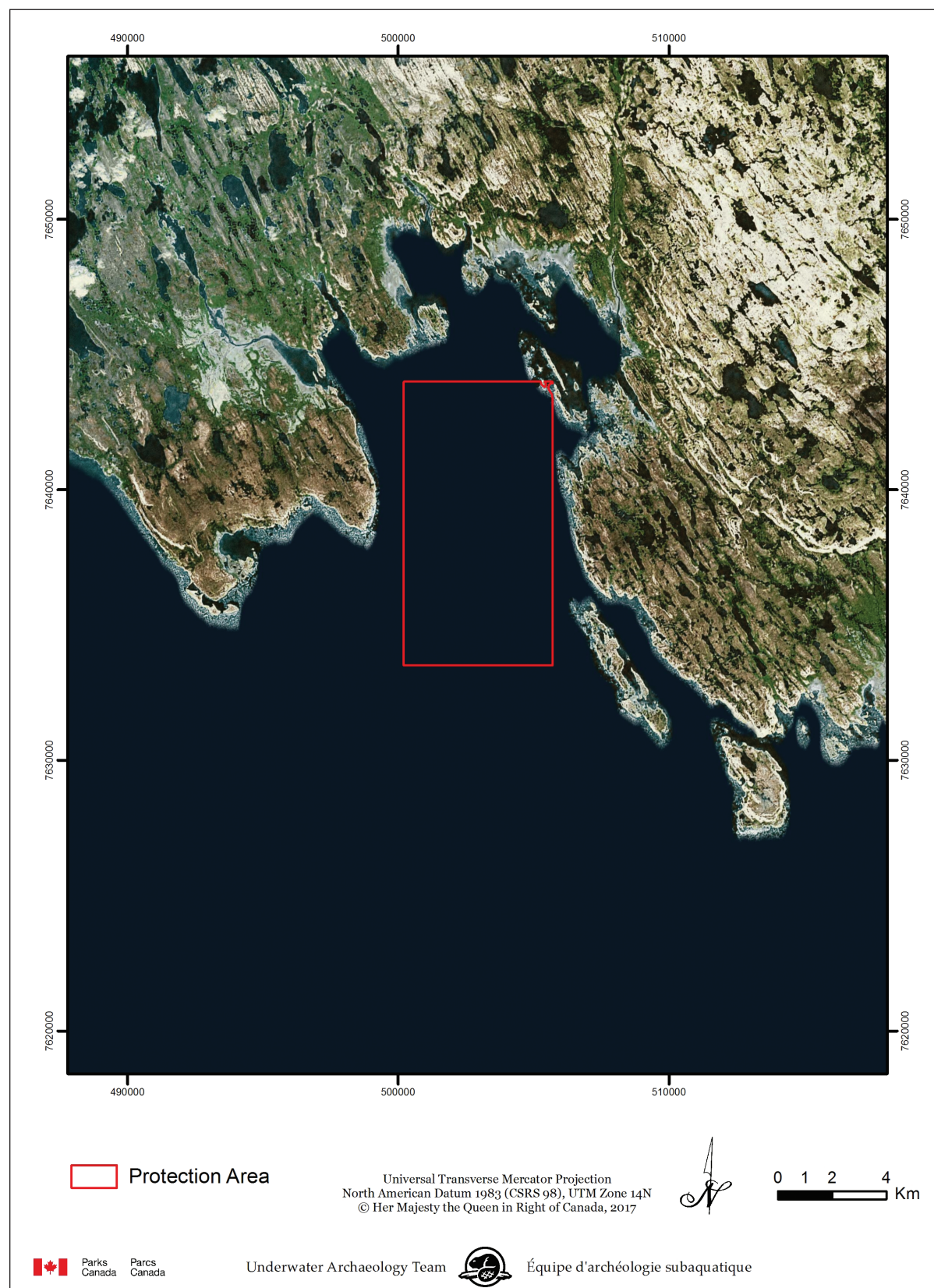


Figure 1.2.2: Addition to the Wrecks of HMS Erebus and HMS Terror National Historic Site of Canada protected area (5.5 km by 10.5 km) to encompass the wreck of HMS *Terror* (Map: C. Dagneau, Parks Canada; Imagery: Esri World Imagery / Earthstar Geographics, TerraColor).

2. HISTORICAL AND ARCHAEOLOGICAL BACKGROUND

The following section provides a short summary of the vast historical and archaeological background information available. For a detailed account of the Franklin expedition, please refer to Cyriax (1939) and Woodman (1991). For more information on the most recent archaeological investigations, including a re-interpretation of the traditional narratives cited above, please refer to the latest fieldwork reports and articles by the Parks Canada UAT (Moore et al. 2017; Moore and Dagneau 2017; Harris and Boyer 2016; Harris et al. 2015) and the Government of Nunavut (Stenton 2014; Stenton et al. 2015).

2.1 THE 1845 FRANKLIN EXPEDITION

On May 19, 1845 the Royal Navy ships HMS *Erebus* and HMS *Terror* departed Greenhithe, England in search of a Northwest Passage, under the command of Sir John Franklin, with Francis Rawdon Moira Crozier second in command. The expedition's two ships set out with an initial complement of 134 officers and men.

Terror was launched at Topsham, England in 1813 as a Vesuvius-class bomb vessel of 325 tons burthen. It saw action on the American eastern seaboard during the War of 1812, including the bombardment of Fort McHenry during the Battle of Baltimore in September 1814. Like other bombs in a period of renewed Royal Navy Arctic exploration after the Napoleonic Wars, *Terror* was refitted as a polar discovery ship in 1836 for Captain George Back's Northwest Passage expedition of 1836–1837 (Figure 2.1.1). *Erebus* was launched in 1826 at Pembroke Dockyard in Wales as a Hecla-class bomb vessel, slightly larger than *Terror* at 372 tons burthen. *Erebus* was similarly refitted as a polar discovery ship in 1839 prior to a successful 1839–1843 voyage with *Terror* to the Antarctic under the command of Captain James Clark Ross. A final refit for both of these barque-rigged ships took place in early 1845 prior to Franklin's voyage. Both ships had already been heavily reinforced for operation in the ice and in 1845 were equipped

with auxiliary-steam screw propulsion systems, and provisioned for a voyage of up to three years (Battersby and Carney 2011; Cyriax 1939:28ff). Contemporary documentation of both ships up to mid-1845 includes paintings, sketches, voyage journals, logbooks, dockyard records, block models and sets of ship plans.

The two discovery ships were last seen afloat by Europeans in late July 1845 while crossing Baffin Bay en route to Lancaster Sound, the eastern entrance to the Northwest Passage. It was at this juncture that a mystery enveloped the Franklin expedition. From the European perspective, nothing whatsoever was heard from the ships by 1847, and they were earnestly expected to emerge from the western end of the passage at any moment. Concern mounted that year: the British government offered sizeable financial rewards for news and assistance rendered, and search expeditions soon began (Ross 2002). A vital clue was later found in 1859 on King William Island by the McClintock expedition of 1857–1859. This clue, a standard form message from May 1847 with marginal additions from April 22, 1848 had been deposited near Victory Point by Captain Crozier and Commander James Fitzjames. It stated that after crossing from Disko into Lancaster Sound, the ships circumnavigated Cornwallis Island and then spent their first winter (1845–1846) at Beechey Island on Barrow Strait. The next navigation season, following the summer melting and break-up of sea ice, Franklin's ships headed south, presumably descending the uncharted Peel Sound and Franklin Strait and then became beset in ice north of King William Island on September 12, 1846. There the ships remained trapped though slowly drifting southwestwards from Larsen Sound and into Victoria Strait, locked in the unyielding embrace of the ice floes for a full year and a half.

At least one party of men carried out exploration on shore in May of 1847, the situation reported as "All well." Soon things took a turn for the worse according to a marginal note added by Crozier and Fitzjames around the earlier May 1847 entry. Franklin died on June 11, 1847 and on April 22, 1848, the surviving 105 crew members to that point, under the command of Crozier, deserted the ships off the northwest flank of King William Island, presumably having been confronted by dwindling supplies and health, and with no foreseeable hope of extrication on the horizon. Making landfall on the island the combined crews headed

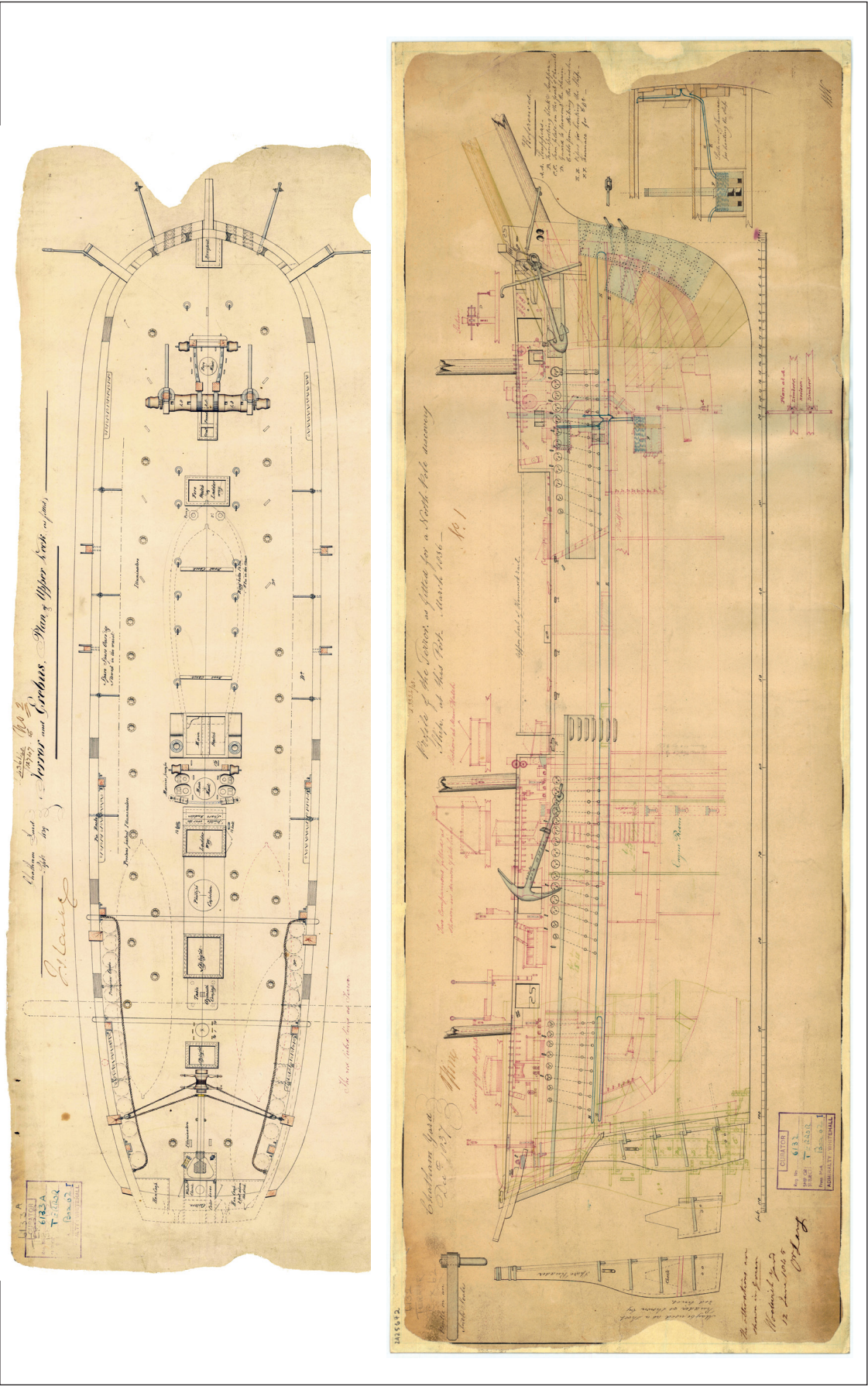


Figure 2.1.1: Selected ship plans of HMS Terror: (top) "Terror and Erebus, Plan of Upper Deck. (as fitted.)"; (bottom) "Profile of the Terror as fitted for a North Pole discovery Ship", 1837/1845 (Courtesy: National Maritime Museum, Greenwich, London; ZAZ5675, J1409; ZAZ5672, J1406).

south towards the Great Fish (modern Back) River on the North American mainland, dragging boats on sledges over the still frozen sea and land. This terse yet invaluable record is more or less the only known written document of the ships' proceedings after their departure from the Whalefish Islands (Woodman 1991; Cyriax 1939:94,158–159).

A succession of 37 Royal Navy and private search, supply and relief expeditions took place from 1847 to 1859 and failed to find any surviving members of Franklin's lost expedition or either of its missing ships (Cyriax 1939:71–99; Ross 2002). These contemporary explorers' accounts and their associated records of Inuit oral histories have been further interpreted and articulated by different researchers (Woodman 1991; Keith and Kamookak 1999; Eber 2008; Woodman 2001; Woodman 2003). It is clear that all remaining 1845 Franklin expedition members perished on the southward retreat (before or after later re-manning of the one or both of the ships) some of whom reached as far south as Starvation Cove on the Adelaide Peninsula, with further traces of the expedition found farther south and east, notably on Montreal Island (Cyriax 1939:182–194). The fate of the vessels themselves was far less clear until 2014 with the discovery of *Erebus* and 2016 with that of *Terror*.

2.2 INUIT ORAL TRADITION AND INUIT KNOWLEDGE

Inuit oral tradition and knowledge were both respectively key to the discovery of HMS *Erebus* and HMS *Terror*. Nineteenth-century Inuit oral tradition recounts that one of Franklin's two ships was crushed in the ice west of King William Island while the other made its way as far south as the Adelaide Peninsula where it finally sank in the waters of Ugjulik (variously spelled Utjulik, Ook-joo-lik, Ootjoolik etc.), around O'Reilly Island. The fact that Inuit witnesses to the event left tangible evidence as to the possible disposition of the Ugjulik vessel, having reportedly seen it firsthand, was a key element in the discovery of *Erebus* in 2014. While the accounts do not wholly agree in their precise details, the corroborating reports of a wreck sunk off the western shore of the Adelaide Peninsula in one location or another at least provided an approximate starting point

for systematic searches that began in the 1960s in the expansive area corresponding to Ugjulik (for example: Schwatka 1880; McClintock 1860:227–228, 236–237).

Nineteenth-century Inuit oral tradition provided far less location information to go on in the search for the other wreck, identified by default as *Terror* after 2014. Most of the Inuit accounts pointed towards Victoria Strait, where one of Franklin's vessels was allegedly quickly crushed by the ice and sunk soon after its desertion in April 1848 (McClintock 1860:211–212, 227–228; Woodman 2003:3).

Parks Canada and the Government of Nunavut also gathered Inuit knowledge, including reported wreck and wreckage information from local community members, chiefly from Gjoa Haven (for example, see Keith and Kamookak 1999). These reported sites were distributed in a large area including both shores of King William Island, the Adelaide Peninsula, and Somerset Island. In 2013, information was received at Gjoa Haven from James Qitsualik concerning a potential wreck in the shallow waters of the eastern flank of Terror Bay (Moore 2013:42). This specific lead was followed-up by Doug Stenton in 2015 and 2016, again with no success. Inuit accounts gathered by earlier nineteenth-century search parties also mentioned the presence of a substantial camp located at or near the head of Terror Bay. A large number of bodies associated with the Franklin expedition were discovered at this location, called the “hospital site” (McClintock 1859:75–76). According to Inuit testimony recorded later by Schwatka, the same site was washed away in 1873 (Schwatka 1882). However, the location of the site has never been positively identified (Stenton 2016:19).

The Government of Nunavut conducted aerial and pedestrian surveys in Terror Bay in 2012, 2015 and 2016 in order to find remains of the Franklin expedition, without success (Stenton 2012:10–11; 2015:12–14; 2016:19–20). Considering the absence of archaeological evidence, the area was identified by the UAT as a secondary marine search zone before the wreck of HMS *Terror* was discovered by the Arctic Research Foundation in 2017 with information provided by Sammy Kogvik of Gjoa Haven (Watson 2016; Watson 2017:324–336).

2.3 PREVIOUS WORK

The recent search effort for Sir John Franklin's doomed expedition vessels, HMS *Erebus* and HMS *Terror*, was initiated by Parks Canada in 2008 with assistance from the Canadian Coast Guard, the Canadian Hydrographic Service, as well as the Government of Nunavut (GN). This initiative grew with time to include other federal departments, as well as public, private and non-profit organizations. The search efforts reached an unprecedented level in 2014 with no less than five platforms conducting side scan sonar or multi-beam echosounder system (MBES) surveys simultaneously in Victoria Strait, and in Wilmot and Crampton Bay. Ultimately, search efforts and dedication from the different partners involved, modern marine survey technology and both nineteenth-century Inuit oral histories and current local knowledge made the discoveries of HMS *Erebus* and HMS *Terror* possible.

After eight years of searching, the wreck of HMS *Erebus* was finally discovered by Parks Canada in September 2014, in Wilmot and Crampton Bay. This discovery led to a series of archaeological fieldwork operations (Harris et al. 2015; Moore et al. 2017). The wreck of HMS *Terror* was discovered two years later by the Arctic Research Foundation in Terror Bay, thanks to key information provided by Gjoa Haven resident Sammy Kogvik. Following the discovery, the UAT conducted a short three-day archaeological investigation of the wreck to confirm its identification as HMS *Terror* (Moore and Dagneau 2017; Moore et al. 2017). This report focuses on the work carried out the following year, during the spring of 2017.

3. METHODOLOGY

3.1 PROVENIENCE SYSTEM

Parks Canada employs an alphanumeric coding system to categorize, identify and reference archaeological data. This hierarchical provenience classification system is outlined in the *Parks Canada Archaeological Recording Manual: Excavations and Surveys* (Parks Canada 2005). The site number 51M applies to the search for Franklin ships. In September 2016, upon the discovery of the wreck in Terror Bay the UAT

assigned the Parks Canada site number 90M to the wreck. All field data and site records linked to the site from September 2016 onwards have been classified under this provenience designation.

3.2 FIELDWORK DESCRIPTION

The UAT conducted five ROV inspection dives on the wreck of HMS *Terror* between April 24 and 29, 2017. An ice camp was set up on the ice directly over the wreck site for this purpose, in the middle of Terror Bay, Nunavut. This project was staged both from Cambridge Bay using Twin Otter aircraft and from Gjoa Haven, using snowmobiles. Three UAT staff members and one GN representative travelled by Twin Otter flights from Cambridge Bay to the site on April 24, along with most of the equipment and supplies. One UAT staff member, four members of the Gjoa Haven Kitikmeot Hunters and Trappers Association (HTA), as well as two CAP Enterprises employees joined them by snowmobile the same day (Figure 3.2.1; Table 3.2.1).

All team members worked on setting up the camp and most importantly digging the access hole through the ice on April 24 and 25 (Figure 3.2.2). A series of short ROV test dives were completed on April 25. The team then conducted five ROV dives over the course of three days (April 26 to 28) to document the wreck using video, still photos and sector-scanning sonar imagery (Table 3.2.2). The camp was dismantled and the site cleared on April 29; that day, UAT and GN staff returned via Twin Otter to Cambridge Bay, while HTA members and CAP staff made their way back to Gjoa Haven by snowmobile.



Figure 3.2.1: Field equipment unloaded from a Twin Otter at the camp site in Terror Bay (Photo: T. Boyer, Parks Canada; 90M01884EF).

Name	Affiliation
Ryan Harris	Project Lead, Parks Canada
Jonathan Moore	Parks Canada
Charles Dagneau	Parks Canada
Thierry Boyer	Parks Canada
Douglas Stenton	Government of Nunavut
John Nahalolik	CAP Enterprises
Gavin Nahalolik	CAP Enterprises
Colin Putuguk	Gjoa Haven HTA
Johnnie Tavalok	Gjoa Haven HTA
Dennis Qirqqut	Gjoa Haven HTA
Johannissee Angel Ukkuktunnaq	Gjoa Haven HTA
Louie Kammimalik	Gjoa Haven HTA

Table 3.2.1: List of fieldwork participants and their affiliations.



Figure 3.2.2: Excavation of the ROV access hole through thick sea ice (Photo: T. Boyer, Parks Canada; 90M00606EF).

3.3 METHODOLOGY AND EQUIPMENT

This archaeological investigation consisted of a series of ROV dives on the HMS *Terror* wreck site. Using multi-beam sonar data acquired on the site in 2016 as a reference, an access hole was positioned and excavated through the sea ice 10 m off the port side (west) of the wreck amidships. The access hole was placed at a suitable offset from the wreck so that ROV navigation around the site was facilitated, while ensuring that entanglement hazards such as the masts, and any collapsed structures were avoided. The access hole (1.7 m long by 1.6 m wide) was dug through 1.75 m of sea ice, and was large enough to allow easy access by the ROV fully equipped with the necessary instruments (Figure 3.3.1).

This inspection was conducted using a Saab Seaeye Falcon ROV equipped with a Kongsberg OE-504 high-definition (HD) colour video camera, a low light black and white video camera and

a Mesotech (Kongsberg) MS-1000 sector-scanning sonar system (675 kHz mini head), designed for underwater navigation and target imaging. An Easytrak Lite (Applied Acoustics) ultra-short baseline (USBL) tracking system was also used for navigation purposes, namely an Easytrak micro transponder (300 series) mounted on the ROV and an Easytrak 902C surface transponder on a pole mount affixed to a corner of the ice hole.

ROV navigation was achieved using the live video and sector-scanner feeds displayed on two different topside screens. The USBL tracking system provided an absolute XYZ position displayed in real-time over the 2016 MBES model of the wreck on a third screen, using HypackMax software. Still photos were acquired automatically every 10 or 30 seconds using a Nikon D4s with a 14 to 24 mm lens in an Aquatica housing mounted on the vehicle. Two battery-powered Orcalight SeaWolf 2260 lights providing up to 22,000 lumens were used for artificial lighting. ROV operations employed four UAT members: a pilot; a co-pilot operating the sector-scanning sonar, photo and video

Dive Number	Date (local)	Duration (h:mm)	Still Photo Intervals
90M-2017-001-HDV	April 26, 2017	2:10	Every 30 seconds
90M-2017-002-HDV	April 26, 2017	2:31	Every 30 seconds
90M-2017-003-HDV	April 27, 2017	2:05	Every 10 seconds
90M-2017-004-HDV	April 27, 2017	1:26	No photos recorded
90M-2017-005-HDV	April 28, 2017	1:17	Every 10 seconds

Table 3.2.2: ROV dive log for the wreck of HMS *Terror*, April 2017. The total ROV dive time was 9:29 (h:mm).

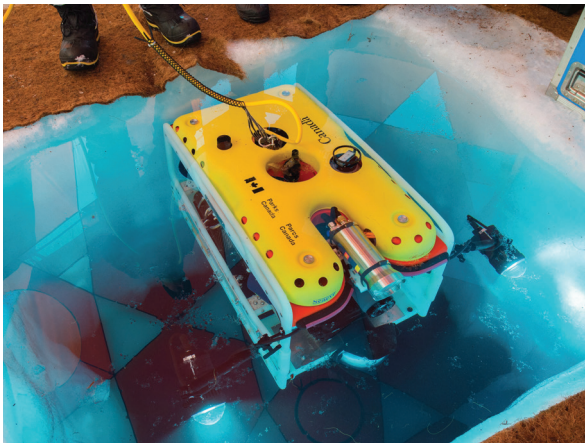


Figure 3.3.1: Parks Canada's ROV Seaeve Falcon in the ice hole, preparing to dive on HMS *Terror* (Photo: T. Boyer, Parks Canada; 90Moo877EF).

equipment; a tender; and a note keeper, the latter responsible for recording the ROV position as well as archaeological features captured at different moments through the dives (Figure 3.3.2).

The UAT collected comprehensive imagery for most of the hull, with the exception of its starboard (east) side, mostly inaccessible due to entanglement hazards in play given that the ROV approached from the port (west) side of the wreck. The five ROV dives captured 9.5 hours of video, 1,130 photos, and 2 hours of sector-scanning imagery. This data was processed, archived, reviewed and analyzed by the UAT at Parks Canada's facility in Ottawa, in order to reconstruct the most detailed picture possible of the wreck, in the form of a site sketch plan (see Figure 4.0.3).

4. ARCHAEOLOGICAL RESULTS

This section presents a preliminary archaeological description of the HMS *Terror* wreck site based on data collected by the UAT in September 2016 and April 2017. It provides details about the hull, upper deck features, and some of the surrounding debris detected and observed so far, with emphasis on the most important diagnostic features.

Most of the specific objectives outlined in Section 1 were achieved during this brief expedition. The hull and its upper deck were thoroughly documented using video and photo cameras, with the exception of the starboard side of the vessel in the mid-ship area. Also, due to relatively poor visibility at depth and time constraints, only a portion of

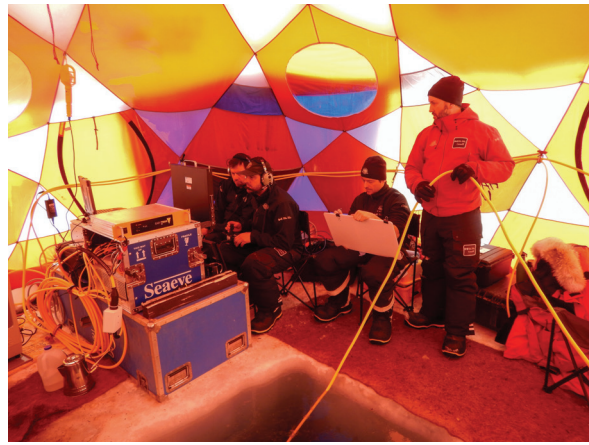


Figure 3.3.2: UAT archaeologists at work during a ROV dive on HMS *Terror* (Photo: D. Stenton, Government of Nunavut; 90Moo686EF).

the port side of the hull was photographed, thereby limiting efforts to generate a three-dimensional (3D) photogrammetric model of this side. Finally, the sector-scanning sonar was used to position and map the ship's boat on the seafloor. This mission was thus a success in many respects.

The following description draws upon the review and analysis of video footage, still photos and sector-scanning sonar data collected during this project. These data were correlated with MBES and side-scan sonar data from 2016 (Moore and Dagneau 2017; Figures 4.0.1 and 4.0.2). Archaeological data are also linked with ship plans of HMS *Terror* and HMS *Erebus* held by the National Maritime Museum in Greenwich, England (Table 4.0.1; Admiralty Collection [Ship Plans] 1837a, 1837b, 1837c, 1839a; 1839b; 1839c; 1839d; 1839e, 1845, hereafter referred to as "*Terror* 1837/1845 plans" or "1839 plans").

The collection of contemporary illustrations held by the National Maritime Museum, Scott Polar Research Institute, National Library of Australia and the Building HMS *Terror* blog by Matthew Betts (2017a) also provided some very instructive contextual data to support our analysis. In short, put in relation with different primary and secondary sources, archaeological data acquired in 2017 greatly enhanced the UAT's level of understanding of the wreck site, although the research is still at a preliminary stage.

Overall, the hull of the wreck is exceptionally well preserved (Figure 4.0.3). It rests at a depth of 24 m (79 ft.) with its gunwales approximately 18 m (59 ft.) deep and thereby stands 6 m (19.7 ft.) proud of the seafloor. The wreck's bow is oriented

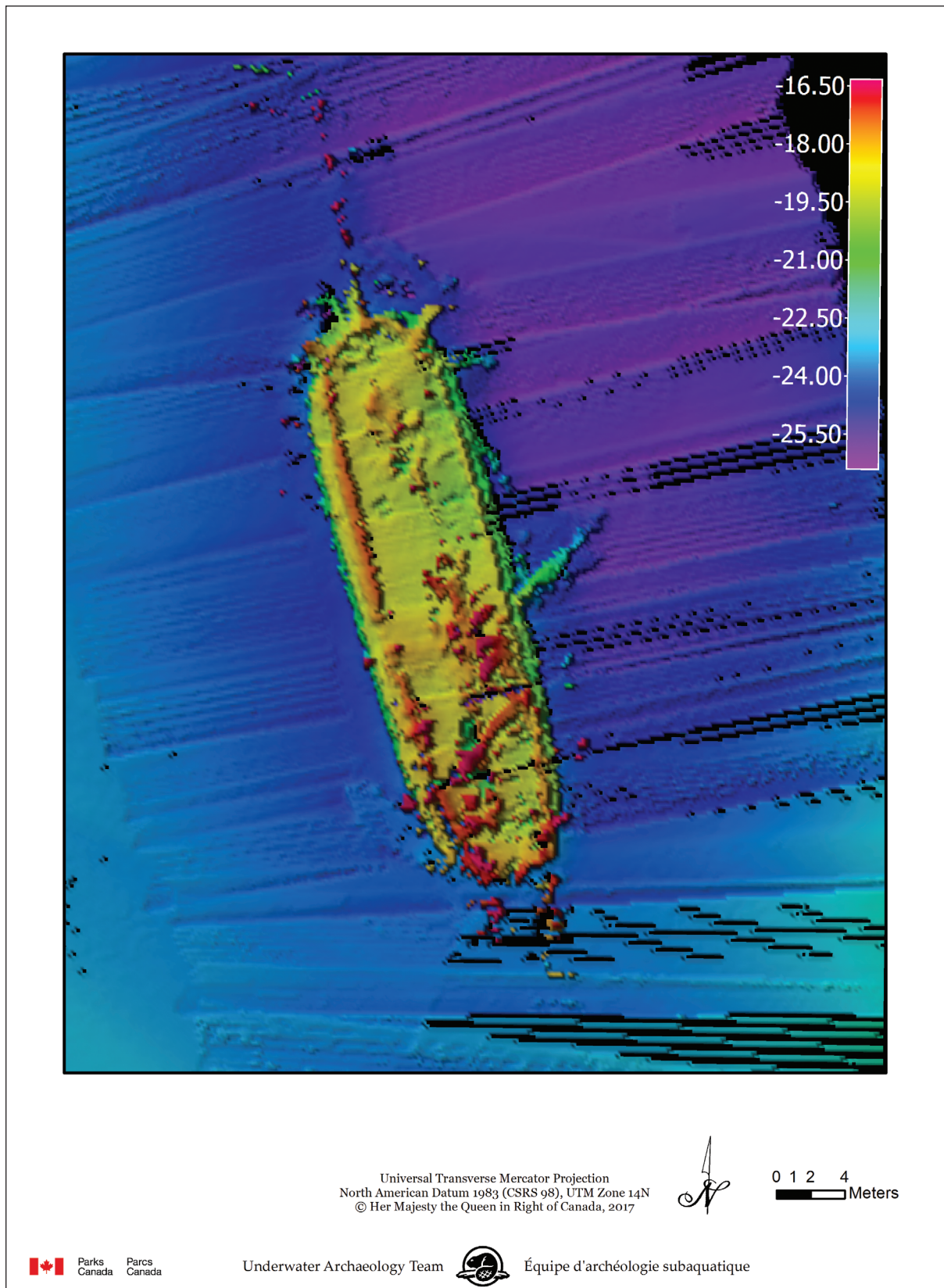
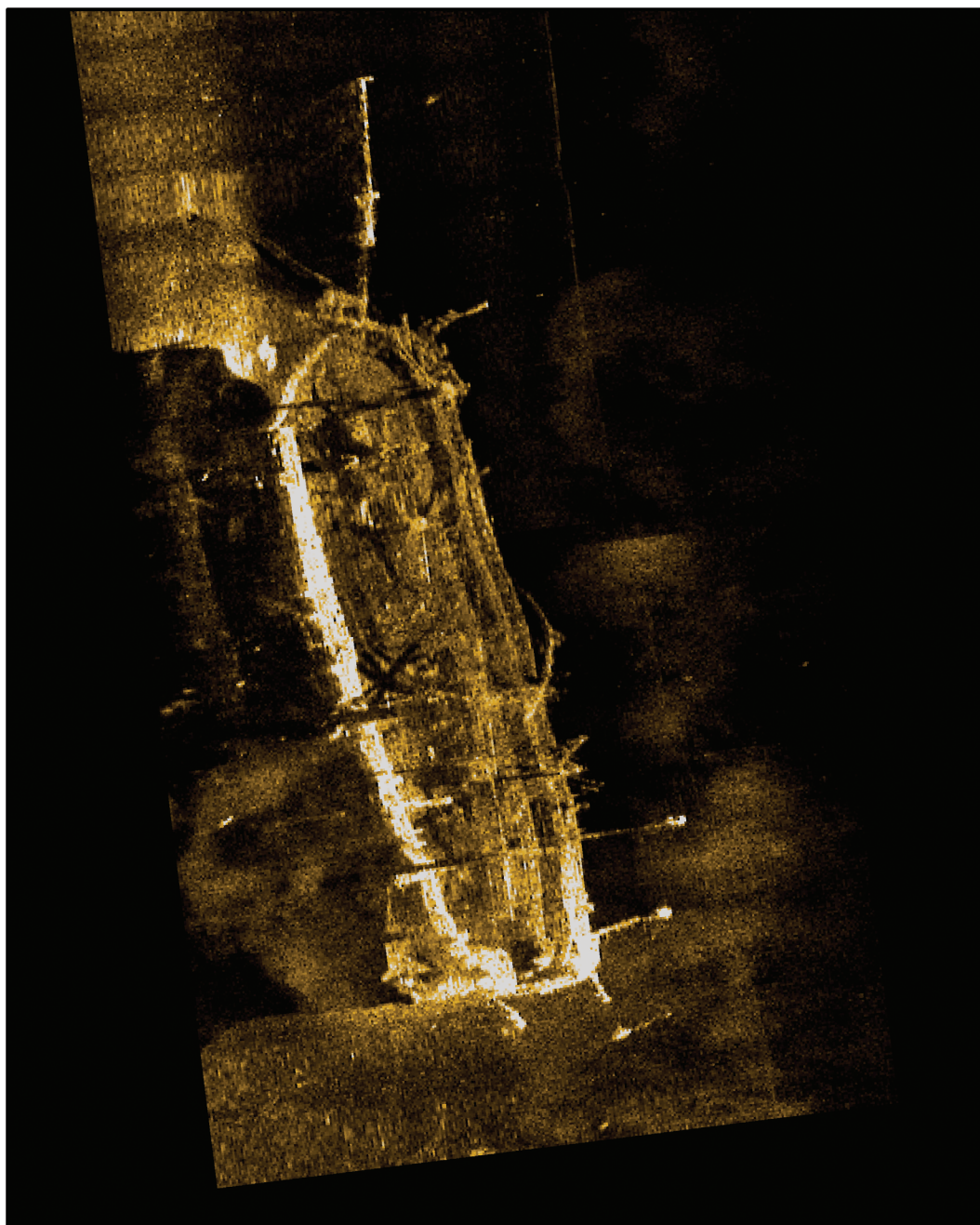


Figure 4.0.1: Multi-beam echosounder imagery of HMS *Terror*, 2016, with depth scale at top right (Map: C. Dagneau and R. Harris, Parks Canada).



Universal Transverse Mercator Projection
North American Datum 1983 (CSRS 98), UTM Zone 14N
© Her Majesty the Queen in Right of Canada, 2017



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Meters



Underwater Archaeology Team



Équipe d'archéologie subaquatique

Figure 4.0.2: Side scan sonar imagery of HMS *Terror*, 2016 (Image: C. Dagneau and R. Harris, Parks Canada).

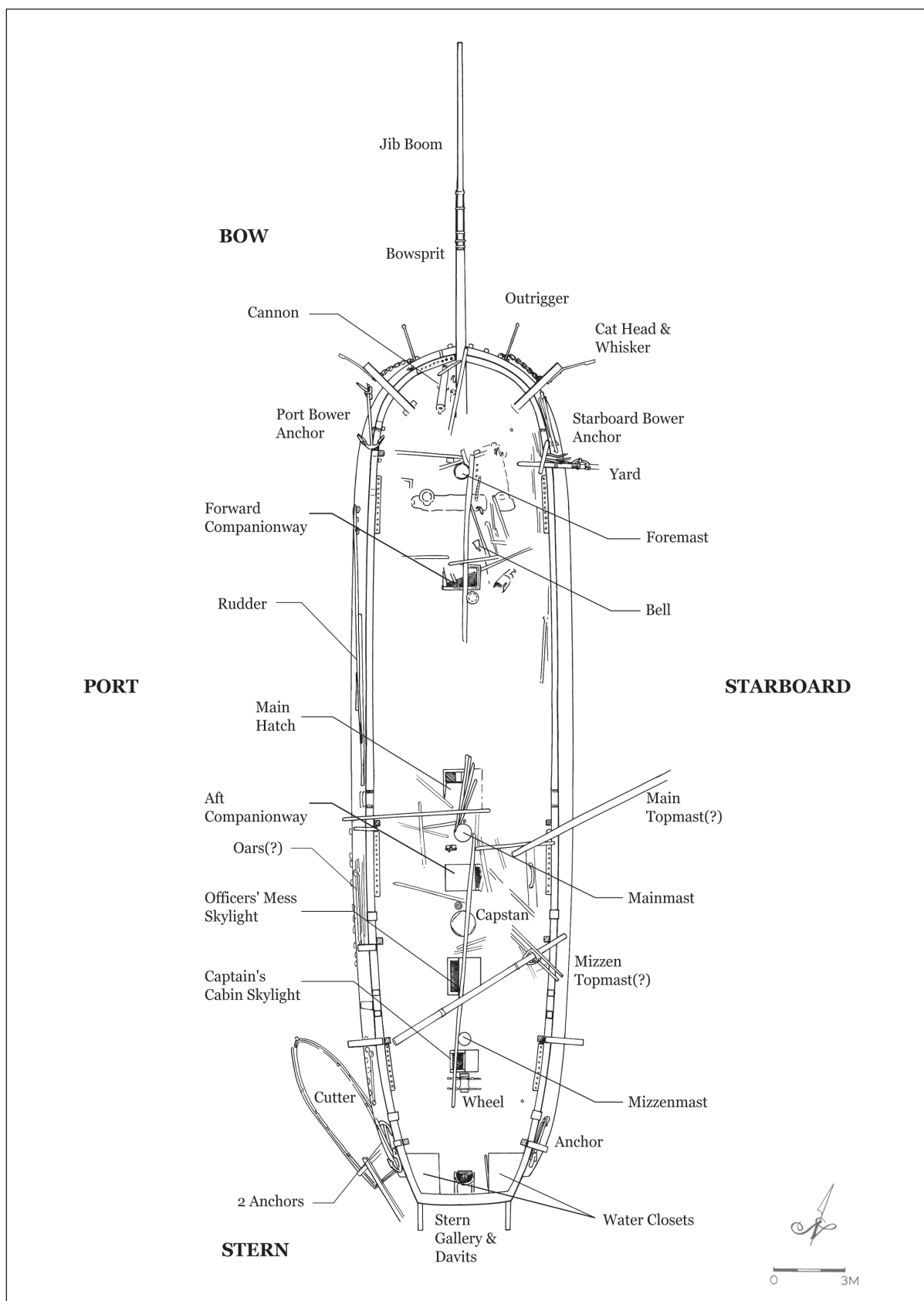


Figure 4.0.3: Preliminary site sketch of HMS *Terror*, 2017. The outline of the vessel is based on the *Terror* Upper Deck plan and features were added based on archaeological data (Drawing: C. Dagneau and C. Pillar, Parks Canada; 90M-2017-101-2).

Plan #	Scan #	Date(s)	Title
ZAZ5672	J1406	December 1837 June 12, 1845	Profile of the <i>Terror</i> . As fitted for a North-Pole discovery Ship, at this Port. March 1836
ZAZ5673	J1407	September 1839	<i>Terror</i> and <i>Erebus</i> , Profile. (as fitted.)
ZAZ5674	J1408	December 1837	Plan of the <i>Terror</i> Upper Deck
ZAZ5675	J1409	September 1839	<i>Terror</i> and <i>Erebus</i> , Plan of Upper Deck (as fitted)
ZAZ5676	J1410	December 1837 1845	Plan of the <i>Terrors</i> Lower Deck
ZAZ5677	J1411	September 1839	<i>Terror</i> and <i>Erebus</i> , Plan of Orlop and Hold (as fitted)
ZAZ5678	J1412	September 1839	<i>Terror</i> and <i>Erebus</i> . Midship Section
ZAZ5683	J1529	March 17, 1845	Drawings,- representing the after part of the “ <i>Erebus</i> ” Arctic ship; [...]
NPC3124	J8649	December 1837	Plan of the <i>Terror</i> ’s Orlop & Hold
NPC3125	J8650	September 1839	<i>Terror</i> and <i>Erebus</i> , Plan of Lower Deck (as fitted)

Table 4.0.1: Selected ship plans of HMS *Terror* held by the National Maritime Museum, Greenwich.

341 degrees relative to true north. The hull sits upright on the bottom with little discernible heel or pitch, although survey and recording activities will refine these observations. The most obvious features observed in 2016 were the ship’s three mast stumps, its mostly intact bowsprit and jib boom, its square transom with stern gallery intact and the longitudinal ice channels along both sides of the hull—the latter particularly characteristic of Royal Navy polar discovery ships of the mid-nineteenth century. Based on the 2016 MBES, the overall hull length is 34.3 m (or 112.5 ft.) and the maximum breadth from outer edge to outer edge of the ice channels is 9.1 m (or 29.9 ft.). The wreck’s upper deck is covered by a thick layer of sediment, marine life, and a number of collapsed standing rigging components such as yards and spars. Despite sediment coverage, selected features can be identified based on the preliminary data gathered in 2016 and 2017.

4.1 HULL

As noted in the previous report, the wreck’s hull is intact from keel to gunwale on both sides and does not seem to have suffered any major structural damage; the most salient damage and decay appears to have been to its standing and running rigging (Moore and Dagneau 2017). The iron plating reinforcement observed at the bow follows a similar pattern as on HMS *Erebus*. While this feature was only scarcely documented by video in 2017, side-scan sonar data from 2016 provide a good idea of its extent. Although not documented

by ROV, four scuppers are visible on sonar images of the port side of the hull, forward of the mainmast, all of which agree with scuppers shown on the 1837/1845 profile plan of *Terror*. The square transom is fitted with four stern gallery windows (Figure 4.1.1).

HMS *Terror*’s bulwarks seem largely intact considering all data available to date. The ice channels running along both sides of the hull also appear to be largely intact. The four boarding ports on the port side of the wreck detected with side-scan sonar in 2016 were also confirmed with the ROV in 2017. Their shape and location are consistent with those shown in 1837/1845 profile plans of *Terror* (Figure 4.1.2). Interestingly, the boarding port on the port side amidships is also equipped with steps atop the ice channel.

Figure 4.1.1: *Terror*’s stern gallery (Photo: T. Boyer, Parks Canada; 90M00785EF).



Figure 4.1.2: A boarding port from port side amidships (Photo: T. Boyer, Parks Canada; 90M01061EF).

The stern gallery is fitted with four double windows, each equipped with four glass panes divided by vertical and horizontal muntins, the rigid wooden frames that support and divide the panes (Figure 4.1.1). From port to starboard, the first external window has its lower left corner pane broken; its muntins and the three other panes are intact. The second window is completely broken; its vertical and horizontal muntins are gone, and only a few glass fragments are preserved along the bottom edge of the frame. The third window is also missing its muntins, although the bottom right glass pane is in position. The fourth and last (starboard) window is intact but covered by sediment and some vegetation. The propeller trunk in the great cabin (as depicted in an 1845 *Illustrated London News* engraving) can be observed through the broken gallery windows.

Based on the side-scan sonar and MBES data, the propeller trunk seems filled with wooden chocks. However, this is less than clear based on available ROV photos and video. Thus, although *Terror's* propeller does not seem to be mounted in position within the propeller aperture, this feature needs to be examined further. On the other hand, it is clear that the ship's rudder is not mounted in position on the rudder post. This very distinctive fitting is actually stowed on the port side ice channel between the fore and mainmast shrouds; its lifting sheave is visible. Interestingly, draft marks "XII" and "XIII" are partly visible on the port side of the rudder post (Figure 4.1.3).



Figure 4.1.3 Rudder post of *Terror* with copper alloy draft marks "XII" and "XIII" (Photo: T. Boyer, Parks Canada; 90M01494EF).

4.2 ANCHORS

Prior to 2017, there was little substantial information on the positions of the different anchors on HMS *Terror*—as many as 12 based on the 1839 *Terror* and *Erebus* profile. Side-scan sonar data from 2016 suggested that an anchor might be located on the seafloor on each side of the bow. As well, a line or chain seemed to be extending forward from the hull to the port-side anchor on the seafloor. In 2017, the two bower anchors were found to be both still in position and hanging from their catheads. The port side bow anchor is catted at the bow, next to the foremast shroud plate, with its crown pointing aft (Figure 4.2.1). Its upper fluke is inserted through a boarding port. The anchor shackle is located under the cathead, facing forward, and the anchor chain extends from it to the hawsehole farther ahead. The iron anchor stock is unfolded and points straight down. The bower anchor on the starboard side is catted as well, although with its stock still folded and attached. The starboard bower anchor chain



Figure 4.2.1: *Terror's* port bower anchor still in its stowed position (Photo: T. Boyer, Parks Canada; 90M01294EF).

is fed through the corresponding hawsehole. The UAT did not find and document with ROV the sonar target believed to be an anchor, detected with side-scan sonar in 2016.

Two stern anchors are present and secured on the port quarter ice channel, and at least one (possibly two) was observed on the opposite (starboard) side (Figure 4.2.2). The two anchors on the port side are partly overlapping and pointing in opposite directions, rigged at the extremity of the ice channel. No other anchors have been observed on the port-side ice channel or on the upper deck to date. The same could not be verified for the starboard side. This brings the total number of known anchors on the site to five, instead of the eight anchors shown on *Terror*'s 1837/1845 plans. Captain Crozier sent back "2 anchors and cables" to lighten his ship after having loaded all the supplies he could from the supply ship *Barretto Junior* at the Whalefish Islands in July 1845 (Crozier 1845). This would have brought the total number of anchors to six, if none were lost or jettisoned during the expedition. It is worth noting some of the anchors located on the wreck or the seafloor may remain undetected. Given that most of the structures and artefacts observed are at least partly covered in kelp and/or sediment, and on account of the limited visibility and ambient light, it is indeed possible that some anchors have been missed (see Figure 4.0.3).



Figure 4.2.2: Two small anchors catted in opposite directions, at the extremity of the ice channel on *Terror*'s port quarter (Photo: T. Boyer, Parks Canada; 90M00781EF).

4.3 HATCHES AND COMPANIONWAYS

HMS *Terror* was equipped with multiple hatches and companionways, as well as skylights. From bow to stern, the following features are discussed below: forward companionway, main hatch, aft companionway, officers' mess skylight, and captain's cabin skylight (see Figure 4.0.3).

The forward companionway's hood is largely collapsed, with some spars resting on top of it. Its port-side aft corner post is still standing, and it has a brass hinge on its face, likely for the door that opened to the port side (Figure 4.3.1). This post was observed during a dive in 2016 (Dagneau 2016:07). The starboard-side half of the forward companionway area is unobstructed by debris and represents the largest opening observed thus far on the upper deck. Although this fore hatch and its associated companionway are absent from 1837/1845 *Terror* plans, they closely match those on 1839 plans. Reportedly the MV *Martin Bergmann*'s crew used this opening in 2016 to introduce a small ROV into the wreck (Watson 2017:330–332).

The next opening on *Terror*'s upper deck is the main hatch, located forward of the mainmast (Figure 4.3.2). Although clear of any debris, this large hatch is almost entirely covered by sediment, except for a narrow opening on its forward edge. Its entire outline is however traceable through the overlying sediment cover and seems to agree with 1839 plans. None of the companionway structures depicted on the 1837/1845 plans seem present.



Figure 4.3.1: Forward companionway hood, mostly collapsed, facing forward (Photo: T. Boyer, Parks Canada; 90M01372EF).



Figure 4.3.2: Main hatch, mostly covered with sediment, with a narrow opening, visible in front of the main mast (Photo: T. Boyer, Parks Canada; 90M0751EF).

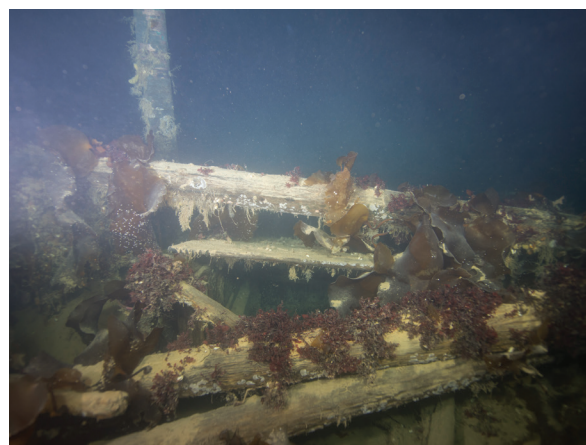


Figure 4.3.3: Starboard side of the aft companionway (Photo: T. Boyer, Parks Canada; 90M1159EF).

The aft companionway is located immediately aft of the mainmast, with its opening on the starboard side. This companionway seems mostly intact, except for its missing door. That said, the opening is blocked by debris and sediment accumulation (Figure 4.3.3). This hatch seems to conform to *Terror*'s 1837/1845 plans, although the winter quarters hood seems much lower and flatter than is depicted on both 1837 and 1839 configurations.

Based on the upper deck ship plan, the next opening on *Terror*'s upper deck moving aft is a skylight located above the officers' mess. This opening is almost completely covered in sediment (Figure 4.3.4). Its roof seems to stand much lower than the nearby captain's cabin skylight. This may indicate this elevated skylight was replaced by a standard hatch and coaming. The hatch is topped with a wooden board that is slightly displaced to starboard, thus leaving a narrow (ca. 25 cm) opening along the port side frame.



Figure 4.3.4: Officers' mess skylight, or corresponding modified hatch slightly open on its port side (Photo: T. Boyer, Parks Canada; 90M1139EF).

At the stern, the captain's cabin skylight and frame are generally intact but the uppermost, port-side vertical frame is missing (Figure 4.3.5). This distinctive skylight has at least one of its window panes missing, on the port side. This opening is just forward of the double-wheeled helm that still stands on its pedestal. As noted above, the configuration of the hatches and skylights on the upper deck, and notably the helm's mounting position close against the captain's cabin skylight head ledge are all consistent with the *Terror*'s 1837/1845 or 1839 plans (Moore and Dagneau 2017:23).



Figure 4.3.5: Captain's cabin skylight and double-wheeled helm (Photo: T. Boyer, Parks Canada; 90M01238EF).

4.4 STANDING AND RUNNING RIGGING

The bowsprit and all three masts are in position, although the masts are broken a few metres above the upper deck. The topmasts, yards and spars seem to have collapsed towards the starboard side, with a few large rigging components now resting directly on the upper deck. It appears that almost all of the more fragile and perishable elements from the ship's standing rigging, such as shrouds, stays, blocks, and deadeyes, have collapsed and/or have decayed; it is likely that many of these rest on the upper deck and on the seafloor immediately surrounding the hull. The same is likely for the ship's running rigging, for which little has been observed yet. The following provides a general description of the rigging elements from bow to stern.

The bowsprit extends from the bow outward with its articulated jib boom visibly intact, including the bowsprit cap for the inner bobstay—although the bobstays are now absent (Figures 4.4.1 and 4.4.2). The bowsprit is stepped approximately 3 m inboard from the stem, in a manner consistent with known modifications introduced in 1845, as seen on the 1837/1845 profile of *Terror* (Moore and Dagneau 2017:26). Both catheads are present, and equipped with an iron whisker boom, used to maintain the jib boom centered by use of multiple jib boom guys. Lower on the hull, two large iron

outriggers are still in position and point at a horizontal angle of 45 degrees out from both sides of the stem.

The foremast is preserved to a height of less than 1 to 2 m above the upper deck. The remaining structure observed both through diving and ROV operations appears more like an empty corrugated iron tube (Figure 4.4.3). It is possible that an iron cable was used for serving the mast if it was sprung. For this reason it was first misidentified in 2016 as a large funnel. One large upper rigging component was documented on the starboard side close to the foremast. Its heel rests on the starboard bulwark and points upwards, and its (original) upper extremity rests on the seafloor at depth. This rigging component is likely a lower yard (foreyard or mainyard), as it is fitted with a large iron yard



Figure 4.4.2: *Terror*'s bowsprit heel, stepped in a manner consistent with the *Terror*'s 1845 modifications (Photo: T. Boyer, Parks Canada; 90M1711EF).

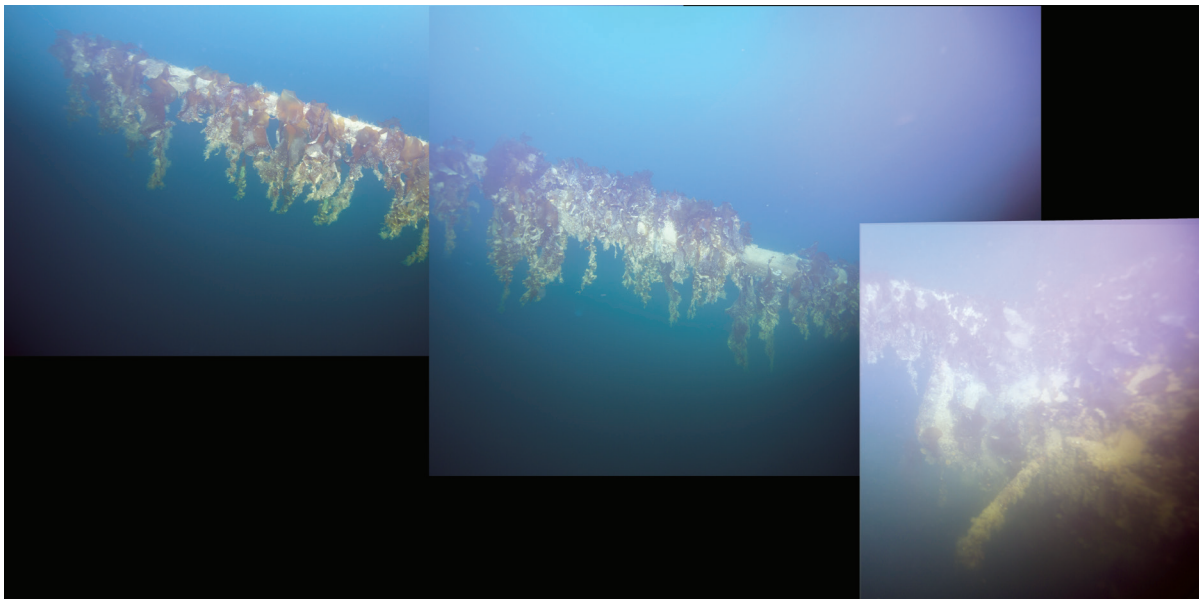


Figure 4.4.1: Photomosaic of the bowsprit and articulated jib boom, from the port side (Photos: T. Boyer, Mosaic: C. Dagneau, Parks Canada; 90M0714EF-90M0716EF).



Figure 4.4.3: Fore mast stump, looking aft. The windlass' port side carrick bitt is visible in the background (Photo: T. Boyer, Parks Canada; 90M1315EF).



Figure 4.4.5: Possible mizzen topmast with its upper end partly resting on the starboard bulwark (Photo: T. Boyer, Parks Canada; 90M01633EF).

truss in its middle. Two copper alloy single blocks with shackles (with distinctive embossed ray patterns) are rigged at each end of the truss. These are similar to a block with a shackle (89M29M100-1) found on *Erebus* (Moore et al. 2017:95).

Terror's mainmast is preserved approximately to 7 m above the upper deck, with its broken head at a depth of 12 m. The mast is fitted with multiple reinforcing mast bands throughout its in situ height (Figure 4.4.4). A copper alloy lightning rod is inserted on its aft face, following Harris' Patented Lightning Conductor for Ships specifications (Harris 1840). Two vertical stanchions with a U-shaped head are situated on each side (yet slightly aft) of the mainmast; these are supports for the Massey Patent bilge pump cranks. There is also a pair of small yards running fore-and-aft, forward of the mainmast, that probably correspond to a (retractable/extendable) studding sail yard; the top yard part is meant to slide out on the bottom yard part, to extend the studding sail on both sides.



Figure 4.4.4: Mainmast, viewed from the port side forward (Photo: T. Boyer, Parks Canada; 90M0741EF).

A large upper standing rigging component, possibly the main topmast, is located outside the hull and leans against the starboard hull's side amidships. This rigging element has fallen overboard in a way similar to the suspected yard on starboard bow. Its shallowest end rests against the starboard bulwark and at some distance inside and over the upper deck. However, it was not possible to fully document this feature during ROV operations in 2017.

Another large mast component approximately 8 m long may be associated with the mizzenmast. This topmast sits across the upper deck next to the mizzenmast, with its upper end, consisting of a trestle tree and cross-tree (a platform for the top), partly resting on the starboard bulwark and partly outboard (Figure 4.4.5). The top portion of the suspected topmast is covered with a copper alloy plate similar to the one observed on the mizzen, in this case, to prevent chaffing from the gaff's jaws.

The mizzenmast is preserved to a height of 5.5 m above the upper deck and is at a depth of approximately 13.5 m (Figure 4.4.6). It is fitted with a lightning conductor of similar design to that of the mainmast. The mizzenmast also appears to be made of two different sections; the lower portion is wider in diameter, and equipped with a spider band. This all-metal pinrail of copper alloy forms a collar around the mast and is fitted with multiple belaying pins. It can be discerned in a daguerreotype portrait of Lieutenant LeVesconte on *Erebus* (1845). The upper portion of the mizzen, slightly narrower, is inserted in the lower portion through a "saddle," likely for the spanker boom to sit on. The mast is protected by copper sheathing just above the saddle, where the spanker's jaws would rub on the mast.



Figure 4.4.6: Mizzenmast, ship's wheel and captain's cabin skylight viewed from the starboard stern (Photo: T. Boyer, Parks Canada; 90M01620EF).

Other spars or yards rest on the upper deck at different locations, including one that runs from the fore to the mainmast, as well as another extending from the mainmast to the mizzenmast. The latter now rests directly atop the capstan and the double-wheeled helm at the stern (Figure 4.4.6).

The shroud plates and associated deadeyes were not observed and documented in most cases, except for the port side foremast and mizzenmast shroud plates. In both cases, the iron plates are affixed to the side of the ice channel, and only the bottom deadeyes are in situ. The top deadeyes and associated shrouds and ratlines probably broke off when the masts collapsed sometime during or after wrecking. Interestingly, between six and eight long wooden objects, likely oars, are still stowed on the ice channel under the port side mainmast shroud plates (Figure 4.4.7). A rudder—with its distinctive shape and straps—is stored on the same ice channel, between the fore and mainmast shrouds. Pinrails were observed inside the gunwales abreast the three masts and



Figure 4.4.7: Six to eight oars stored on the port side mainmast shroud plates (Photo: T. Boyer, Parks Canada; 90M0953EF).



Figure 4.4.8: Pinrail (or pin rack) on the port side amidships with belaying pins in position (Photo: T. Boyer, Parks Canada; 90M00164EF).

on both sides of the bow. In all cases, copper alloy belaying pins were still in position in their wooden rails (Figure 4.4.8). Their configuration is consistent with *Terror* 1837/1845 plans.

4.5 DAVITS

Although mostly damaged, two pairs of boat davits survive on both sides of the wreck, as well as one pair at the stern, yielding a total of five pairs observed to date. The side davits are not of a type depicted in the mid-ship section plan of *Terror* from 1839 that have straight uprights; rather they have curved heads as depicted by the 1848 midship section of HMS *Investigator*, and by contemporary artwork showing *Erebus* and *Terror* in 1845 (for example, Stanley 1845a; 1845b; Figures 4.5.1 and 4.5.2). Each davit is composed of a curved davit post affixed to the exterior of the bulwarks and an associated davit stanchion fitted inside the bulwark. Despite the discrepancy between their



Figure 4.5.1: Pair of davits on the port quarter (Photo: T. Boyer, Parks Canada; 90M00755EF).

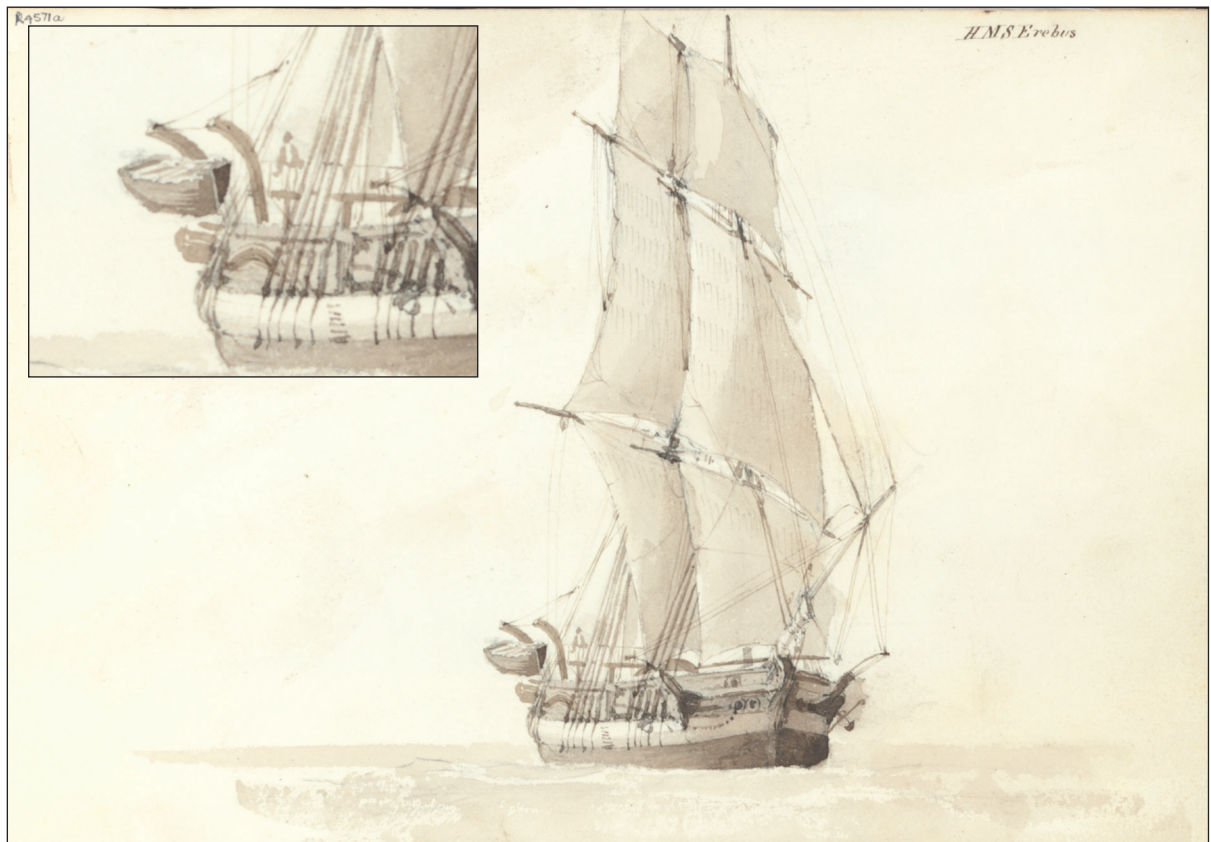


Figure 4.5.2: HMS *Erebus*. Drawing by Lieutenant Owen Stanley, 1845 (Courtesy: National Library of Australia, 2484731).

form as depicted in the midship section and their form on the wreck, their locations on the latter are indeed consistent with the *Terror*'s 1837/1845 upper deck plan. Vertical timbers or posts were also observed, next to the forward boarding ports on both sides of the wreck. Their specific function is unclear at this point; they may be part of a hood or covered gangway structure used during the winter. These do not appear on the ship plans.

the muzzle towards the bow. Based on its apparent size and proportions, it seems identical to the light bronze six-pounder (89M99X1-6) recovered from *Erebus* in 2014 (Moore et al. 2017:102–104).

Terror's windlass is located just forward of the foremast. This apparatus is mostly hidden under wooden debris and marine growth, except for its two vertical carrick bitts that are visible. A short distance aft is the ship's bell—also initially observed

4.6 OTHER ARTEFACTS AND FEATURES

The MV *Martin Bergmann*'s crew first reported a bronze cannon at *Terror*'s bow following an ROV dive to the site in 2016 (Watson 2017:330–332). Although the cannon could not be relocated during the 2016 UAT archaeological dives, it was recorded during the 2017 ROV operations. The bronze cannon lies prone on the upper deck on the port side of, and more or less parallel with, the bowsprit heel (Figure 4.6.1). While mostly buried, its cascabel and vent patch are clearly visible, demonstrating that the breech is towards the stern and



Figure 4.6.1: Bronze cannon at the bow. A grey metal pipe is visible between the gun and the bowsprit (Photo: T. Boyer, Parks Canada; 90M1708EF).



Figure 4.6.2: *Terror's* bell, bedded in silt and nestled amongst wooden debris between the forward companionway and the windlass (Photo: T. Boyer, Parks Canada; 90M01792EF).

by the crew of the MV *Martin Bergmann*—situated between the windlass and the forward companionway, lying on its side on the sediment covering the upper deck, and amongst wooden debris (Figure 4.6.2). Its overall shape is similar to HMS *Erebus's* bell (89M99X1-1) but no dates or markings on it have been observed given its partial burial (Moore et al. 2017:116–118).

One of the most prominent features of the *Erebus* wreck site, its capstan, is a feature also found on *Terror*. It stands upright on the upper deck in the space between the main and mizzenmasts (Figure 4.6.3). Although it appears to be intact, not much



Figure 4.6.3: Possible funnel located between the aft companionway (left) and the capstan (right) (Photo: T. Boyer, Parks Canada; 90M1128EF).

can be said at this point about it, as it is largely covered by marine growth and sediment. Another important and amazingly well preserved feature on *Terror's* upper deck is its double-wheeled helm, located aft of the captain's cabin skylight (Figure 4.6.4). It still stands on its pedestal, with remains of the tiller rope still wrapped on the barrel. The steering device is partly obscured by vegetation and a fore-and-aft spar that fell on top of it. Interestingly, the aft face of the pedestal is fitted with an inclinometer (heel indicator). As noted above, the helm's mounting position close against the captain's cabin skylight head ledge is consistent with the *Terror's* 1837/1845 and 1839



Figure 4.6.4: *Terror's* double-wheeled helm, looking forward. Its barrel aft face is copper sheathed, and fitted with an inclinometer (heel indicator) (Photo: T. Boyer, Parks Canada; 90M01609EF).



Figures 4.6.5: Starboard side water closet, looking aft to starboard. Its door is partly open (Photo: T. Boyer, Parks Canada; 90M01596EF).



Figures 4.6.6: Port side stern water closet, looking aft towards the port side (Photo: T. Boyer, Parks Canada; 90M1570EF).

plans and was one of the keys to the confirmation of the identification of the wreck in 2016 (Moore and Dagneau 2017:23).

There are two small “water closets” on both sides of the rudder trunk on the quarterdeck (Figures 4.6.5 and 4.6.6). These features are marked as “Hen Coop” on *Terror*’s 1839 ship plans, but could have been used as latrine or storage space for the 1845 expedition, since the former water closet had to be moved to make way for the rudder scuttle when *Terror* was fitted with a steam engine and retractable propeller system. A rough drawing made by Lieutenant Owen Stanley (1845a) shows similar structures fitted on *Erebus*’ quarterdeck in June 1845.

The starboard side water closet has its sliding door only slightly open. The side wall of the cabin has a star shaped opening, presumably for lighting and ventilation. The port side water closet has its door completely open (or missing); one can see a white (possibly painted) shelf, as well as a toilet seat, chest, or bench inside. These two spaces are the most elevated structures of the wreck, along with the remaining main and mizzenmasts and the davits. Their state of preservation is quite astonishing and very promising.

Other features documented with the ROV on the upper deck include several vertical pipes projecting up from the deck spaces below. In all instances, the dimensions of these features in hand are only approximations based on video and photo imagery. The first pipe is a small copper pipe (ca. 2 to 3 cm in diameter and 1 m high) standing on the port side of, and close against, the bowsprit heel (Figure 4.6.1). It is possibly a funnel for a heating apparatus in the sick bay; indeed a

similar feature has been observed projecting out of the sick bay of the wreck of *Erebus*. The second pipe (ca. 40 cm in diameter and about 1 m high) located aft of the forward companionway, is covered by iron corrosion product. Although its location suggests it should be a pump tube, its shape and material makes it more likely a funnel for the Frazer Patent stove or the Sylvester heating apparatus below.

A third example (ca. 15 cm in diameter and about 4 m high) is a copper-alloy corrugated pipe assembled from multiple sections, located between the aft companionway and the capstan, and offset to the port side (Figure 4.6.3). It is framed by two small copper alloy supports (ca. 1 cm diameter, 40 cm high), or frame bolts. The general location of this tube corresponds to the engine funnel as shown on ships plans and in a May 1845 sketch of *Terror* and *Erebus* by Lieutenant John Irving (Figure 4.6.7; Irving 1881). Its function is unclear however, as it seems too small for an engine smoke stack, and too large to be a steam exhaust. Lieutenant Irving (1881: 16 May 1845) mentions the engine funnel in his correspondence:

Our engine [...] has a funnel the same size and height as it had on the railway, and makes the same dreadful puffings and screamings, and will astonish the Esquimaux not a little.

One suggestion made by Matthew Betts (2017b: pers. com.) is that the observed funnel could have been for a jury stove installed in the officer’s mess below—a modification possibly introduced during the expedition to cope with the absence of heating ducts in this space.

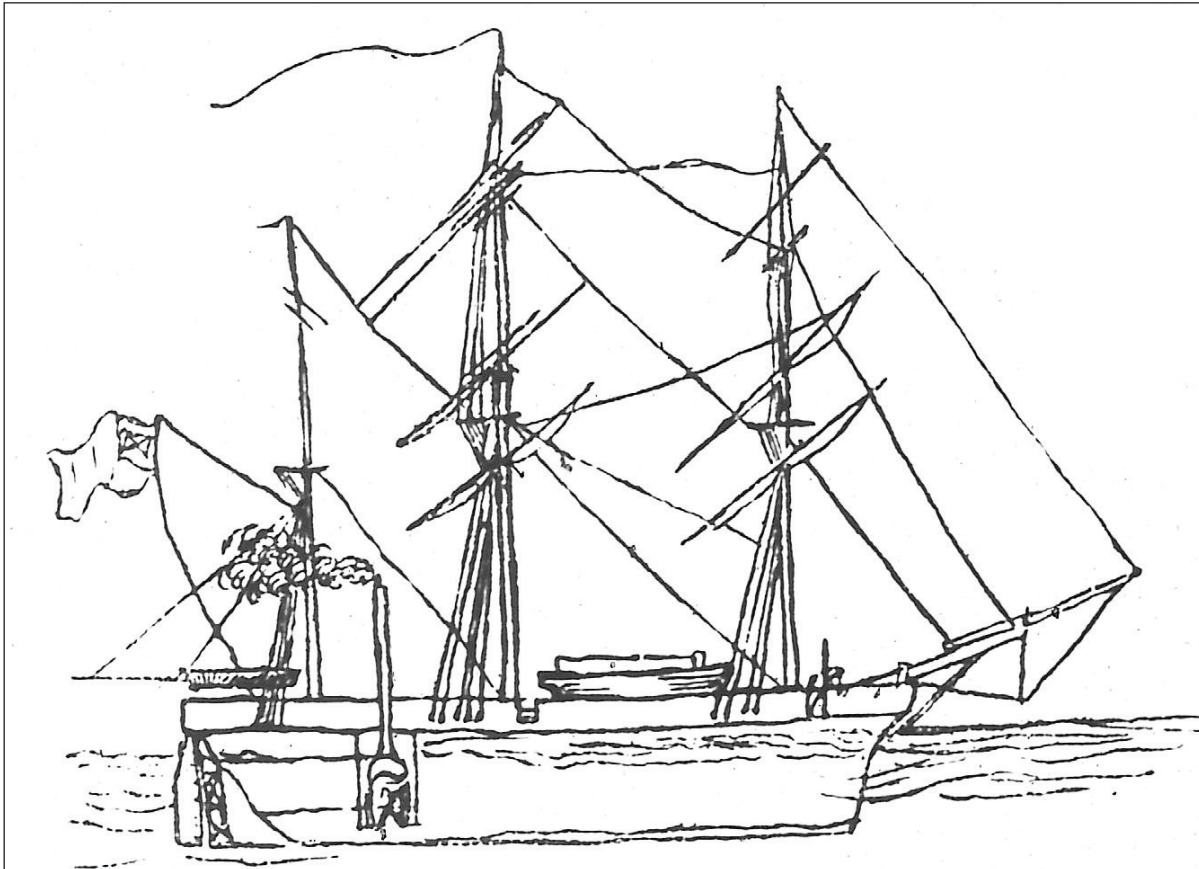


Figure 4.6.7: “Adaptation of Locomotive Machinery to the Ships”. Sketch by Lieutenant John Irving of the steam engine adaptation on *Erebus* and *Terror* (Irving 1881:119).

Lastly, a fourth vertical copper pipe (ca. 3 to 4 cm in diameter and 2 to 3 m high) is located at the stern, forward of the starboard water closet. Based on its location it could be the captain’s cabin stove pipe.

4.7 BOAT

The debris field around *Terror* is by no means as extensive as that around *Erebus*. Although side-scan sonar and MBES surveys covered only a limited area of about 10 m of seafloor around the hull perimeter, the data suggests that there is no sizeable debris other than the collapsed standing rigging components discussed above; one of *Terror*’s boats located off the port quarter is a notable exception however (see Figures 4.0.3 and 4.7.1).

Thus, the most interesting and only artefact located on the seafloor to date is a small wooden boat located on *Terror*’s port quarter. The boat rests upright on the bottom at a depth of 23 m, is mostly filled with sediment, and is oriented with

its bow facing north-northwest (ca. 310° True). It is in good condition with the exception of its upper strakes and weather board. The clinker-built boat has a curved, V-shaped stem, gunwales fitted with square oarlocks, and a square transom with a distinctive cut-out boom support. The stem of the boat was examined in detail. Due to silt cover it is not possible to state if any identifying markings typical of the period, such as the boat’s length and



Figure 4.7.1: The bow of the boat with its stem at right (Photo: T. Boyer, Parks Canada; 90M1515EF).

place of construction, are present. A treble block can be seen inside the boat, although it is mostly buried. Articulated brass hooks, possibly boom tacks, are affixed to both sides of the boat amidships. Based on sector-scanning sonar data, its length is ca. 7 m (23 ft.), its breadth is ca. 1.8 m (5 ft. 11 in.), and its square transom is 0.8 m (2 ft. 7 in.) wide (Figure 4.7.2).

There are a number of period illustrations showing HMS *Erebus* and HMS *Terror* during polar expeditions, most depicting boats hanging from davits and/or stored on the upper deck. Lieutenants Graham Gore's and Owen Stanley's artwork from 1845 in particular is very instructive on the general shapes and sizes of boats used for the Franklin expedition. Double-ended as well as square-transom craft of different sizes are depicted (Gore 1845; Stanley 1845b).

More importantly, *Terror*'s 1839 profile plan depicts nine boats for the 1839–1843 Antarctic expedition: a pinnacle (28 ft.), a galley (30 ft.), two large cutters (25 ft.), one smaller cutter (23 ft.), two whale boats (30 ft.), a gig (22 ft.) and a dinghy (12 ft.). *Terror*'s 1839 upper deck plan also shows five boats on deck: two square-transom boats (23 and 28 ft.-long pinnaces or cutters) lashed on top of each other between the fore and mainmasts, as well as three double-ended boats (30 ft.-long whale boats) near the stern. It is very likely that some of the larger boats would have been kept at the ready on the sides and stern davits as well, in order to save space on deck. A similar complement of small boats had to be employed for the 1845 expedition, although space seems to have been scarcer. An India-rubber boat made by Peter Halkett was also embarked on *Erebus* in 1845, and possibly on *Terror*. This newly invented inflatable boat was

tested in 1845 when Commander Fitzjames and Lieutenant Fairholme used one to travel between *Erebus* and *Terror* (Fitzjames 1845; Fairholme 1845). The collapsible boat probably helped save some space, by replacing one of the rigid wooden boats.

Space was indeed a constant preoccupation. For instance, Crozier wrote in a letter: “We have now a mean draught of 16 ft and all our provisions not yet on board – I send home our largest cutter (and fill launch with patent fuel) 2 anchors and cables [...]” (Crozier 1845). His letter suggests that at least another smaller cutter was aboard for the remainder of the expedition. While the large cutter referred to by Captain Crozier may be a 25 ft. cutter as listed and depicted on *Terror*'s plans, the smaller boat found in situ would be one of the 23 ft. cutters.

Based on its location on the bottom, this cutter was probably hanging from the port quarter davits at the time of sinking. An Admiralty Drawing of a “Cutter” (1852) provides a good idea of what this boat would have looked like (Figure 4.7.3).

4.8 ARCHAEOLOGICAL INTERPRETATIONS

Although the archaeological study of HMS *Terror* is still in its preliminary stages, the data assembled to date can be used to put forward a few working hypotheses about the circumstances under which the vessel came to be in Terror Bay and its pre-sinking disposition.

Based on our current knowledge of sea ice movements around King William Island, past and present, there is a high probability that *Terror* was drawn by sea ice towards Alexandra Strait from its 1848 desertion point; this can be inferred from an historical ice climatology study of the region (Moore, Harris and Zagon 2012:21–23). It is also possible that natural forces alone, chiefly ice disgorging southwards through Alexandra Strait, could have transported *Terror* into Terror Bay (Zagon 2017: pers. com.).

Based on its location alone it is not possible to determine categorically if *Terror* either: (i) drifted unmanned from its known desertion point of April 22, 1848 and was carried to Terror Bay; (ii) was re-manned and was carried by ice and/

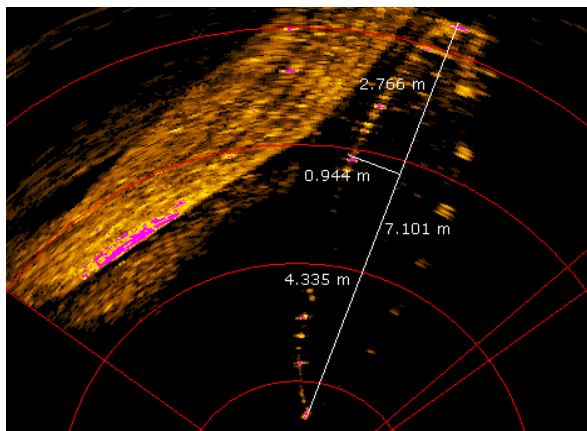


Figure 4.7.2: Sector-scanning sonar imagery of the boat (Image: R. Harris and C. Dagneau; MS1000-20170426).

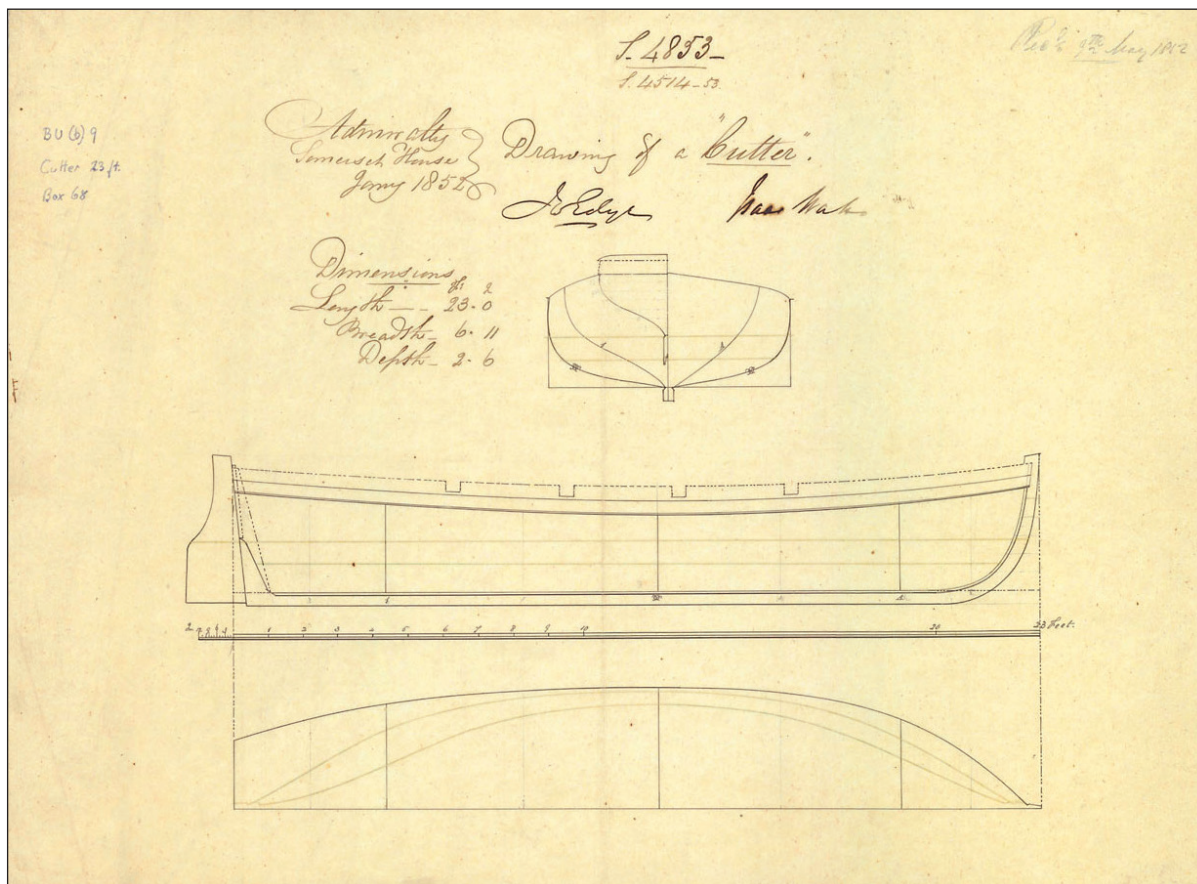


Figure 4.7.3: British Admiralty drawing of a 23-ft. long cutter, 1852 (Courtesy: National Maritime Museum, Admiralty Collection (Ships Plans) ZAZ7031, J4853).

or navigated to Terror Bay, or (iii) if it was remanned and navigated in open water into Terror Bay. There is no evidence to support or rule out either hypothesis at this stage.

Looking beyond its location and to the wreck itself, we can put forward some other hypotheses. The fact that both bower anchors are catted at *Terror*'s bow means that the vessel was not anchored as would have been normal in open water prior to its eventual sinking. We do not know however if any ice anchors were deployed prior to sinking, which could have been the case if the hull was surrounded by thick ice.

The presence of vertical stove funnels, including one within the capstan bars swing space, winter hoods on the companionways, and possible covering structures on the forward boarding ports all seem to indicate the ship was left in winter quarters (i.e. in a cold weather configuration) (Figure 4.8.1). This suggestion is also supported by the presence of two fore-and-aft spars, both situated

so as to have acted as ridge poles for winter awnings. As well, there is further circumstantial evidence from the fact that there is no rudder mounted on the rudder post; there is however a rudder stowed on the port ice channel. Given that *Erebus* and *Terror* each carried a primary and spare rudder, this is not proof that the primary rudder was stowed, as the rudder on the ice channel could be the spare. Lastly, it appears that the propeller aperture is filled with the chocks positioned when the propeller was not in use. While this last observation remains to be confirmed, at present there is no evidence that the propeller was in its working position at the time of sinking.

At this stage, it is unclear what combination of forces or circumstances, both natural and human, brought *Terror* into Terror Bay. But based on the preliminary data presented within this report, it appears more likely that *Terror* was in a winter quarters configuration rather than ready for navigation in open water.



Figure 4.8.1: “H.M.S. Terror January 1837”, by Owen Stanley, showing the *Terror* in winter quarters during Sir George Back’s 1836-1837 expedition into Hudson Bay (Courtesy: The Thomas Fisher Rare Book Collection, University of Toronto, F7383).

5. CONCLUSIONS

This report described the principal activities and findings of the UAT’s work at the wreck of *Terror* in April 2017. This preliminary investigation was completed using non-intrusive methods alone, namely an ROV equipped with photo and video cameras, as well as a sector-scanning sonar. The exterior of the *Terror* was carefully inspected and recorded (with the exception of the starboard side), work which has yielded a better idea of both the site’s integrity and archaeological potential. A boat was positioned and mapped using the sector-scanning sonar. Some further insights into the state of *Terror* prior to its sinking have been

gained; for example, the two bower anchors were catted and the propeller and rudder do not seem to be in their working positions. It is also hypothesized that *Terror* was in a winter quarters configuration immediately prior to its sinking.

Taken together, the data collected at the site in 2016 and 2017 now provides Parks Canada with a solid benchmark to plan further research at the wreck site. Yet more archaeological work will have to be done in order to achieve a complete site assessment, like the one recently completed for HMS *Erebus* (Moore et al. 2017), and to establish definitive conclusions about the fate of the ship. That said, the present 2017 fieldwork is an essential step toward achieving these goals.

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