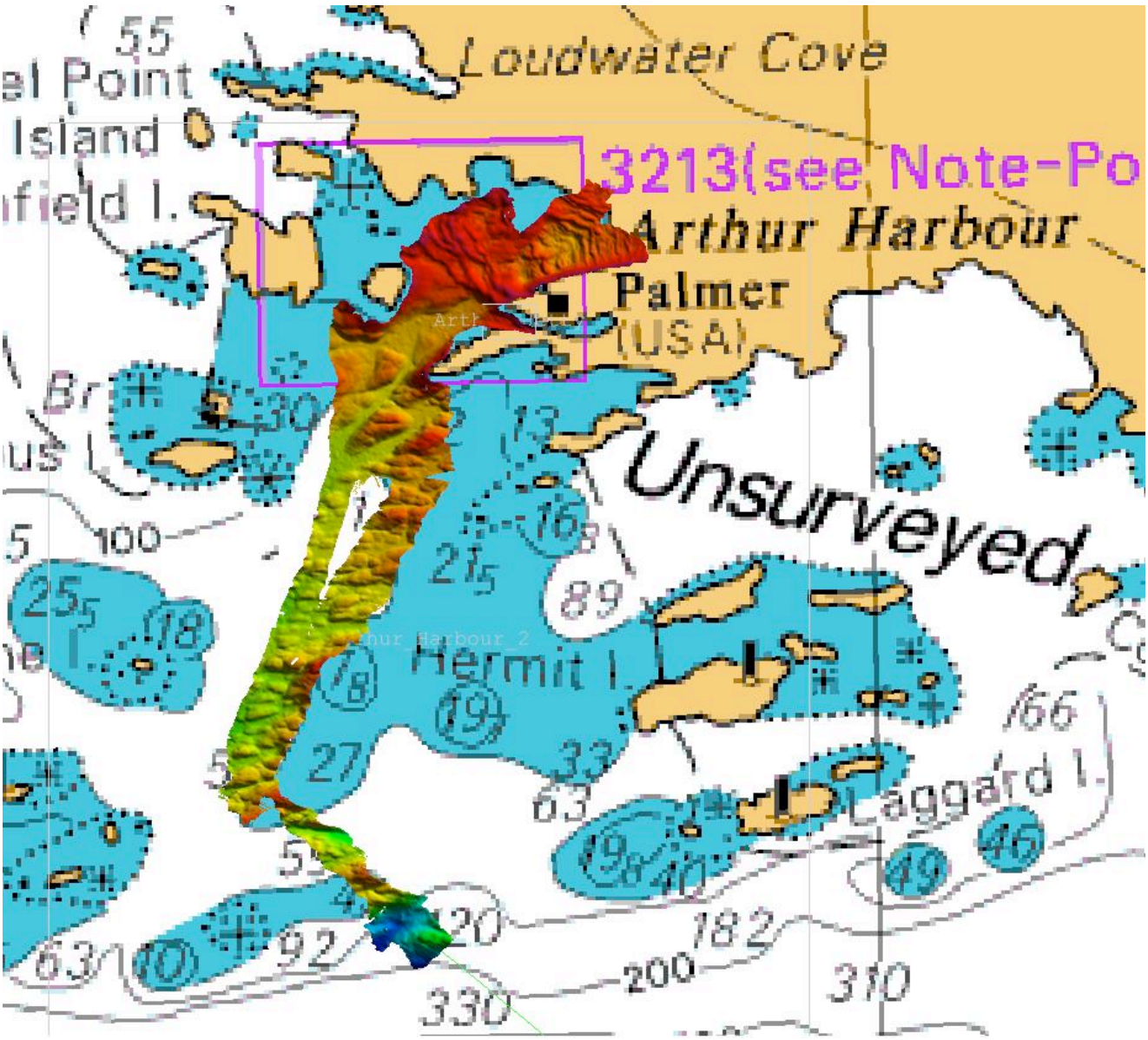
| | |
|---|---|
| General Area | ANTARCTICA – Anvers Island |
| Name of Survey | Palmer Station, Arthur Harbour |
| Unit Name | HMS PROTECTOR – Survey Motor Boat JAMES CAIRD IV |
| Company | Royal Navy |
| Surveyed by | Lieutenant Commander P J Payne RN |
| Charge Surveyor | Lieutenant Commander P J Payne RN |
| Start Date of Survey | 02 April 2012 |
| End date of Survey | 02 April 2012 |
| Survey Category | IHO Order 2 / CATZOC B |
| HMOG Edition | 2/11 |

H102/PRTR/10/12

07 September 2012

**INTRODUCTION**

1. Whilst conducting an informal base visit to Palmer Station in Arthur Harbour, Antarctica, HMS PROTECTOR took the opportunity to undertake a bathymetric survey of the area. The main purpose was to provide the National Oceanographic and Atmospheric Administration (NOAA) with bathymetric data to assist in the planning and construction of a new jetty for re-supply ships within the small inlet to the south of the station. In addition to this, the opportunity was taken to conduct as full a MBES survey throughout Arthur Harbour as the ship's schedule allowed. This was considered of considerable use, as the Harbour provides shelter from the often harsh conditions in this area.



Extract of chart 0446 showing extent of area surveyed.

**WEATHER**

2. The harbour provided good shelter from the prevailing winds, and conditions remained suitable throughout the period for SMB survey operations. Full weather details for the 2011/12 Austral Summer Season will be forwarded separately.

**EXTRANEOUS ACTIVITIES**

3. This was not a tasked survey, and as such needed to be fitted around other tasking. PROTECTOR was required to leave the area prior to completing the entire area to IHO Order One survey standards. All

data gathered has been rendered with a recommendation as to the different categories for several areas that were surveyed to different standards.

**SURVEY DATA**

4.1 A Kongsberg Simrad EM3002 MBES fitted to the SMB JAMES CAIRD IV was used to collect bathymetric data throughout the survey.

4.2 The EM3002 system was calibrated by conducting a successful patch test in Mare Harbour, Falkland Islands on the 13th February 2012.

4.3 Post-processing was conducted using Caris HIPS SIPS Ver. 7.0. All post–processing was conducted in accordance with HMOGs Ver 02-11, RN Standard Operating Procedures.

4.4 The data was processed in two areas. The shallow area to the south of the station was binned at 1m and the remainder at 2m to enable an assessment as to whether an IHO Oder 1 Survey had been achieved.

4.5 There was a great deal of ice in and around the area. This tended to be the limiting factor as to how close the SMB could safely get to land.

**GEODETIC DATA**

5.1 Two new geodetic stations were established within the area; PROTECTOR 01/12 and PROTECTOR 02/12. As has been found in other areas of Antarctica, the EGM08-25 model seems to be in error when compared to tidal mean sea level checks. In this instance the EGM08-25 height calculated from the GGPS observations was 1.955m higher than MSL as calculated by a 39hour MSL check on the long term US Gauge at the Station.

**NAVAIDS**

6. Primary control of the survey was achieved using C&C Technologies C-Nav 3050 GPS system using the fully corrected $C^2$ RTG Dual position. The boat's navigational system was satisfactorily calibrated, statically and dynamically in February 2012 in Mare Harbour, Falkland Islands. The survey is referred to the International Terrestrial Reference Frame (ITRF) 2008 datum, Geodetic Reference System of 1980 spheroid, Universal Transverse Mercator Projection grid Zone 20S, Central Meriden 63°W. Online monitoring of the position while online showed that the position at no times fell outside of the specification for an Order 1 survey.

**TIDAL DATA**

7.1 A tide pole and gauge were installed and a 25 hour comparison conducted. Unfortunately a gauge failure shortly after the 25 hours meant that a 39 hour MSL check could not be conducted using the Ship's gauge. The US Research Station, however, operates its own gauge and they were able to provide data from Jan 2001 up to the last day the Ship was in area.

7.2 All data received from the Palmer Station Tide Gauge is forwarded at the enclosures. Palmer Station staff had little knowledge of the gauge and could not provide any calibration details or definitive statement as to whether the gauge was tied into any datum. A number of 39hour MSL checks have been averaged out giving a figure for MSL as being 0.02m above the zero of the US gauge.

7.3 Having conducted the MSL check, the hourly data provided by the US gauge was compared with the Ship's Gauge data giving an average difference of 4.14m (STD 0.05m). While not ideal this was then used alongside the 25hour pole/gauge comparison and the figure provided by UKHO for Chart Datum below MSL (1.1m) to give Sounding Datum as 0.98m on the pole or 3.07 above the zero of the Ship's tide gauge. All workings are on the H143 spreadsheet. A mixture of half hourly RN tide gauge readings (where available) and hourly US gauge readings have been used for reducing the data.

7.4 Comparing the collected data against the nearest Admiralty Total Tide Station (2033, Dorian Bay) shows a 0.28m difference (STD 0.07m). This is undoubtedly due to the fact that Dorian Bay is someway removed and therefore not suitable to be used in reducing soundings inside Arthur Harbour.

## ENVIRONMENTAL DATA

8.1 The SV&P probe on SMB JAMES CAIRD IV was employed throughout the survey to measure Sound Velocity (SV) and cross-checks were made with the hull mounted SV sensor.

8.2 Due to the large amount of ice and therefore fresh water in the harbour, SV measurements were made at regular intervals throughout the survey period. Despite this the online monitoring regularly indicated the SV dropping out of tolerance (difference of >5m/s between SV&P and hull mounted) which is indicative of a large number of spatial changes in surface SV as the SMB moved into and away from larger concentrations of ice and fresh water.

8.3 The rapidly changing SV environment has induced vertical errors in the data set of upto 5% of the depth which cannot be resolved.

## SEABED FEATURES AND CONTACTS

9.1 No seabed samples were taken during the survey.

9.2 There are no charted wrecks in the area surveyed.

## COASTAL TOPOGRAPHY

10. A number of Shape Files provided by the base staff have been included at Enclosure F including an outline coastline created from satellite imagery.

## RESULTS

11.1 Due to the SV errors found throughout the data set and the number of gaps in the data set this survey can unfortunately only be classified as an IHO Order 2 Survey and CATZOC B for ENC use.

## RECOMMENDATIONS

12.1 The current charts of the area are not related to WGS84 making a comparison difficult. The main route into the harbour is generally deeper than charted, with the 30m contour being some 800m further to the NE than charted. As this harbour affords considerable shelter in an area prone to high winds and sea states, it is recommended that a new large scale chartlet of the area is produced allowing much larger ships than the chart currently indicates access.

12.2 The eastern end of the bay also needs to be altered considerably to take account of the apparent glacial retreat.

12.3 It is also recommended that the source data diagrams and CATZOC are updated where applicable.

Enclosure:

A. Digital Bathymetric Data Files
B. H Forms
C. Geodetics Folder
D. Mud Maps
E. Palmer US Tide Gauge Data 2001 to 2012
F. US Supplied Shape Files