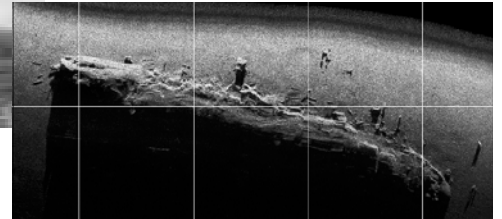
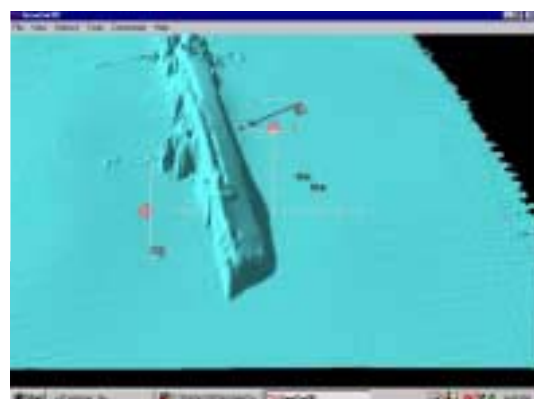
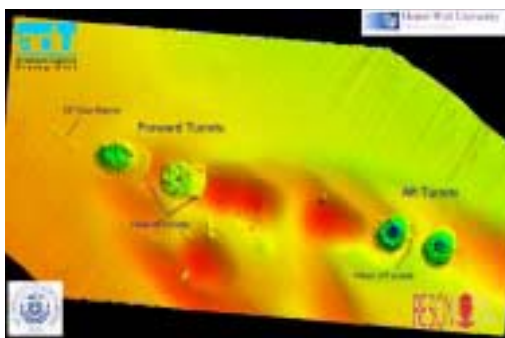


# SCAPAMAP 2000 – 2002



*REPORT COMPILED FOR HISTORIC SCOTLAND  
ON THE MAPPING  
AND MANAGEMENT OF THE*

*SUBMERGED ARCHAEOLOGICAL  
RESOURCE IN SCAPA FLOW, ORKNEY*



## **Acknowledgements**

The initial idea for the ScapaMAP project was conceived by Ian Oxley while working at Heriot-Watt University on his PhD thesis and came to fruition with the support of Gordon Barclay (Historic Scotland). Ian was also responsible for the management of the project in its first year.

The final outcome of the project, however, was the culmination of the support of many individuals and organisations during the programme.

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**Bobby Forbes**  
**Dive Unit**  
**School of Life Sciences**  
**Heriot-Watt University**  
**Orkney Campus**

## **SUMMARY**

- Year 1 of ScapaMAP included desk-based research and fieldwork involving a range of collaborators
- Fieldwork comprised geophysical survey, Remotely Operated Vehicle (ROV) survey and diver-based assessment
- An assessment was made of existing information relating to the wrecks including historical, oral testimony and photographic data
- Contact was made with a variety of users in order to assess their interests in the sites
- A large number of datasets and images derived from the geophysical survey have been collated and archived, and some manipulation and analysis has been carried out
- A database designed specifically for maritime archaeological management purposes has been set up
- A range of images and datasets have been prepared for input into ArcView GIS projects
- Recommendations on the future management, education and research initiatives are discussed.

## Glossary

Acronym	Meaning
ADU	Archaeological Dive Unit
ARCs	Admiralty Raster Charts
C-COM	Center for Coastal and Ocean Mapping
CRM	Cultural Resource Management
DAN	Diver Alert Network
EANx	Enriched Air Nitrox
GeoZui3D	Georeferenced Zooming user interface 3D
GIS	Geographic Information System
ICZM	Integrated Coastal Zone Management
JHC	Joint Hydrographic Center
JNAPC	Joint Nautical Archaeology Policy Committee
JNCC	Joint Nature Conservation Committee
MCA	Maritime & Coastguard Agency
MoD	Ministry of Defence
NDT	Non-Destructive Testing
NMRS	National Monuments Record for Scotland
ODBOA	Orkney Dive Boat Operators Association
ODIG	Orkney Diving Interest Group
OIC	Orkney Islands Council
PMRA	Protection of Military Remains Act
ROV	Remotely Operated Vehicle
RTK	Real Time Kinematic
SAC	ScapaMAP Acoustic Consortium
SMR	Sites and Monuments Record
UNESCO	United Nations Educational, Scientific and Cultural Organization
WGS72	World Geodetic System 1972
BSAC	British Sub-Aqua Club
PADI	Professional Association of Diving Instructors
SAA	Sub-Aqua Association

## List of Figures

Figure	Title	Page
1	Scapa Flow and harbour limits.	2
2	ScapaMAP Survey area.	3
3	Plan of the SMS <i>Brummer</i> .	12
4	Seasonal seawater temperatures in Orkney Waters 1990 - 2000.	13
5	Number of divers visiting Scapa Flow 1981 - 2001.	14
6	Estimated number of divers visiting each wreck site in 2001	15
7	Image of deployed sonar tow fish.	17
8	IMAGENEX 858 image of the site of the SMS Bayern.	17
9a	Uncorrected image of the SMS <i>Koln</i> from Klein 2000.	18
9b	Corrected image of the SMS <i>Koln</i> from Klein 2000 .	19
10	Corrected image of the SMS <i>Brummer</i> from Klein 2000 .	19
11	Imagenex 858 image of SMS <i>Koln</i> .	20
12	Imagenex 858 image of SMS Markgraf	21
13	Halliburton Subsea swathe bathymetry image of Scapa Flow survey area.	23
14	Halliburton Subsea swathe bathymetry image of SMS <i>Koln</i> .	23
15	Halliburton Subsea swathe bathymetry image of SMS Bayern.	24
16	Halliburton Subsea swathe bathymetry image of HMS <i>Royal Oak</i> .	24
17	Halliburton Subsea swathe bathymetry image of HMS <i>Vanguard</i> .	25
18	June 2001 Reson survey area with overlayed navigation lines.	29
19	June 2001 Reson survey area with overlayed processed bathymetry.	29
20	Reson SeaBat 8125 screen information display at the SMS <i>Brummer</i> site.	30
21	Reson SeaBat 8125 information at the SMS <i>Koln</i> site after smoothing is applied.	30
22	Reson SeaBat 8125 information at the SMS <i>Koln</i> site after colour coding is applied.	31
23	Captured GeoZui3D image of the SMS <i>Koln</i> .	31
24	Data post processing procedures.	32
25	GeoZui3D image of mosaiced data lanes.	33
25	Sketch of the bow of the SMS <i>Dresden</i> .	35
27	Captured GeoZui3D image of the SMS <i>Koln</i> showing diver survey area..	36
28	Captured GeoZui3D image of the SMS <i>Brummer</i> showing diver survey area..	37
29	Captured GeoZui3D image of the SMS <i>Dresden</i> showing diver survey area..	38
30	Sketch of the stern section of the SMS <i>Brummer</i> .	41
31	Sketch of the bow section of the SMS <i>Dresden</i> .	42
32	Sketch of the bow section of the SMS <i>Koln</i> .	43
33	GeoZui3D image of the salvage site of the SMS <i>Kaiserin</i> .	46
34	Tables and fields for a proposed maritime archaeological management database.	56
35	ScapaMAP database opening menu.	57
36	ScapaMAP database vessel data entry form.	57
37	ScapaMAP database History entry form.	58
38	ScapaMAP database Co-ordinates entry form.	58
39	ScapaMAP database Biotope entry form.	59

## List of Plates

Plate	Description	Page
1	German High Seas Fleet at anchor in Scapa Flow.	2
2	Reson SeaBat 8125 acoustic projector and sonar receiver.	26
3	Sound velocity probe.	26
4	Data capture station.	28
5	Survey planning and navigation station.	28
6	Hybal ROV on deck.	33
7	Hybal ROV exploring wreck.	33
8	Stills mosaic of bow plates of SMS <i>Brummer</i> .	38
9	Video mosaic of port edge of SMS <i>Koln</i> .	43
10	Encrusting marine growth on SMS <i>Koln</i> .	44
11	Fine sediment and brittle stars coveing vertical surfaces on SMS <i>Koln</i> .	44
12	Plate separation on SMS <i>Koln</i> showing rivet holes.	44
13	Corrosion on hull plates SMS <i>Koln</i> .	44
14	Bow of SMS <i>Brummer</i>	45
15	Spotting tower at the site of the SMS <i>Kaiser</i> .	46

## List of Tables

Table	Description	Page
1	Estimated number of divers visiting each scheduled monument site	16

<b>Section</b>	<b>Description</b>	<b>Page</b>
<b>1</b>	<b>Introduction</b>	<b>1</b>
<b>2</b>	<b>Objectives</b>	<b>3</b>
<b>3</b>	<b>Maritime Archaeology - Past &amp; Present</b>	<b>5</b>
3.1	Overview	5
3.2	Models of Military Shipwreck Management	6
<b>4</b>	<b>Assessment of Wreck Sites</b>	<b>10</b>
4.1	Historical Data Sources	10
4.2	Remote Sensing Surveys	16
4.3	In-Situ Survey Methods	34
<b>5</b>	<b>Discussion</b>	<b>47</b>
5.1	Resource Management and the management Scheme	47
5.2	ScapaMAP Project	52
5.3	Education & Increasing Public Awareness	53
<b>6</b>	<b>Recommendations</b>	<b>56</b>
<b>7</b>	<b>Bibliography</b>	<b>57</b>
	<b>Appendices</b>	
I	National Monuments Record of Scotland record for the SMS Markgraf.	
II	Examples of Information on Scapa Flow Wreck from the World Wide Web.	
III	Oral Testimonies.	
IV	Information Provided by Recreational Diving Agencies on Marine Archaeology.	
V	Orkney Islands Council Department of Harbours Diving Permits.	
VI	ODBOA Code of Practice.	
VII	ODBOA Leaflet - A Voluntary Underwater Conservation Zone for Orkney Waters.	
VIII	Proposed ScapaMAP Poster.	
IX	ScapaMAP Website Information.	

# 1 INTRODUCTION

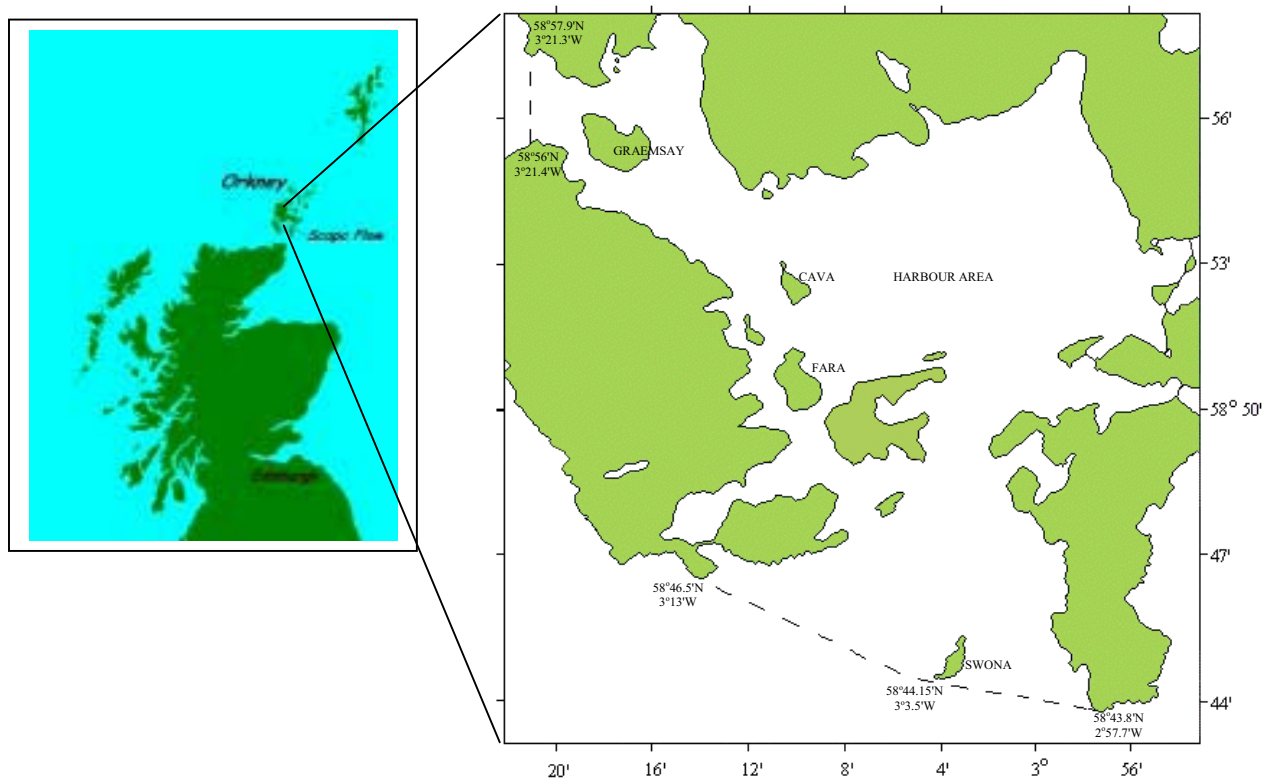
Scapa Flow is an almost totally enclosed expanse of water, bordered to the north by Mainland Orkney, to the east by the Holms, Burray and South Ronaldsay, on the west by Hoy and the south by Flotta. Its relatively sheltered waters and strategic position in Britain's coastal defences lead to Admiral Jellicoe establishing Scapa Flow as the home base for the British High Seas Fleet prior to the outbreak of the Great War. Today the area is a designated harbour under the jurisdiction of Orkney Islands Council Department of Harbours.

Following the surrender of the German High Seas Fleet they sailed under escort to the Firth of Forth and then proceeded to Scapa Flow to be interned. (Figure 1 & Plate 1). Over the next few months moral among the remaining crews deteriorated as little information came from the Armistice talks. In the misbelief that the interned fleet would be used against Germany in future conflicts on the 21<sup>st</sup> June 1919, while the British High Seas Fleet were out on manoeuvres, Admiral Von Reuter gave the order to scuttle all 74 vessels. Few vessels were saved, with the majority being partly or completely submerged. The scuttling is said to be the largest intentional sinking ever. The fleet comprised of five battle cruisers, eleven battleships, eight cruisers and fifty destroyers.

Military remains in Scotland have been relative neglect as a historical and archaeological resource. Their full importance (and their long term preservation) has been partly rectified by *Defence of Britain Project* (Hunter 2000). However, they have yet to receive the full weight of archaeological credibility, and to be properly appreciated. Hunter suggests that although the scuttling of the German High Seas Fleet took place adjacent to the islands of Fara, Cava and Rysa Little, no tangible evidence of salvage working or of low tide wreckage appears to have survived.

The naval wrecks of the Scapa Flow therefore form a unique underwater record of one of the great periods of British and German maritime history. In a relatively short period of time they have seen radical changes in their perceived value, from weapons of mass destruction (1918-21), salvage resource (1923), diving amenity (1960s onwards), to present day national historic and archaeological heritage (1990's). Today three battleships, four light cruisers, two torpedo boat destroyers and the four 600 ton gun turrets of the battleship SMS *Bayern* remain on the seabed. The protection of relatively recent wreck sites by legislation is widely regarded as a farsighted and appropriate approach (Dromgoole, 1996). These wrecks are of particular importance and the Scheduling by Historic Scotland under the Ancient Monuments and Archaeological Areas Act, 1979 is a significant step in the protection of such sites.

The sites lie in an environment, which is itself constantly changing and subject to a variety of natural and anthropogenic impacts (Kerr 1999). However, historic shipwrecks represent considerable opportunities for what might be termed "economical" exploitation i.e. generating returns without unnecessarily damaging the core asset. Many opportunities exist for research because of excellent archaeological preservation conditions, their historical potential, or perhaps as special marine habitats. Similarly, educational opportunities are many and varied allowing links to our common heritage, and recreational access is becoming increasingly important because of the steady rise of interest in marine activities. Attempting to manage the shipwreck resource effectively requires appropriate CRM decision-making as it is impracticable to attempt to try and protect everything.



**Figure 1.** Location of Scapa Flow showing extent of Orkney Islands Council Harbours Department jurisdiction.



**Plate 1:** Interned German High Seas Fleet at anchor in Scapa Flow, Orkney. Photograph taken from Houton with the island of Cava in the centre of the image.



There have also been recent advances in the quantification of processes acting on historic shipwreck sites, in the ways the data can be incorporated into management schemes (with their assessment, monitoring and intervention procedures), and the ways that such data can be managed and manipulated in GIS, deterioration matrices, and formation and predictive modelling (Oxley 2001).

Such developments will serve to underpin the success of strategies of *in situ* management that seek to maximise the value of submerged heritage resources such as impact mitigation, raising of awareness, promotion of wider access, and the fostering of research initiatives.

Fieldwork involved on-site investigations of particular areas of the seven German wrecks selected on the basis of factors such as susceptibility to impact or nautical technological importance. Visual, photographic and video recording of archaeological features were obtained together with the mapping of biological habitats. Target areas would then be identified to become sampling stations for the long-term condition monitoring of environmental variables or anthropogenic impact.

### 3 MARITIME ARCHAEOLOGY - PAST AND PRESENT

#### 3.1 Overview

Different nations have widely varying histories regarding the investigation, resource use, and management of historical wreck sites. Most obvious is the awareness of value, fragility and opportunity. Countries that have tackled these issues with varying degrees of success include USA, Canada and Australia.

However, we are now beginning to see a more holistic approach to historic shipwrecks in relation to the wider archaeological resource. The current trend for the management of submerged archaeological sites (both existing and newly discovered) is therefore to consider management *in situ* as opposed to excavation, recovery and museum display. Amongst the factors influencing this trend are:

- increasingly high costs of recovery coupled with responsibilities for the curation and preservation of recovered remains in perpetuity;
- technological advances which enable the presentation of submerged sites to a wider audience such as remote video links, internet access and tourist submarines;
- the rapid increase in the rate of discovery of new sites and the increasing burdens of responsibility on governments and heritage organisations;
- the growth of expertise in assessing the nature, rate and effect of impacts on submerged sites;
- current advances in Cultural Resource Management (CRM) and its relevance to Integrated Coastal Zone Management (ICZM).

Heritage legislation is gradually related to all types of archaeological remains. Furthermore such legislation is beginning to encompass a wider scope rather than just focusing on one site and is incorporating landscapes and other attributes of the natural environment. UK parliamentary devolution has enabled more integrated approaches to be proposed within the each Home Country, particularly those which seek to bring submerged archaeology into line with terrestrial archaeological procedures (Historic Scotland 1999, Oxley 2001).

The area of historic shipwreck management is a complex subject that is developing rapidly worldwide. The many inter-related issues include: government heritage policy (AIMA & ACDO 1994), legislation (Dromgoole 1996), resource valuation (Kaoru & Hoagland 1994: 209), relative assessment of historical and archaeological significance, relationship to other marine environmental procedures (Oxley 1998b), coastal zone management developments (Cuthill 1998), information technology (Mather and Watts 1998), site assessment methodologies (Murphy 1998), impact assessment and mitigation studies (Vrana & Mahoney 1995: 176), site formation, preservation and materials deterioration research, monitoring and *in situ* conservation (Gregory 1999), and strategies to increase user-group awareness and involvement.

These issues have a global perspective currently being addressed by the UNESCO Convention on the Protection of the Underwater Cultural Heritage (Dromgoole & Gaskell 1999), they are usually approached at the national level.

## Development of UK Shipwreck Management and Legislation

The UK has a relatively undistinguished and often criticised record, with management strategies largely developing accidentally (Fenwick & Gale 1998). Throughout history, and accelerated by the advent of recreational SCUBA diving, there has been an opportunistic approach to shipwrecks, characterised by artefact collection based on a pervasive culture of "finders-keepers". In the 1970s, in many countries (including the UK) blatant looting caused the passing of emergency temporary legislation (i.e. the Protection of Wrecks Act 1973). In the 1980's, this pattern was repeated with the passing of the Protection of Military Remains Act 1986 in response to unauthorised salvage of HMS *Hampshire*<sup>1</sup>, in Orkney waters. Recognising the inconsistencies in the current situation the Joint Nautical Archaeology Policy Committee has published a set of proposals for legislative change aimed at securing the protection of the underwater cultural heritage (JNAPC 2000a).

Archaeological sites of any type underwater in the UK are *not* protected unless there has been a specific legal order of protection. Although there are relatively few pieces of legislation with direct relevance to archaeology underwater, their interrelationships are often complex, misunderstood and subject to variations in interpretation. Separate legislation is currently applied to shipwreck sites thought to be of significance and there is no provision for the comprehensive portable antiquities legislation that has equal application regardless of the environment in which the find was made.

### Need for an Integrated Approach

The need for a similarly integrated approach to the UK's submerged heritage is apparent. As described in *Taking to the Water* (English Heritage 2000) marine archaeological sites should enjoy parity of esteem and treatment with terrestrial archaeological remains. If a 10-20,000 ton structure dating to WWI or WWII, complete with the interred remains of hundreds of people killed in military action, unchanged apart from natural degradation, existed on land there would be considerable support for appropriate protection and management.

Approaches to shipwreck heritage management based on a high level of marine environmental knowledge are preferred in many countries. "Museums under the Sea" commonly feature formal policy documents for specific sites or areas (often called "conservation" or "management" plans) based on comprehensive desk-based and on-site assessments (e.g. Lenihan 1989). Management is pro-active with quantified environmental information, i.e. collected to a standard and using techniques acceptable to the wider disciplines of marine science. The subject is also viewed within a wider spectrum of environmental awareness, incorporating concepts such as sustainable development and the precautionary principle, and mechanisms such as Integrated Coastal Zone Management. Key components include: "good data is a pre-requisite for good decision making"; the identification of users and stakeholders; understanding the site's environment; carrying out comprehensive baseline surveys; defining site formation transforms and processes of change; monitoring periodically and effectively; responding to change; increasing appropriate involvement and promoting non-intrusive access. Similarly, there are more options for looking after sites where they lie, minimising disturbance and un-necessary impacts. The success of such strategies is predicated upon a comprehensive understanding of the marine environment of the site (Oxley 1998c).

## 3.2 Models of Military Shipwreck Management

Examples of a positive, government department, research-oriented approach to a military wreck of considerable national significance include the National Parks Service work on the USS *Arizona* (Lenihan 1989). The investigation of the USS *Arizona*, one of the battleships sunk at Pearl Harbour,

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<sup>1</sup> 10,850 ton armoured cruiser, situated about one and a half miles off Marwick Head on the West coast of Orkney. Over 640 men lost (including Lord Kitchener) on 5 June 1916, thought to have struck a mine. Surveyed in 1977 and 1983.

represents a major landmark in site assessment studies as no one had previously confronted the problem of developing a long-term preservation program for a whole ship *in situ*. The programme included collecting a baseline inventory of biological communities on the structure of the 600 foot battleship, which would help determine the biochemical processes impacting the vessel fabric. The programme also included the development of a series of degradation hypotheses that can be tested together with a description of fouling layers and their effects on corrosion, the effect of fanning by egg-laying fish which exposed teak decking to wood-boring molluscs. Stations around the vessel were also established to enable quantified measurements of the state of deterioration of structural elements to be collected at periodic intervals. It was determined that corrosion and the bio-fouling process are affected by numerous water quality attributes chiefly oxygen, pH and motion. Samples of the water inside the wreck were also collected and chilled for determination of the presence of sulphides and hydrocarbons (Murphy 1987, Lenihan *et al* 1989).

The US National Parks Service has pioneered the training on non-specialist personnel to take part in monitoring exercises<sup>2</sup>. Techniques are de-mystified so far that significant tasks can be achieved (*e.g.* the characterisation possibly one of the largest structures ever mapped underwater, the *USS Arizona*).

### **Museums Under the Sea and Memorials**

One particular issue is that of places of respect or memorials to those who have fallen in past conflicts. In the same way as war cemeteries in this country and abroad, concerns arise that there is a lack of policies for management as alternatives to abandoning the sites to natural decay.

Many important iron and steel vessels are submerged world wide, and the management of those vessels *in situ* may be the only viable alternative to their eventual disintegration (Murphy 1987). This factor has driven the "Museums under the Sea" initiatives, which can be found in Australia and the USA.

### **Barriers to Integrated Management**

English Heritage (2000) identifies some of the barriers to integrated management such as the fact that the submerged archaeological resource cannot be easily accessed without specialist skills, techniques and equipment. Such techniques however are readily available to recreational divers. Indeed the increased popularity of "Technical" diving amongst recreational divers through out the 1990's has also opened the way to exploration of deeper sites such as the HMS *Hampshire*. They are not generally available on the required scale to government agencies apart from specific cases such as the Ministry of Defence in relation to HMS *Royal Oak*, or the organisations, which call on the technical support of the Archaeological Diving Unit. In addition, however, specialist management skills are also required in these environments. Consequently access to the resource is relatively expensive and it is also situated in potentially hazardous environment, subject to continuous and sometimes rapidly destructive change.

The quality of data collected on submerged archaeological sites is variable and to a large extent unquantified. The type of data needed to understand these sites and all the factors affecting them are not defined. Over 11,000 British and Allied vessels were lost in the two World Wars but, to date, only 264 HM ships that have sunk within UK coastal waters have been charted (*i.e.* have reasonably accurate positions), with another 58 uncharted. Only 82 military wrecks are included in the National Monuments Record of Scotland. Information about these sites is generally restricted to prior surveys carried out by the Royal Navy subsequent to the losses primarily to ensure that the wrecks do not represent a hazard to navigation (*i.e.* wire sweeping).

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<sup>2</sup> Lenihan (1989) describes the submerged site responsibilities and activities of over 200 National Parks Service rangers and maintenance personnel from a number of US National Parks situated across the world.

Other important issues, according to English Heritage (2000), include:

- The remains of other nations lie in the territorial waters of this country, and the remains of UK military vessels are situated in the territorial waters of other countries and in international waters,
- The density of shipwreck remains in UK territorial waters is likely to be amongst the highest in the world with the greatest number in English waters, due to the combination of high volumes of past shipping traffic, a long history of seafaring and coastal warfare,
- Despite these advantages the resource is poorly surveyed, not well understood and, as a result, has poorly developed research frameworks,
- Very few of the sites have been ground-truthed or assessed in terms of their preservation and susceptibility to impacts, by an archaeologically-competent authority,
- In marine archaeology generally in this country the professional framework is poorly developed and supported, and amateur archaeologists have a more central role than they do on land,
- The number of recreational divers per length of coastline and proximity to the coast, are possibly the highest in the world, the number of sport dives is similarly significant in terms of the world proportion of dives. Many of these dives are on wreck sites.

### **Historic Military Shipwreck Management in Orkney**

The legal protection of military shipwreck sites that involved the loss of life is not uncommon in developed countries, but the relevant authorities do not always have the resources and capabilities to expand this function to obtaining, and acting upon, information about the sites themselves (Dromgoole 1996).

Important differences in the way each site are managed in terms of the interests of stakeholders. Examination of the approaches taken to broadly physically similar wreck sites in the same Region is useful in both putting the remains of the German High Seas Fleet into context but also in informing possible routes towards integrated historic shipwreck management throughout Orkney waters.

In one of the many anomalies in the protection of military wrecks generally the HMS *Royal Oak* is overseen by the harbour authorities and is controlled under Orkney Islands Council Bye-Laws as is the HMS *Vanguard*. HMS *Hampshire* and all the other military wrecks are effectively un-protected.

Orkney wreck diving and issues have been central to the development of military wreck management in the UK since before the passing of the Protection of Military Remains Act 1986 (PMRA). The latter legislation was prompted by illegal activity on HMS *Hampshire* in the early 1980's by a commercial diving company. Similarly, details of activities on dive trips to SE Asia to visit deep British warship wrecks that involved great loss of life (HMS *Prince of Wales* and HMS *Repulse*) which featured on an Orkney based dive operator's website prompted the recent controversy over shipwreck diving and "war graves". This issue culminated in Ministry of Defence Ministers having to respond to questions raised in the House of Lords (HoL 2000), which in turn led to the current MoD consultation exercise on diving on military wrecks.

Resources on which to base new assessments are slim, or difficult to access, e.g. the results of prior surveys (e.g. the diver-based survey in the 1970's held in the Harbour Office) and information about the effects of salvage on the site derived from documentary and oral testimony evidence.

### HMS *Royal Oak*<sup>3</sup>

The MoD's actions in recent years on one site, that of HMS *Royal Oak*<sup>4</sup>, have indicated their inconsistency. The site is very high profile, very visible in shallow water in Orkney overlooked by the local authority harbour control offices, and it is leaking oil (and has been since the sinking). However, in these times of increasing environmental concern the MoD has been forced to be seen to be interested in dealing with the threat of pollution and many hundreds of thousands of pounds have been spent in attempts to contain the oil, whilst still respecting the wishes of the survivors groups to disturb the wreck as little as possible. These have manifestly failed to the embarrassment of the MoD and work is now underway to remove the oil as far as is possible. HMS *Royal Oak* does not seem to be regarded by the Ministry of Defence as having historic or archaeological significance.

### HMS *Vanguard*<sup>5</sup>

Access to the site of HMS *Vanguard* has been restricted in recent years since the construction of offshore oil industry facilities on Flotta. Navigation is controlled by Orkney Harbours under Orkney Islands Council Bye-Laws. The wreck is recognised in some circles to have historic value (Schleihauf 2000) but does not seem to have been translated into archaeological interest. Information on the salvage on the site is given in Appendix I.

### HMS *Hampshire*

This wreck is of high historical significance but there has been no discussion of the need to manage the site or investigate it archaeologically. It is solely the province of recreational divers who sometimes, but not always, seek the endorsement of the Ministry of Defence before visiting the site. There have been numerous rumours over the years that the site is regularly disturbed and artefacts removed.

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<sup>3</sup> Battleship, 29,150 tons, sank 14<sup>th</sup> October 1939, torpedoed with the loss of 833 men in Scapa Flow, Orkney.

<sup>4</sup> Battleship, 29,150 tons, sank 14<sup>th</sup> October 1939, torpedoed with the loss of 833 men in Scapa Flow, Orkney.

<sup>5</sup> Situated about 1 mile NNE of Flotta, sank 9 July 1917, battleship, 19,560 tons, over 700 men lost, due to explosion in magazine.

## 4 ASSESSMENT of WRECK SITES

Effective maritime archaeological management requires base maps of the archaeological resource and quantified data on associated environmental parameters such as biological species and habitats, corrosion potential, sediment characteristics and behaviour, water quality, and factors such as impacts from visitors and nearby development. Three strategies were adopted in order to develop the required data sets.

- A review of available recorded materials and personal recollections of the events
- Use of currently available survey technologies for site assessment
- Assessment of techniques currently in the development stage

### 4.1 Historical Data Sources

The recorded knowledge base of the German wrecks, similar to most submerged sites in the UK, is generally poor. Accurate maps for the sites do not exist. Furthermore, baseline environmental data and an adequately researched periodic monitoring programme are not available. In the case of the wrecks of Scapa Flow probably the most up-to-date knowledge of the sites is held by the recreational divers and dive boat operators.

The following data types were assessed initially.

#### **Sites and Monuments Registers**

In general, local and national authorities are limited to geophysical surveys carried out many years ago for the purposes of ensuring the safe navigation of other sea users. This information and text reports forms the basis of recent initiatives to establish and populate national Sites and Monuments Registers. In Scotland, the initial data incorporated into the National Monuments Record - Maritime comprised a download from the Wrecks database of the Ministry of Defence's Hydrographic Office. An example of the NMRS text record for the SM S *Markgraf* is attached as Appendix I.

#### **Ministry of Defence's Hydrographic Office Charts**

Copies of the following Admiralty charts were obtained.

**1909 Scapa Flow and Approaches (Northern Sheet)** This chart was produced following surveys carried out by the survey vessel HMS Triton between 1906 – 1909 and was the last chart produced prior to the scuttling of the German High Seas Fleet.

**1921 Scapa Flow and Approaches (Northern Sheet)** This is the 1909 chart with the addition of the German vessels and is first chart produced after the scuttling of the vessels. As the Admiralty were only primarily concerned with safety to navigation this chart only displays the position of 48 vessels. Vessels that were successfully beached are not shown on the chart.

**1985 Scapa Flow and Approaches (Chart 35)** Much of the information presented on this chart is derived from Admiralty surveys carried out during the period 1905 – 19. Bathymetric data was obtained by lead line survey although much of the geographic positions are based on the *World Geodetic System 72 Datum* (WGS 72).

#### **Scapa Flow Dive Guides**

Due to the popularity of Scapa Flow as a recreational diving location several dive guides and historical accounts have been written about the wrecks in Orkney Waters with some specifically on

the German High Seas Fleet. Historical accounts of the events which led to the scuttling and of the salvage work by Cox and Danks can be found in:

- Jutland to Junkyard. S.C.George 1973 (Reprinted 1999)
- The Man Who Bought a Navy. G.Bowman 1964 (Reprinted 2000)
- The Grand Scuttle – The Sinking of the German Fleet at Scapa Flow in 1919. D.van der Vat 1982

Books specifically written to assist recreational divers while diving the German wrecks are:

- The Wrecks of Scapa Flow. D.M.Ferguson 1985.
- Shipwrecks of Orkney, Shetland and Pentland Firth, D.M.Ferguson 1988.
- The Naval Wrecks of Scapa Flow. P.L.Smith 1989
- Dive Scapa Flow. R.MacDonald 1990

Although these books provide a good background to the wrecks of Scapa Flow they are now some what dated and information on the current state of the wreck sites is inaccurate in many cases.

Most diveboat operators in Orkney had websites that provide information and images of the wrecks of Scapa Flow. Examples of the information given on such sites are included in Appendix II a - b. A list of members of the Orkney Dive Boat Operators Association and other operators is also given together with their website URLs.( Appendix II c)

### **Historical data**

Assessment of this type of data has been limited to secondary sources focusing on the previous history of the vessels (i.e. Battle of Jutland) or technical and naval architecture aspects (Breyer 1973, Preston 1972). The latter, however, have been useful for providing small scale plans and drawings (see Figure 3). The National Maritime Museum and the Hydrographic Office hold blueprints of some of the vessels in their archives. This material however is in a poor state but did however provide a number of plans of vessels. Applications to German military archives have met with no response.

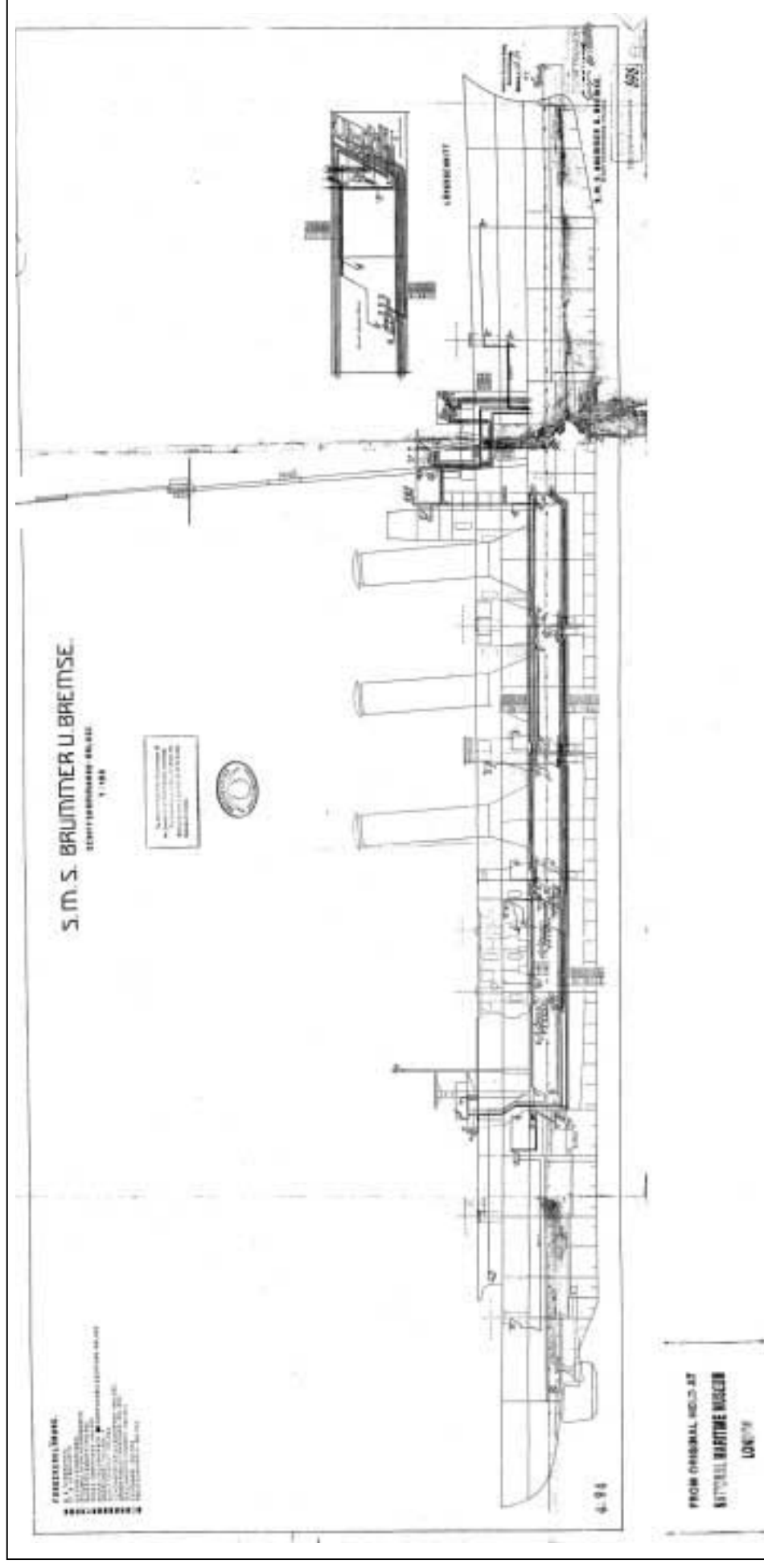
### **Oral testimony**

As the timescale is relatively recent, there are still people around who participated in, or have knowledge of, some activities on the sites including salvage operations. An example of the type of material that can be generated from this initiative is included as Appendix IIIa from Dougall Campbell who participated in extensive salvage operations on the wrecks in the 1970's. Appendix IIIb is the recollections of a diver involved in the salvage of the HMS *Vanguard* between 1958 – 59.

The Orkney Library Archive has an extensive collection of sound recordings and photographic material from these periods. Film material is also held at the National Maritime Museum of the scuttling.

### **Comparable material**

A few examples of comparable vessels still exist around the world preserved as museum vessels. One example is the USS *Texas*, patterned after HMS *Dreadnought*, launched 1912, preserved as the first battleship memorial in the US, her reciprocating engines were named National Engineering Landmarks in 1975, and the vessel was designated a National Historic Landmark in 1977. Placed under the stewardship of the State of Texas Parks and Wildlife in 1983, the ship is open to the public.

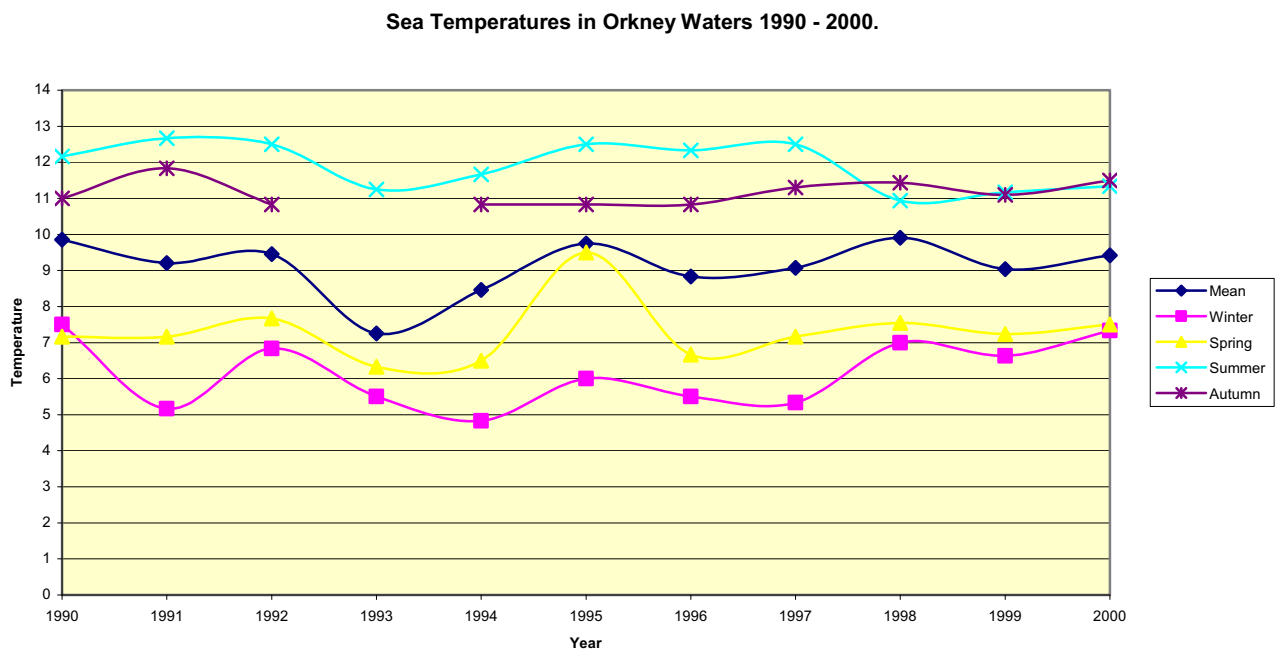


**Figure 3.** Plan of the SMS *Brummer*.

### Environmental data

An extensive literature review of current practices in marine archaeological site evaluation and monitoring has confirmed that a management approach based on a high level of environmental information is preferred, public access to information is important, and periodic monitoring is required for adequate historic shipwreck management (Oxley 1998c).

Historical data of basic environmental parameters such as water temperature and salinity for Scapa Flow is lacking. Attempts were made to obtain information from a variety of sources including Orkney Islands Council Harbours Department, Talisman Energy Flotta Terminal on the Orkney Water Test Centre (now ERT Orkney Ltd.). Although data has been collected by these organisations in the past much of the historical data has been lost following restructuring of the organisations. The most complete data set was provided by the Marine Hatchery (Orkney Water Test Centre) on Flotta. This data spans from 1990 – 2000 and seasonal fluctuations are shown in Figure 4 below.



**Figure 4.** Seasonal sea temperatures in Orkney Waters 1990 -2000. Data supplied by Marine Hatchery, Orkney Water Test Centre.

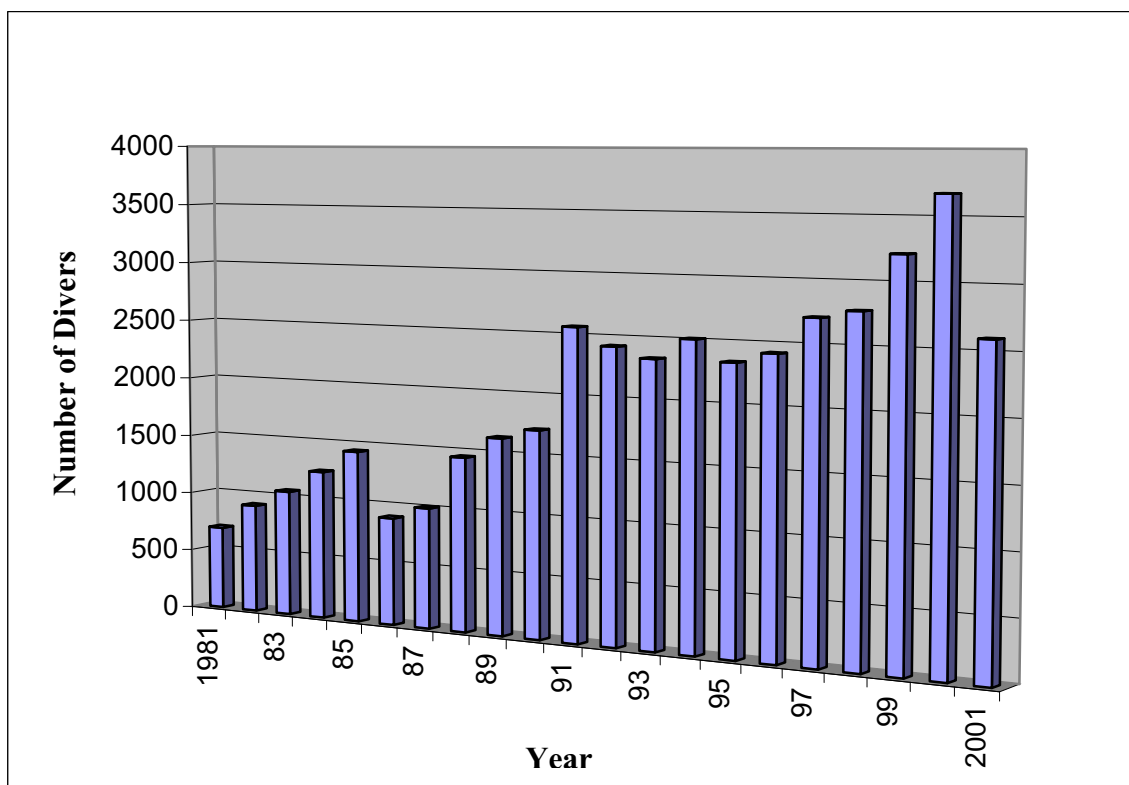
The environmental data is essential in the development of regional management and planning initiatives, to inform future local management plans, maximise tourism and economic development possibilities. The results also help avoid unnecessary impacts to the submerged archaeological resource through enhancements to the information available for development control and impact assessment (e.g. oil pollution from the shipwrecks themselves) (Kerr 1999). It is clear that this fundamental information is sadly lacking.

### Recreational diving activities in Orkney

Following the advent of Self Contained Underwater Breathing Apparatus (SCUBA) recreational diving has become the fastest growing area of the leisure market. In the UK this has been particularly so since the 1980's. Wrecks in particular hold a great fascination for recreational divers and

consequently Scapa Flow, with its high concentration of sites within a relatively small area, has become an internationally renowned location for wreck diving holidays, rivalled only by those of Truk Lagoon and the Great Lakes.

Until recent years the majority of recreational diving taking place in Orkney has been within Scapa Flow. The number of diveboat operators has grown since 1981 from three part time operators to 12 full-time operators in 2000. As Scapa Flow is a designated harbour area, diving within the Harbour requires a “Permit to Dive” from OIC Harbours Department.(See Appendix IVa). Permits are generally issued to the group leader and not the diveboat operator and therefore provide a means of assessing the growth of recreational diving within Orkney. Figure 5 shows the estimated number of divers visiting Scapa Flow since 1981.



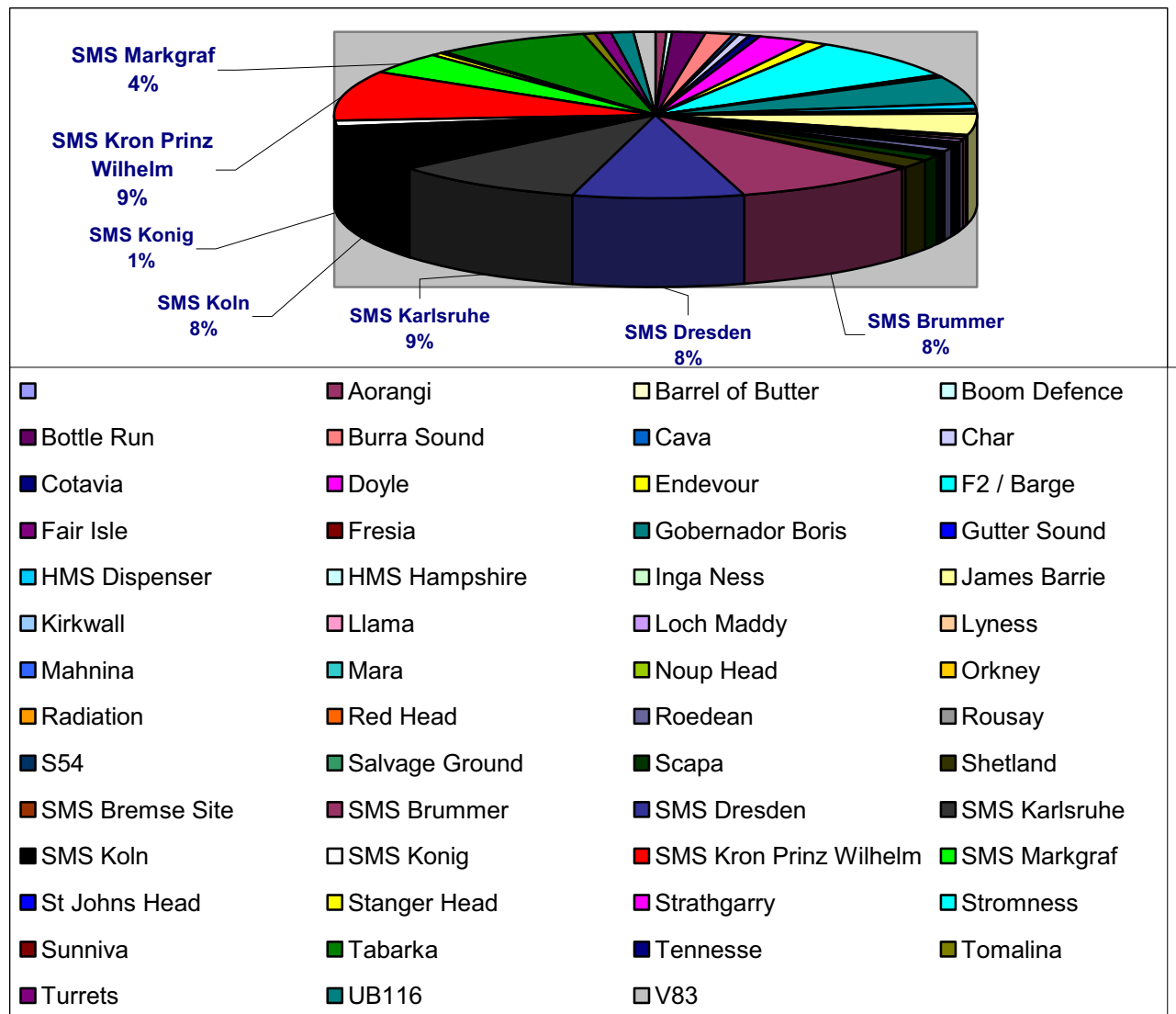
**Figure 5** Number of divers visiting Scapa Flow since 1981. Numbers are estimated on OIC Harbours department *Permits to Dive* and based on 10 divers per permit.

The numbers of divers have been estimated based on 10 divers per permit. Over the last 2 years dive boat operators have returned actual numbers of divers to the Orkney Hyperbaric Unit, these compare favourably with using *Dive Permits* as a method of estimating diver numbers.

Over the last three seasons several of the dive boat operators have been carrying out trips to the North Isles and Shetland. The primary aim of these expeditions has been to locate and diving new wreck sites.

During the period July - November 2001 data was collected for the Diving Alert Network (DAN) **Project Dive Exploration**. This study is examining diver's general diving patterns and state of health. Dive locations are reported as part of the study. Approximately 260 divers participated in this study, approximately 10 % of the total number estimated to have visited Scapa Flow in 2001. Based on this information it is therefore possible to estimate the relative frequency with which the various dive sites are visited. This data is shown in Figure 6. It should be noted that this data was derived from

divers onboard the vessels that conduct expeditions outside Scapa Flow and therefore represents an underestimation of the true proportion of the dives being undertaken on the German wrecks.



**Figure 6** Estimated frequency with which wrecks in Orkney Waters are dived. Data based on information collected during the Diving Alert Network (DAN) *Project Dive Exploration* July - November 2001.

Based on the estimated number of divers visiting Orkney each year and the relative frequency with which each site is dived it is possible to determine the likely number of divers diving on the Scheduled wrecks in Scapa Flow. It is assumed that on average each diver makes 10 dives over the period of 6 days. These are given in Table 1

As can be seen from Figure 6, the other sites of major importance are:

- **Burra Sound Block Ships** – Tabarka (7.8%), Gobernador Boris (5.3%) and Doyle (2.5%)
- **F2 & Barge** – 8.1%. This is a popular second shallower dive.

- **Bottle Run** – this is a drift dive down through Gutter Sound near Lyness. The seabed is littered with debris from salvage works and from waste (bottles) thrown over the side of British vessels bunkering in the area.

These are all shallow dives and tend to be chosen as a second dive by some groups for safety reasons.

Dive Site	Frequency Dived (% of Total Dives)	Estimated Number of Dives (2001)
SMS <i>Brummer</i>	9.4	2070
SMS <i>Dresden</i>	8.6	1890
SMS <i>Koln</i>	8.9	1950
SMS <i>Karlsruhe</i>	9.8	2160
SMS <i>Markgraf</i>	4.2	920
SMS <i>Konig</i>	1.0	220
SMS <i>Kronprinz Wilhelm</i>	8.9	1950
	<b>50.8</b>	<b>11160</b>

**Table 1** Estimated number of divers visiting each scheduled monument site. Calculations based on DAN *Project Dive Exploration* and Orkney Harbours Department *Permits to Dive*.

## 4.2 Remote Sensing Surveys

In order to survey large areas of seabed the use of remote sensing techniques has become the standard method in conducting marine geophysical surveys in the commercial sector. To date these techniques have only been used to a limited extent in archaeological site survey, primarily in site location rather than site monitoring. The techniques employed are used to provide data sets portraying different characteristics of the seabed.

The most commonly used techniques are:

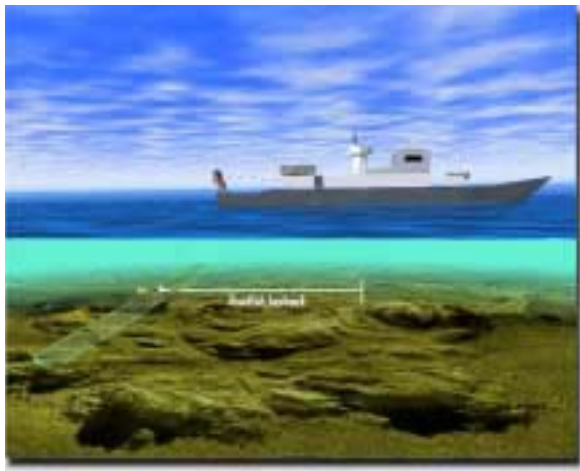
- **Side scan sonar** – nature of the seabed sediments
- **Multi-beam swath bathymetry** – seabed topography
- **Magnetometry** – variations in the earth's magnetic field

All of these techniques were employed during the project and are described below.

### Side Scan Sonar

Side scan sonar uses narrow beams of acoustic energy (sound) transmitted from a towfish to image the seabed. A fan shaped beam is emitted (ping) from either side of the towfish as it travels across the seabed (Figure 7.). Tow speed has to be matched to the pinging frequency to ensure good coverage of the ensonified area. The image of the seabed is therefore built up one line at a time. Hard objects reflect more energy resulting in dark areas on the image. The absence of sound, such as shadows behind objects, show up as white areas on the image. The image therefore gives an indication of the type of sediment and the height of objects off the seabed. Figure 8 shows a typical sonar trace. As the beams are fan shaped the area directly under the fish is not targeted by the beams. This is seen as a white strip along the centre line. The width of this zone indicated the height the fish is above the seabed. This information is important as the height of the fish above the seabed determines the size of

the area ensonified (footprint). This must also be taken into consideration during the post-processing phase in order to produce a geometrically corrected mosaiced image.



**Figure 7.** Image of deployed sonar tow fish from vessel showing ensonified area either side of fish and layback relative to vessel.

Due to the characteristics of propagation of sound through water high frequencies (500kHz – 1MHz) only travel short distances but give high resolution. Low frequencies (50kHz – 100kHz) on the other hand travel considerable distance but energy returns are also low, resulting in lower resolution data.

In order to georeference the side scan data it is important to know the position of the towfish in relation to the surface vessel. The fish position can be calculated based on the amount of tow cable deployed (lay-back) and the depth of the fish. Alternatively an acoustic transponder can be attached to the fish to relay this information. Knowing the lack-back therefore allows corrections to be applied to the vessels navigational information that is usually supplied by Global Positioning System (GPS).



**Figure 8.** IMAGENEX 858 sonar image, as seen by operator from the site over of the SMS *Bayern*. The main panel shows image as it is built up during tow. The left channel indicates a relatively uniform seabed in terms of sediment type and contours. The right hand channel however indicates a number of objects projecting above the level of the surrounding seabed. The red rectangle in the main panel is magnified in the right panel. This clearly indicates that the two objects at the top of the panel project significantly higher off the seabed than the two at the bottom.

Following the survey, data then requires post-processing in order to correct any obvious navigational inconsistencies. Once corrected the information can then be mosaiced to produce a sonograph of the area surveyed.

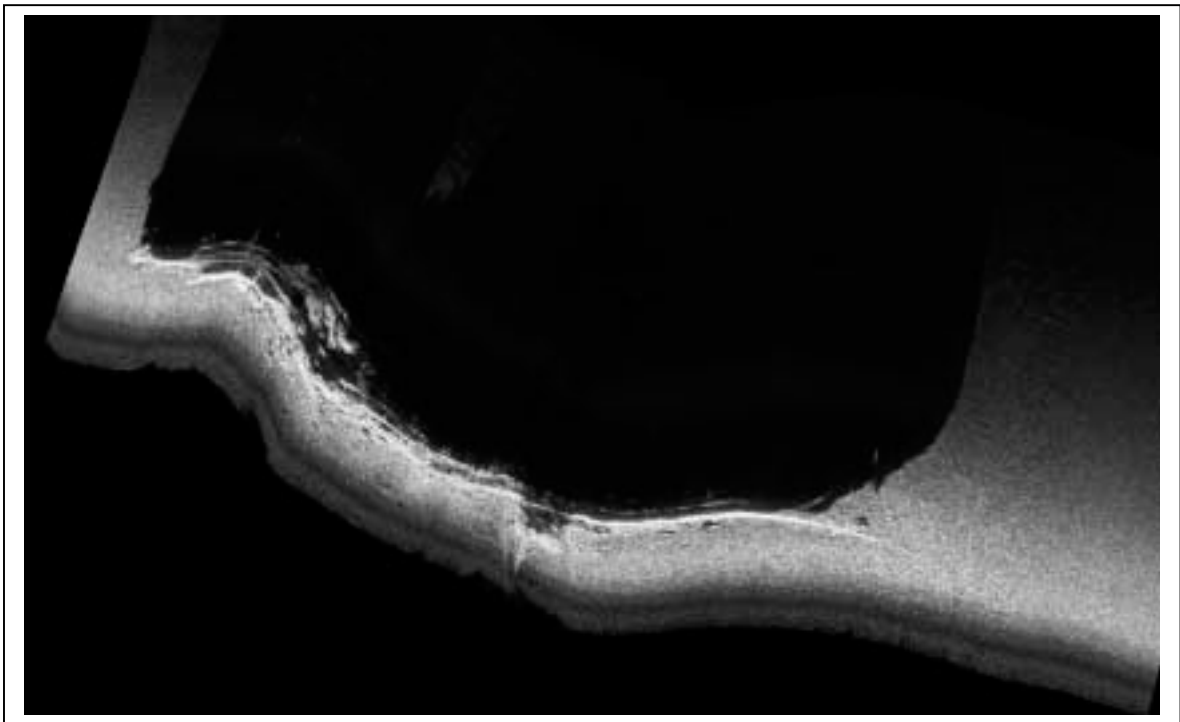
### 1999 Klein 2000 side scan sonar

An impromptu survey using the Klein 2000 sidescan arose in 1999 and six of the seven wrecks of interest were surveyed. The data was gathered following biological habitat mapping trials from a vessel-of-opportunity, with variable navigation input. Consequently, the navigation data was poor and the sonar data required considerable post-processing to correct the errors in the navigation data to

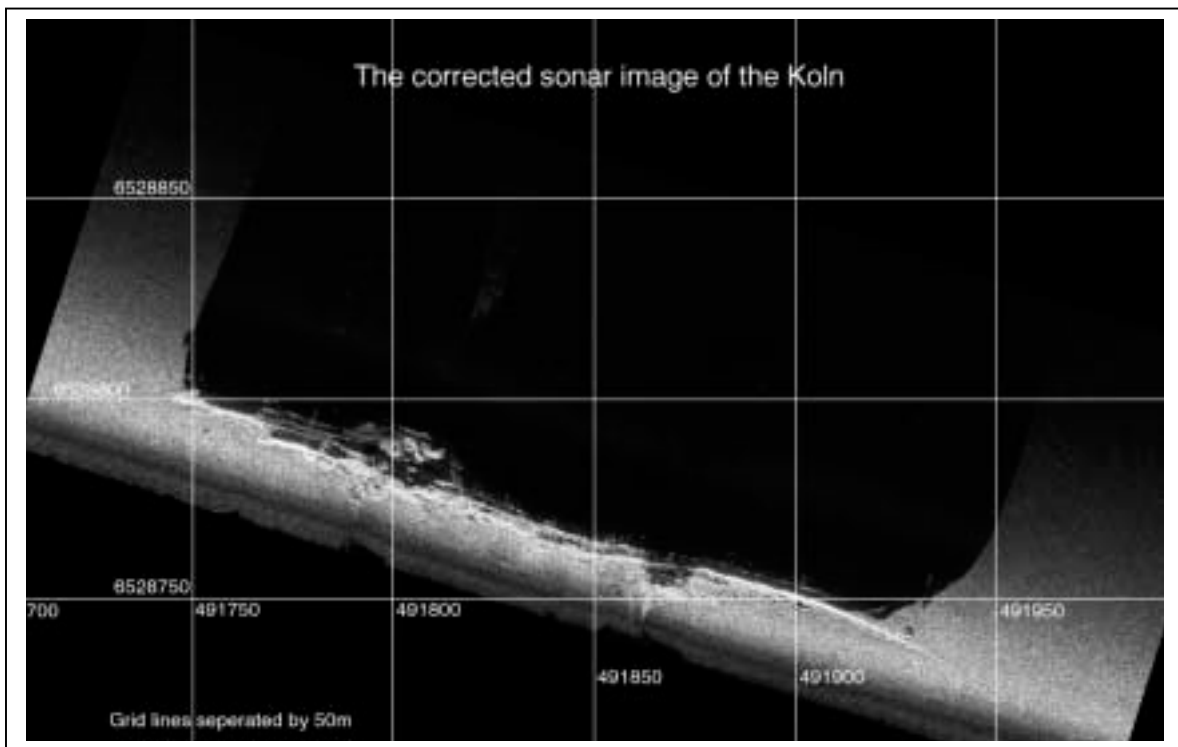
produce useable images. Figure 9a and 9b shows the image generated by the raw data and following post-processing and integration of the corrected navigation and flight data respectively.

Despite these problems the data was used in preliminary planning for diving operations as they revealed some interesting features. The corrected sonogram image of the SMS *Brummer* (Figure 10) shows the damage to the hull around the area of the engine room where salvagers have entered to remove the non-ferrous metals. Amidships there are three distinct areas that have given a strong sonar return, indicated by their darker shading compared to the surrounding seabed sediments. This is the area where the three funnels would have been. These would have fallen from the vessel on or shortly after impact leaving large holes in the hull allowing debris to spill from the hull.

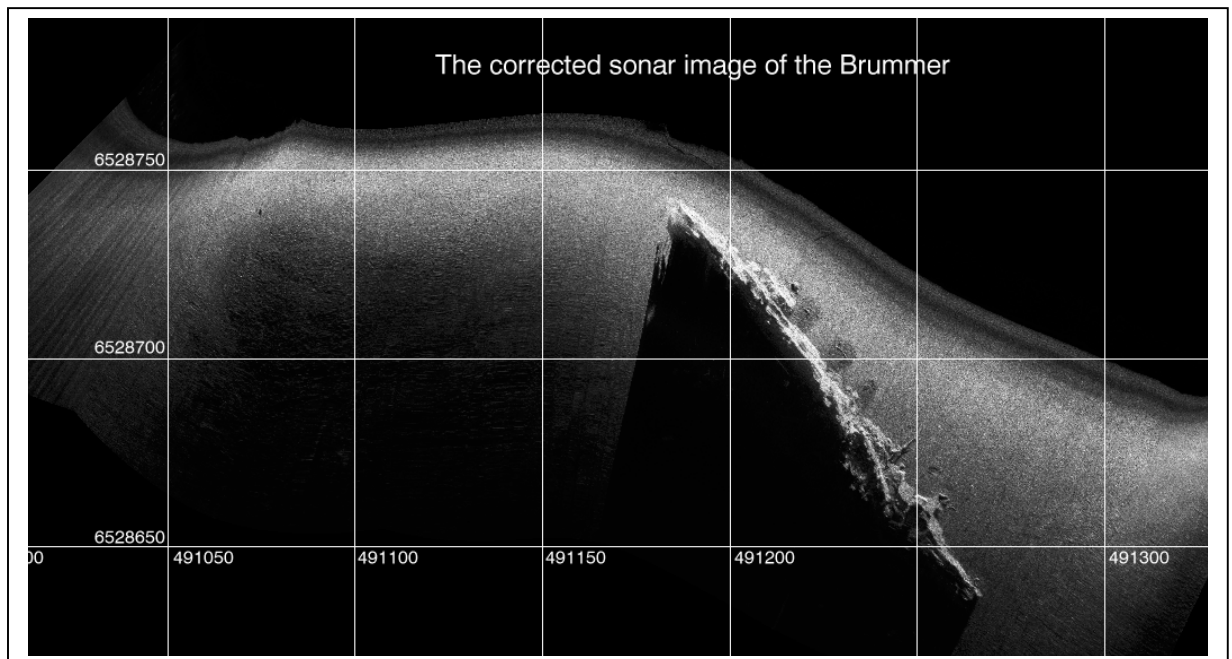
The data has been included in the Project Archive. (CD-ROM disks ScapaMAP Klein 1999 1 – 2). It would be possible to carry out further corrective work on this dataset to render more useful information.



**Figure 9a.** Klein 2000 sonogram from raw data of the SMS *Köln*.



**Figure 9b.** Klein 2000 sonogram of the SMS *Koln* after post-processing of the raw data. The bow is located at the bottom right of the image with the vessel lying on her starboard side. The curved appearance of the dark shadow (grey scale has been reversed for clarity) indicates the bow is clear of the seabed as there is no acoustic shadow. The damage to the hull around the area of the engine rooms where the salvagers have broken into the hull is clearly visible.



**Figure 10.** Corrected sonogram of the SMS *Brummer*. The bow is at the top of the image with the vessel lying on her starboard side. Three debris fields are clearly visible in the area where the three funnels would have been.

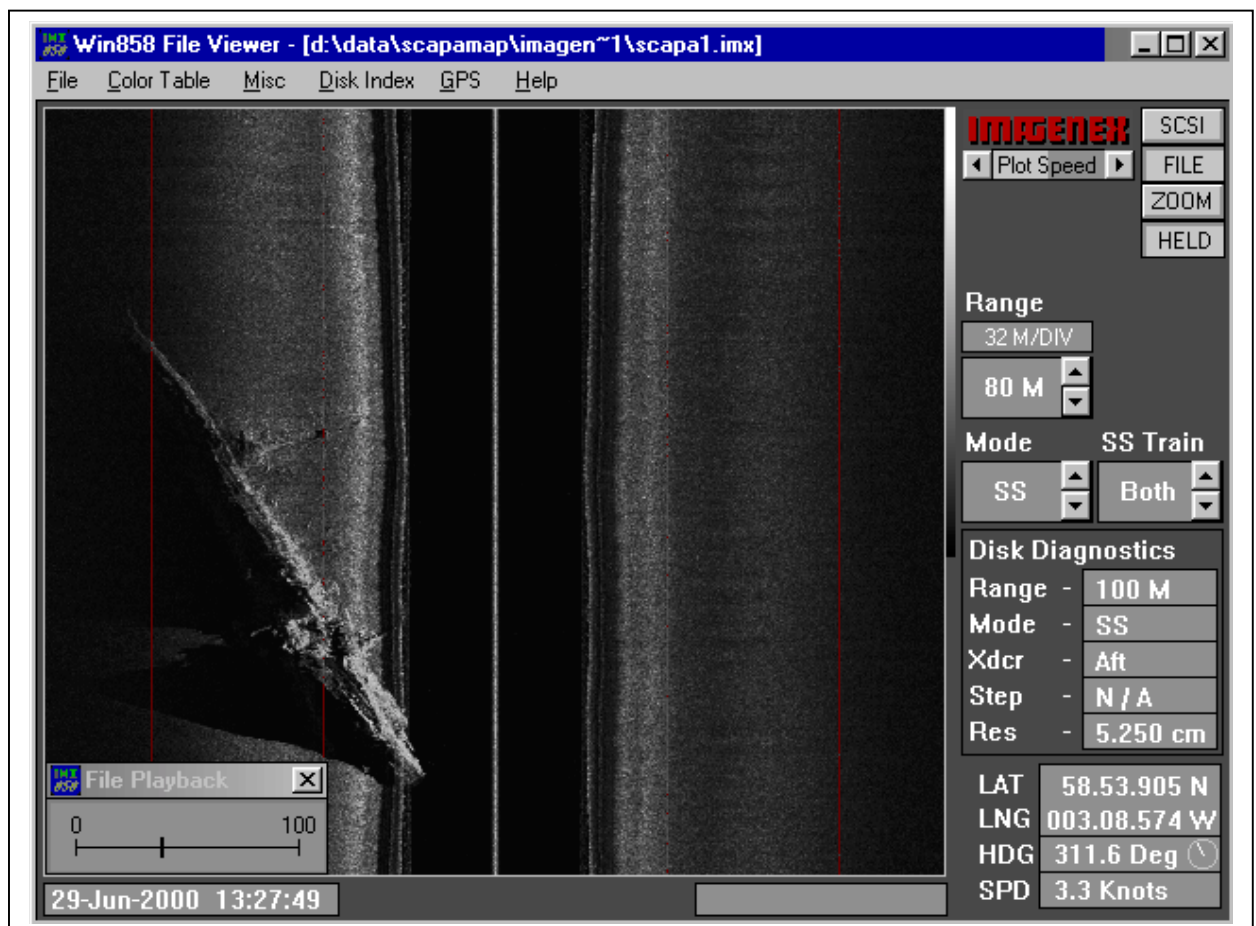
## 2000 IMAGENEX 858 SIDE SCAN SONAR

An extensive IMAGENEX 858 side scan sonar survey was carried out on an area scale and in detail around each wreck in 2000. MV Simitar, the ADU support vessel, was used for this purpose. All the wrecks were covered together with a large proportion of the intervening debris field.

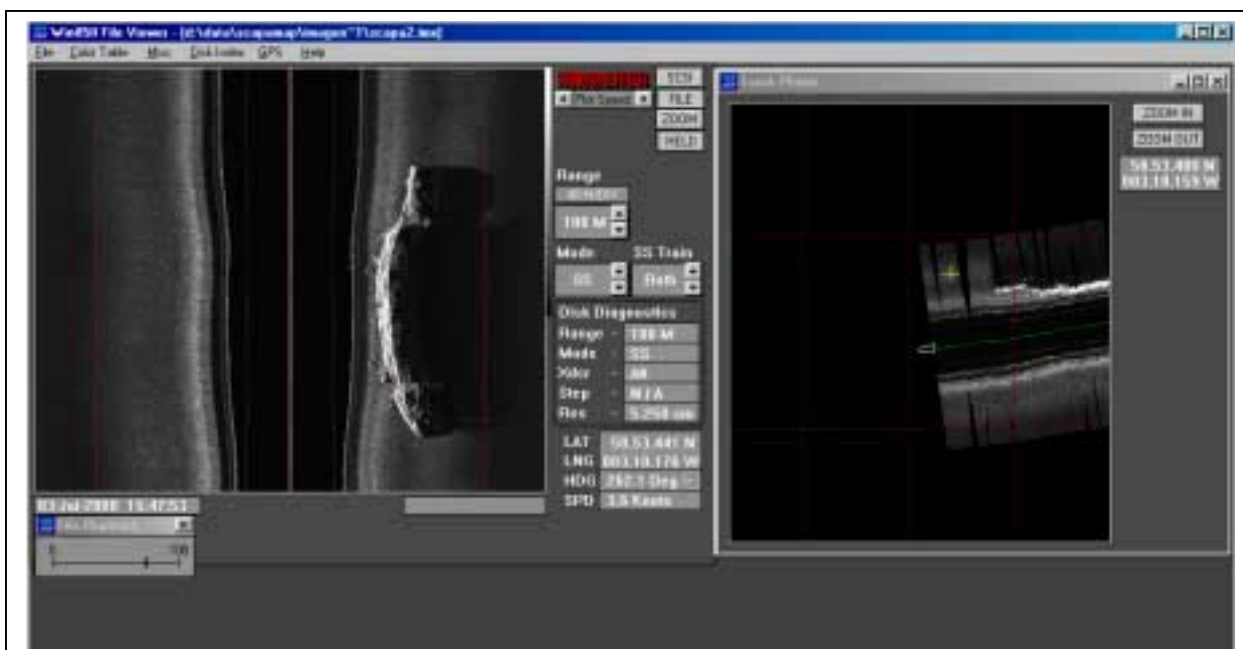
The acoustic information was recorded as continuous data strings for the individual days surveys rather than as individual lanes. This resulted in problems with trying to mosaic the data. However, it would be possible to cut the original data strings into the individual lanes and subsequently mosaic the information.

Figure 11 and 12 shows the information of the SMS *Koln* and SMS *Markgraf* as seen by the operator during the survey.

The data from this survey together with a Viewer is archived on three CD-ROM disks (ScapaMAP-IMAGENEX 1 – 3.)



**Figure 11.** IMAGENEX 858 screen image of the SMS *Koln*. Bow is at the top left of the image with the vessel lying on her starboard side.



**Figure 12.** IMAGENEX 858 image of the SMS *Markgraf*. Bow is at the top of the image with the vessel lying upside down on the seabed. Right hand panel displays boat navigation and ping information.

## Multi Beam Swathe Bathymetry

Bathymetry can be obtained using echosounder based techniques. However, conventional single beam methods require a large number of passes to obtain an accurate topographic map of the seabed. In a multi-beam system several transducers are mounted in a single unit. Each beam is corrected for slant angle to provide accurate depth measurements. Due to the greater footprint of this system navigation tracks can be positioned to allow overlap, greatly increasing the accuracy of the information gained.

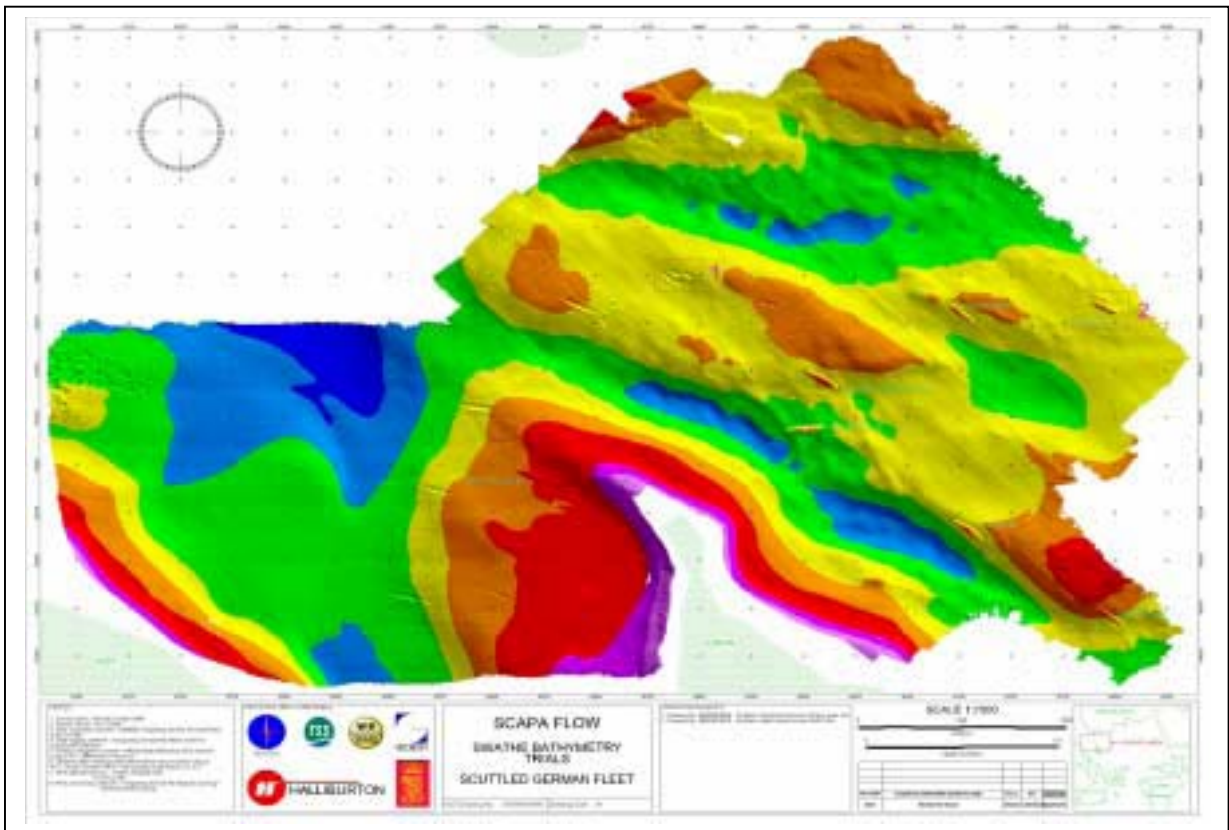
As the system is generally hull mounted ship motion must be taken into account. The transmit fan is split into several individual sectors with independent active steering compensating for vessel pitch, roll and yaw, thereby providing a best fit to a line perpendicular to the survey line. Water column profile provides slant angle correction.

## 2000 Halliburton Subsea Multi-Beam Survey

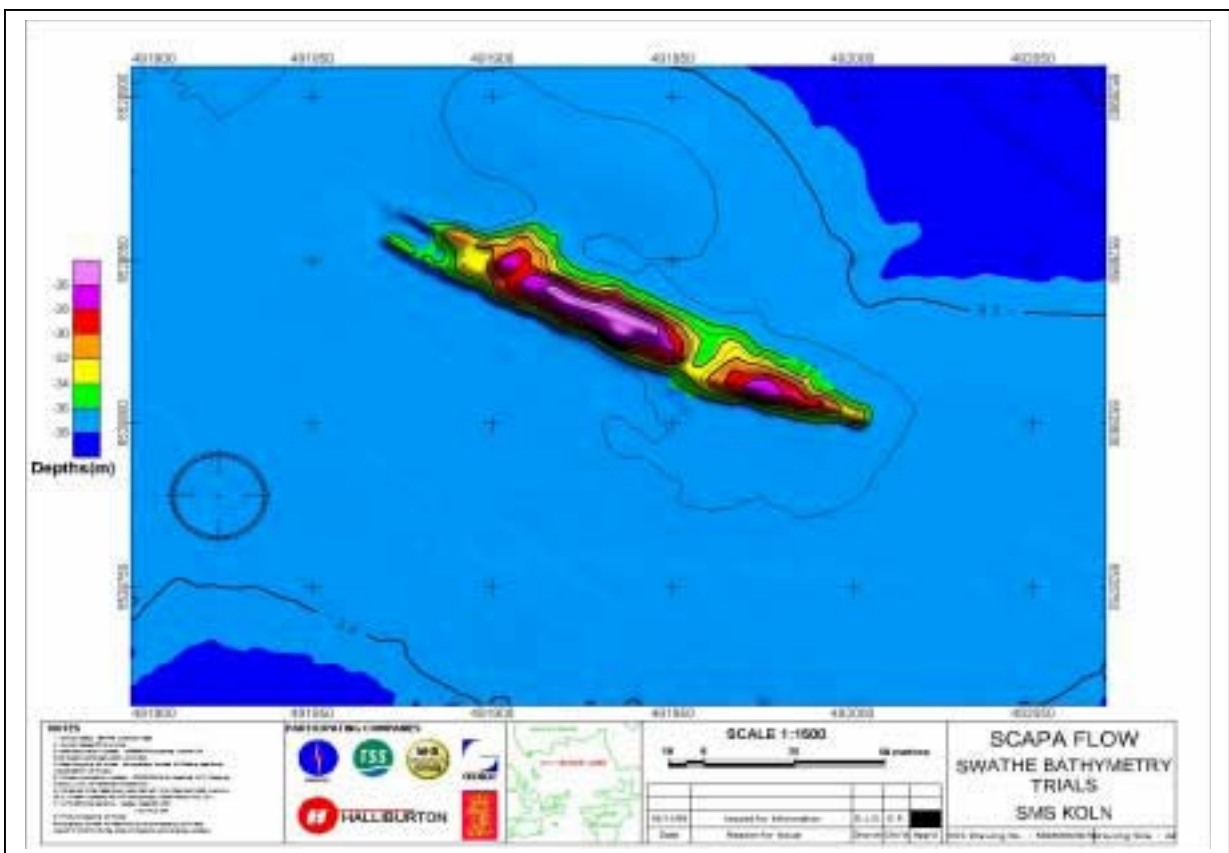
In the Spring of 2000 the offshore survey company Halliburton Subsea carried out a training programme for surveyors in Scapa Flow. The training programme included a moderately high-resolution survey of the subject area using the Kongsberg Simrad EM3000 shallow-water multibeam system. Integrated into the system was a Seatex Seapath 200 providing precise attitude, a TTS POSMV system provided a data string for attitude and heading and another output into the Halliburton Subsea Winfog system for position and heading. Halliburton Subsea also set up their Sercel Aquarius 5002 dual frequency RTK (Real Time Kinematic) satellite station which broadcast high-precision correction data to the vessel.

The only data that is currently freely distributed is a low-resolution mosaic produced from their on-board work and some individual images of specific wreck sites. Images given to the project by Halliburton Subsea are in the folder *Halliburton Subsea 2000* of the project archive.

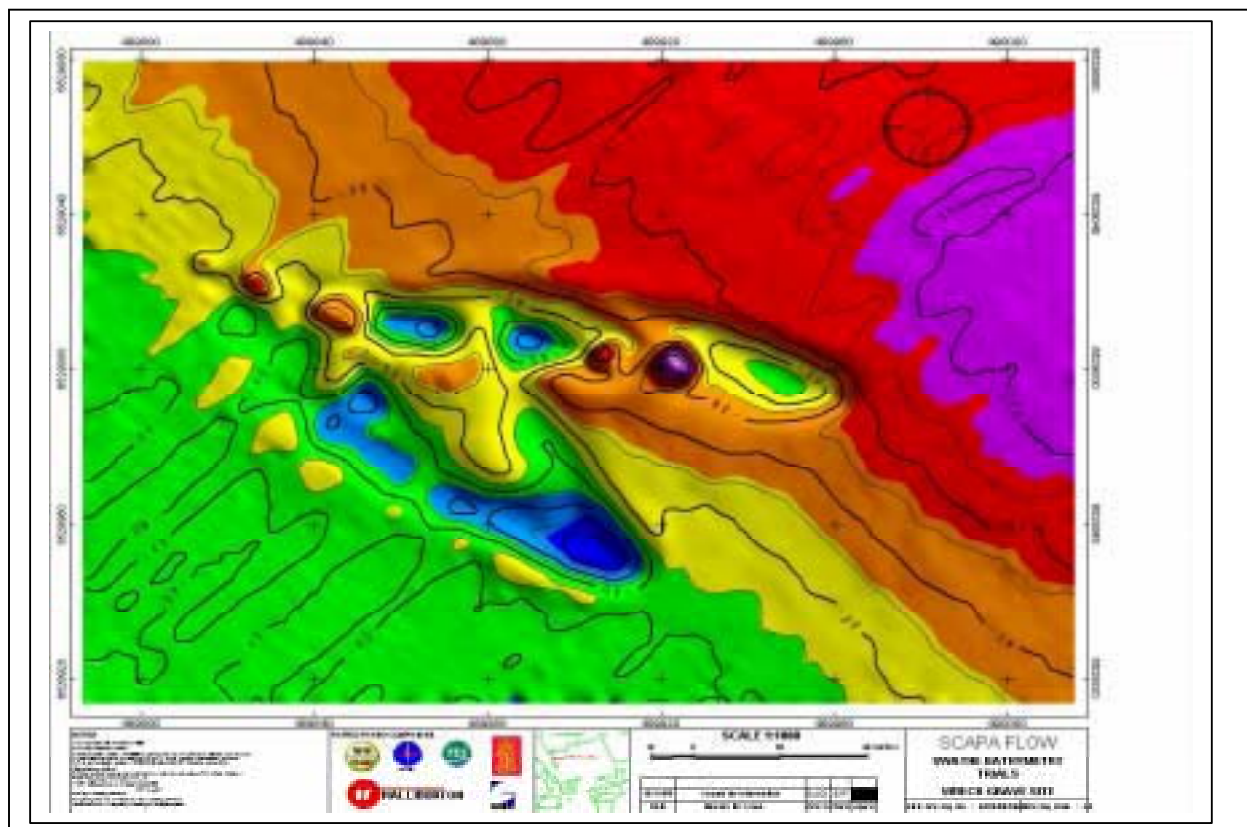
Figure 13 shows the bathymetric chart of the area surveyed indicating the position of the remaining wrecks and the depressions in the seabed where vessels have been salvaged. Figure 14 is a high resolution image of the site of the SMS *Koln*. Figure 15 shows the site of the SMS *Bayern*. The image indicates a “V” shaped depression in the seabed. Salvage records indicate that the first attempt at raising the vessel were not successful. The impression on the seabed is therefore likely to be due to the initial impact then a second made when it sank after the first attempt to float her. Four objects projecting above the seabed are also seen, these are the gun turrets. In addition to the German vessels the sites of the HMS *Royal Oak* and HMS *Vanguard* were also surveyed (Figure 16 and 17 respectively).



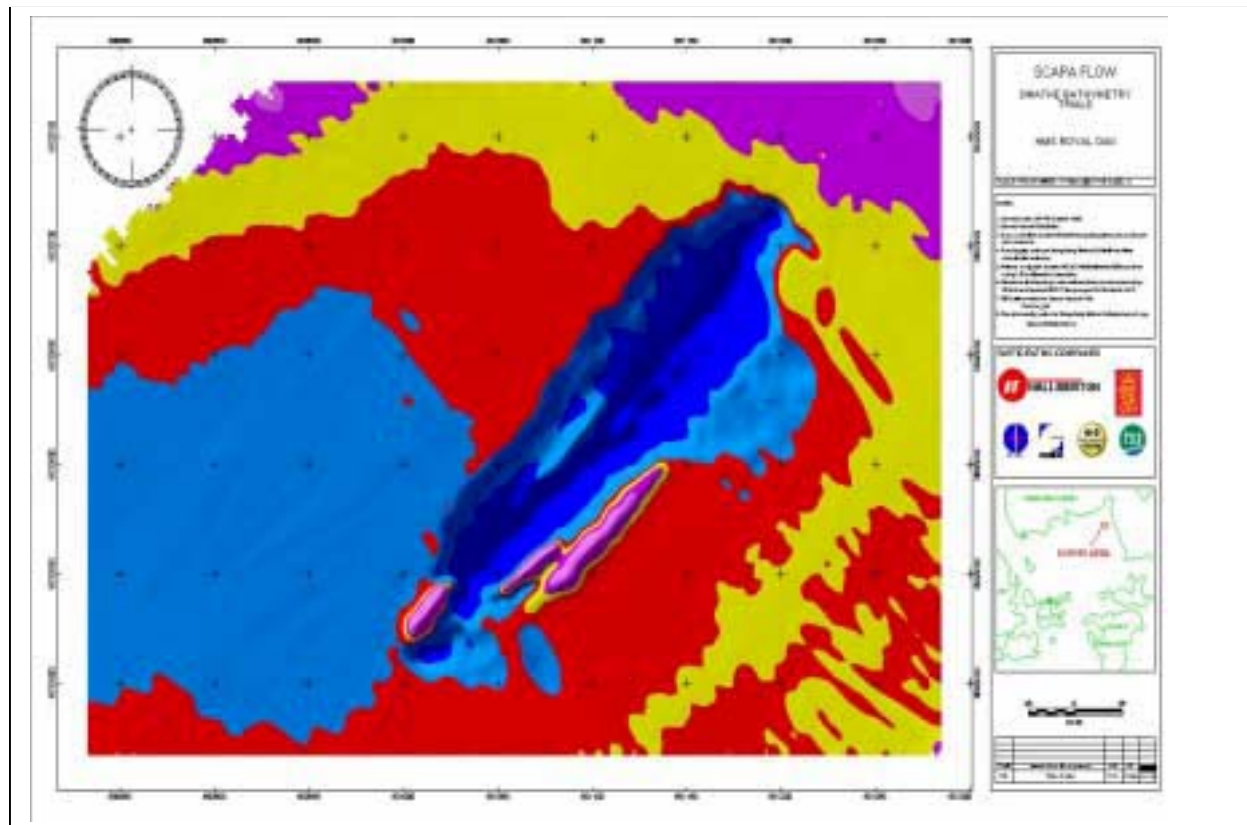
**Figure 13.** Swathe bathymetry of area surveyed by Halliburton Subsea. Remaining German vessels and salvage sites clearly visible.



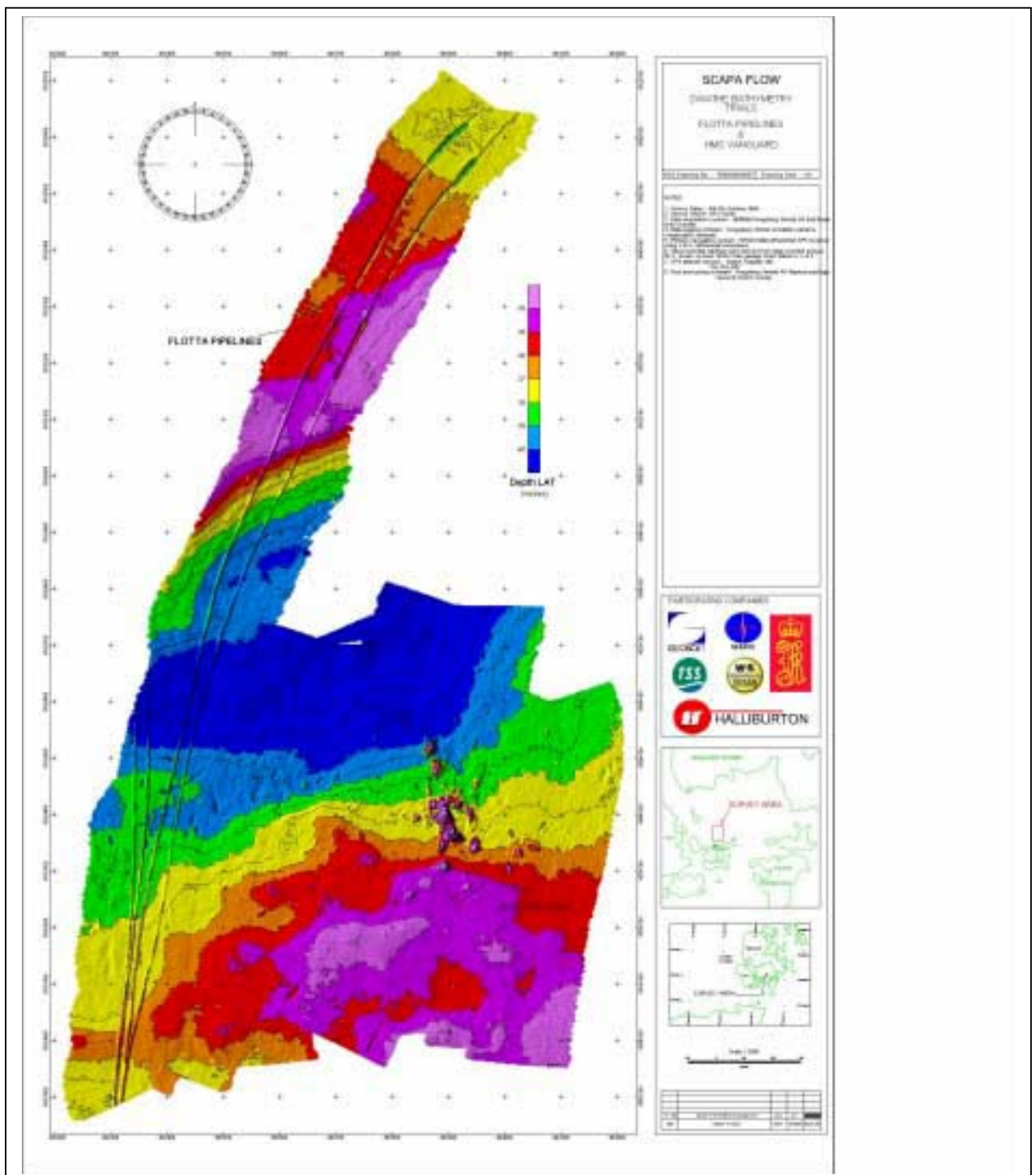
**Figure 14.** High resolution swathe bathymetry of the site of the SMS *Koln*, surveyed by Halliburton Subsea.



**Figure 15.** Swathe bathymetry of the site of the SMS *Bayern* surveyed by Halliburton Subsea. Image indicates a complex area with four clearly defined objects projecting above the seabed.



**Figure 16.** High resolution swathe bathymetry of the site of the HMS *Royal Oak*, surveyed by Halliburton Subsea.



**Figure 17.** Swathe bathymetry of area around the site of the HMS *Vanguard* surveyed by Halliburton Subsea. It is clearly seen that this is a complex site with numerous objects on a relatively flat seabed.

## ScapaMAP Acoustic Consortium Multibeam Survey 2001

During 13 - 16 June 2001 a new, dynamically focused, very high resolution multibeam echosounder - the Reson SeaBat 8125 - was used to provide the highest resolution data of the wreck and surrounding area to date.

In order to facilitate this work the ScapaMAP Acoustic Consortium (SAC) was formed with the aim of augmenting the project's other work with acoustic remote sensing data. The consortium comprised of:

- International Centre for Island Technology, Heriot-Watt University,
- Reson Offshore Ltd.,
- Center for Coastal and Ocean Mapping (C-COM) and Joint Hydrography Center, University of New Hampshire (JHC)
- Archaeological Diving Unit, University of St. Andrews. (ADU)

In addition to the industrial and academic partners involved directly, ScapaMAP received financial aid, or aid in kind, from the following sponsors:

- Historic Scotland
- GSE Rentals Ltd., Aberdeen, UK
- TSS (UK) Ltd.
- C-Map/USA
- The Carnegie Fund for the Universities of Scotland

The survey system provided by the SAC members consisted of the Reson 8125, a TSS POS/MV 320 attitude and navigation system, and a Racal Landstar DGPS receiver, installed aboard the S/V Scimitar.



**Plate 2.** Reson 8125 multibeam echosounder and sound velocity probe being prepared for deployment onboard MV Scimitar



**Plate 3.** Sound velocity probe used to determine water column composition to allow for beam distortion corrections.

The Reson 8125 focused multibeam echosounder head comprised of an acoustic projector (455kHz) and sonar receiver element (Plate 2). The 8125 was mounted on a pole for deployment together with a sound velocity probe (located just above the 8125) to measure the sound speed at the head. A dipping velocity probe was used to profile the water column (Plate 3). Information from this probe was fed into the laptop to provide sound speed corrections for discontinuities in the water column.

The SeaBat 8125 is a wide-sector, wide-band focused multibeam sonar utilizing 240 dynamically focused receive beams. The system measures a 120° swath across the seafloor (3.5 times the depth of the water column), detects the bottom, and delivers the measured ranges at a depth resolution of 6 mm. The backscatter intensity image is displayed in real time on the sonar display. The SeaBat 8125 can be controlled through its native graphical user interface, or from a multibeam data collection system, such as the SeaBat 6042 version 7.

The Data Capture Station (Plate 4) comprised of a Reson 81P topside processor, 6042 data capture system and TSS POS/MV320. Survey planning and processing station (Plate 5) comprised of laptops used for planning survey lines, feeding them to the helm for ship control and to post-process the data from the previous lane.

Based on the operating parameters of the SeaBat system and the depth of water in the survey area navigation lines were established to ensure swathe overlap between adjacent navigation lines. Figure 18 shows the screen display on the navigation system with the navigation lanes over-laid. Bathymetric data gathered by the SeaBat system is integrated and overlaid onto the existing raster navigation chart. The insert at the top right of the image shows a zoom of a section of the navigation lane showing one of the wreck sites. Figure 19 shows the display during the survey showing the integrated bathymetric data from SeaBat being built-up to form the processed chart of the area.

During the survey period the Reson SeaBat 8125 was actively pinging for 39.5 hours. This represents a total of 291,290 pings producing 69, 902,204 individual soundings over an area of 3.5km x 5km. Data resolution over the wide area was 5 metres, while over the wreck sites this was 0.75 metres. Integrating the positioning system with the echosounder therefore provides accurate 3D co-ordinates for each sounding. Data interpretation is carried out through the software interface *Terraforma* that allows the coordinates to be displayed and manipulated in real-time. As seen from Figures 18 & 19 one approach is to colour code the bathymetric information producing colour graduated charts.

Figure 20 shows the information displayed on the screen at the site of the SMS Brummer. As can be clearly seen the display is composed of the individual soundings received by the SeaBat data capture system. Due to the varying incidence angles of individual beams on each ping a pseudo-3D image results. Figures 21 & 22 show the information once it has been smoothed and coded in grey-scale and true colour.

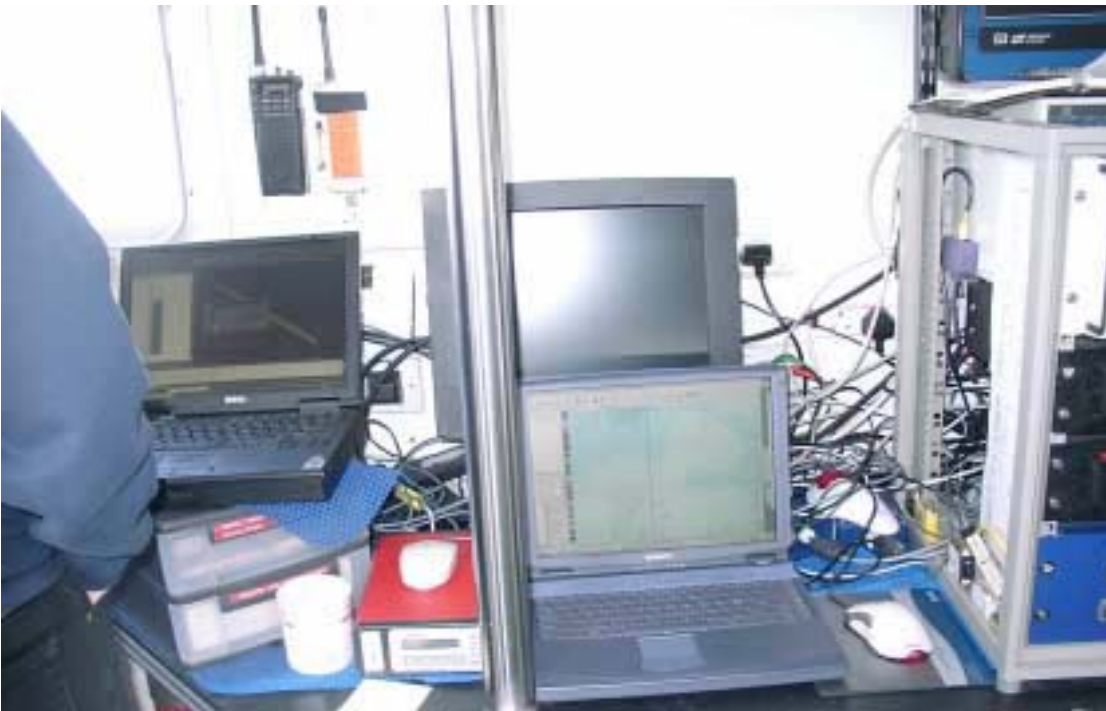
### **3D Visualisation Software**

As each sounding has three dimensional co-ordinates ( two geographical and depth) it is possible to view this information using 3D visualisation software.

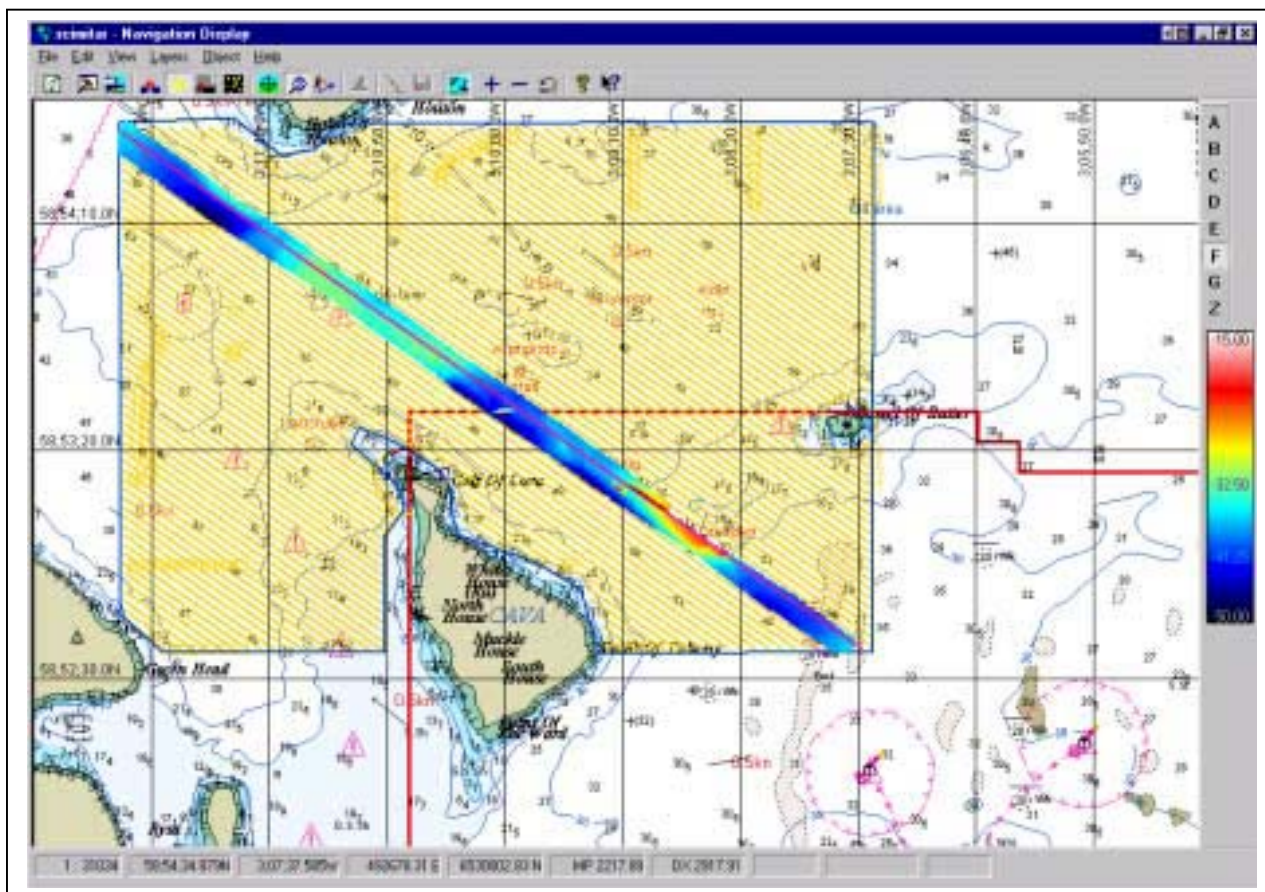
Images of all seven scheduled sites and the SMS *Bayern* gun turrets have been rendered for viewing by Dr Brian Calder at C-COM in both GeoZui3D ([Geo](#)referenced [Zooming](#) [user](#) interface [3D](#)) and Fledermaus software. Figure 23 shows a captured image of the SMS *Koln* that has been zoomed and rotated so that the view of the vessel appears to be that of an observer near the seabed looking from bow to stern.



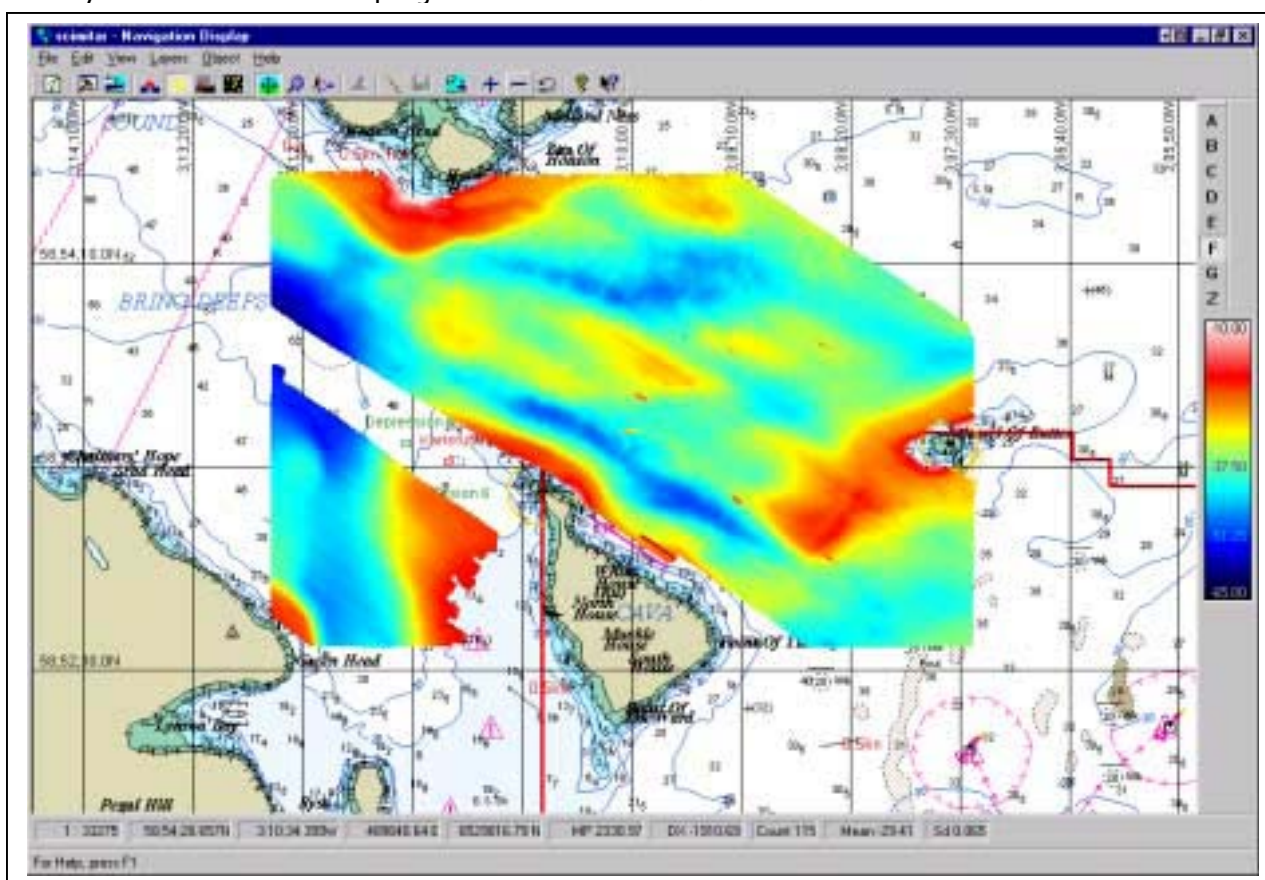
**Plate 4.** Data Capture Station comprising Reson 81P topside processor, 6042 data capture system and TSS POS/MV320.



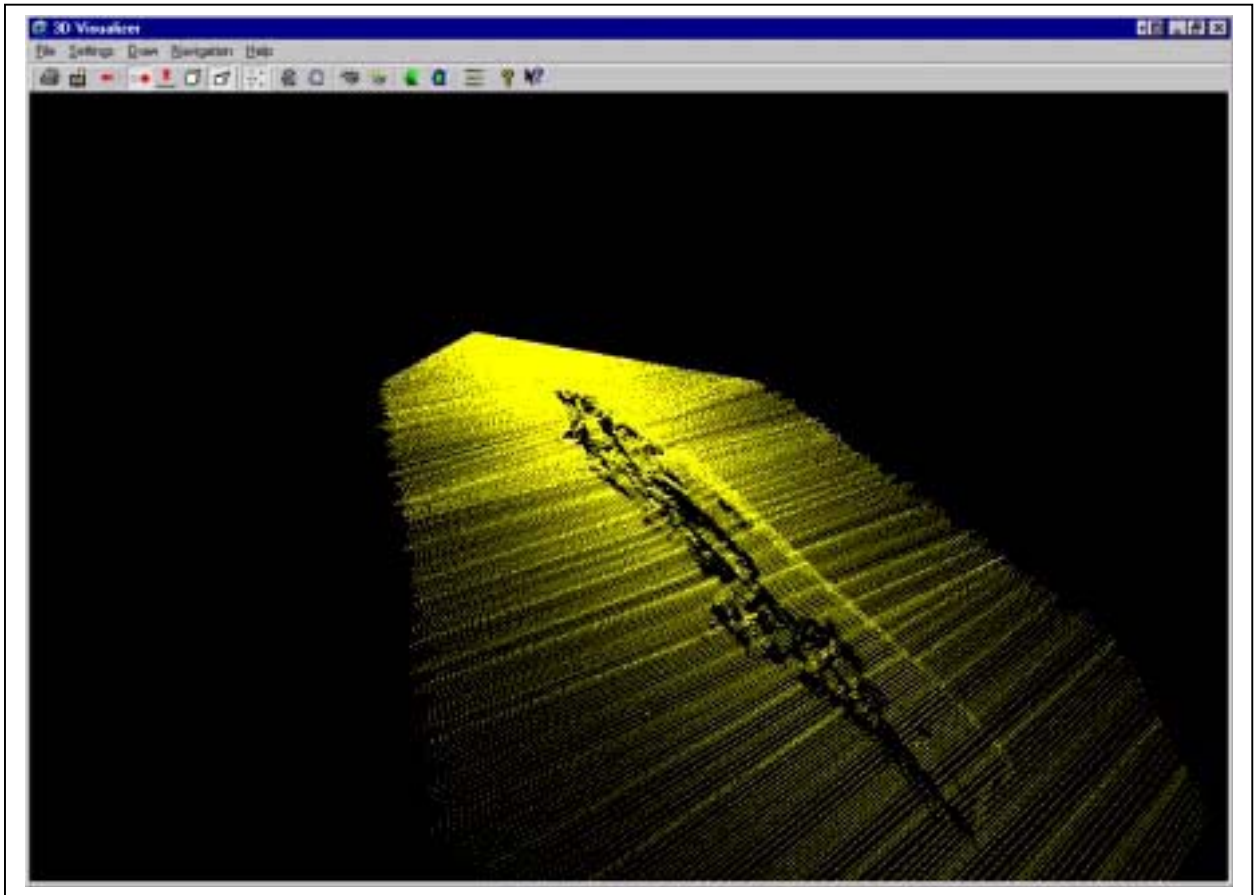
**Plate 5.** Survey planning station comprising of two Differential Global Positioning Systems (DGPS) integrated to laptops with raster charts to provide accurate navigation and position fixing.



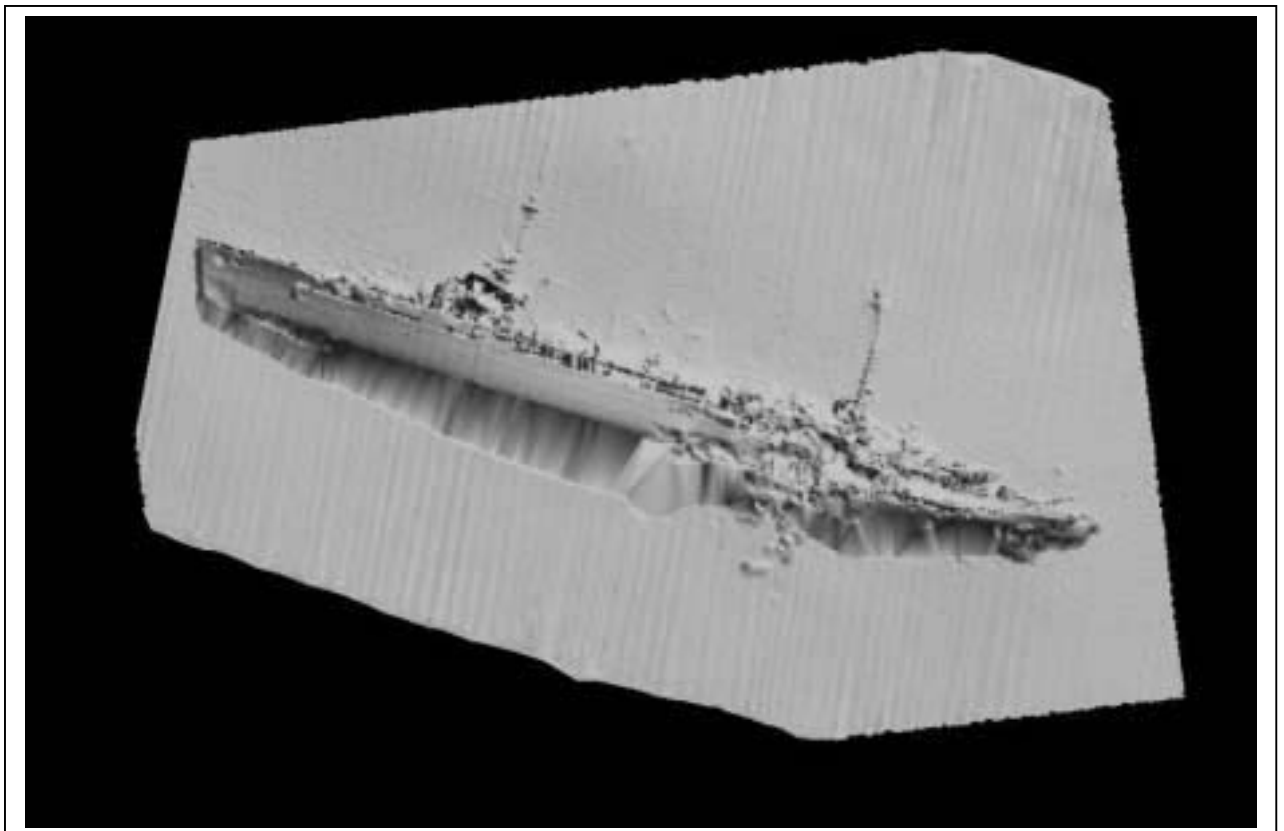
**Figure 18.** Screen of SeaBat 8125 system showing established navigation lanes with overlaid bathymetric data. Insert top right shows zoom view of area.



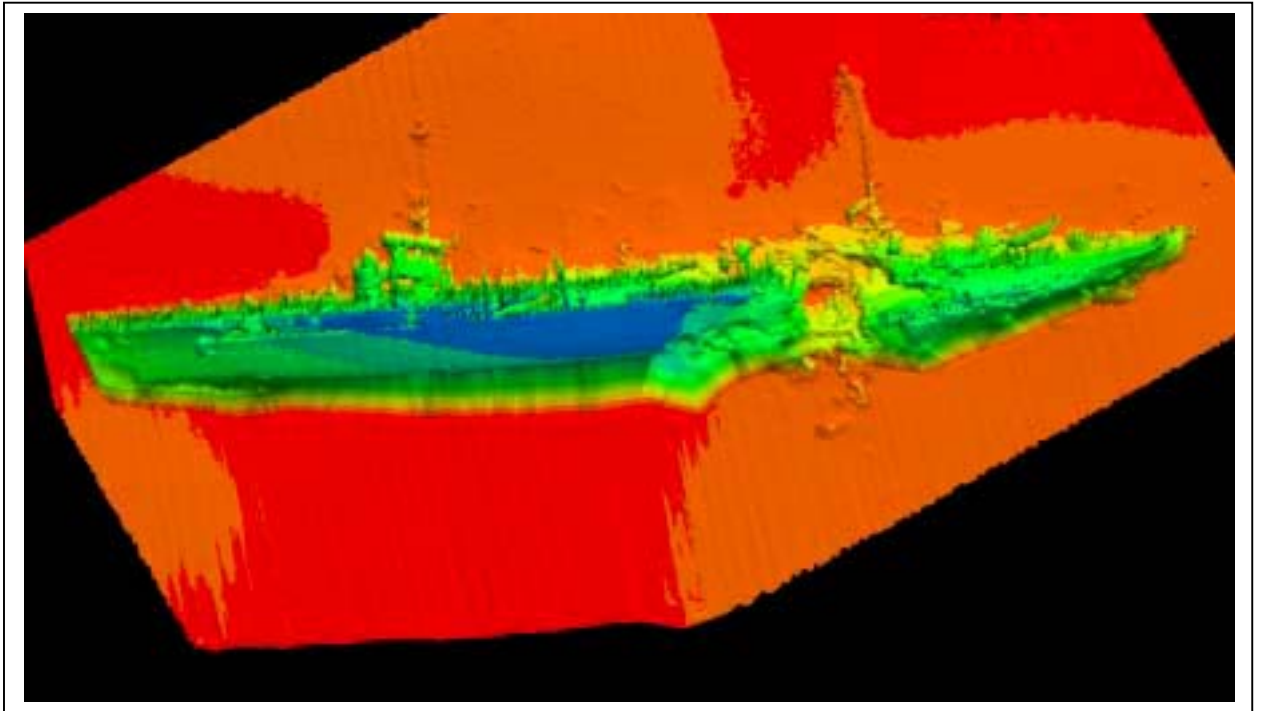
**Figure 19.** Screen view of SeaBat 8125 composite bathymetric data following two days of survey.



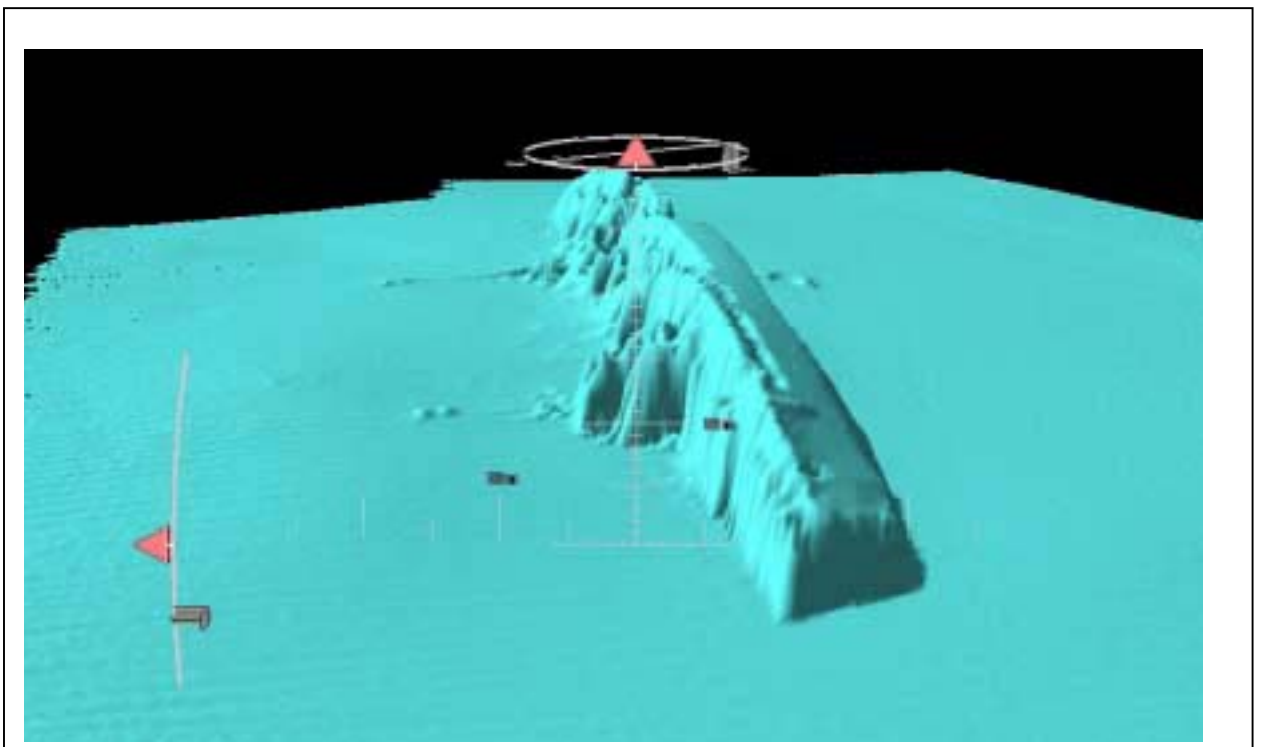
**Figure 20.** Image of the SMS *Köln* composed of the individual soundings obtained using Reson SeaBat 8125 multibeam echosounder.



**Figure 21.** Grey-scale coded image of the SMS *Köln* obtained using Reson SeaBat 8125 multibeam echosounder.

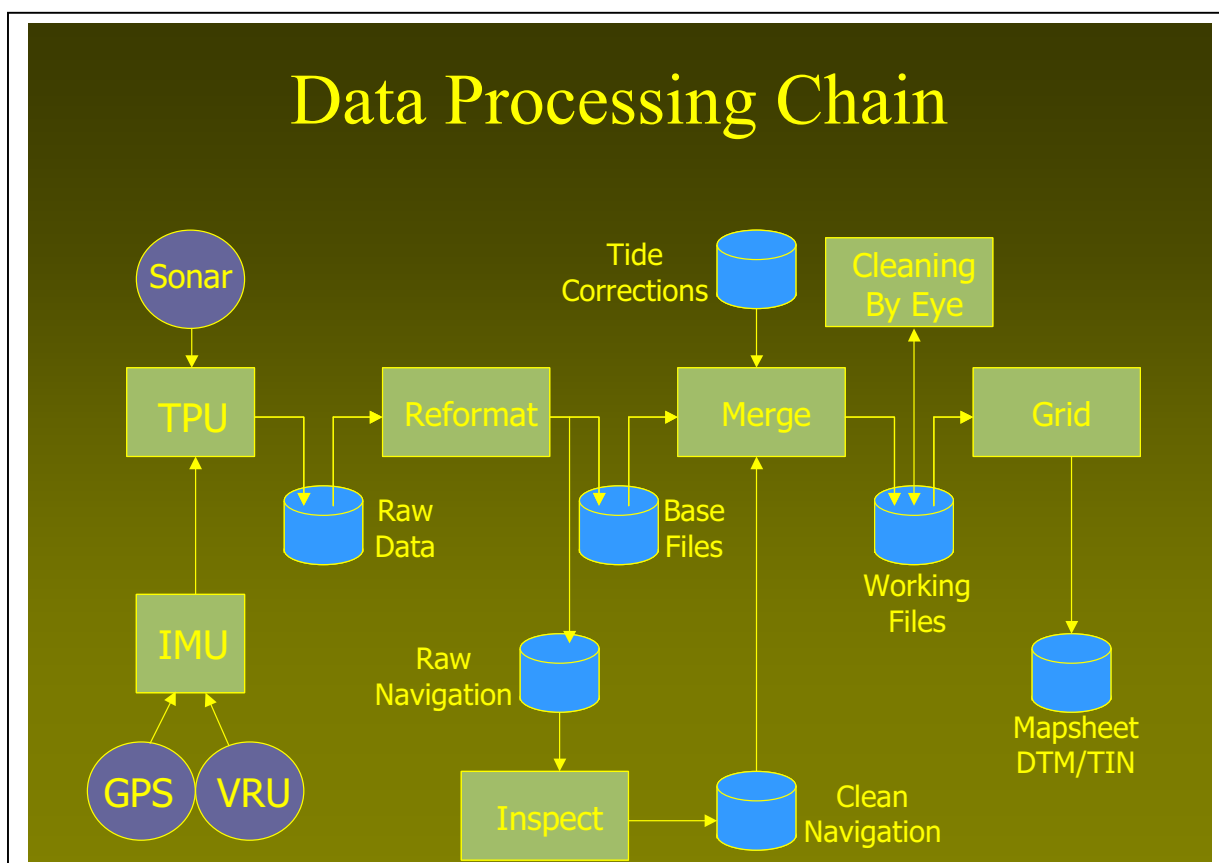


**Figure 22.** Colour coded image of the SMS *Köln* obtained using Reson SeaBat 8125 multibeam echosounder



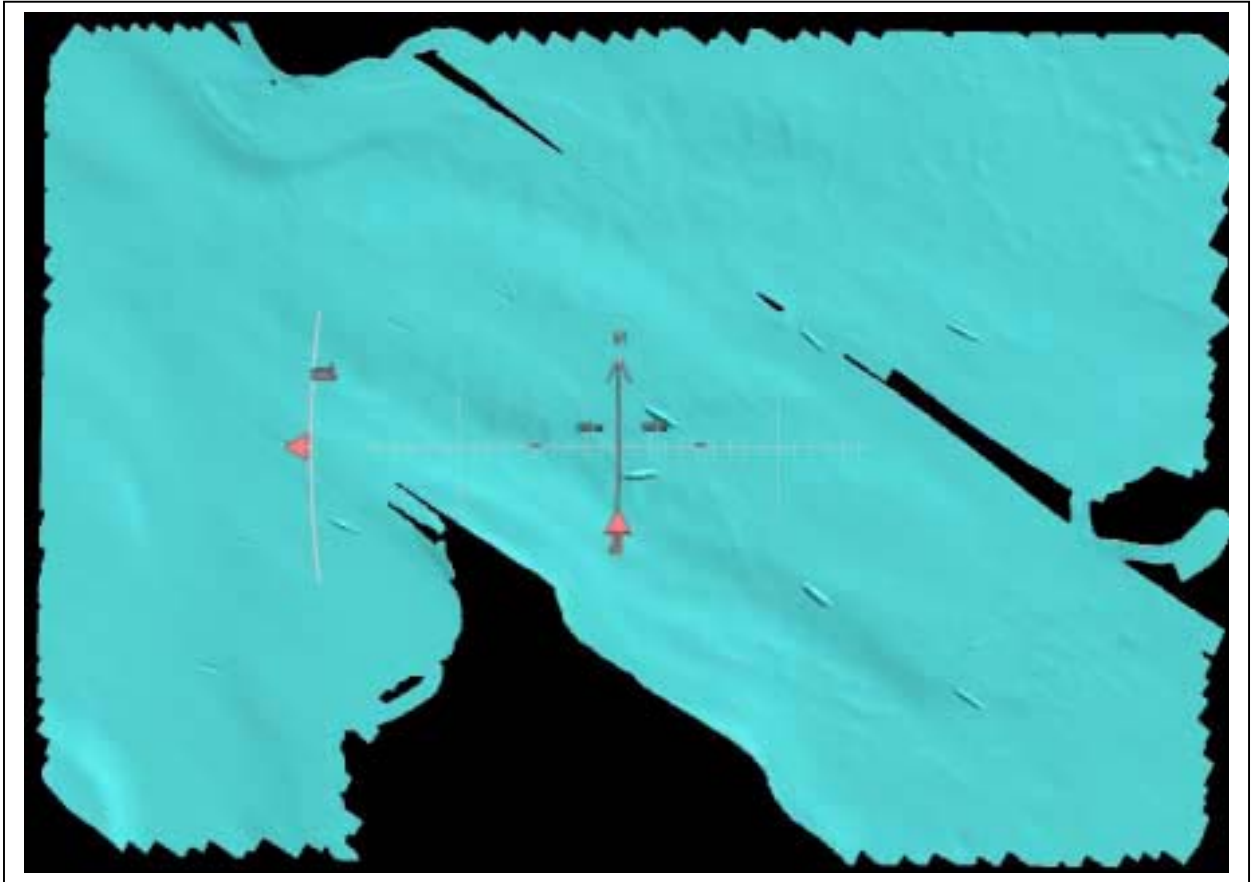
**Figure 23.** Captured image of the SMS *Köln* obtained using GeoZui3D visualiser looking from bow to stern.

Over the period of the survey Orkney Islands Council informed the team that the tidal station at Stromness was non-operable. Consequently, tidal data was obtained from a tidal gauge set up at Scapa Pier on the eastern side of Scapa Flow by Sonar Research & Development Ltd., who were conducting remote sensing work around HMS *Royal Oak*. This data was found to be incomplete and unsuitable for this purpose. Further enquiries however have revealed that the OIC tide gauge had only failed to send information to the printer in the OIC Harbours Office and that a complete data set for the period had been stored on computer hard disk. This was obtained and the Centre for Coastal and Ocean Mapping have added the tidal corrections to the RESON survey data. Figure 24 gives an overview of the steps required in post-processing the data to produce a final image.



**Figure 24.** Data processing chain used from acquisition of data from various input sources to produced a georeferenced image.

This process allows all the bathymetry data to be referenced to a known datum. Once this is achieved it is possible to mosaic all of the data from each survey lane. Figure 26 shows a GeoZui3D captured image for the entire survey area. They existing wrecks and depressions left by salvaged vessels are clearly visible.



**Figure 25.** Captured *GeoZui3D* image of mosaiced survey lanes following navigation and tidal corrections of survey data.

### 4.3 *In Situ* Survey Methods

Conventional underwater archaeological survey involves the use of divers to conduct site investigations and obtain accurate drawings, stills photographs or video. More recently the use of Remotely Operated Vehicles (ROVs) have been used for initial site survey.

#### Remotely Operated Vehicle (ROV) Survey

ROVs are commonly used in the inspection of offshore oil and gas structures and to a large extent have replaced divers in the field of routine inspection work. A variety of ROVs, ranging in size and capability, are used for this purpose. The smaller vehicles, due to payload restrictions, are simple “eye ball” systems carrying photographic and video capability. Larger vehicles are capable of taking additional instrumentation to conduct non-destructive testing (NDT) tasks such as corrosion measurements.

Vehicle power is supplied via an umbilical to the surface support vessel. Consequently, unlike conventional SCUBA diving techniques the vehicle can stay underwater indefinitely and its range is only limited by the depth rating of the vehicle and length of umbilical. The quality of the video obtained in this manner is generally more dependent on the piloting skills of the vehicle operator rather than the visualisation system on the ROV.

The local ROV facility, *Roving Eye*, was established as a tourist attraction to take non-divers out to see the German wrecks providing them with a “diver’s eye” view of the wrecks. *Roving Eye* was employed for one day on the SMS *Dresden* in order to test the utility of the vehicle for archaeological monitoring (Plates 6 & 7). Over five hours of continuous video was obtained together with a record of the vehicle's track collected via a sonar beacon (pinger). Using GIS layering it would be possible to incorporate the vehicle track data and possibly hotlinking video footage to the vehicle's track plot.



**Plate 6.** Hybal ROV operated by *Roving Eye*. Acoustic pinger to provide accurate tracking of the vehicle during operation is located on the skid.



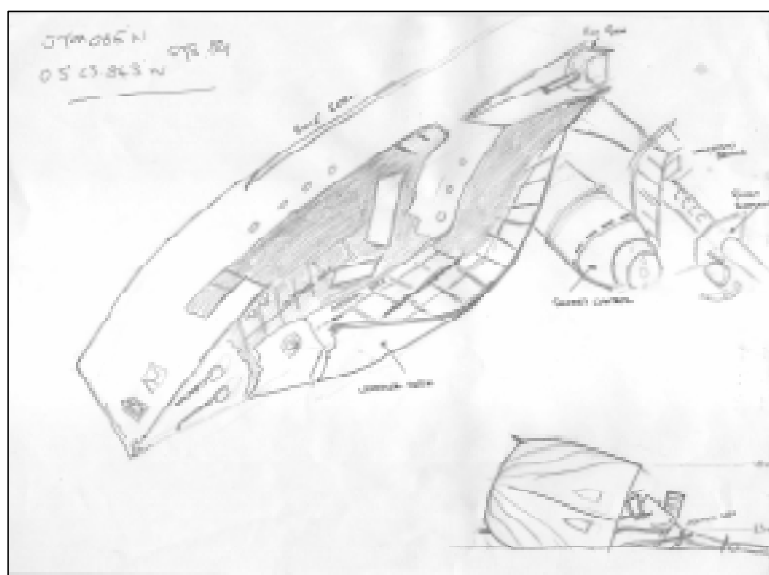
**Plate 7.** Hybal ROV undertaking general video survey of the SMS *Dresden*.

### *In situ* Diver Survey

Conventional underwater archaeological site investigation has used divers to carry out survey work. Although, limited by a number of factors that constrain the time spent at depth, site investigations by diver generally reveal more information than ROV surveys. In a study published by the Joint Nature Conservancy Council (JNCC) skilled observers only observed 70% of the species present at a site compared to those recorded by divers. (Holt *pers.comm.*). This however has to be seen as a trade off with the time divers can spend at the depths of the German wrecks.

The only comparable survey work undertaken on a structure of similar size and shape has been the USS *Arizona* in Pearl Harbour. Underwater visibility is similar to that found in Scapa Flow however, the USS *Arizona* is located in shallower water allowing the divers greater underwater time on each dive to conduct survey work. Due to the depth and repetitive nature of the operation all dives were conducted on Enriched Air Nitrox (EANx). This allowed some extensions to the no-decompression dive times compared with air while still maintaining suitable safety margins for this type of operation.

Initial recognisance dives were carried out by member of the University Dive Unit and the ADU and sketches produced to assist in planning subsequent surveys. Figure 26 shows an initial sketch of the bow section of the SMS Dresden.

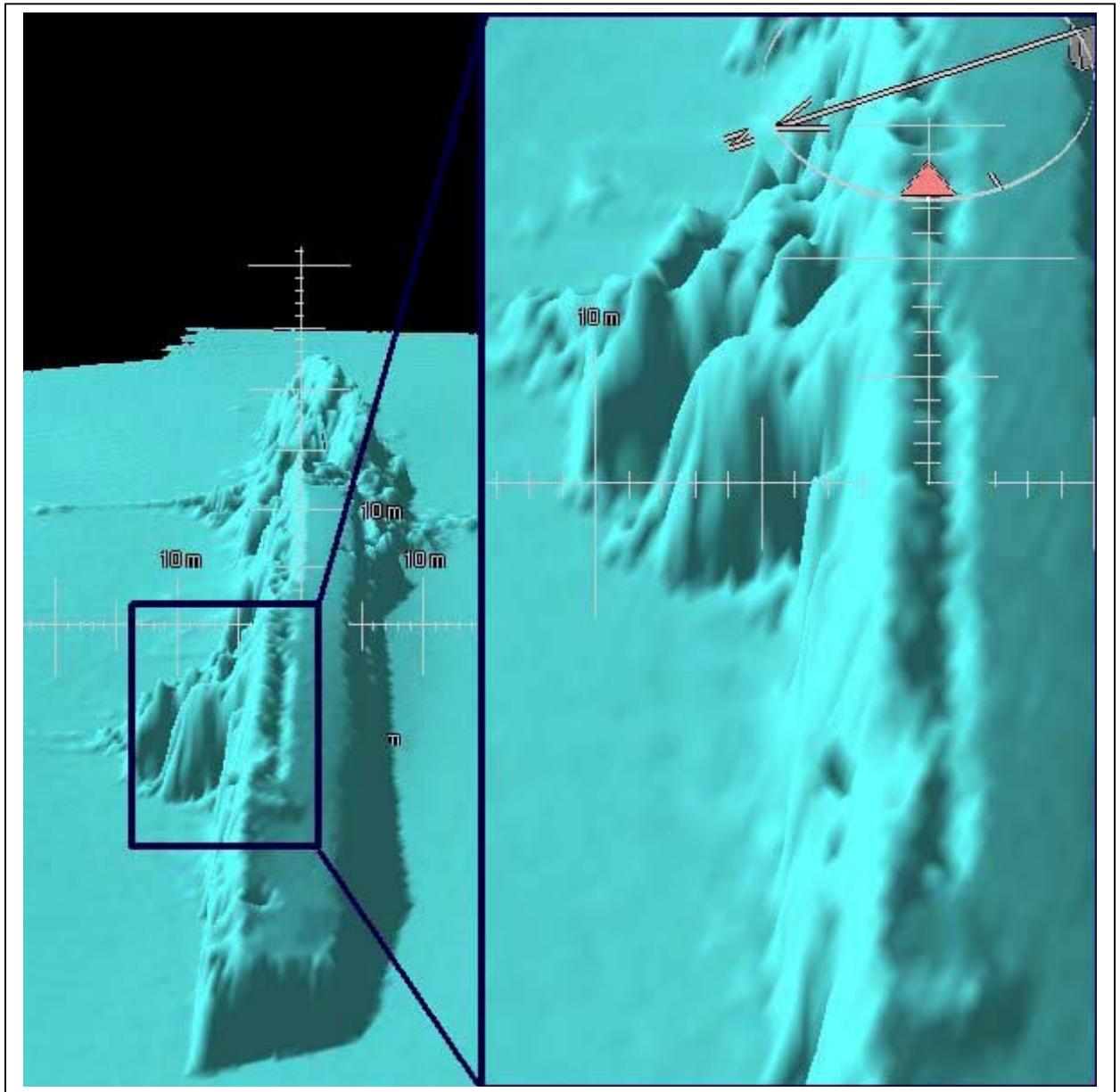


**Figure 26.** Sketch of the bow section of the SMS *Dresden* produced by Steve Liscoe of the ADU.

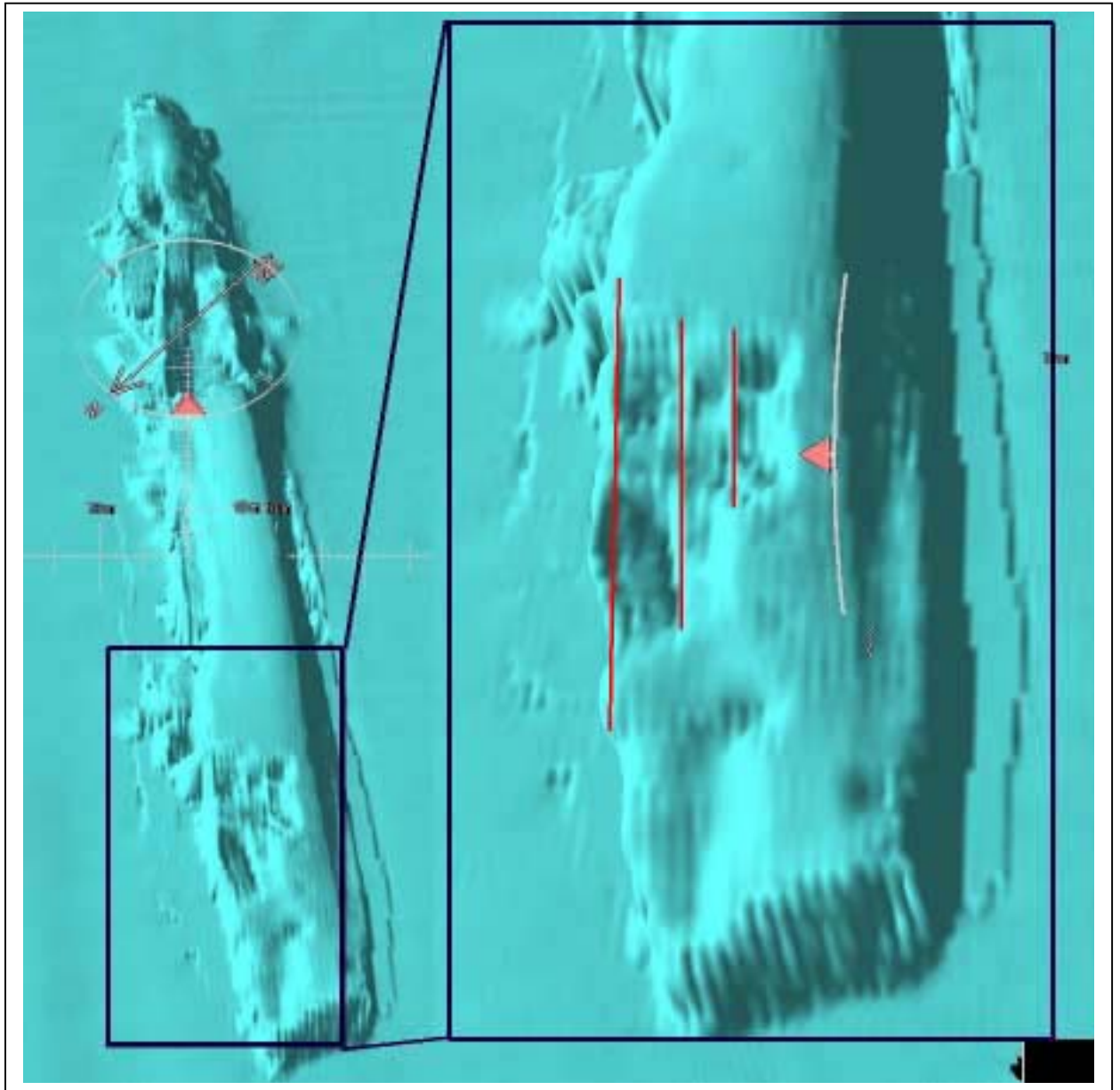
The next phase of diving operations involved general photography and video of the sites. Photographs were obtained using either Nikonos underwater cameras or a Nikon F90 in a Subal underwater housing with suitable underwater strobe units. Stills images were scanned and are incorporated into the archive (CD-ROM disks ScapaMAP Photo Archive). All video was shot using a Panasonic DV100 digital camera in an underwater housing.

The final phase of the diving operations involved more detailed investigation of the sites in areas of the wrecks that appeared to have undergone recent deterioration. These were selected based on prior information from divers and images obtained during the RESON multi-beam survey in June 2001. These were largely the areas near the bow and stern of the vessels and are shown in Figures 27 - 29.

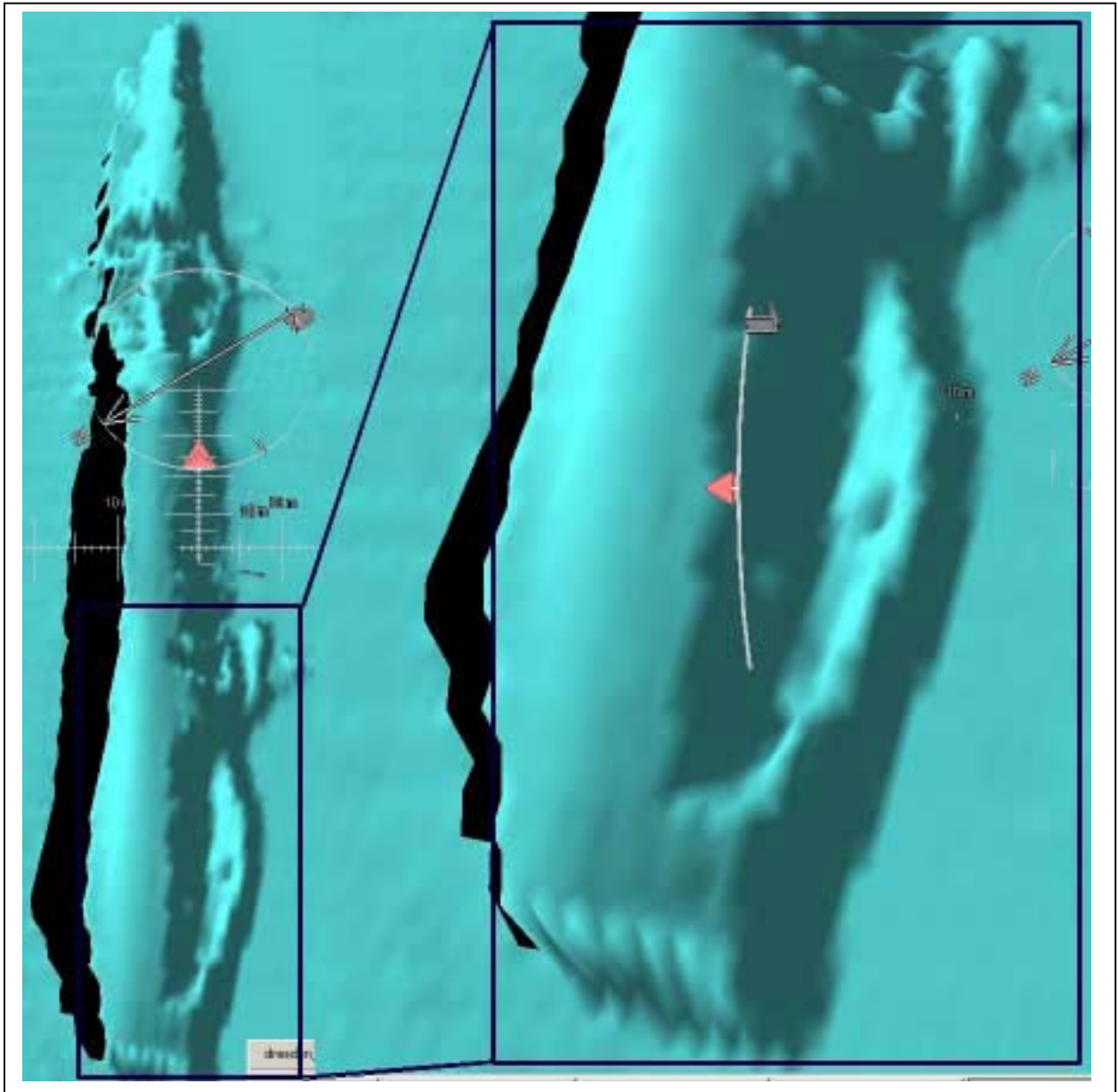
Vessel design allows for weight bearing loads when the vessel is in an upright position. Lying on their side, as in the case of the light cruisers, significant stresses are placed on the hull structure as structural loads are designed to be through the keel. Deterioration has most likely been accelerated in these areas by the use of explosive charges to remove the armour plate or gain entry into the engine room area for non-ferrous metals.



**Figure 27.** Image of SMS *Köln* site captured from GeoZui3D visualisation software using RESON multi-beam data. Enlarged area represents survey area at the bow of the vessel and shows area where the port side plates adjacent to the deck have started to corrode and collapse.



**Figure 28.** Image of SMS *Brummer* site captured from GeoZui3D visualisation software using RESON multi-beam data. Enlarged area represents survey area at the bow of the vessel. The concave area at the bow is the result of the collapse of the starboard hull (underneath). Without support the port hull plates have separated and hang suspended. The three red lines represent the edges of the main, first and second decks which are now exposed due to the collapse of the hull plates in this area.



**Figure 29.** Image of SMS *Dresden* site captured from GeoZui3D visualisation software using RESON multi-beam data. Enlarged area represents survey area at the bow of the vessel.

The image shows how the deck has detached from the side of the starboard deck between the bow and bridge and "peeled" away to form an overhang.

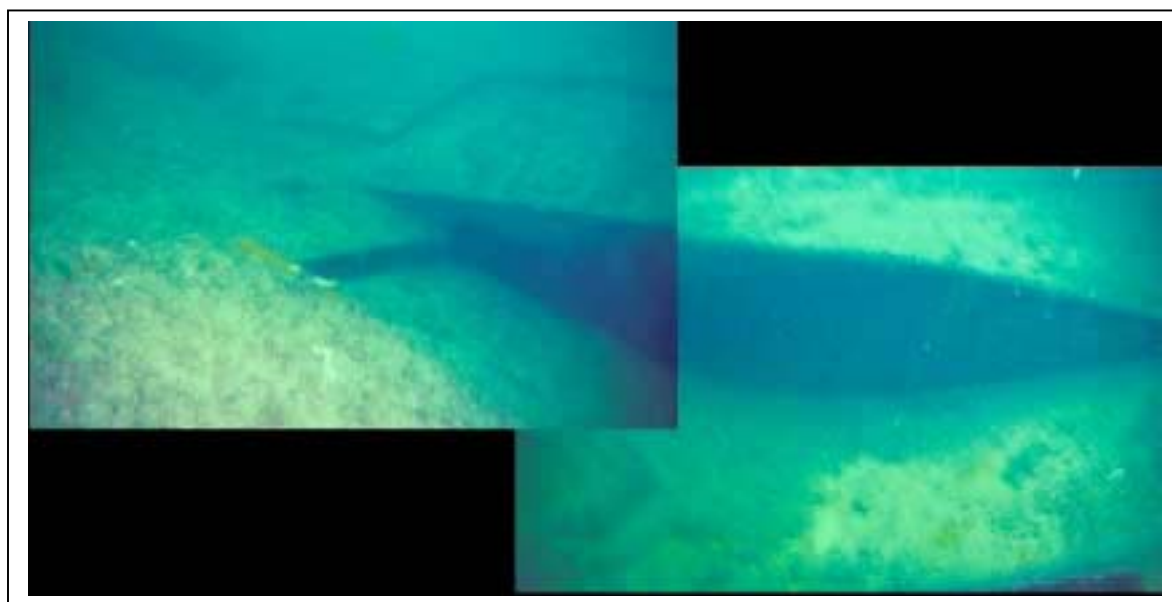
Conventional survey techniques were used in these areas. Fixed datum points were established and distances to notable features measured. Scaled drawings were then produced. Figures 30 – 32 show the stern of the SMS *Brummer*, the bows of the SMS *Dresden* and SMS *Koln*.

Still photographs of the areas surveyed were taken using a Nikonos camera with a 28mm lens and underwater strobe unit. Unfortunately poor underwater visibility, due to a phytoplankton bloom, limited stills photography to relatively small areas of the vessel being taken in a single image. Images were digitised for archive purposes.

### Image Mosaicing

The well-recognised need for rapid methods of seabed mapping has seen the development of several remote sensing techniques, as described earlier, to provide large area maps of the seabed. Such techniques rely on data acquisition through indirect sensing of the seabed and hence require verification of the data for interpretation. Secondly, the resolution of these systems, although sufficient for large-scale mapping, do not in many instances give sufficient resolution to provide a true interpretation of the complexity of seabed biological communities or archaeological sites. Direct visual imagery can provide a means of providing this information.

An approach adopted to produce a large visual image of a site has been image mosaicing. Traditionally this technique has involved taking a series of overlapping stills images (tiles) and hand crafting these together to form a large mosaiced image. This technique is employed to produce high-resolution large images or in situations where visibility limits the size of the individual image footprint. This process however is time consuming both in terms of the necessity for accurate repositioning of the camera system and in the hand crafting of individual images to correct for optical distortion at the edges to allow accurate mosaicing. An example of this approach used to show the plate separation on the port side at the bow of the SMS *Brummer* is shown in Plate 8.



**Plate 8.** Simple hand crafted mosaic of the plate separation of the plates on the port side near the bow of the SMS *Brummer*. The image is composed of two stills images corrected for optical distortion at the edges of each frame.

A more recent approach has been to use digital video for this purpose. Video mosaicing is a rapidly growing area of research and development in many areas of marine survey and advanced research

into the applicability of such techniques to historic shipwreck management have been incorporated into the ScapaMAP programme.

Video consists of 25 stills images per second, by sub-sampling the video sequence a similar approach to stills mosaicing can be applied. Although in its infancy, this technique has several advantages over the use of stills images. In particular the use of video obviates the need for repositioning of the stills camera prior to each shot and the use of digital images allows for computer automation of the mosaicing process.

Again poor underwater visibility hindered attempts to obtain suitable video for the easy production of mosaiced images of large sections of the survey sites. Restricted field of view reduces the footprint on a single swathe thereby increasing the number of swathes required to cover a given area. This increases the error in mosaicing individual swathe lanes together and reducing the value of the mosaic as a accurate scale visual representation of the area. However, despite this some useful video was obtained for inclusion in the archive and useful mosaics produced. Currently, the mosaic software is being redesigned by colleagues at the University of New Hampshire to accommodate and correct some of these problems. A mosaic of the area of deterioration running along a 15 metres section of the port edge of the SMS *Koln* from the bridge to near the bow is shown in Plate 9.

Video footage was shot during the preliminary site investigations and detailed site surveys. This has been included in the project archive.

Figure 30.

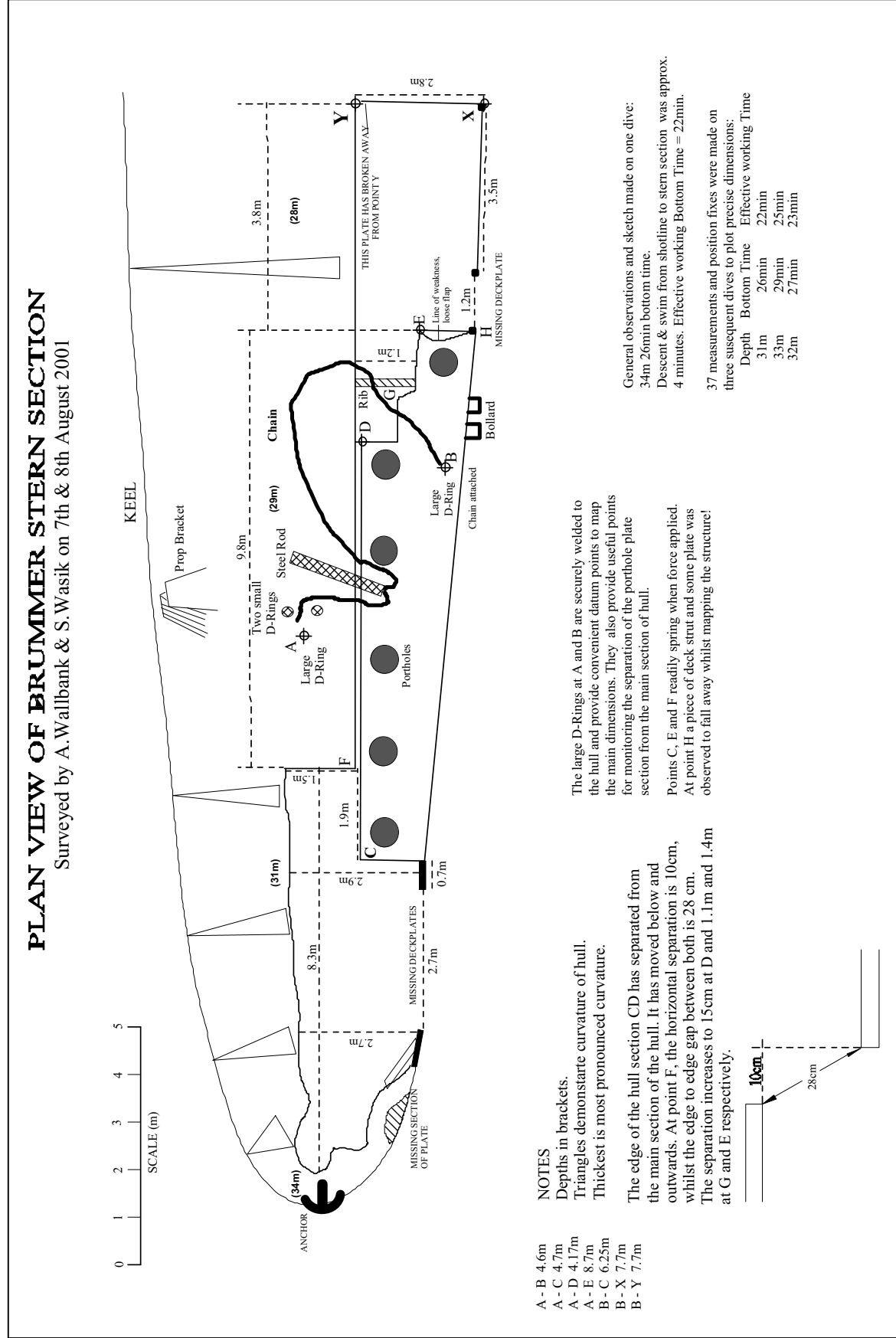
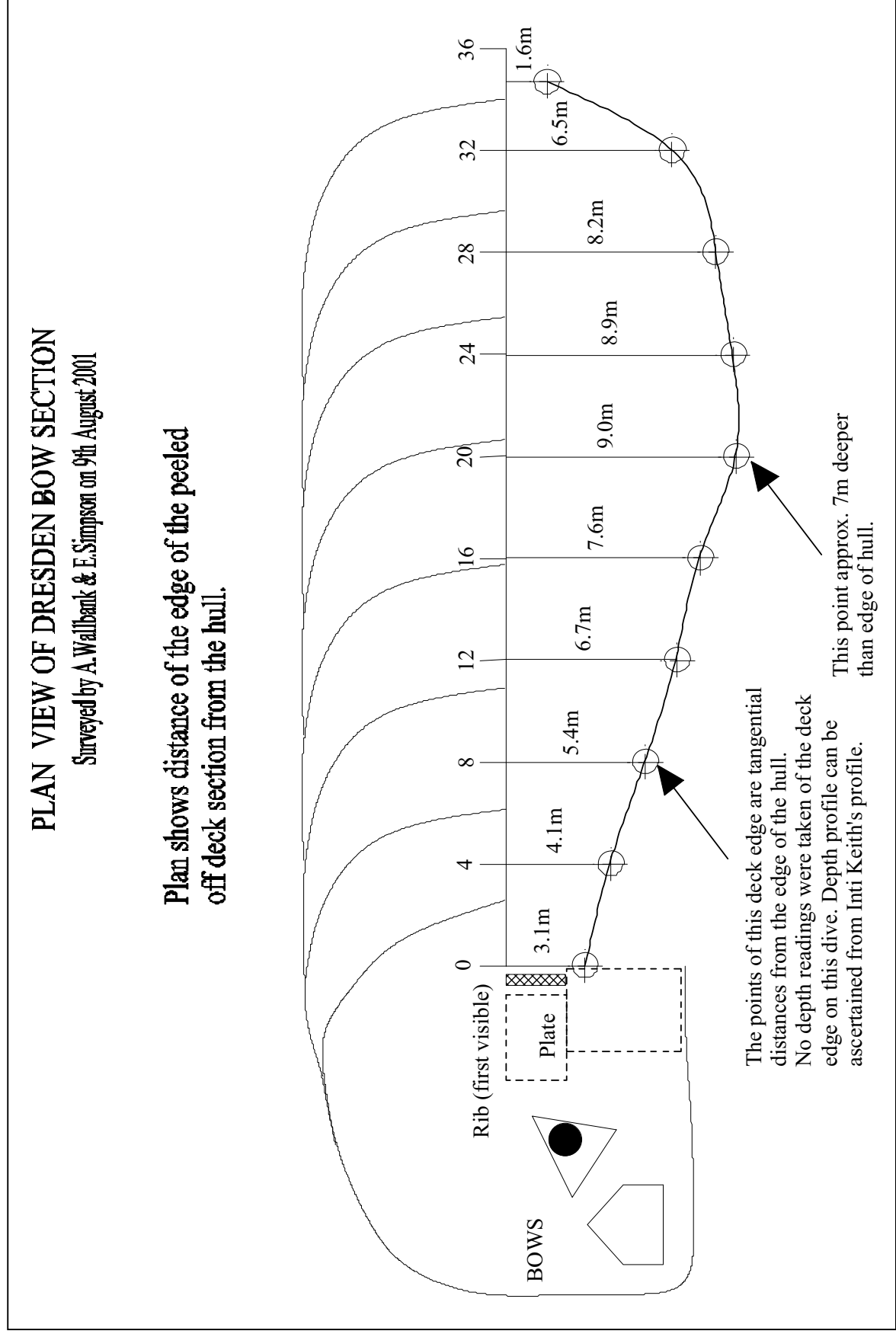
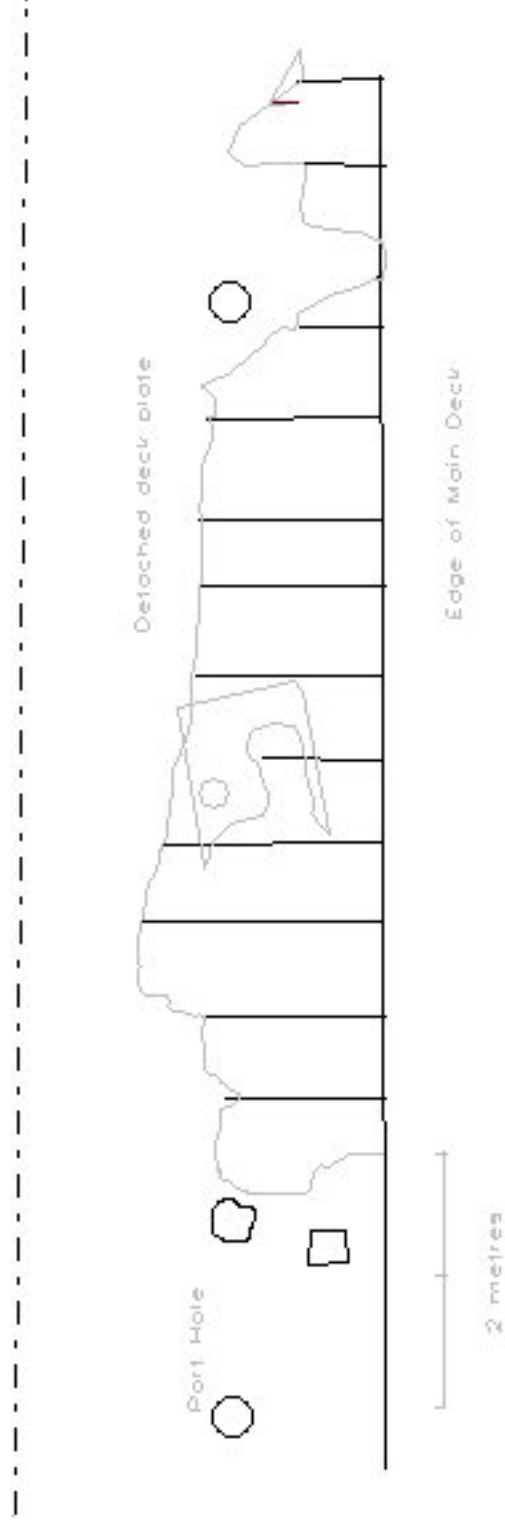
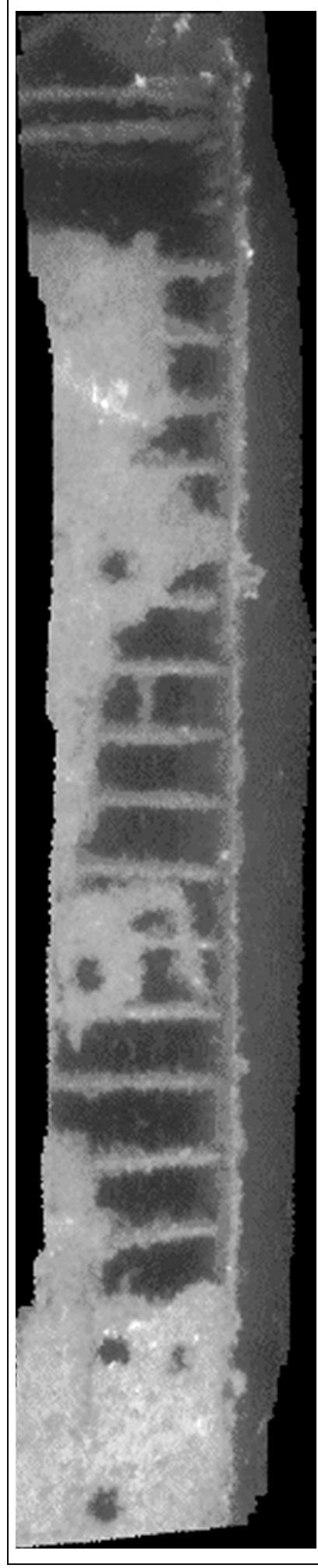


Figure 31.





**Figure 32.** Scale drawing of the section along the port side of the SMS *Koln* between the bridge and the bow.



**Plate 9.** Mosaiced image constructed from miniDV video shot of the area between the bridge and the bow on the SMS *Koln*. Image shows the deterioration of the plates along the port side where it joins to the deck.

## Survey Findings

Scaled drawings of the areas investigated are given in figures 30 - 32. Results of the observations made on each of the vessels surveyed are given below.

### SMS *Koln*

The SMS *Koln* is the most intact of the three light cruisers with the only major area of structural deterioration around the engine room area (Fig. 21 - 23). There are however areas, particularly at the bow section, showing active signs of deterioration. Significant corrosion of the port side hull plates has occurred, and an area from just forward of the bridge and extending forward to the area where the forward gun turret was located has now opened up. This area can be seen in figure 23 (GeoZui3D image) and in plate 9 (video mosaic). A smaller area of plate deterioration was also noted near the bow.

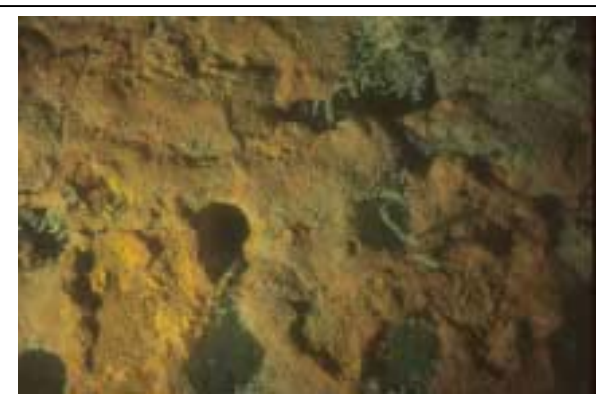
Examination of the hull structure itself revealed areas where hull plates were beginning to separate indicating that the hull was under stress.



**Plate 10.** Encrusting marine life on the hull plates of the vessel primarily consisting of barnacles.



**Plate 11.** Horizontal surfaces are generally covered in fine sediment and are populated with detritus feeding invertebrate species.



**Plate 12.** Close up of edge of plate showing where plate separation has occurred causing the rivets to be pulled through and corrosion to start.



**Plate 13.** Plate with encrusting marine life removed showing advanced state of corrosion.

Much of the surface of the wreck is covered with encrusting marine life such as barnacles, hydroids and tunicates. Horizontal surfaces are generally covered in a layer of fine sediment with associated detritus feeders. Dense populations of brittle stars are found in some areas where a slight current sweeps over the upper surface of the wreck.

### **SMS *Brummer***

The SMS *Brummer* shows the greatest signs of deterioration of the sites surveyed, the bow section being in an advanced state of collapse. Sections of the starboard side at the bow have fallen to the seabed leaving the port side unsupported. This has resulted in the port side of the hull beginning to collapse due to lack of support. The hull plates in this area have separated and are hanging suspended and unable to take any load. Separation is greatest at the bow and runs for approximately 5 metres towards the stern. The starboard side plates have now collapsed to the seabed and the foremost part of the deck has separated from the hull and now lies resting on the seabed at an angle. This area can clearly be seen in plates 8 and 14. In figure 28 (GeoZui3D image) this area appears as a concave impression in the hull. It is expected that the remains of this section will probably fall to the sea floor in the near future.

The area immediately aft of this also shows extensive corrosion and has collapsed into the hull itself. This covers an area approximately 17 meters long and extends down three decks. Again this area is clearly visible in figure 28. The inserted red lines running parallel to the main deck indicate the exposed edges of the underlying decks.



**Plate 14.** Bow of SMS *Brummer* taken from the keel looking through the collapsed starboard side to the underside of the foredeck that has also partly collapsed. The separation of the port hull plates can clearly be seen in the top centre of the picture.

The stern section is reported to have collapsed about 4 years ago. While carrying out diving operations in this area it was noted that a small section of rib with hull plate had detached from the main hull and fallen to the seabed.

### **SMS *Dresden***

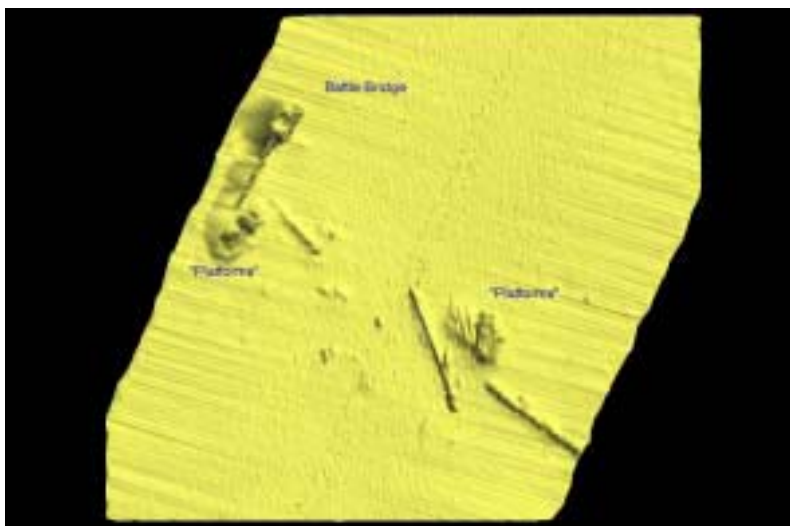
The SMS *Dresden* has shown considerable deterioration in the last 4-5 years. Presently the upper deck has “peeled” away from the starboard hull from near the bow back to near the bridge. Consequently, the upper deck now lies at an angle and is most likely held in place by the capstan shaft, which pass through the upper and underlying decks. This can be clearly seen in figures 26 & 29. As with the other wrecks the exposed surfaces are generally fouled with encrusting marine growth. There were however areas along the edges of deck plates where the underlying metal was exposed. This indicates that the plates had undergone recent flexing resulting in the removal of the encrusting marine growth.

Each season a mooring is secured to the shaft by *Roving Eye* in order to deploy an ROV from their vessel. Roving Eye operate tours for non-divers who wish to see the German wrecks. One tour a day is undertaken, weather permitting, throughout the tourist season (April – October). Passengers can then observe the video received from the ROV as it is piloted around the wreck. No abrasion was noted around the shaft, although there is a likelihood that the radius of rotation of the mooring could cause the chain to come in contact with the wreck structure.

The dives carried out on the SMS *Dresden* concentrated on the bow section in order to establish the present degree of deterioration of the hull structure in this location. Distances were measured between the ribs on the under sided of the deck and the corresponding rib on the starboard hull. Figure 31 shows the degree of separation of the deck from the hull along its length.

## Salvage Sites

The salvage sites of the SMS *Kaiser* and SMS *Kaiserin*, which had produced targets during the SeaBat remote sensing survey were also dived. Debris consisting of masts, spotlight platforms and the battle bridge were found at the site of the SMS *Kaiser* and masts and the spotting tower were found at the site of the SMS *Kaiserin* (Plate 15).



**Figure 33.** GeoZui3D image of the salvage site of the SMS *Kaiserin*. Debris consists of masts, spotlight platforms and the battle bridge.



**Plate 15.** Spotting tower at the site of the SMS *Kaiser*.

## 5 DISCUSSION

The subject of applied historic shipwreck resource management is not well researched or published and the available literature is often patchy, incomplete or difficult to obtain. Nevertheless, historic shipwreck management is topical throughout many areas of the world (for Ireland see Breen & Forsythe 2001, and for Scotland Oxley 2001) and a variety of initiatives have been implemented to reconcile the conflicting interests in such sites (AIMA & ACDO 1994). Widespread discussions are also currently underway regarding the protection of shipwreck resources in international waters, promoting a consistent approach across political and environmental boundaries (Strong 1999). Perhaps this foresees a time when we might have a consistent and integrated approach to historic shipwrecks across environmental, administrative and jurisdictional boundaries. Nevertheless, it is clear that management approaches based on a high level of marine environmental knowledge are preferred in many countries, and that formal policy and proposal documents (often called "management" or "conservation" plans) based on comprehensive desk-based and field assessments are relatively common (e.g. Lenihan 1989 and *Monitor* National Marine Sanctuary 1997).

On the whole mitigation strategies to deal with observed impacts have often been implemented as short-term, stopgap measures (Oxley 1998). Secondly, the variety of factors involved in deterioration processes, as well as the complexity of their relationships, are not widely understood or accepted (Gregory 1999). The recommended conditions for protecting one type of archaeological material or context will not necessarily be conducive to preserving another and the real effects of even simple stabilisation strategies (such as sand-bagging) are not yet fully understood. It is highly likely that management strategies that do not fully take into account the actual factors governing the causes of change to a site will inevitably fail.

Management cannot be seen as being synonymous with preservation and it cannot eliminate change completely but only promote procedures that might reduce the detrimental effects resulting from recognised impacts. Deterioration cannot be completely avoided either and therefore *absolute* preservation *in situ* is not achievable. All sites are dynamic, continuing to form in the sense that degradation processes keep on altering the material remains albeit at slow, often imperceptible, rates. On the positive side effective management can facilitate wider appreciation and access to the submerged sites and the information potential that they contain (Cuthill, 1998; Kaoru & Hoagland 1994). This process serves to maximise the benefits to be gained (by the public at large and future generations) through appropriate activities based on education, research or recreation.

The management of historic shipwreck resources can be seen as an ongoing, pro-active necessity backed up with quantified environmental information (i.e. data collected to a standard and using techniques acceptable to the wider disciplines of marine science). The process should also be viewed within a wider spectrum of environmental awareness, incorporating concepts such as sustainable development and the precautionary principle, and mechanisms such as Integrated Coastal Zone Management (Commission on the European Communities 2000).

### 5.1 Resource Management and the Management Scheme

In order to understand the management of historic shipwreck sites within their environmental context it is useful at this point to review the key factors driving resource management such as:

- Good data is essential for good decision making,
- Identify users and stakeholders, and involve them,
- Understand the environment,
- Carry out comprehensive baseline surveys,

- Understand site formation and processes of change,
- Monitor periodically and effectively,
- Respond to change,
- Neutralise or diminish negative influences and build on positive ones,
- Increase appropriate involvement and promote non-intrusive access.

To achieve these aims a Management Scheme is a mechanism for gathering, interpreting and sharing data and turning it into information that is then used to provide robust and stable management advice to support justified and sustainable management decisions. These, in turn, contribute to maintaining and/or restoring conditions on the site conducive to the long-term aims of the Management Scheme, guided by the overriding aim of non-net loss of any part of the archaeological resource.

The following principles are derived from best practice in the management of marine protected areas (see SNH *et al* 1997) and they provide a useful framework for the development of an historic shipwreck Management Scheme:

1. *The voluntary principle should be adopted as far as possible* - set within the statutory requirements of any relevant legislation, management measures should be reached by *mutual agreement* among relevant authorities and with the consent and approval of interested groups and local people.
2. *A balance of management styles should be sought* - to co-ordinate legislative styles with the involvement of the local community, to achieve protection and conservation through local co-operation.
3. *From the outset, the Conservation Objectives and management measures for the site and its significant archaeological features should be clear and widely promoted* - this information should be widely disseminated to avoid misinterpretations and incorrect assumptions that could potentially create otherwise avoidable problems.
4. *The creation of an appropriate Management Scheme that can manage human activities in a structured and sensitive way* - where damage is being caused there may be a requirement for some limitation of specific human activities.
5. *Management of the archaeological resource should be based on long term resource protection and sustainable use* - a long term view (i.e. 25 year planning period) shifts the focus of discussion from current conflicts towards the sustainable, long term aspirations of individuals or organisations.
6. *Enlisting support throughout the implementation of an appropriate Management Scheme* - promotion of local support through mechanisms such as the wide dissemination of literature and public presentations.
7. *An understanding that management is a dynamic process and that management measures need to be regularly assessed, revised and adapted where necessary* - management must be flexible - through the mechanism of an appointed Management Group new measures may be introduced and inappropriate measures removed or adapted. As far as is reasonably practicable all stages of the scheme and its processes must be testable.

The rise in popularity of recreational pursuits (eg SCUBA diving) can impact archaeological resources whether in the form of accidental damage, the inconsiderate collection of 'souvenirs' or deliberate acts of vandalism. In the UK this has led to increasing concern over interference to those military sites which involved the loss of life on the so-called "war graves". However, in response to calls for prohibitive restrictions on access to some of these sites the three main diver training organizations;

British Sub-Aqua Club (BSAC), Sub Aqua Association (SAA) and the Professional Association of Diving Instructors (PADI), in collaboration with a range of other interested parties (e.g. Receiver of Wreck, MoD, Joint Nautical Archaeology Policy Committee), have produced a voluntary code of practice for recreational divers. Called *Respect Our Wrecks* the campaign aims to encourage non-intrusive recreation, better reporting of new finds and safer diving (JNAPC 2000b).

## **Management Stages**

The development of effective site management can be broken down into stages such as preliminary assessment, proposing the Management Scheme, establishing a monitoring programme and, finally, implementing the Management Scheme. The whole process is one of evaluation, review and determination of management needs on a site that should be undertaken by the relevant responsible authorities. The Scheme may involve the production of a document (management plan), implementing a long term management system, set archaeological conservation objectives, concentrate on measuring and tracking impacts, or designing a programme to plan specific interventions.

The next stage in the Management Scheme development process would be the synthesis of the assessment data to analyse the nature and effects of current use and activities to reach common understanding of those processes that may have a beneficial, neutral or harmful impact.

Within the Management Scheme there will be a requirement for the ability to adapt to:

- changes in patterns and intensity of human activities;
- the natural changes in marine resources, wildlife and natural features (e.g. the shape and structure of seabed topography);
- increases in knowledge of the site through monitoring and research;
- and, any development in the understanding of the significance for the archaeological resource of the aforementioned activities and processes.

## **Ministry of Defence consultation on military wrecks**

One issue, with direct relevance is the access to military wrecks in Orkney and elsewhere in the UK and the legislation that governs such sites. The Protection of Military Remains Act 1986 provides for the protection of the remains of military aircraft and vessels that have crashed, sunk or been stranded and this includes any associated human remains. Wreckage of ships have to be designated as a "protected place" or as a "controlled site" by the Secretary of State for Defence. Once designated it is an offence to tamper with, damage, move, remove, unearth or enter such remains. Divers are allowed to visit such sites provided that no damage results. However, there are many problems with the 1986 Act and its relation to archaeological and historical remains (Dromgoole 1996). In any event no sites have been designated and there has been recent widespread expression of concern about the behaviour of some recreational divers on some military wreck sites, particularly those which involved the loss of life, the so-called "war graves". In response to questions raised in the House of Lords in November 2000, the Parliamentary Under-Secretary for State, MoD, responded by noting the concerns, stating that the MoD is to undertake a review of its policy on military sites (HoL 2000).

## **Forming a Management Group**

It is considered that, although one relevant authority may normally take the lead in co-ordinating the development of the management scheme, other groups including users, industry and interested parties are involved in developing the scheme. To achieve this it may be necessary to form advisory groups and a process for regular consultation during the development and operation of the scheme.

This mechanism, if it can operate both from the top down and the bottom up, will help overcome conflicts caused by a multiplicity of overlapping and under-lapping interests. Similarly, because of the highly fluid and connected nature of the sea, which efficiently transmits substances and processes for long distances, a protected area will rarely succeed unless its management is embedded in an integrated ecosystem management regime.

The support of wider stakeholders in the decisions on the use of the site is also needed if effective management is to be sustained in the long term. Participation in the Management Scheme represents an opportunity to share interest, involvement and responsibility. Therefore information about the aspirations of local people should be used to generate a collective sense of stewardship, communication and the free exchange of information. Experience across the world in protected area management indicates that this support usually requires an involvement in the decision-making itself (Kelleher 1999).

This need was clearly identified at the start of the project and efforts were made to identify and make contact with all the principal users and stakeholders in the archaeological resources submerged in the Flow. Initial relationships with the dive boat operators and their representative body, the Orkney Dive Boat Operator Association (ODBOA), developed slowly but in a reasonably cordial manner. A good relationship has been established with various sectors of Orkney Islands Council such as the Heritage Officer, Steve Callaghan, and the Director of Harbours. Members of the ODBOA adhere to a Code of Practice on general diving procedures, this has been included as Appendix VI.

Following the establishment of the Orkney Hyperbaric Unit (OHU), the Orkney Diving Interest Group (ODIG) was established. Although, originally set up to deal with safety related matters, ODIG's remit now encompasses all matters relating to diving in Orkney waters. ODIG comprises of representatives from the Orkney Hyperbaric Unit, Orkney Health Board, Stromness Medical Practice, Northern Constabulary, ODBOA and the MCA. An observer from the Health and Safety Executive usually attends. Following the scheduling of the German wrecks Historic Scotland were invited to send a representative to the November 2001 meeting of the ODIG. Meetings are generally held three times a year.

Over the period of the project, three of the principal stakeholders met to discuss future heritage management issues in the Flow and in Orkney waters in general. The idea for a voluntary reserve for shipwrecks was discussed and was formally launched on the 19 March 2002. The leaflet produced to promote this initiative is included in Appendix VII. The ScapaMAP project provided them with published information and guidance for divers has recently been produced by the diver training organisations and the Joint Nautical Archaeology Committee.

The scheduling on the German wrecks was included on the agenda for discussion at the November 2001 meeting of the ODIG. Following the discussion it was agreed that the current practice of ODBOA members periodically dropping shot lines as marker buoys on the wrecks for divers could result in damage to the wreck structure. A subsequent meeting was organised with representatives from HS, OIC Harbours, ODBOA and OIC Heritage Officer, hosted by Heriot-Watt University to look at alternative practices. The possibility of using more permanent buoyage systems was explored. Subsequently, ODBOA approach HS for Scheduled Monument Consent to establish such a system that has now been granted.

In addition to the leaflets now produced on wreck conservation discussions within the group have resulted in a change to the wording on the OIC Harbours Dive Permit to reflect the status of the wrecks. Copies of the old and new permits are included in Appendix V.

## **5.2 ScapaMAP Project**

### **5.2.1 Historical Data Sources**

As mentioned previously existing data on the wreck sites and environmental parameters were sadly lacking. To some extent this has been addressed by the current project and production of the data archive. However, further work could be done in this area particularly concerning the oral testimony of people directly connected with many of the events. Recently several public talks have been given about the project to increase public awareness of the issues on wreck conservation and management. Several members of the audience had been present in the later stages of the salvage work of Cox and Danks and divers who were employed in the 1970s by Dougall Campbell. Much additional information could be gathered from these sources on the initial salvage attempts and on the processes of site formation from the later.

### **5.2.2 Field Work**

Anecdotal evidence suggests that considerable deterioration in the hull structures have taken place in recent years. A variety of remote sensing and conventional survey techniques were used during the course of the project to assess their effectiveness of detecting these changes.

#### **ROV SURVEY**

ROVs can be used to carry out visual site investigations of varying levels of data acquisition and are a cost effective alternative to the use of divers. One day's hire of a vessel and ROV cost £800 and provided about 6 hours of underwater video.

However, in order to provide information that can be used in monitoring the development of the site the vehicles position must be recorded. Relatively simple tracing can be achieved by the use of an acoustic transponder attached to the vehicle. Increasing the number of transponders in the acoustic array can increase accurate position fixing of the vehicle on the site. This process requires more set-up time and consequently reducing the amount of video that can be obtained. However, the quality of the data obtained as it is georeferenced out ways the reduced quantity obtained.

The quality of the video obtained is also dependant on the skills of the vehicle pilot.

#### **REMOTE SENSING**

Several remote sensing techniques were used during the project to assess their effectiveness in site investigation. The main drawback which has prevented the widespread use of such systems in marine archaeology is the cost of hire / purchase of the equipment. A common feature of all the systems used is the ability to map large areas in relatively short periods. Consequently, on a project such as ScapaMAP, where a large area is involved and located in relatively deep water, these techniques provide an important primary tool for site investigation.

#### **Side Scan Sonar**

Difficulties were encountered with both of the side scan systems used, particularly in interfacing the navigational data. Even though relatively high resolution images can be obtained they are effectively useless without accurate geo-referencing. In light of the experiences gained during the surveys these problems could be easily avoided in future surveys. Despite problems in the current work sufficient

navigational data correction was achieved to allow valuable information was obtained on the nature of the seabed and site positions.

The area of side scan sonar development is progressing rapidly with higher resolution and stereo systems currently under research and development which will allow even greater clarity of imaging in near future.

### **Multi-Beam Swathe Bathymetry**

Due to the nature of sites investigated, large shipwrecks standing proud on a relatively flat uniform seabed the multibeam swathe bathymetry produced the most striking visual images. Coupled with the ability to view in 3D these proved the most valuable method of site survey in the current study. The usefulness of this method in producing striking visual images diminishes as relief becomes less pronounced, the site is less well defined in terms of structural integrity or is covered by sediment. Due to the high degree of accuracy of this system one important use of this technique, under such circumstances, could be the measurement of sediment transport at these sites.

### **Magnetometry**

It must however be borne in mind that various techniques provide a means of gathering different types of data and generally provide information relating to one particular aspect of the site under investigation. As a result, a more complete picture of the site can be obtained by using different methods to complement each other.

### **CONVENTIONAL IN-SITU DIVER SURVEY**

*In situ* diver surveys are the most accurate method of determining the true condition of the wreck structure. However as shown by the work of the Submerged Cultural Resources Unit (SCRU) on the USS *Arizona* production of accurate plans of the site is labour intensive and time consuming with projects spanning several years.

It should also be borne in mind that the USS *Arizona* is in considerably shallower water and therefore presents fewer logistical problems than the wrecks in Scapa Flow. The work on the USS *Arizona* was conducted using air diving techniques. The use of mixed gas diving, such as Enriched Air Nitrox, is become commonplace in scientific diving operations. The depths encountered on the wrecks in Scapa Flow are ideal for the use of such methods. The additional bottom time afforded using these gases, without increasing the risk of decompression illness to the diver whilst increasing the working efficiency, makes such survey work considerably more practical compared to only a few years ago.

The detailed surveys carried out during the present study were carried out by divers relatively unfamiliar with the sites and over two short survey periods. The information gathered, has yielded valuable baseline information for future work at these sites.

### **VIDEO MOSAICING**

As shown in Plate 9 large images can be generated in relatively poor conditions of underwater visibility. Relatively large areas can be surveyed during short dive times to produce the visual images. Provided suitable datums have been established this rapidly developing technique provides a useful tool for rapid visual mapping of structures. Therefore, repeating this process periodically would provide a means of rapid assessment of site changes.

Currently the main disadvantage of this method is, as the visibility is reduced the process is less able to cope with sites where there are sudden large vertical changes in site relief.

### **5.3 Education & Increasing Public Awareness**

An analogy to the problems currently facing marine archaeology parallels that of marine conservation in the late 1970's and 1980's. During that period there were fewer qualified marine scientists available to deal with the questions being raised. Consequently, a number of marine conservation bodies were established and utilised enthusiastic recreational divers with an interest in marine conservation to carry out the fieldwork. Although the use of volunteers greatly increases the volume of data that is collected great care must be exercised in interpretation of this for a number of reasons:

- the accuracy with which data is collected can be variable due to operator skills and lack of commitment when carrying out routine tasks
- the use of numerous observers may possibly affect the reproducibility of data collection

Consequently, the majority of survey work carried out by volunteers tends to be limited in its scientific scope. Where more detailed information is required trained volunteers are used and the data must be scrutinised by experienced scientific personnel. However, the most significant role played by volunteers has been in creating a much greater public awareness in the need for marine conservation.

In the field of marine conservation volunteers are extensively used in carrying out field survey work.

A number of strategies will be required to cater for the interests of a wide range of interests involved in the German wrecks of Scapa Flow, either actual visitors to the sites or those appreciating them from a distance. ScapaMAP has co-operating as far as possible with these initiatives.

#### **Nautical Archaeology Society Training Programme**

Opportunities for laying the groundwork for increasing the frequency of NAS courses run in Orkney have been discussed with Phil Robertson (NAS Training Co-ordinator for Scotland). In addition, there are possibilities of developing structures with dive boat operators and the local archaeological community (Orkney Archaeology Trust and Orkney College). In the latter case using the foreshore and inter-tidal aspects of the NAS curriculum. These initiatives may help to broaden awareness - raising opportunities and encourage temporary visiting divers to Orkney to improve their behaviour and enhance their experience during their stay. Secondly, attention could be paid to the expansion of archaeology issues from the traditional land-based perspective to include submerged heritage.

An attempt was made in 2001 to run an NAS Part 2 course in Orkney for recreational divers already holding NAS Part I certification. However, the cost of hiring a dive boat for the week increased the cost of the course to the point where it became prohibitive. An alternative future approach may be to market NAS courses directly through ODBOA members.

#### **Historic Military Shipwreck Assessment in Orkney**

As previously mentioned there has been considerable controversy following the publicised activities of recreational divers on military wrecks thought of as "*War Graves*" (Western Daily Press, 2000). Following discussions with Marion McQuade of the Ministry of Defence a proposal was submitted to conduct the NAS Part 2 course on the site of the HMS *Vanguard*. This was seen as an opportunity to

test the effectiveness of supervised diving visits to another sensitive site in the Flow. The broad objectives were :

- to gain some reliable information about the condition of the site (to form the basis for future repeat monitoring), and as a control to the German wreck sites,
- to raise awareness of historic shipwreck issues,
- to promote more acceptable visitor diver behaviour,
- and to try out a method of controlled access to another type of "protected" site, i.e. a "war grave".

Due to the sensitive nature of this site strict guidance protocols were developed and approval was gained from the Ministry of Defence. The Orkney Islands Council Director of Harbours, whose interest focuses on the implications of diving in the area of the wreck for the safety of commercial vessel traffic, has given outline agreement to this initiative.

Although to date this has not taken place it is hope that this can be organised in the near future.

### **Opportunities for Increasing Access to Non-Divers**

Keith Bichan's initiative of providing an ROV - based tourist opportunity in Scapa Flow (Plate 6 - 7) could be extended to visit more of the German wrecks. In addition, further initiatives have been discussed with Steve Callaghan and Tom Muir for regenerating the text and displays in Lyness Museum to incorporate a more heritage-friendly and conservation oriented message. They are also keen to investigate the possibilities of adapting GIS products relating to the sites into facilities such as computer and video kiosks.

3D and animated visualisation is regarded as a useful tool for presenting images of the seabed to the lay public and those who do not dive. There is considerable scope for developing such applications for use in museums and exhibitions. Data sets from the swathe bathymetry in 2001 have been rendered for use with GeoZui3D to demonstrate the potential of this approach. Further work however would be required to develop this to the stage where it could be used for display purposes. An alternative approach is to present this information in "poster" form, an example of which is given in Appendix IX.

During August – October 2001 the value of such a guide received limited qualitative evaluation by visiting recreational divers. Divers were asked to plan and conduct their initial dives using existing information. Following the dive the divers were asked to describe the overall layout of the structure they had seen and relate this to the information obtained pre-dive. There was general agreement that the current artist's impressions of the wrecks were inaccurate in many respects. They were then shown the GeoZui3D image of the wreck they had just dived which in some cases gave the divers a greater appreciation of the structure of the wreck. On subsequent dives the divers planned their dives using the GeoZui3D images and the general opinion was that this added significantly to their understanding of the wreck structure and the enjoyment of the dive. A significant number of divers admitted to downloading the images of the wrecks from the ScapaMAP website (<http://www.ccom.unh.edu/scapamap>) and laminating these to be used as guides on their dive. The information given on the website is given in Appendix X

The quality of data obtained from the RESON remote sensing survey far exceeded the expectations of the survey team. Coupled with the 3D visualisation software developed by C-COM there is the potential to refine this data set into a multi-media CD-ROM package to be used as an educational tool and dive guide to visiting divers.

## **ScapaMAP Information System Development**

Marine information systems based on the principles of GIS are frequently used in coastal zone management and marine science applications (Wright & Bartett 1999). Such applications are also widely used in terrestrial archaeological CRM, and extending these initiatives to shipwreck management would seem to have many advantages given the rapid advances in hydrographic surveying and methods of integrating and querying datasets (Wright *et al* 1997). In relation to Scotland's shipwreck heritage the current project hopes to build on overseas initiatives on aspects of shipwreck management such as site assessment (Murphy 1998), intra-site (Mather & Watts 1998) and area (Green *et al* 1998) management. Site delineation and boundary definition for archaeological sites are also likely to become of increasing importance, particularly in international waters (Palmer and Pruett 1999).

### **ScapaMAP Database**

A draft database system has been constructed for ScapaMAP based on fields and tables developed specifically for maritime archaeological management purposes (Figure 34). The latter were used by Connect Archaeology to set up a database structure and data entry system (Figure 35 - 36). Several tables are available for a wide range of archaeological and environmental information to be stored and manipulated (Figures 37 – 39.). The populating of these fields with data from Year 1 is underway.

### **ScapaMAP GIS**

GIS initiatives have indicated many benefits for historic shipwreck management. Such applications allow:

- archaeological, environmental and historical data sources to be readily integrated
- rapid computer analysis facilitates the interpretation of complex variables
- examination of relationships that would otherwise be difficult i.e. historic charts and modern imagery
- site interpretations can be generated for lay audiences.

In addition, the strengths of carrying out GIS-based maritime archaeological field surveys, have been demonstrated in that survey areas containing no cultural material, although permanently recorded, can be eliminated from further consideration, new data provides immediate feedback for field investigations, daily decision making can be made on such cumulative up-to-date data, gaps in data collection become quickly obvious and fieldwork can be re-programmed in a timely fashion.

The requirement during Year 1 was to assemble datasets for ArcView projects from existing geophysical survey data to demonstrate the utility of GIS for managing and presenting spatial data relating to historic shipwrecks. A major obstacle has been the various ways in which marine survey data is collected and the characteristics of the accompanying navigational data. Examples of the differences in position fixing the German wrecks can be seen in the Excel spreadsheet illustrated as Figure 20. Compatibility is critical to geo-referencing the data and consequently should all be in the same co-ordinate system measured to the same geographical datum. However because the availability of suitable instrumentation and compatible positioning equipment has been constrained by cost this has not always been the case.

**Figure 36:** Tables and fields for a proposed maritime archaeological management database.

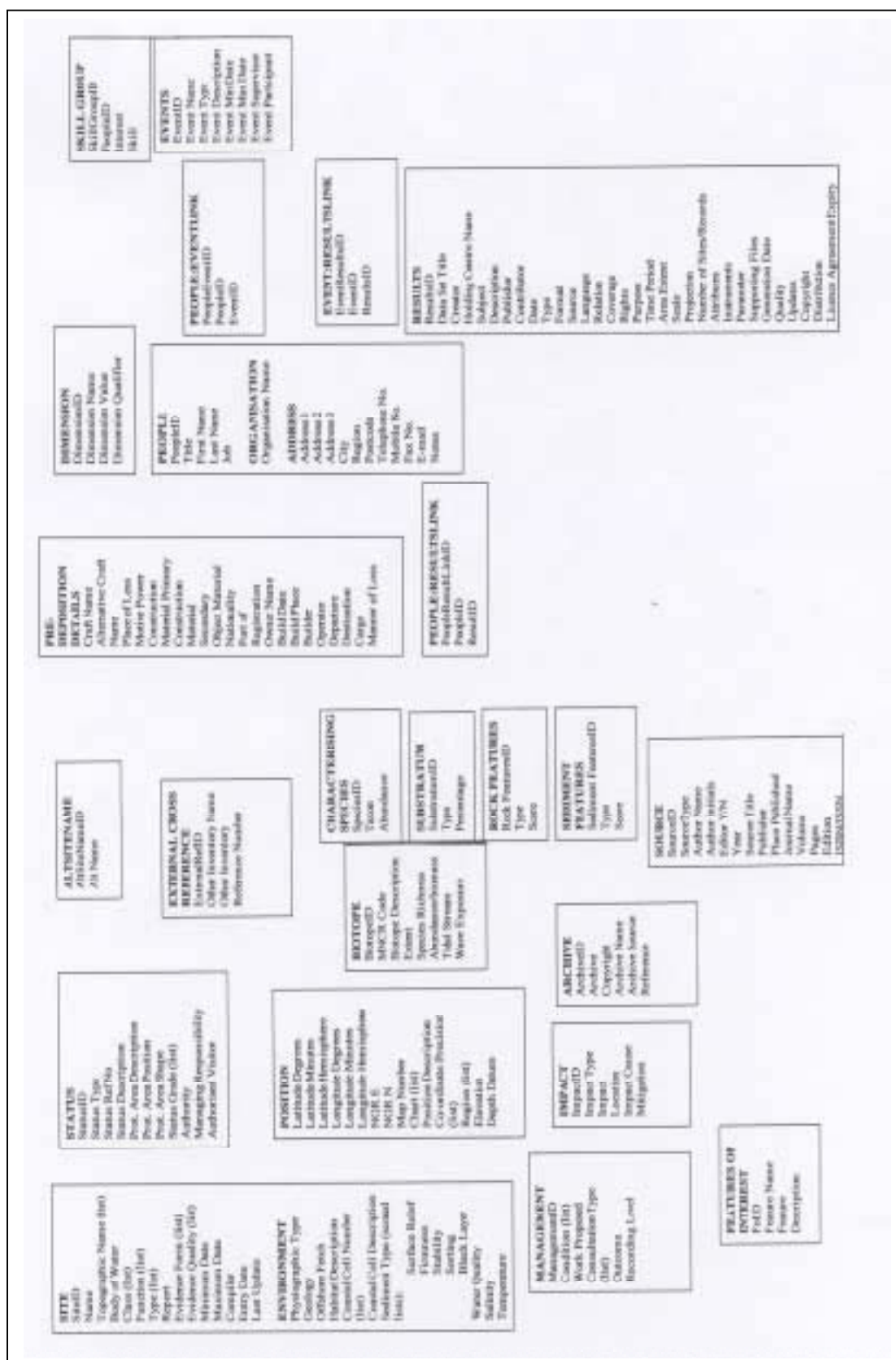




Figure 35: ScapaMAP database opening menu.

Historic Ships - [vessel data entry : Form]

Go to: [ ] New Record Close

Vessel Attributes History Location Archive Bibliography Events Impacts Status Management Co-ordinates Biographies

[ ] SMS KRONPRINZ WILHELM

Topographic Name: Sound of Caves Function: Capital Warship

Body of Water: Scapa Flow Type: Battleship

Evidence Form: Coherent Vessel Structure

Alternative Names:

From	to	Name
1912	1918	SMS KRONPRINZ

Records: 14 of 1

Date recorded: 13-Jan-01

Date updated: 13-Feb-01

Other System UIDx:

UID Type/Authority	UID
NMRS Number	HY305W 8008

Record: 2 of 19

Form View

Figure 36: ScapaMAP database vessel data entry form.

Historic Ships - [vessel data entry : Form]

File Edit View Insert Format Records Tools Window Help

Go to: [ ] New Record Close

ID Vessel Attributes History Location Archive Bibliography Events Impacts Status Management Co-Ordinates Biographies

**Last Voyage Details:**

Nationality: [German] Owner: [German Government] Check spelling

Port of Registry: [ ] Operator: [ ]

Departure: [ ] Cargo: [ ]

Destination: [ ] Manner of Loss: [Scuttled]

**Report Text:**

5-6 March 1916 sortie into the Hooften  
 25 April 1916 long-range escort duties for battle cruiser action against Lowestoft-Yarmouth  
 31 May 1916 Battle of Jutland (remained undamaged)  
 19 Aug 1916 action against the east coast of Britain  
 19 Oct 1916 action against Dogger Bank  
 5 Nov 1916 sortie as far as Danish west coast, on that occasion struck by torpedo from British submarine J1 near Utters  
 From 6 Dec 1916 again ready for active service  
 5 March 1917 in collision with sister ship OROSCIER KURFURST in Heligoland Bight, under repair until 14 May 1917  
 11 - 19 Oct 1917 in action near the Baltic Island  
 23 April 1918 sortie into the northern North Sea  
 26 Nov 1918 interned at Scapa Flow  
 HMS O. Scottish seamen caused the ship to explode the next

Record: 14 2 of 19

Form View

Figure 37: ScapaMAP database History entry form.

Historic Ships - [vessel data entry : Form]

File Edit View Insert Format Records Tools Window Help

Go to: [ ] New Record Close

ID Vessel Attributes History Location Archive Bibliography Events Impacts Status Management Co-Ordinates Biographies

Type: [ ] Nothings: [332958.408] Eastings/W: [1001292.38] Datum: [OSGB 36]

Site: [ ] Co-Ordinate Qualifier: [ ] Co-Ordinate System: [Ordnance Survey Digital]

Use for plotting? ☒ Transformed by: [ ] Authority: [Historic Scotland]

Notes: [Historic Scotland proposed Scheduling position]

Type: [ ] Nothings: [58.8337] N Eastings/W: [115975667] W Datum: [ ]

Site: [ ] Co-Ordinate Qualifier: [ ] Co-Ordinate System: [Lat/Long Decimal Degrees]

Use for plotting? ☐ Transformed by: [Gridquest] Authority: [ ]

Notes: [Transformed from Historic Scotland Scheduling position (NGR) to lat/long]

Record: 14 2 of 2

Record: 14 2 of 19

Form View

Figure 38: ScapaMAP database Co-ordinates entry form.

Historic Ships

File Edit View Insert Format Records Tools Window Help

vessel data entry : Form

Goto: [ ] New Record Close

ID Vessel Attributes History Location Archive Bibliography Events Impacts Status Management Co-Ordinates Biotopes

Biotope ID: 1578 MINOR Code: [ ]

Biotope Description: [ ] Extent: [ ] Tidal Stream: [ ]

Species Richness: [ ] Wave Exposure: [ ]

Abundance: [ ]

**Sediment Features:** Type: [ ] Score: [ ]

Record: 14 of 1

**Rock Features:** Type: [ ]

Record: 14 of 1

**Species:** Taxon: [ ] Abundance: [ ]

Record: 14 of 1

**Substratum:** Type: [ ]

Record: 14 of 1

Record: 14 of 19

Form View NUM

Figure 39: ScapaMAP database Biotope entry form.

## **6 Recommendations**

### **Management Strategy**

1. There is a clear need for a coherent policy for historic wreck protection and management within the UK. Although this can be achieved at a local level through groups such as the ODIG this should also be approached at the national level. Historic Scotland should start a dialogue with English Heritage, the Ministry of Defence and other appropriate organisations in order to develop such a policy. Consideration should also be given to including recreational diving federations in these discussions.
2. Consideration should be given to actively raising the awareness and expertise of Historic Scotland staff at all levels (and in particular Inspectors of Ancient Monuments and Monument Wardens). This could be included in existing staff development courses.
3. ScapaMAP and other initiatives suggest there has been accelerated deterioration of all the Scapa Flow wrecks over the last 4 years. There is therefore scope for further geophysical survey to provide very high-resolution bathymetry and co-registered backscatter to provide enhanced base maps of the wrecks and their environment. There is also a need to develop a monitoring strategy to address continued site formation processes and visitor safety issues.

The strategy could therefore take the form of:

- Large area high resolution remote sensing survey at intervals of 5 years
- Annual ROV / diver inspections at the start of the diving season or when the need arises
- Conventional NDT techniques such as corrosion potentials should be included in routine monitoring of the sites.

### **Education**

4. Consideration should be given to expanding the archive information based on oral testimonies.
5. It is envisaged that a CD-ROM containing archive video of the scuttling, ScapaMAP project overview and the GeoZui3D software and data files would be an asset both as a dive guide and educational tool in the conservation and

management of the Scheduled sites. The development and funding for the production of this should be investigated. Revenue generated could be used for future survey and educational initiatives.

6. A formal, local pilot scheme should be established to promote NAS courses to increase diver awareness for wreck conservation and assist in the collection of data on site formation processes.

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# Appendix I

National Monuments Record of  
Scotland (NMRS)

record for the

*SMS Markgraf*

## National Monuments Record of Scotland record for the SMS *Markgraf*

Markgraf: Scapa Flow

Type of Site: Maritime/ Warship; Capital Warship; Battleship/ Battleship  
NMRS Number: HY30SW 8007

### Location

Map reference: HY 328 010

Parish: Maritime - Orkney

Council: Orkney Islands

### Archaeology Notes

HY30SW 8007 3285 0105

N 58 53.5167 W 3 9.9167

Formerly HY30SW 8851

Horizontal Datum = OGB

General water depth = 45

Orientation of keel/wreck = 080260

### Circumstances of Loss Details

The German cruiser MARKGRAF was scuttled in Scapa Flow.

### Surveying Details

1919. A dangerous wreck, with the least depth of 20.1 metres, is reported at 58 53 31N, 003 09 55W.

8 April 1936. The wreck has been sold to Metal Industries Ltd.

15 June 1976. Salvage operations have commenced at 58 53 31N, 003 09 50W approximately. Report by Orkney Islands Council, Notice to Mariners 3/76 and Temporary Notice to Mariner's 1218/76.

8 November 1977. Salvage operations continue.

Report by Orkney Island Council 24 October 1977.

20 August 1979. The wreck is to be salvaged by Undersea Associates Ltd.

Source; Lloyd's List, 15 August 1979.

31 January 1980. Salvage operations have been completed.

Report by Orkney Island Council, Notice to Mariners 1/80.

25 February 1980. The salvage company is in the hands of the receiver. A minimal quantity of material has been raised. It is assumed that no change has been made in the charted depth.

Report by Orkney Island Council, 11 February 1980.

20 October 1981. The salvage rights have been sold to Clark Diving Services.

9 September 1982. The vessel lies upside down in general depths of 45-50 metres. The bottom has been blasted open. Fix from compass bearings: Cava light 242 degrees [magnetic], Barrel of Butter 102 degrees [magnetic], Building (conspicuous) 007 degrees [magnetic].

Report by R Good, 13 August 1982.

Hydrographic Office, 1995.

MARKGRAF. The wreck lies in 43 metres of water and rises 18 metres from the seabed. She is upside down and the bottom has been blasted open. Bearings on surrounding objects, for use in locating her, are illustrated in the source.

Source; Butland and Siedlecki, BSAC Wreck Register, Scotland 1 1987.

# Appendix II

## Example of information found on the Wrecks of Scapa Flow on the World Wide Web

- |      |  |
|------|--|
| IIa  | Dolphin Scuba Services<br>'Garisle', Burray, Orkney, Scotland. KW17 2SS                  |
| IIb  | Scapa Flow Technical<br>John Thornton<br>Polrudden House<br>Peerie Sea Loan<br>Kirkwall. |
| IIc  | ODBOA URLs   |
| IIId | General Information on Scapa Flow Wrecks   |

## **IIa** Example of diver guide wreck condition information from Dolphin Scuba Service's website

Dolphin Scuba Services  
'Garisle', Burray, Orkney, Scotland. KW17 2SS  
[www.orkney.com/divescapa/](http://www.orkney.com/divescapa/)

### ***Kronprinz***

The *Kronprinz* lies upturned in about 36-38m of water with her starboard decks embedded in silt and her port side open, surface to wreck can be as little as 12-14m depending on tide. The 5.9-inch casemate guns are visible on the port side, as is the mast and spotting top lying flat on the seabed. Further aft along the wreck, beneath the overhanging decks is the 12 inch gun turret, moving along the side to the front you reach the port barrel, 35 feet from the turret is the muzzle, the end of the barrel jammed into the teak deck. Looking at the muzzle, on the divers left is the starboard armament (the only visible survivors, fired at the battle of Jutland!). At the stern, the rudders still stand intact, quite a sight!!

### ***Konig***

Today the ship lies almost completely upside down with her bows pointing approximately south east, gaps can still be found between her starboard decks and the seabed, but as the years pass the massive weight of her hull forces her superstructure deeper into the clay seabed. She lies in 35-38m of water, surface to hull 20-24m depending on tide, and is now the most damaged of the German wrecks lying in the Flow. Salvage by Nundy Metals has left her hull plates torn open and her insides blasted and torn out, armour has been removed as were hull plates, some parts of the ship are removed as far as the inner bulkhead, leaving ribs exposed. Diving this great ship can be somewhat confusing, much of her is blasted to a unrecognisable state and the sheer size means it is impossible to get 'the full picture' in just one or two dives!

### ***Markgraf***

Today her superstructure is sunk deep into the seabed, with her starboard side uppermost and open, however her weight continues to force her over. Surface to hull is around 24m and she lies in about 43-45m depending on the tide, she is without a doubt the most impressive of the battleships, again due to the sheer size of the ship it is impossible to see everything in a dozen dives or more, let alone one! The mast and spotting top lie out on the sea bed, long stripped of all instruments, under the over hanging deck, midships, the 12-inch gun turret can be found, half buried in the silt, the gun buried out of sight. Moving forward the gap between deck and seabed narrows until your left with a line of portholes, many open, form a line along the seabed, at the bow the you pass the anchor chain hawse, moving up, the forward torpedo tube, extensively salvaged. At the stern section the twin rudders still stand, the quarterdeck lies flat on the seabed, the curve of the stern is lined with portholes, and salvage work has left a huge hole in the port side. A brilliant dive!

### ***Dresden***

The wreck lies on her port side and is fairly intact. The most interesting parts of this wreck are the bridge, bow section and fairly intact stern. Shot lines are usually placed at the starboard forward wing gun and the bow. The bridge section and shelter deck are very impressive, the mast and armoured lookout runs out along the sea bed, steel rigging ropes drape across bent hand rails, the armoured bridge with narrow viewing slots lies below, with glass intact! Moving towards the bow you will notice the precarious way in which the deck now overhangs, its only a matter of time before it collapses, up to the bow her sleek lines still look impressive. Anchor chain drapes out from the starboard hawse and ends at a large anchor some 50m ahead, finning back along the starboard top edge of the wreck the gap between hull and deck 'yawns' open, the inner workings of the capstan reveals chain and the shot line to the surface, for divers with enough air a short swim aft soon brings you back to the forward wing gun and second shot line.

### ***Brummer***

The *Brummer* lies on her starboard side in a depth of around 36m, surface to hull is in the region of 20m, it is arguably the most impressive of the Light Cruisers. From the bow, finning aft the 5.9 inch gun looms up at you, passing along the barrel and over the protective shield, you reach the conning tower. The armoured command centre, with horizontal viewing slits. On top sits the gun control range finder. Beyond this lies the bridge and signal deck. The mid section is blasted out but the stern is intact, the officers accommodation and the 5.9inch guns are worthy of a mention.

### ***Karlsruhe***

The *Karlsruhe* lies on her starboard side in about 24-27m of water, this is the most broken of the light cruisers but is no less impressive a dive. From the shot line which is usually situated aft of the bridge, swim forward keeping the deck on your left, the armoured command bridge looms into view and is easily explored with a

torch through the open doorway and windows , access is restricted, very little remains inside. Next comes a pair of 5.9-inch guns, the starboard gun lies on the seabed, the port gun above it on a now sliding deck, moving forward, mooring bollards vanish into the sea bed along with anchor chain disappearing through the remains of the deck hawse pipes. Only the frame of the bow, where the flag staff once stood now remains, looking back the decks are clearly sliding away from the hull. Swimming along the hull, various plates have been removed, up over the port side you pass rows of port holes as you fin aft back to the shotline. Moving towards the stern of the vessel, salvage work appears to have caused the hull to twist over on itself, as you near the stern the area becomes intact again , a 5.9-inch gun lies under twisted plates, its barrel protruding. Beneath the quarter deck is the officers accommodation. You pass the 2nd gun , then round the stern to the rudder, the stern anchor lies on the seabed, as you fin forward back to the shot you spot familiar items in the debris, life boat davits, boiler fire gratings, wire, pipes and fuse boxes.

### ***Koln***

The *Koln* lies in 34-36m on her starboard side, surface to hull is around 20m, she is in very good condition with little salvage damage, and she probably shares the top spot with the *Brummer* as one of the best wrecks of the 'Fleet' to dive. The shot on the *Koln* is usually just forward of the aftermost gun, portholes and a doorway lead into what was once the officers accommodation, further aft the second gun is located before finning around the stern to the rudder. Moving forward past the two guns again, the midship section is heavily salvaged, a large section reduced to rubble, following the centre line the hull becomes intact again, your first sight is the 3.4-inch high elevation gun mounted before the main mast, the barrels horizontal point forward. Just forward of this gun the second shot line is usually tied to one of the life boat davits, once noted the diver proceeds to the command bridge and armoured conning tower, minus the sighting periscope. The guns from the foredeck are missing, a large hole allows access to what was once the crews quarters.

IIb

# Scapa Flow Diving and John's Charters

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[Return to top of page](#)

## Scapa Flow and its wrecks



Scapa Flow is a sheltered open lagoon, encircled by the Orkney islands. It contains some of the most interesting wrecks in the world. For years it was the main anchorage of the British Royal Navy, and has many relics left of British naval history. In June 1919, the interned German navy scuttled most of its High Seas Fleet to prevent them from falling into Allied hands. Despite subsequent salvage, 8 of them remain and provide excellent wrecks for interested sports divers.

These pages are about these wrecks.

### Wrecks and diving

- [The wrecks](#)
- [Historical background.](#)
- [Scuttle photos](#)
- [Destroyer photos](#)
- [Recollections of 1940](#)
- [Salvage in the 1970's](#)
- [Dive operators](#)

### Scapa dive reports

- [Totnes BSAC – 1991](#)
- [Totnes BSAC – 1995](#)
- [Totnes BSAC – 1999](#)
- [Kronprinz Wilhelm – 1994](#)
- [Gas Diving – 1999](#)
- [Wolfgang Rotschek - 1996 \(in Austrian\)](#)

### Other sites about Orkney

- [Die Wracks von Scapa Flow](#)
- [Guns and Armour of Scapa Flow](#)
- [Orkney - the islands](#)
- [Orknet - an Orkney virtual tour](#)
- [Welcome to Scapa Flow](#)
- [Diving Souvenirs](#)
- [A fishing record !](#)
- [Teddy F@ts](#)

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## Scapa Flow wrecks

<b><u>Battleships - Koenig class</u></b>	<b><u>Cruisers - Dresden class</u></b>
<ul style="list-style-type: none"> <li>• <a href="#">Koenig</a></li> <li>• <a href="#">Kronprinz Wilhelm</a></li> <li>• <a href="#">Markgraf</a></li> </ul>	<ul style="list-style-type: none"> <li>• <a href="#">Dresden</a></li> <li>• <a href="#">Koeln</a></li> </ul>
<b><u>Cruisers - Konigsberg class</u></b>	<b><u>Cruisers - Bremse class</u></b>
<ul style="list-style-type: none"> <li>• <a href="#">Karlsruhe</a></li> </ul>	<ul style="list-style-type: none"> <li>• <a href="#">Bremse</a></li> <li>• <a href="#">Brummer</a></li> </ul>
<b><u>Other diveable wrecks</u></b>	<b><u>Non diveable wrecks</u></b>
<ul style="list-style-type: none"> <li>• <a href="#">Bayern gun turrets</a></li> <li>• <a href="#">F2 Escort vessel</a></li> <li>• <a href="#">Gobernador Bories</a></li> <li>• <a href="#">HMS Hampshire</a></li> <li>• <a href="#">HMS Roedean</a></li> <li>• <a href="#">James Barrie</a></li> <li>• <a href="#">V 83 torpedo boat destroyer</a></li> </ul>	<ul style="list-style-type: none"> <li>• <a href="#">HMS Royal Oak</a></li> <li>• <a href="#">HMS Vanguard</a></li> <li>• <a href="#">Inverlane</a></li> </ul>

## Maps

**Current High Seas wrecks**



**Original positions of High Seas Fleet**



## References.

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MacDonald, Rod **"Dive Scapa Flow"** Mainstream Publishing (1998)  
ISBN 1 85158 983 X

This useful book has been updated and revised. It includes new material on deeper wrecks such as HMS Hampshire and HMS Strathgarry.

Smith, Peter **"The Naval Wrecks of Scapa Flow"** Orkney Press (1989)  
ISBN 0 907618 20 0

This book contains a detailed history of all the German wrecks plus extensive diving details

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## Markgraf

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### Battleship - Koenig class



[Markgraf](#)

### Commission.

Ordered in August 1911 the Markgraf was built in the Weser Yard in Bremen. She was launched on 4th June 1913 and completed on 1st Oct 1914. Markgraf means Marquis.

### History

The Markgraf was part of the 3rd Battleship Squadron. She saw action at Jutland, being hit many times in her vanguard position by the British Queen Elizabeth battleships.

Her captain was shot by British marines during the great scuttle and his grave can be seen in the Lyness naval cemetery. She sank around 4.30pm on 21st June 1919.

### Diving

The Markgraf lies on her port side at 58.53.31 : 3.09.55. The seabed is around 45 metres, with a least depth of around 24 metres. This is the deepest German battleship. Like all the battleships she is virtually upside down so to get underneath her means getting to the gunwales at around 38 metres. Depending on the shot position, the diver lands on the upturned hull and looks over the side into 20 metres of gloom and darkness. It is important to ensure that you are on the right side! Off you go, skydiving down the side of the hull. If the shot is amidships then you should see the 6 inch guns pointing out as you approach the gunwales at 38 metres. This gives a useful reference point as the direction that the guns are pointing will show you where you are on the wreck. Amidships, the gun barrels point out 90 degrees to the hull, whereas towards the bows the guns point towards the bows. So you can hang in the water above the gun barrels and navigate yourself accordingly. Below you it is dark as the decks run sharply under the hull.

As you descend towards the unseen sea bed at around 45 metres the underneath of the wreck reveals itself as a dark, imposing cave. Your torch beam just seems to go nowhere. To venture into this cave takes previous dive planning and some courage. But once inside it's not so bad. You can see the green of the outside as the bulk of the 25000 ton ship lies above you.

It is possible to swim underneath most of the wreck. Just follow the coal brick road. In the middle you will come across part of the midships crane. One diver goes above and the other underneath. Somewhere in the darkness of the cave lies one of the 12 inch gun turrets, but it takes adventurous diving to find it.

### **Stern of SMS Markgraf**



There are 2 enormous rudders on the stern that are worth visiting. The hull is largely intact and well fitted with thick slabs of armour plating, some of which have peeled away. Some blasting damage can be seen near the bows. The bows themselves tip over sharply into the darkness.

The Markgraf is an exciting and challenging dive. Its depth and position are such that good dive planning is essential. The sea bed is dark and silty and so on a dull day this wreck can be gloomy and quite intimidating. It is a cleaner wreck than the other battleships with less obvious damage done by salvage work.

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# Dive

## *Scapa Flow . . .*

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# *Welcome to the premier wreck*

*"We watched the last great battleship slide down with keel upturned, like some monstrous whale."*

The words are those of a schoolboy from Stromness, a witness in 1919 to one of the most momentous events in naval history. The deliberate sinking of an entire fleet of German warships was a sight that would remain etched on his memory for the rest of his life. And it's the same with divers who've explored the wrecks that remain on the seabed of Scapa Flow and elsewhere in the seas around our islands. The ships lie in a pristine environment and as those who've swum among them will tell you, it's an experience that's both exhilarating and addictive.

Breach detail of the C gun on the SMS Dresden - ©Tom Easop

8.8cm gun from the SMS Seydlitz - ©Tom Easop



# Wreck diving site in Europe . . .

## HISTORY

Scapa Flow; the very words are steeped in maritime history, and indeed the Flow has served as a natural harbour since the days when Viking longships first invaded Orkney waters. Ringed by a necklace of islands, this great expanse of almost landlocked sea provided a safe anchorage for the Royal Navy through both world wars.

It was to Scapa Flow that the German Imperial Navy's High Seas Fleet was taken at the end of the Great War to suffer the ignominy of internment.

But Rear Admiral Ludwig von Reuter was determined the 74 vessels under his command would never fall into enemy hands. On June 21, 1919 he issued the extraordinary order that would send his fleet to the seabed.

We will never know the emotions von Reuter experienced as one by one his vessels disappeared – some tumbling turtle as they went to the bottom, others plunging headlong as their sterns lifted high above the water.

But one thing is certain. The admiral could never have imagined his actions would one day turn the Flow into a Mecca for sports divers.

The vast majority of his warships were later brought back to the surface in the greatest salvage operation ever attempted. But it is the eight remaining vessels, protected now as havens for underwater exploration, that continue to put Orkney on the international map – and make Scapa Flow the premier wreck diving site in Europe.

The clear waters around Orkney provide a magical environment for diving. The wrecks themselves serve as havens for wildlife and, as you marvel at the vessels themselves, you'll be joined by fish large and small – some keen to be fed by hand.

Whatever your level of ability there's a wreck to explore – from the blockships sunk in shallow channels to prevent enemy vessels breaching the Flow's defences, to the German wrecks themselves, and the technical challenge posed by ships lost in far deeper water.

## GESCHICHTE

Scapa Flow – dieser Begriff ist eng verbunden mit der Geschichte der Seefahrt, und in der Tat hat Scapa Flow ja bereits für die Langeschiffe der Wikinger als natürlicher Hafen gedient, als diese vor langer Zeit in Orkney ankamen. Fast vollständig von Inseln umgeben, bot dieses grosse natürliche Seebecken während beider Weltkriege einen sicheren Ankerplatz für die Britische Königliche Marine.

Hierher, nach Scapa Flow also, wurde die Deutsche Kaiserliche Hochseeflotte gegen Ende des Ersten Weltkrieges gebracht, um dort interniert zu werden.

Aber Admiral Ludwig von Reuter war fest entschlossen, alle 74 Schiffe unter seinem Kommando nicht in Feindeshand fallen zu lassen. Am 21. Juni 1919 erliess er daher den ausserordentlichen Befehl zur Selbstvernichtung, der seine Flotte auf den Meeresgrund sinken sollte.

Wir werden wohl nie wissen, welche Gefühle von Reuter empfand, als seine Schiffe, eines nach dem anderen, verschwanden – einige kenterten, andere stürzten mit dem Bug voran in die Tiefe, während das Heck noch hoch über das Wasser hinausragte.

Aber eines ist sicher – der Admiral hätte sich nie vorstellen können, dass seine Handlung dazu führen würde, Scapa Flow in ein Mecca für Sporttaucher zu verwandeln.

Die grosse Mehrheit seiner Kriegsschiffe wurde später wieder in der grössten Bergungsaktion, die je durchgeführt wurde, an die Oberfläche zurückgebracht. Aber es sind jene verbleibenden acht Schiffe, die – heute unter Schutz gestellt als wahres Paradies für Unterwassertauchgänge und Forschungsaufzüge – dafür sorgen, dass Orkney international bekannt ist – und Scapa Flow das wichtigste Reiseziel für Wracktaucher in Europa ist.

Die klaren Gewässer um Orkney bieten ein geradezu magisches Tauchambiente. Die Wracks selbst sind Wohnort für viele Meeresbewohner und während Sie die Schiffe bewundern, werden Sie von grossen und kleinen Fischen begleitet werden – einige von ihnen sogar wild darauf, mit der Hand gefüttert zu werden.

Je nach Ihren Tauchfertigkeiten gibt es unterschiedliche Wracks zu erforschen – von den Blockschiffen, die in niedrigen Wasserwegen versenkt wurden, um feindliche Schiffe daran zu hindern, die Verteidigungsanlagen des Flows zu durchbrechen, bis hin zu den deutschen Wracks und den technischen Herausforderungen, die sich aus den weitaus tieferen Gewässern, in denen diese Schiffe lagen, ergeben.

*Orkney and her great natural harbour provide you with unparalleled opportunities for diving adventure*

# The Wrecks . . .

## KONIG

One of the three giant battleships from the German High Seas Fleet that remain in Scapa Flow. Lying upside down on the seabed, the *König* is home to a wealth of marine life.

## KRONPRINZ WILHELM

Sister ship of the *König*, the *Kronprinz Wilhelm* is also 575 feet long and has a beam of 97 feet. An awesome spectacle for divers, look out for portholes, gun turrets and the crew's mess.

## MARKGRAF

Armed with ten 12-inch guns in five turrets, the *Markgraf* was once capable of steaming at 23 knots. Like the other battleships, the wreck of the *Markgraf* is covered today in sponges and anemones.

## BRUMMER

One of five light cruisers in the Scapa Flow aspect, the *Brummer* once reached the seas at speeds of up to 28 knots. Lying on her starboard side, the *Brummer* has much of her deck equipment still intact.

## COLN

At 510 feet, the light cruiser *Coln* is longer than the *Brummer* and could travel slightly faster. Also lying on her side, her wreck is in superb condition and regarded as a must by Scapa Flow explorers.

## DRESDEN

A sister ship of the *Coln*, the *Dresden* has many original features still in place. A wealth of wildlife adds to the diving experience.

## KARLSRUHE

The fourth light cruiser once carried eight 5.9-inch guns and took part in the German conquest of the Baltic Islands. Salvage work has exposed large areas of the engine-room and there are numerous open hatches and holes to peer into. The guns still remain although mostly now lie on the seabed alongside the wreck.

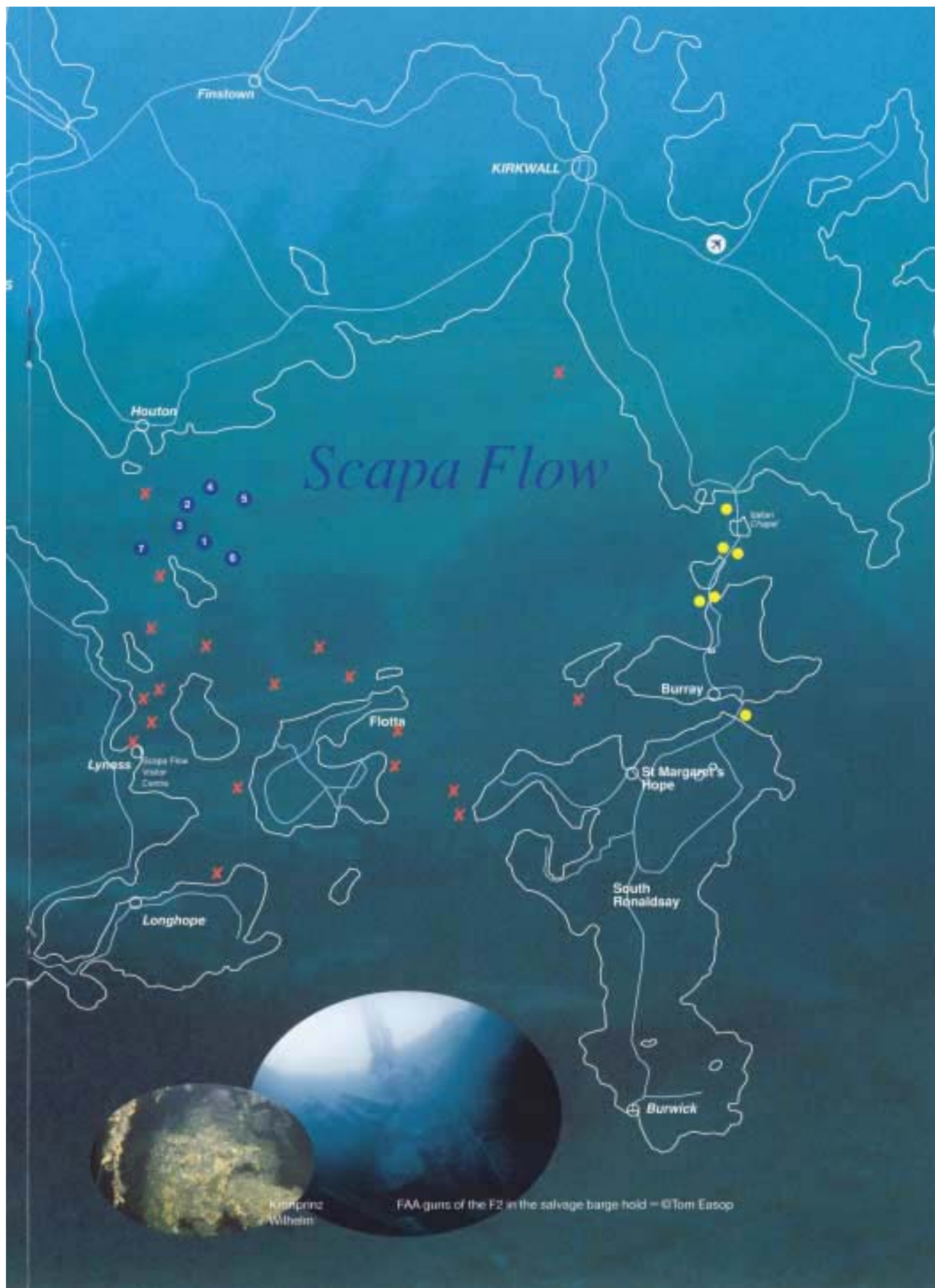
## ✱ OTHER WRECKS

Numerous other wrecks are also waiting to be discovered including the V83 and S54 - German torpedo boats, F2 - a German WWII escort vessel, HMS *Rodean* - a fleet minesweeper, the *James Barrie* - an Icelandic trawler, the *Strathgarry*, UB116, YC21, the SMS *Bayern* gun turret and many more. As well as all this, there is the High Seas Fleet Scrapyard made up of remains from wrecks salvaged between two World Wars, remains of ships too numerous to be listed individually but which include the *Hindenberg*, *Seydlitz* and *Von der Tann*. The wrecks of HMS *Royal Oak* and HMS *Vanguard* also lie in Scapa Flow - however these are war graves and cannot be dived.

## ● BLOCKSHIPS

Relished by today's divers, these were vessels deliberately sunk to safeguard British warships during the two World Wars. The aim was to use the ships to block the main channels into the Flow. Popular blockships include the wrecks of the *Tabarka*, *Gobernador Bories* and *Doyle*, as well as remains of the *Inverlona*, *Budrie*, *Rotherfield*, *Urmstone Grange*, *Ronda*, *Thames*, *Busk* and *Minieh*. The Blockships of Burna Sound make superb subjects for underwater photography with excellent visibility and abundant marine life.





# Safe Diving . . .

To ensure your dive adventure in our islands is both safe and enjoyable, check that your holiday is based aboard a boat operated by the Orkney Dive Boat Operators Association (ODBOA). All ODBOA charter boats meet the stringent marine safety standards set for the waters they operate in. They're operated by experienced skippers with the know-how to help you make the most of diving in the seas around Orkney.

ODBOA operators are committed to tailoring the service they offer to suit your needs. You can live aboard your dive boat or, if you'd prefer it, choose from an excellent range of shore-based accommodation and go for a day boat option instead. If you're just starting out, or need to touch up your skills, PADI, IANTD and TDI training courses are on offer.

Although dive boats operate all year round, the main diving season runs from March to November. Scapa Flow, ringed as it is by a necklace of islands, provides shelter for diving in most weather conditions. If you've never experienced the magic of an Orkney summer, you'll be amazed by the length of diving days in June, July and August. In mid-June it's possible to play golf or read a book outdoors at midnight. So you'll need to stay up late if you fancy a night dive during the summer months!

The wrecks of Scapa Flow lie in a range of water depths. There are deep and challenging dives for experienced divers and vessels lying in shallower waters for beginners and the less experienced to enjoy.

Technical diving has been underway in Orkney since 1993 and training in the use of nitrox, trimix and rebreathers is available within the safety of Scapa Flow. Experienced technical divers will find deep-water wrecks within easy reach – and the expertise on hand to provide them with some truly memorable diving.

All ODBOA dive boats have ready access to a professionally operated decompression chamber operated by Heriot-Watt University in Stromness. Doctors from the Stromness practice are on hand to provide a round-the-clock treatment service for 365 days of the year. The GPs have been trained in diving medicine to Health and Safety Executive approved standards.

When you're booking your dive holiday in Orkney, it makes sense to ensure your operator is a member of the ODBOA.

## SICHERES TAUCHEN

Um sicherzustellen, dass Sie Ihr Tauchabenteuer auf unseren Inseln sicher genießen können, überprüfen Sie bitte, dass Ihr Urlaub auf einem Boot gebucht ist, das von einem Mitglied des Verbandes der Tauchbootführer in Orkney (ODBOA) geleitet wird. Alle ODBOA Charterboote müssen strenge maritime Sicherheitsstandards erfüllen, die für die Gewässer, in denen sie tätig sind, festgelegt wurden. Sie werden von erfahrenen Skippern geführt, die das Know-How haben, um Ihnen zu helfen, aus Ihrem Tauchurlaub in den Gewässern um Orkney das Beste herauszuholen. ODBOA Leiter bemühen sich darum, den Service, den sie Ihnen anbieten, genau auf Ihre persönlichen Bedürfnisse zuzuschneiden.

Sie können an Bord Ihres Tauchbootes wohnen, oder, falls Ihnen das lieber ist, Ihre Unterkunft aus einer ausgezeichneten Reihe an Landunterkünften auswählen und von dort aus Tagesausflüge auf dem Tauchboot unternehmen. Falls Sie erst neu anfangen oder Ihre Kenntnisse auffrischen wollen, stehen Ihnen PADI, IANTD und TDI Trainingskurse zur Verfügung.

Obwohl die Tauchboote das ganze Jahr über betrieben werden, findet die Haupttauchsaison zwischen März und November statt. Scapa Flow, nahezu vollständig von Inseln umgeben, bietet Tauchern Schutz vor den meisten Wetterbedingungen. Wenn Sie noch nie die Magie eines Orkneysommers erlebt haben, werden Sie von der Länge der Tauchtage in den Monaten Juni, Juli und August überrascht sein. Mitte Juni ist es möglich, um Mitternacht Golf zu spielen oder ein Buch zu lesen. Sie müssen also wirklich spät aufbleiben, wenn Sie während der Sommermonate Lust auf eine nächtliche Tauchtour haben sollten!

Die Wracks von Scapa Flow liegen in unterschiedlichen Wassertiefen. Es gibt tiefe Tauchgänge, die sehr viele Herausforderungen bieten für erfahrene Taucher, sowie weniger tief liegende Schiffe für Anfänger und weniger erfahrene Taucher.

Technisches Tauchen gibt es in Orkney seit 1993 und in der sicheren Umgebung von Scapa Flow gibt es Trainingsmöglichkeiten für den Einsatz von Nitrox, Trimix und Kieselauttauchgeräten (rebreathers). Erfahrene technische Taucher werden die tiefer gelegenen Wracks als leicht zugänglich erleben – und gleichzeitig Fachleute zur Seite haben, die ihnen zu wirklich Erinnerungswerten Tauchgängen verhelfen können.

Alle ODBOA Tauchboote haben die Möglichkeit, die von der Heriot-Watt-Universität professionell geleitete Dekompressionskammer in Stromness zu benutzen. Die Ärzte in Stromness sind in der Lage, rund um die Uhr an 365 Tagen im Jahr medizinischen Beistand zu leisten. Diese Ärzte sind auf einem behördlich vorgeschriebenen Sicherheitsstandard in Tauchmedizin ausgebildet.

Wenn Sie Ihren Tauchurlaub in Orkney buchen, ist es also sinnvoll, darauf zu achten, dass Ihr Tauchreiseveranstalter ein Mitglied von ODBOA ist.



# Other Attractions . . .

## STROMNESS

Your first glimpse of Stromness when you arrive in Orkney by ferry is of row upon row of neat stone houses, many with piers and slipways leading down to the sea. With an excellent harbour, Stromness is the main base for Orkney's fleet of dive boats. Between dives, you'll find the old town an excellent place to stay, with a wide range of accommodation on offer. The pubs are warm and welcoming – great places to talk diving over a glass of locally-produced beer or malt whisky. Stromness is home to a well-equipped dive shop. And if you fancy stepping back in time, why not try a hard hat dive in the harbour wearing a three-window copper helmet with air pumped through a hose from the surface.

## OTHER ATTRACTIONS

You'll find the watering holes of Kirkwall a great place for a night out. The skyline of Orkney's main town is dominated by St Magnus Cathedral, which was built by the Vikings who once ruled these islands.

Head south from Kirkwall and your journey will take you across the four Churchill Barriers, built during world war two to keep enemy vessels out of Scapa Flow after the sinking of HMS Royal Oak. Crossing the final barrier will bring you to St Margaret's Hope. This attractive village is the base for some of the Scapa Flow dive boats. There are excellent places to stay and enjoy an evening out, including an award winning restaurant where seafood is the speciality.

No dive holiday in Orkney should miss out on a visit to Lyness, home to a massive Royal Navy base during the 1939-45 conflict. Here, at the Scapa Flow Visitor Centre, you can take a fascinating trip down memory lane as you discover the enormous scale of naval operations in the area during the two world wars.

If you're looking to expand your sporting activities during your stay, there are swimming pools in both Stromness and Kirkwall. A superb range of fitness and leisure facilities are available in both towns – and both are also home to excellent golf courses. Sea angling trips can be arranged and the freshwater lochs of Orkney provide some of the best wild brown trout fishing to be found anywhere in the UK. Bikes can be hired and Orkney provides excellent walking country – with the trip to the legendary Old Man of Hoy rock stack perhaps the most memorable of those waiting to be discovered.

Orkney probably has more historic sites than anywhere else in Britain. One area is so rich in Stone Age monuments that it recently became only the third World Heritage Site in Scotland.

The islands' wildlife is another claim to fame. The company of spectacular seabirds is guaranteed on boat journeys to dive sites. Look out too for seals, porpoises and dolphins.

## WEITERE TOURISTEN-ATTRAKTIONEN

Nehmen Sie kurz vor Ihrer Ankunft in Orkney von der Fähre aus den ersten Blick auf Stromness wahr. Zwischen den langen Reihen attraktiver Steinhäuser erblicken viele davon mit ihren eigenen Piers und Anlegestellen direkt am Meer. Stromness besitzt einen hervorragend ausgestatteten Hafen und ist das Zentrum der Tauchbootflotte Orkneys. Zwischen Ihren Tauchgängen haben Sie die Möglichkeit, diese alte Stadt kennenzulernen und das große Angebot an Unterkünften zu nutzen. Die Pubs sind warm und gemütlich – der richtige Platz, um bei einem Glas Bier oder Whisky (beides "made in Orkney") Ihre Tauchenergebnisse auszutauschen. In Stromness gibt es übrigens auch ein gutausgestattetes Tauchgeschäft. Falls Sie Lust haben sollten, einen kleinen Abstecher in die Vergangenheit zu machen, könnten Sie im Hafen Helmtauchen ausprobieren und dabei einen dreifensterigen Kupferhelm tragen, bei dem die Luft direkt von einem Schlauch von der Oberfläche her hineingepumpt wird.



Lyness War Museum - Hoy



Divers at Churchill Barriers



Puffins



Stromness Harbour



Seals

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**ORKNEY**

Islands Council

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# Appendix III

## Oral Testimonies

### IIIa

Narrative generated by oral testimony from Dougall Campbell who was a principal partner in salvage activities on the German wrecks in the 1970's

### IIIb

**HMS Vanguard Salvage 1958 -1959**

**Information from University of Kansas World War I website**

### **IIIa Narrative generated by oral testimony from Dougall Campbell who was a principal partner in salvage activities on the German wrecks in the 1970's (see illustrations Figure 22)**

Mr Dougall Campbell,  
Tigh Ard,  
Glentirranmuir,  
Kippen,  
Stirling.  
FK8 3HU

#### **Background**

We purchased the assets of Nundy Marine Metals in November 1971 and started the 1972 season in March of that year. Our salvage operations stopped in November 1977 due to falling scrap prices and the law of diminishing returns. The more that is taken out the less there is to take out. I resigned from Scapa Flow Salvage Ltd in 1978 and the company was sold to Underwater Associates.

The Company, Scapa Flow Salvage Ltd., was owned by David Nicol a demolition contractor from Dysart in Fife and myself. The office was in Dysart and that side of the operation was run by David Nicol. I was the Operations Director and ran the day to day operations from our base at Rinnigill on Hoy, just southeast of Lyness. We normally employed three divers and a boatman/tender. For the lifting using the boom defence vessel *Barneath* there were additional personnel, deckhand, stoker and cook. At one stage we employed five divers, but that was only for specific phases.

#### **Targeted materials**

There were two main objectives of our salvage, armour plate and non ferrous metals, (copper, bronze or gunmetal, and brass). Arthur Nundy had already removed most of the side armour from the *Kronprinz* and *Konig*, so initially we concentrated on the *Markgraf*. When we had removed the side armour we then had to concentrate on removing the heavy cross armoured bulkheads just forward of the forward turret and just aft of the aft turret. As the battleships are all *Konig* class, what was on one was always on the other. This also was the same with non-ferrous condensers, pumps, copper pipes, evaporators etc. In the engine rooms of which Nundy had cleaned out the major components from the battleships, we did have some success on the light cruisers. We did not have as fitted drawings of any of the ships so we had to do a bit of intelligent exploration to find generator rooms and other areas where there was fairly large items of non ferrous.

#### **Methodology**

When working on particular wrecks we had them marked off with small pellet buoys on a floating downline to the highest part of the wreck closest to where we were working. This kept the rope from fouling and getting severed. We picked up the rope with a grapple and tied our dive boat by the stern as the dive compressor and umbilicals were located there.

We were not using U.S. Navy decompression tables at that time, so our bottom times were fairly short. The quickest and most effective method of removing most items was by using explosives. Our average charges being in the region of 150lbs to remove one of the armour plates which would weigh in the order of 25tons. Smaller one to five ton lifts could be recovered using air bags, but our main lifting was done with the *Barneath* and latterly *GWR 15* floating crane which could lift 50 tons.

Non ferrous was collected and stored at Rinnigill in a large shed whilst the heavy armour was wet stored alongside Rinnigill Pier. Normally at the end of a season we would charter a vessel or vessels and ship the metals south. The non ferrous was shipped to Inverkeithing and the armour usually went to Germany. Some armour went to Sheffield and small amounts of the 7" plates went to a specialist firm in Edinburgh for the manufacture of whole body monitors that were used to check for possible radioactive contamination of individuals at nuclear establishments.

## Salvaging HMS *Vanguard*, 1958 - 1959

These reminiscences have been contributed by Frank Lilleker, who began in "standard dress" (ie the classic hard-hat diving) in 1958-1959. He has provided all the photographs as well. Note that the bulk of the ship still remains on the bottom of Scapa Flow, just to the north of Flotta.

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**Salvage Vessel *Barneath* Raising *Vanguard*'s Propellor Shaft**

I was surprised to know that the *Vanguard* is still remembered. I have great affection for the vessel for I started my career on her using antiquated diving equipment for which I had no training and my first introduction was to fall through a hatch and get myself entangled. Due to an oversight we didn't have enough air hose to make two suits, so if you got into trouble you had to get yourself out.

In the second year I introduced free diving and managed to do the most difficult jobs to prove that scuba equipment was not only for pleasure. Once free of the myopic helmet I could survey the wreck and reach areas not otherwise accessible. When I finally convinced the firm to allow me to use free gear it was the equivalent of flying over a town rather than walking through the streets, kicking up mud. The argument against free diving was that you couldn't heave strops and shackles but I found ways of doing this and by the following year standard diving was a thing of the past.

*Vanguard* lies in 108ft of water and, due to all the magazines blowing up, the whole ship was torn open, the turret tops and all the guns were blown out of their mountings. I found one 68 ton gun barrel that had obviously been projected high into the air and landed some 150ft away from the ship burying itself breach down to a depth of 15ft. One gun turret complete with barbette, and a conning tower were standing some distance away, propellor shafts were bent and the side armour gaped out like a peeled orange. One item I recovered was what I thought was a safe but turned out to be a flag locker.

My contract specified that I report to Rinnigill Pier at Hoy to join the *Ocean Raleigh*. Wages £20 per week out of which I was expected to pay for food and accommodation when ashore.

I thought a vessel with a name like that must be some well-appointed luxury yacht. Tied up to the jetty was an ancient steam drifter bearing the name. The bow had been fitted with a roller for lifting, but apart from that very little had changed from its original purpose as a fishing boat. Life, to say the least, was basic. The

accommodation was a tiny mess space with bunks at either side, a curtain being drawn to cut out some of the light. The mattress consisted of three kapok lifejackets which still bore the stains and smell of fish. The only benefit, in common with most steam vessels, was that it was warm and there was always the opportunity to dry out against the boiler. As the result of part of a propellor blade having broken off the vessel had a certain rythm when doing her best six knots - I can only describe it as the music to the cartoon series "Captain Pugwash."



### ***Ocean Raleigh***

We arrived over the wreck and I was dressed in standard diving gear and sent down. When I had been told of the method of diving I had hoped I might be in the company of experienced men and could learn the trade from them, instead my colleague was a young man who had completed a shallow water course in London Docks. Not wishing to admit that my experience was less than his, I allowed myself to be dressed and tried to remember the few details I had gleaned from the Siebe Gorman manual on deep diving. The helmet has three valves, a one-way in the air supply to prevent the suit emptying in the event of a severed airline or pump failure. In the early days of diving it had been known for the air to fail which allowed the water pressure to exert such force the man would be found compressed into the helmet whilst the soft tissues would be drawn up the airline to the horror of the linesman who had to retrieve the remains. It is only the equal pressure inside the suit that makes diving possible. The second valve is spring loaded which allows the escape of unwanted air and is controlled by the diver to adjust his buoyancy. The third, a spitcock normally left closed, but used to expel air more quickly if he wants to control his ascent. When I became more experienced I used to open the valve, take a mouthful of water and squirt this over the face glass which frequently misted, and then use my newly-grown beard to burnish the surface to perfection.

My first dive was into a mass of twisted metal and it was the only dive during which I got into serious trouble. Trying to look like a real diver I was wearing a red woolly hat and my entry into the water was as per the book. My nerves however, had got the better of me and as I descended I took too firm a grip on the shot rope which resulted in me spiralling down, winding my lines round this rope, so by the time I touched down I and the shot rope were as one. What slack was left allowed me to take one step forward and I promptly fell through a hole up to my armpits. All attempts on my part to lift out were of no avail, and under the impression that air would do the trick I asked for the supply to be increased. My next realization was that my circular window was no longer in front of my face and I was now looking at the connection between the helmet and the corset. As the suit continued to expand my hat was tilted over my eyes and nothing I could do would move it (I have never worn a hat since). I found out afterwards the reason I had become stuck - my distance line had been tied to my front weight and had obviously caught in a scrap of metal. The use of the distance line is for the diver to secure one end to the bottom of the shot rope and walk round, paying out the rope in hope of finding something of value. The mud and silt would be stirred up so unless there was some movement of tides it was often a case of feel rather than see. Finally I broke loose and headed for the surface festooned in ropes and pipes. The owner, Arthur Nundy, was not impressed and it was with great reluctance I tried again (possibly only because I didn't have my fare back home). On this occasion all went well, I regained my confidence, and from that moment I

started my career in diving. I did this once again at a later date with a different ending, but I won't go ahead of myself.

The above photograph shows the ship's propeller which was lying free of the ship which we lifted with the later vessel.

With regard to the gun, it is of course only conjecture, but as it was standing vertically in hard ground I can only assume the barrel must have entered the water vertically to have buried itself at depth. Regarding the weight of a 12" , Arthur Nundy of Nundy Marine Metals came up with this figure, and as he had been a foreman rigger involved in the German salvage during the Cox & Danks' years, I took it to be correct. [*editor's note: the 12-inch Mk XI, XI\* and XII weighed 66.7 - 67.7 tons*]. What is certain, every gun barrel was blown out of its trunnions and was scattered in and around the wreck.

The salvage vessel which was acquired at the end of the first year was an ex-boom-defence ship, the *Barneath*, and in order to get maximum lift a four-fold set of blocks were run down either side of the deck and attached to the Robertson steam winches which were each capable of pulling eight tons. The heads of these blocks were connected to a cable which was looped over the horns of the ship and at the centre of this loop was a single pulley from which hung a strop thus giving tremendous lifting power. When both winches were pulling at their maximum, the deck wasn't a healthy place to be!

I connected the strop to the gun barrel and despite lifting the stern of the *Barneath* out of the water, could not budge it. We decided to put a charge down the bore and cut it a few feet below the seabed. I tied a piece of wood at the appropriate distance to the firing cable so that the charge would hang in the correct position. Once the water had cleared, the next dive revealed a shining bright barrel, still in position, denuded of its marine growth, the charge apparently having slipped the wood and gone down to the breach end. One last attempt was made to recover the barrel and this time it came away, the vibration having broken the soil around it. Upon inspection we found the breach had been blown out by our efforts and this from a charge of only about 15 lbs.

I gather that the *Vanguard* is now a war grave. What little evidence was left of the crew could only be found in the coal/oil sludge where bones are preserved. This and the leather boots and belts still buckled were the only remains.

I remember that one of our crew, probably now long-gone, used to row over each morning when we were moored over the wreck and back again at night, walking a considerable distance to his home. At that time there were only a few families living on the Island - he showed me a postal order which had fluttered down on Flotta after the explosion.

After my disastrous start life settled down to a routine. Weather permitting we would tie up over the wreck to four buoys to allow the ship to move into position when a likely find was made. As the ship was only a drifter and not a boom vessel which came later, its capacity to lift more than a few tons on the bow meant that the propeller was almost out of the water and the homeward journey took many hours, so we tried to find items of value (copper and brass) which could be brought over the side and dropped into the fish hold.

Due to the depth two dives were permitted per day of 40 minutes on the bottom and 30 minutes for stops. If all went well one lift could be completed and the wire sent down a second time during the duration of the dive. This first lift could be hazardous for the diver might see something of value, such as a valve, and only after the lift had started and the mud settled he would find it attached to a length of pipe held only by some rotten bolts at the end of which might be another valve or something equally heavy. This would slowly rotate above his head, looking as if it would break free at any moment.

On one occasion I slung the end of a piece of pipe and when it was pulled clear of the wreckage it turned out to be a Morris barrel, a training aid which fitted inside a 12 inch barrel and allowed the gun to be used with sub-calibre ammunition. This slipped the noose of the wire when about half way up and landed back a few feet away - the second lift was made after I was clear and on stops, so did not pose a problem.

This photograph is of a firing pistol from the rear turret, its only purpose was to complete an electrical circuit to fire the primary charge in the breach. When it first came out of the water the exposed part of the butt was highly polished - an hour later it was green. Today this would have been a single button, then it was solid brass weighing about 12 lbs. I don't collect souvenirs but thought this was unique.



Firing Pistol - used to fire the 12-inch guns, when the central circuits fails



Firing Pistol

I kept the firing pistol not so much for what it was but that it is an example of nature taking over her own. I therefore have left the marine growth on it. No other souvenirs I'm sorry to say, I wish now that I had collected a few.

To continue with my narrative:- As the year progressed it was obvious that a steam drifter was not man enough to lift the heavier items, gunbarrels, armour etc., and it was a welcome sight to see the *Barneath* when we went to collect it. However, the *Ocean Raleigh* still supplied a couple of interesting incidents - as the Orkneys are exposed to the Atlantic storms the weather can change in a matter of minutes. So it was when we were half way out to the wreck, a storm blew up with such ferocity the vessel could make no progress and we were being driven towards one of the islands, possibly Flotta. I can't recall whether we even had an anchor on board, it wouldn't have been stowed over the bow where the lifts were made.

It wasn't my idea, but I was dressed again and given a wire and shackle, and told to look for something to secure. At first the relief of leaving the heaving boat to the bubble silence of the seabed was very welcome, but as I walked along in the gloom I envisaged what to do if I found nothing. Would I continue on, finally walking ashore to remove my helmet and watch my livelihood founder? Or what would I do if I found myself walking into a wreck, having my lines tangled whilst the ship continued to drift until I parted company with the

compressor? Luck was on our side that day, for I came across an Admiralty mooring laid down many years ago, and secured to it.

A second incident happened again when the weather suddenly changed. Arthur Nundy, when working on the salvaged German ships had seen tons of coal drop from the upturned hulls to lighten them enough to get close in shore, and as coal was the most expensive item he thought we could find great piles of the finest Welsh coal lying on the seabed ready for the taking. A bucket grab was organised, I was dressed as usual in helmet etc, walking along the seabed with the drifter doing what it was best at - drifting. Every time I came across a hump on the seabed, I called the bucket down to take a bite. This went on hour after hour, because the water was shallow enough to allow continuous diving, but with no result. I made the mistake of finding one solitary lump of coal, and placed it on top of a bucket of mud - this brought renewed interest and further searching was ordered.

Again the weather put an end to the operation and I was told to surface - only then did I find that my airline and telephone had wound round the chain above the bucket and as the vessel was now moving at an increased pace and heading towards a rocky shore, nothing could be done until I was back on board. With my lines entangled this was only possible if I could make my way round the bucket. Moving at any speed in standard dress is near impossible, the only way to get any traction is to reduce the air to the minimum and bend forward to the diagonal -.I must have looked more ridiculous than usual, chasing a bucket of mud across the seabed. Finally I managed to get hold of the edge, and with much effort freed myself. The storm eased and our efforts at coalmining were never repeated.

The *Ocean Raleigh* was collected by a firm of breakers, and with it went the first phase of my diving career. Having progressed to a better salvage vessel I was still lumbered with helmet and boots, but that would not be for much longer.



**One of *Vanguard's* Condensers**



Lifting One of the Weir Pumps  
(you can learn more about Boiler Room operations by clicking [here](#))

The *Barneath* needed some alterations to convert her to a lifting vessel - eyes and brackets were welded in place, and for the benefit of Health & Safety a large steel vat with an airline attachment (laughingly called a recompression chamber) was installed. This was quite useless for it was impossible to control the pressure and if anyone was silly enough to complain of pains they would probably come out a midget. I took the opportunity of washing the woollens, where previously they could have stood up in their grey mantle with the accumulated salt - they were now only off white and more comfortable to wear.

We had a visit from the buckets, a firm of solicitors from Glasgow who enjoyed themselves dressing up and one being brave enough to climb down the pier ladder and immerse his head.

The larger vessel meant more crew and another diver was recruited. This man, newly out of the Navy, identified us immediately as a bunch of amateurs and decided to show us how it was done. When moored up, he was dressed up to the corsellette stage when he demanded to know where was his standby diver. I said I assumed it was me, "Then why aren't you dressed?". I gently pointed out it would be of little purpose for he had all the airline (we not having enough for two sets) - "In that case I'm not going". He left that evening on a passing ferry. Naval training might be correct but the world of commercial diving is totally different.

The next diver, a chap I briefly knew, fared a little better for he managed the exploratory dive and after a quarter of an hour asked to be brought up. It was with some difficulty we got him over the rail for he had become paralysed from the waist down. After two days there was no improvement so he was transported to Kirkwall hospital and after a week sent home. I met him some years later, it had never happened again and the cause remains a mystery.

I had now become quite proficient as a standard diver, so much so I started to get careless. On one occasion I came up to a wall of steel, probably the stern, and thinking I could be clever made myself light enough to do a controlled ascent with the object of landing on whatever I found up there. The reduction in water pressure meant my suite expanding and instead of a gradual rise I found myself rushing to the surface. The danger lies in either the linesman being unaware and not shortening the lines allowing the diver to fall back down with only atmospheric air in his suit, giving him the squeeze, or the diver coming up under the ship and flattening his helmet on the hull. The black shape above told me I was heading for the latter and I waited for the inevitable crunch and the rush of water. The crunch came but the water didn't. I had gone headlong into festoons of mussels so thick they cushioned my upward fall and apart from again looking ridiculous I came to no further harm. Back down to stops where for the time being I could avoid explaining myself. Stops were boring and cold and to counter this I would lie back and study the primitive life passing the face glass - jelly fish and plankton in a great variety of shapes would hold my interest whilst the passing potato peelings gave the promise of food to come.

We had the luxury of a shower, and as the vessel was a steam ship hot water was always available. There is no better way to get the temperature back to normal. In a locker were boxes of rocket line which proved invaluable for marking lifts, also a first aid box which contained ampoules of morphine dated 1942 - as they didn't have an

"inject by" date I waited for the opportunity to use them. I didn't have long to wait for we had a serious accident a few weeks later.

The fact that we had the ability to lift enormous weights didn't mean all went well. Everything depended on the final strop for it had to be weak enough to break should the lift prove stubborn. Shackles which were almost too heavy to be man-handled would be distorted out of shape, and strops made from two inch diameter wire would snap and had to be respliced, giving the crew hours of work. Therefore, to sling some immovable item would not be popular with the three deck crew who did the splicing.

Armour plate was especially desirable as the metal was pre-atomic and could be used for special purposes. For some reason the lids of the turrets had an odd shaped hole cut into one corner. The reason for this I can't imagine but it did make it possible to sling them. The deck armour was so thin that in places two three-quarter inch plates were riveted together, the designers obviously thought Naval battles would be fought at close quarters. For the same reason three torpedo tubes were installed, two tubes out from the sides and one through the stern. To enable a torpedo to be fired from the side when the ship was steaming a ramp had to be first run out to allow the torpedo to clear the ship's side without the pressure caused by the forward movement of the ship which would jam the torpedo in the tube. One of these ramps were salvaged later by my colleague, some seven tons of gunmetal.



ne of the "torpedo bars" mentioned in the text.  
Click [here](#) for an enlargement.

The stern tube was apparently still in place and the sliding door closed. That part of the ship could still be recognised (together with the bow), so it was decided to blow a hole near the door to recover it and get to the tube. This was done but upon inspection the inside of the door had a circular flange against which was a roughly shaped piece of plate bolted in place, which gave the impression the tube had been removed for maintenance. The door was poor compensation for two days work and I reasoned that the tube could not be far away and an investigation was called for. The hole we had blasted would allow me to enter and after calling for more pipeline which I coiled down to avoid chaffing on the sharp edges, I made my way inside and started groping around the compartment. In the pitch blackness I made my way along and then across, still not feeling the round shape I was seeking. My time was up so I traced my line back along the way I had come only to find the airline appeared to exit a hole no bigger than my helmet. Feeling around the hole the obstruction seemed solid. I must have learnt something by this stage for rather than panic I metaphorically sat down and waited for the mud to settle. The apparent wall which had prevented my leaving was several baulks of timber which now had weight rather than buoyancy but were not heavy enough not to have moved when I disturbed the water. Once I knew that it was easy to slide the wood out of the way and return to stops. My stay on the bottom had been longer than usual so stops consequently had to be much longer. Timber was kept on warships for damage control purposes, it was usually kept together with canvas pads to shore up and make-good leaks. This tube therefore and the two others, as far as I know, are still on board so a wasted week but we were about to be redeemed, not without consequences! Enclosed photograph of a torpedo ramp. Note the last picture of the double-acting pump still had cordite attached. The condenser, I am told, was twenty eight tons of non-ferrous.

We were on our way back on a Friday afternoon after a very unsuccessful week when the weather, for a change, was warm and calm, the water having only the slightest chop except in one particular place about half way home. I had noticed this before, a calm area with a rainbow edge made by oil. The oil must indicate something, and as we were early with nothing to unload I pleaded to have a look and by sheer good luck landed alongside a tanker, the decks festooned with flexible copper refuelling pipe. The ship, I assume, was a fleet auxiliary - how it came to be lying on its side in fifty feet of water was a mystery.

I slung as many of these six and nine inch pipes I could see and this made up for our disappointment earlier in the week. However, as usual there was a down side, for what I could not see was that one of the pipes remained connected to a cast iron valve and due to the electrolytic erosion when copper and iron are together, it broke off like a carrot releasing oil fuel to pollute a wide area. We kept quiet about this episode and hoped nobody would connect us with it.

The diving season lasted from April until November, during which time I had a weeks holiday. On return I brought with me several items of free diving equipment which included a dry suit, face mask, fins, and a Heinke demand valve. As the patent for the Aqualung was still in force and the crux of the design required the exhaust and diaphragm to be together, Heinke got round this by extending the outlets in the form of two horns having a ball valve in each. This was convenient for me for I was able to hold the valve in place against a harness on my chest - the front position of the valve made for easier breathing and I had nothing on my back to get tangled. An airline meant there was no worry about running out of air, and a bypass into the suit allowed me to compensate for pressure and adjust my buoyancy. A duck's beak valve in the cuff allowed the suit air to escape if I held my arm up, but this would not happen in a normal working mode. Two marker lines with small cork floats completed the equipment.

In that first free dive I was amazed by the things I had missed. The propeller was an example because it was some twelve feet off the seabed and unless the standard diver saw it on the way down his restricted vision through the face glass and the stirred mud meant he would miss it. Another example was the turret, for unless the diver landed inside it he would have great difficulty in clambering in without disturbing the mud and there I found many useful items which could be marked including the lifting hoists and heavy hydraulic cylinders used to deliver ammunition from the magazine. All this was seen in one dive, and when I reported back Nundy saw the potential and ordered all the necessary gear to enable the change to free diving as soon as possible.

Over the next few days I surveyed the ship, the bow was recognisable with anchor chains spread out on the seabed. Looking up at the stem from seabed level it reminded me of a gutted fish for the hull had been blown out with plating hanging down on either side. I swam up to one of the portholes (or is it scuttles?) and chose to look into one at the same moment a seal decided to look out - I don't know which of us was the more shocked.

From the bow to the stern it wasn't possible, due to the damage, to know exactly what part of the ship I was looking at although the propeller shafts identified the after engine room. The stern still had some decking, in the centre of which was a saluting gun. In a tangled mass of wreckage I found the ship's bell still hanging - it proved a problem to sling because of its shape but we eventually recovered it. I understand it was normal to hand ships' bells back to the Admiralty, and what its final destination was I never knew.

We became quite proficient at recovering the twelve inch guns, I didn't find any gun smaller. First I would mark the position with a light line, then the rowing boat would plumb the line so that the *Barneath* could, using her

mooring cables, position the horns over the spot. Next a cable was secured to the small end of the barrel after it had been taken through the lifting strop - the strop was then slid down over the small end to be positioned at the balance point using crowbars. The heavy lifting tackle was lowered and if we were lucky could be connected to the strop. Even if it missed by one foot it was impossible to swing it over, so more manoeuvring was called for. After much straining the shackle pin went home and the lift could begin.

The four-fold purchase blocks would lift up from the decks and line up with the top of the horns, the strain then being taken up. At times we didn't know what was secured (as in the case of the condenser), just a promising shape showing through the wreckage. The ship's bow would be pulled down, the wires groaning and shedding oil. If nothing happened the winches would slack off, the ship would be repositioned using the mooring cables, and the lift started again. The horns were never designed for such punishment and welds would part like rifle fire. We waited, tried again until either the strop broke, the ship heaved up and the blocks fell back on the deck, or a deep rumble and we knew whatever it was had broken through. Now the slow lift to the surface, we all wanting to be first to identify the prize. It was on one of these occasions that the accident occurred.

The work had become routine, and with it a blazé attitude towards the ever-present danger of ever flailing wires. We had completed the lift and started our preparation to leave the site, I don't know what we were talking about but I was in conversation with Arthur Nundy when he suddenly vanished. One moment all was serene, the next a crash of falling blocks the ship heaving up and the crumpled shape of Arthur some distance away. It was obvious that the wire which had been used to position us and was laying on the deck, suddenly took the weight of the gun when the strop broke. It had whipped up under Arthur's arm (it could have been worse) and sent him flying. It was fortunate he was wearing heavy clothing, in shirtsleeves it could have taken his arm off. He lay there half conscious so I felt quite justified when I emptied one of the tubes of morphine into his good arm - we returned to the pier, drove him across the Island to the only doctor who gave first aid and arranged transport to Kirkwall Hospital - a long journey by ferry.

I phoned three days later and was told he was in plaster, but the nurse said that in view of the doctor reporting his eyes were dilated he might have landed on his head so they would keep him in a few more days. I should have admitted my first aid but didn't. A week or so later he was back.

So the season continued, and as the days shortened we prepared to finish. My last act was to fill a now redundant canvas suit with explosives to be placed among the wreckage in anticipation that at the start of next year useful salvage might be revealed.

Although we didn't think in these terms it was almost a symbolic act, the passing of an era. At the bottom of the ladder I clasped my former self round the waist and together we descended for the last time. It was with great sadness I watched as the explosion dirtied the water and we steamed away.

This about concludes all I can remember of those two years. I have tried to be as accurate as possible and hope it will convey a picture of what the work entailed. I think there was some work done after 1958, but I don't think it lasted for long.



The Author.

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Last Updated: 30 September, 2001.

[Return to WWI The Maritime War](#)

[Return to WWI Archive main page.](#)

# Appendix IV

Information provided by Recreational Diving Agencies on  
Maritime Archaeology

IVa	PADI Information
IVb	BSAC Information
IVc	SAA Information
IVd	<i>SAA Respect Our Wrecks</i> Information



## War Graves - UK

**War Graves** - UK A recent campaign to try and ban all divers from diving war graves in the UK has been initiated by a group of journalists and representatives of survivors associations. The campaign has been started in the Western Daily Press newspaper, but presents a very imbalanced, one sided view of the issues (see [www.westpress.co.uk](http://www.westpress.co.uk)).

A small minority of rogue divers have been pilfering from and disturbing wrecks. Not only are they spoiling wrecks for future divers, breaking the law, upsetting the relatives of those that have lost their lives on the ships, but by bringing live munitions ashore, also endangering life. This has provided the press an opportunity to tarnish all divers with the same brush.

PADI and other organisations have been working hard to promote respectful, responsible diving, under the Respect Our Wrecks banner. This campaign has proved effective and interest and support has extended worldwide. Recently, an educational brochure, Wreck Diving - Don't Get Scuttled was produced, advocating a Look Don't Touch policy to wreck diving. This brochure is available from your local PADI dive centre. The Respect Our Wrecks code summarises the key points in this brochure: (The general theme is valid world-wide, and something that all divers should embrace).

- **1. Respect War Graves** Many wrecks are also war graves. Treat them with the respect you would give a churchyard
- **2. Respect the Wreck.** Environment Many wrecks provide habitats on which marine life now thrives. Treat them with the care you would afford coral reefs.
- **3. Respect the Future.** Explore wrecks, where allowed, but don't damage or disturb them. Take photos rather than souvenirs, so that our wrecks remain for future divers to see.
- **4. Respect our History.** Many wrecks have an important history and hold clues to our maritime past. If you find anything of interest, report it to the Receiver of Wreck in the UK or the appropriate organisation in your own country, who will pass on such information to archaeological experts.
- **5. Respect Yourself.** Make sure that you are appropriately trained for wreck diving.
- **6. Respect Your Family and Friends.** Some wrecks contain dangerous cargoes or live munitions. Don't disturb them or bring them ashore.
- **7. Respect the Law.** Know and respect maritime laws - and avoid a criminal record.

Don't let the actions of a few rogue divers spoil your opportunities for respectful wreck diving in the future.

### ***Response to Press from PADI International Limited***

The vast majority of British divers deplore the activities of the few rogue divers who flout the law, have a disregard for our underwater cultural heritage and are disrespectful of war graves. However, a current campaign is trying to ban all divers from war graves.

Divers are fortunate in being able see for themselves these historic underwater sites and to pay their respects to our heroes. Many research the history of the wrecks beforehand, those that don't, more likely have a heightened interest in the past when they leave. Some take photographs, some are there to appreciate the new marine habitat the wreck may have created. There are those who help the survivors associations, for example to lay wreaths and those that are relatives of war heroes

themselves; others help monitor the state of wrecks and report them to the authorities. The majority of divers play a positive role and help ensure that our war heroes are remembered for future generations.

The Professional Association of Diving Instructors (PADI) is working hard with other organisations to stamp out the small number of rogue divers who create problems for us all.

Education is paramount and has already proved successful. A code of practise for diving on wrecks (Wreck Diving - Don't Get Scuttled) has been developed and promoted to divers in the UK. The Code is supported by many government departments and agencies and also by other organisations. These include the Maritime and Coastguard Agency, the Department for Culture, Media and Sport, English Heritage, Historic Scotland, Cadw, Department of the Environment Northern Ireland, the National Trust and the Ministry of Defence.

The educational campaign is trying to make divers part of the solution rather than part of the problem. A measure of success is that 'Respect Our Wrecks', a joint initiative of the recreational diving organisations in the UK (PADI, SAA and BSAC) to take this educational campaign forward, is being copied internationally to achieve the same aims. Self-regulation by the divers is working, but effective, long-term education takes time.

Reporter Shirley Ward, who tragically lost her father when HMS Repulse sank, is using her reporter colleagues on local and national newspapers to promote campaigns to ban diving on all war graves. She is in a privileged position to promote her campaigns. Unfortunately, if the campaigns are successful and divers are banned from war graves, much of the good work will be undone. PADI will no longer have the opportunity to promote respectful and responsible diving on war graves. These war graves will pass from public memory and will sadly again become vulnerable to those who disregard the law.



## **New Leaflet on Wreck Diving Code**

The diving organisations (BSAC, PADI and SAA) have been working together with the other member organisations of the Joint Nautical Archaeology Policy Committee to produce a new leaflet on wreck diving. It contains a code which deals with all aspects of wrecks, including safety and looking after the environment. One of its main themes is to make all divers aware of the legal and moral responsibilities of wreck diving, especially respecting war and other sea graves.

The few divers who desecrate war and other graves give all divers a bad name in the eyes of the non-divers. If such activities are not stopped then many wrecks, perhaps thousands, could become inaccessible to all divers because of these selfish uncaring few. The diving organisations, through our Respect Our Wrecks campaign, are ensuring that as many divers as possible (including those who do not belong to BSAC, PADI and SAA) are aware of wreck diving issues and understand their responsibilities for good diving practise. The diving organisations will have no hesitation in advising those who have concern, or believe that they have evidence about wrong doings, to redirect such information to the relevant authorities.

The leaflet, called Wreck Diving - Don't Get Scuttled, is available to all divers. The new leaflet is a companion to the recent Underwater Finds - What to Do leaflet, which is still available (together with the more detailed booklet Underwater Finds - Guidance for divers).

# NDC Bulletin

The Technical Newsletter of the British Sub-Aqua Club.

Issue No. 39 March 2001

**'Wrecks are only piles of scrap...'**

**Why should we respect them?**

**Chris Underwood NAS**



Over the past thirty years or so sport diving has grown rapidly. Estimates vary on the annual number of dives in British waters, but it is certainly hundreds of thousands, perhaps millions. Wreck diving is clearly the main focus for many of these dives and developments in diving techniques have led to longer and deeper dives providing access to wrecks previously beyond the reach of the sport diver. These dives combined with the impact from commercial exploitation of the coastal zone and the environment threatens the long-term existence of the underwater cultural heritage.

Wrecks are a non-renewable resource.

'British shipwrecks are as yet a poorly understood and little examined resource, but have the potential to provide unparalleled evidence for trade and exchange and the movements of peoples and ideas'. It has been suggested that there should be a distinction made between wrecks such as the Mary Rose and the rest. A recent article put forward the case.

**'Sorting scrap-yards from Mary Roses'....**

*Diver Magazine. Deep Breath. October 2000*

Was the Mary Rose archaeologically important 50 years after her loss in 1545? Almost certainly not, she would have been valued as a source of scrap in the form of ordnance, ships fittings, etc.

If modern wrecks are currently considered to be scrap-yards, will some of them not become important in the future? Yes, but knowing which ones is a more difficult question to answer. Some of the best examples of post-industrial revolution technology lie on the seabed in the form of ships fittings or cargo, if not the wrecks themselves. Inevitably someone will want to study the development and typology of port-holes, marine engines, steam valves, etc. Much of this material has been recovered, but was the location recorded, what other artifacts were in association, what wreck did the objects come from? Many of these wrecks will not be assessed by professional archaeologists, there are simply not enough of them, but there are thousands of divers who could with some guidance play a valuable role in recording them.

It is also a common misunderstanding to assume all modern wrecks could be rebuilt from the original records. In many cases records may exist, but for all intents and purposes are lost through a number of factors.

Archaeologists often appeal for artifacts to be left in situ, not in a desire for personal ownership, but more to do with the interpretation of a site. It is a fundamental principle of archaeology that sites are studied as an association of objects rather than as a series of isolated finds. The disturbance or removal of artifacts from sites makes the interpretation of sites more difficult, basically there are fewer clues. Ideally artifacts should be left on the seabed unless there is a clearly identified threat to their survival.

There have been comments that accuse archaeologists of taking over sites that were found by sport divers. NAS Training employs numerous archaeologists who help amateurs develop their skills and often then work together on projects.

There are currently about 50 sites designated under the Protection of Wrecks Act (1973) and it is widely acknowledged that sport divers were responsible for finding over half of them. There is no reason why continued involvement is not possible. An obligation of the license application procedure is to have a 'nominated archaeologist' who assists the team with the development of a project design that incorporates acceptable archaeological standards.

The Advisory Committee on Historic Wreck Sites advises the government on matters relating to new and existing designated sites under the Act and currently includes Chris Allen of BSAC and Stuart Bryan from the SAA.

BSAC, SAA and PADI are also represented on the Joint Nautical Archaeology Policy Committee, a committee that meets to discuss archaeological policy matters. The committee was also responsible for the preparation of leaflets such as the recent 'Wreck Diving, Don't get Scuttled' that forms part of the recently launched 'Respect our Wrecks' initiative.

While the role of the sport diver has not been defined in maritime archeology, there are various roles in which divers could actively take part. 'Ground truthing' (identifying and verification of existing records), the surveying and monitoring the condition of sites that form part of the National Sites and Monuments Record are all roles that divers could play.

*WreckMap* part of our wider 'Dive with a Purpose' initiative is a project designed to focus on specific areas such as the Sound of Mull.

Background information for the 'Adopt a Wreck' scheme and our *WreckMap* projects will be available at the London International Dive Show in March and is currently on the NAS web-site.

NAS can be contacted at:

Fort Cumberland, Fort Cumberland Road, Eastney, Portsmouth, PO4 9LD

Email [NAS@nasportsmouth.org.uk](mailto:NAS@nasportsmouth.org.uk)

web-site [www.nasportsmouth.org.uk](http://www.nasportsmouth.org.uk)

Tel/Fax 023 9281 8419



14th January 2001

**Re: War graves**

Dear Sir,

The vast majority of British divers deplore the activities of the few rogue divers. But the Western Daily Press campaign is trying to ban all divers from war graves. Is this not like all of the war memorials and cemeteries on land being closed to members of the public? All we ask is the right for divers to visit these war graves, in the same way as you can visit cemeteries. Divers are fortunate in being able to see for themselves these historic underwater sites and to pay their respects to our heroes. There are groups of divers who help the survivors associations. Divers also monitor the state of wrecks (for example, for seeping oil pollution) and report them to the authorities. These and other charitable works are where divers can play a positive role with war graves.

The diving organisations are working hard and successfully to stamp out the small number of hooligans in our midst. We too are angry with these few rogues who create problems for us all, both for survivors, for relatives and for divers. We echo the sentiments in the article written by the Reverend Andrew Phillips on the 9th of January. Many Acts of Parliament, although passed with best intentions, have practical problems and the Protection of Military Remains Act is one of these. The Ministry of Defence seeks more appropriate measures to protect war graves. One of the key strategies is raising the awareness of divers to the problems. Education of divers, particularly through the diving organisations, is important and already a Code of Practice, which covers war graves, has been produced by the organisations and distributed to divers. The Code is supported by many government departments and agencies and also by other organisations. These include the Maritime and Coastguard Agency, the Department for Culture, Media and Sport, English Heritage, Historic Scotland, Cadw, Department of the Environment Northern Ireland, the National Trust and the Ministry of Defence. This support of the education of the diving community is to make divers part of the solution rather than part of the problem. A measure of success is that 'Respect Our Wrecks', a joint initiative of the BSAC, PADI and SAA diving organisations, is being copied internationally to achieve the same aims. Self-regulation by the divers is working. However, education takes time and we need to be given time for it to reach all divers. Reporter Shirley Ward, who tragically lost her father when HMS Repulse sank, is using her reporter colleagues on other newspapers to promote campaigns to ban diving on all war graves. She is in a privileged position to promote her campaigns. Unfortunately, if the campaigns are successful, and divers are banned from war graves, then much of the good work will be undone. It will no longer be the responsibility of the diving organisations to educate their members in this matter, other than to point out the legal situation. These war graves will pass from public memory and will sadly again become vulnerable to those who disregard the law.

Sincerely,

Stuart Bryan (SAA) Jane Maddocks (BSAC) Suzanne Pleydell (PADI)

[For information on work being done by divers please go to here](#)

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A joint initiative will be launched at the London International Dive Show this weekend by SAA, PADI and BSAC to help raise awareness of the issues surrounding wreck diving in the UK and to ensure the best possible wreck diving practices are observed by recreational divers. The awareness campaign itself is the culmination of many years' work with other interested parties, including the Maritime and Coastguard Agency, Ministry of Defence and archaeological groups (including the Nautical Archaeology Society and the Joint Nautical Archaeology Policy Committee), to clarify the issues and

find ways to disseminate information. The diving organisations embrace these efforts wholeheartedly and are attempting to bring the issues directly to the attention of divers in the UK.

A minority of divers are still pilfering from and damaging wrecks and a small number are even desecrating war graves. Not only are they spoiling wrecks for future divers, they may be breaking the law and in some cases upsetting the relatives of those that have lost their lives on the ships. Some divers are destroying our history and the marine environment, either by not thinking what they are doing, or even deliberately. Others are endangering life by bringing live munitions or other dangerous material ashore.

Respect Our Wrecks is intended as a philosophical approach to one of the most popular diving activities in the UK, wreck diving, which is enjoyed by thousands of recreational divers every year. We believe that raised awareness of these issues will also result in increased peer pressure amongst divers to curb the poor wreck diving practices being conducted by the few.

Veronica Robbins, Receiver of Wreck comments "the Maritime and Coastguard Agency wants divers to enjoy safe, legal, responsible diving and fully supports this very important initiative".

Respect our wrecks today so that everyone can still enjoy them tomorrow

### **1) Respect War Graves**

Many wrecks are also war graves. Treat them with the respect you would give a churchyard

### **2) Respect the Wreck Environment**

Many wrecks make great habitats for marine life. Treat them with the care you would give to coral reefs

### **3) Respect the Future**

Explore wrecks, where allowed, but don't damage or disturb them. Take photos rather than souvenirs, so that our wrecks remain for future divers to see

### **4) Respect our History**

Many wrecks have an important history and hold clues to our maritime past. If you find anything, report it to the Receiver of Wreck, who will pass on such information to archaeological experts

### **5) Respect Yourself**

Make sure that you are appropriately trained for safe wreck diving

### **6) Respect Your Family and Friends**

Some wrecks contain dangerous cargoes or live munitions. Don't disturb them or bring them ashore

### **7) Respect the Law**

Know and respect maritime laws - and avoid a criminal record

For further information, please contact

Stuart Bryan , Sub-Aqua Association , 26 Breckfield Road North , Liverpool L5 4NH

Tel: 01453 812527 email - [Stuart@bryan19.fsnet.co.uk](mailto:Stuart@bryan19.fsnet.co.uk)

Suzanne Pleydell , PADI , Unit 7, St Philips Central ,Bristol BS6 7PG BSAC 26

Tel: 0117 300 7310 email - [suzannep@padi.co.uk](mailto:suzannep@padi.co.uk) Breckfield Road North Unit 7, St Philips Central

Jane Maddocks , BSAC , Telford's Quay , South Pier Rd , Ellesmere Port , Cheshire CH65 4FL

Tel: 0151 350 6200 email - [jmaddocks@newnet.co.uk](mailto:jmaddocks@newnet.co.uk)

# SAA Code of Practice for Wreck Diving



## Mission Statement

*The SAA is committed to conserving our underwater heritage for future generations of divers to enjoy. The SAA achieves this and the safety of divers by promoting sound and responsible practice through its training programme. The SAA encourages participation by its members in research and adoption of wrecks for research and monitoring purposes.*

## Introduction

Although wrecks are found throughout the world's seas, it is in UK waters that wreck diving is especially popular. Every wreck has a history, including its sinking, and the curious diver will want to know more. Wrecks are exciting to explore and also make great habitats for fish and other aquatic life.

Most of the wrecks dived around our coast sank during the First and Second World Wars and are now an important part of our history. Not just the history of battles and wars, but also of naval architecture and technology as well. It is fascinating to learn about the development of vessels, which have evolved according to social needs, and the progress of technology.

The seabed holds the remains of many tragedies, for the sinking of a vessel is often accompanied by loss of life. These sunken vessels still claim lives - the lives of divers inadequately prepared for difficult dives. Wreck diving, particularly when wrecks are penetrated, requires a high level of experience and advanced skill training available from clubs within the SAA. Preparation and planning is important and this includes research and local knowledge. Research is always the best way of fully appreciating a wreck, perhaps identifying its name, how it was sunk and understanding the lives of those on board.

There are divers who see a wreck as an area of conquest; they see a remaining porthole as something to take home. Objects removed will deteriorate if they are not properly conserved. These "souvenirs" almost always end up rusting away forgotten in a garage or garden. But more importantly, taking items from wrecks means that there is nothing left of interest for other divers to see. Wrecks are not a renewable resource and the SAA promotes consideration for the majority of divers who want to visit and appreciate intact wrecks. Contemporary standards of behaviour are replacing former unsociable diving activities and only if wrecks are respected will there be anything for future generations of divers to enjoy.

## Guidelines and Code of Conduct

Important archaeological evidence will be destroyed by thoughtlessness. If you think that an object or wreck may be of historical importance, then leave it where it lies as it may be fragile. Record its position (depth, GPS, etc) and contact the Receiver of Wreck for advice.

All wreck already belongs to someone. Remember that if you bring anything to the surface, you are required by the Merchant Shipping Act 1995 to report it to the Receiver of Wreck so that its true owner can be found. Sometimes you may be allowed to keep the object or you may be entitled to a reward for restoring it to its owner. Divers who actively remove items from wrecks for commercial gain are diving beyond the limits of the SAA.

Many wrecks of military vessels or aircraft are the last resting-places of those who gave their lives in the Great Wars. War graves should not be entered or interfered with, as is it an offence under the Protection of Military Remains Act 1986. Imagine the distress that it causes relatives and comrades of those who died. It is like damaging or desecrating a churchyard. Remember that other sunken vessels, such as trawlers or merchant ships, may also be graves from peacetime tragedies and should also be respected.

Other wrecks may have toxic material or munitions on board. As well as injuring yourself, think of the danger you are putting your family, friends and others in if you bring hazardous objects ashore. The acquisition or possession of munitions is a criminal offence under the Firearms Act 1968. For your own safety, it is illegal to dive on some wrecks that contain dangerous material.

It is also illegal to dive on designated historic wrecks that are protected by the Protection of Wrecks Act 1973, unless you have been approved by the controlling authority.

Divers now understand the effects on coral reefs of poor diving technique. Wrecks also provide a habitat for marine life which destructive diving or careless anchoring may ruin. Use available fixed shot-lines where possible. If you need to use your own line or anchor, ensure that they are secured off the wreck wherever possible. Use safe diving techniques that will not spoil the site for other divers, whatever their interest.

Clubs and groups of divers are now adopting particular wrecks for research purposes. Some of these divers take part in detailed structural surveys, some undertake historical research and others study the marine life and monitor changes of the ecology of the wreck. The SAA promotes this positive attitude towards wrecks and the environment.

- Get appropriate training before you enter wrecks.
- Research the wreck site before diving on it.

- Leave wrecks intact for other divers to see.
- Know the law - if you must remove an object, you must report it to the Receiver of Wreck. Commercial salvage cannot be undertaken within the SAA.
- Know the law - it is a criminal offence to dive on designated historic wreck sites without a licence or on designated dangerous wreck sites.
- Respect war and other graves beneath the sea.
- Take care on wrecks that contain munitions or toxic materials and leave such materials alone. Acquiring or possessing munitions without authority is illegal.
- Protect the environment.

**Look after yourself and look after the environment, so that wrecks may remain, not only as history today, but also as history for tomorrow.**

For further information see the leaflet 'Underwater Finds - What To Do' (available from SAA Headquarters and dive shops) or telephone the Receiver of Wreck on 01703 329 474.

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Join sea-site - the marine archaeological environment mailing list  
<http://www.mailbase.ac.uk/lists/sea-site>

# Appendix V

## DEPARTMENT OF HARBOURS *DIVING PERMIT*

### IV-a

Diving Permit prior to 1 January 2002

### IV-b

Diving Permit after 1 January 2002

# IV-a

## DEPARTMENT OF HARBOURS

**Permit No: 000**

### DIVING PERMIT

***In terms of the Orkney Harbour Areas Byelaws 1977, permission is hereby granted to the underlisted person(s) to dive for the purpose of pleasure diving in the ALL section(s) of the Orkney Harbour Areas***

***dd - dd mmonth 2002***

***subject to the following conditions:***

***Mr forename surname, party diving from BOAT NAME, c/o Mr Skipper Name, Skipper Address,***

1. ***The Orkney Harbour Areas Byelaws and any other Legislation, Rules, Notices, or Orders as shall apply shall be complied with at all times.***
2. ***The person or persons to whom the permit is granted and the person in charge of the craft used for the purposes of the permit shall comply with all instructions or directions given to them by the Department of Harbours and shall keep Orkney Harbour Radio fully advised of the movements of craft used by divers.***
3. ***The person or persons to whom this permit is granted has permission to dive upon the wrecks of the "BRUMMER", "DRESDEN" and "KOLN" only, being wrecks in the ownership of Orkney Islands Council. The owner's permission must be obtained before any other individual wrecks are dived upon. They must also bring to the attention of all divers the following regulations regarding removal of artefacts, and ensure that no artefacts are brought on board their vessel, unless they have written permission to do so from the owner of the wreck.***
4. ***(a) No part or artefacts of the wrecks may be removed without the prior written permission of the owner of the wreck. This includes any part or artefacts on the sea bed in the area of the wreck sites. Any part or artefacts removed must be declared to The Receiver of Wreck, The Maritime and Coastguard Agency, Southampton. Forms for this purpose are available from your local Coastguard Station, this office or direct from the Receiver of Wreck. (02380 329474).***

**(b) With reference to the wrecks of the "BRUMMER", "DRESDEN" and "KOLN" it should be noted that (i) the granting of this permit in no way implies permission to remove any parts or artefacts from these wrecks and separate application must be made for any such permission, and (ii) all fittings which in the opinion of the Ministry of Defence are of a confidential character and any cash, notes, securities for money, books or personal effects remain in the control of the Ministry of Defence and persons are strictly prohibited from removing any such items. Any person locating any such items shall notify the Department of Harbours so that a report can be made to the Ministry of Defence.**

5. The wreck of H.M.S. "ROYAL OAK" and the wreckage of H.M.S. "VANGUARD" are designated "war graves" and it is not the policy of the Ministry of Defence (Navy) to permit diving on such vessels. Paragraph 33 of the Orkney Islands Council General Byelaws prohibits diving within 100 metres of any of Her Majesty's ships or vessels including the wrecks of any such ships or vessels.

*Divers should also be aware that diving on the wreck of H.M.S. HAMPSHIRE<sup>®</sup> is not permitted as it is also a war grave and is covered by The Protection of Military Remains Act 1986.*

6. No person or persons shall dive within 500 metres of the Flotta Terminal, the Single Point Moorings and all submarine pipelines associated with the developments on the island of Flotta or the Single Point Moorings (details of which are available from the undersigned).
7. This permission is granted on condition that neither the Orkney Islands Council nor any of its servants or agents shall be liable to any person for any loss or damage of any kind howsoever caused or arising from the use of this Diving Permit or arising by virtue of Orkney Islands Council's ownership of the wrecks of the "BRUMMER", "DRESDEN" and "KOLN" and the person or persons to whom the permission is granted shall relieve and indemnify Orkney Islands Council from and against all loss, damage, responsibility, liability, claims and expenses which may be sustained or incurred by or made upon or against them on account of or by or through the said use or the failure to comply with the conditions of this permit.
8. The person in charge of the craft used for the purpose of the permit shall ensure that the Diving Flag - International Code Flag "A" is flown at all times when divers are in the water.
9. Orkney Islands Council reserves the right to grant diving permits to such other persons at such times as it considers appropriate.

Date:

.....  
Harbours Operations Manager

# IV-b

DEPARTMENT OF HARBOURS



**Permit No:**

XXX

DIVING PERMIT

In terms of the Orkney Harbour Areas Byelaws 1977, permission is hereby granted to the underlisted person(s) to dive for the purpose of pleasure diving in the ALL section(s) of the Orkney Harbour Areas

**dd - dd mmonth 2002**

***subject to the following conditions:***

Mr forename surname, party diving from BOAT NAME, c/o Mr Skipper Name, Skipper Address,

1. ***The Orkney Harbour Areas Byelaws and any other Legislation, Rules, Notices, or Orders as shall apply shall be complied with at all times.***
2. ***The person or persons to whom the permit is granted and the person in charge of the craft used for the purposes of the permit shall comply with all instructions or directions given to them by the Department of Harbours and shall keep Orkney Harbour Radio fully advised of the movements of craft used by divers.***
3. ***The person or persons to whom this permit is granted has permission to dive upon the wrecks of the 'BRUMMER', 'DRESDEN' and 'COLN' only, being wrecks in the ownership of Orkney Islands Council. The owner's permission must be obtained before any other individual wrecks are dived upon. They must also bring to the attention of all divers the following information regarding the protected status of the wrecks.***
4. ***The wrecks of the 'BRUMMER', 'DRESDEN' and 'COLN' (together with the wrecks of the 'KARLSRUHE', 'MARKGRAF', 'KÖNIG' and 'KRONPRINZ WILHELM') are Scheduled Ancient Monuments, protected under the terms of the Ancient Monuments and Archaeological Areas Act 1979. This means that they can be visited without a licence, but they must not be tampered with in any way and nothing may be removed from the site. This includes any part or artefacts on the sea bed within 250 metres of the wreck sites. It is a criminal offence to tamper with the wrecks in any way or remove any artefacts or other material from the wreck sites. Further advice on the scheduled wrecks can be obtained from Historic Scotland.***

5. The wreck of H.M.S. 'ROYAL OAK' and the wreckage of H.M.S. 'VANGUARD' are designated "war graves" and it is the policy of the Ministry of Defence (Navy) NOT to permit diving on such vessels. Paragraph 33 of the Orkney Islands Council General Byelaws prohibits diving within 100 metres of any of Her Majesty's ships or vessels including the wrecks of any such ships or vessels.

***Divers should also be aware that diving on the wreck of H.M.S. 'HAMPSHIRE' is not permitted as it is also a war grave and is covered by The Protection of Military Remains Act 1986.***

6. ***No person or persons shall dive within 500 metres of the Flotta Terminal, the Single Point Moorings and all submarine pipelines associated with the developments on the island of Flotta or the Single Point Moorings (details of which are available from the undersigned).***
7. ***This permission is granted on condition that neither the Orkney Islands Council nor any of it's servants or agents shall be liable to any person for any loss or damage of any kind howsoever caused or arising from the use of this Diving Permit or arising by virtue of Orkney Islands Council's ownership of the wrecks of the 'BRUMMER', 'DRESDEN' and 'COLN' and the person or persons to whom the permission is granted shall relieve and indemnify Orkney Islands Council from and against all loss, damage, responsibility, liability, claims and expenses which may be sustained or incurred by or made upon or against them on account of or by or through the said use or the failure to comply with the conditions of this permit.***
8. ***The person in charge of the craft used for the purpose of the permit shall ensure that the Diving Flag - International Code Flag "A" is flown at all times when divers are in the water.***
9. ***Orkney Islands Council reserves the right to grant diving permits to such other persons at such times as it considers appropriate.***

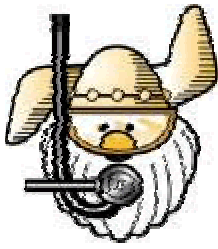
**Date:**

.....  
**Harbours Operations Manager**

# Appendix VI

Orkney Dive Boat Operators Association  
Code of Practice

# VI



## ORKNEY DIVE BOAT OPERATORS ASSOCIATION CODE OF PRACTICE

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### General Responsibilities

1. Dive boat skippers are responsible for safety of all passengers and crew while on board their vessel.
2. Dive boat owners are responsible for ensuring both vessel and skipper have appropriate certification for area of operation and that certificates and training records are in date.
3. Divers are responsible for the possession of a current diving qualification appropriate to the planned dive and a valid certificate of medical fitness to dive.
4. Diving operations are the responsibility of the diving group, individual or nominated diving supervisor. Divers are responsible for discussing dive plans with the skipper through a nominated representative.
5. The skipper may advise on matters considered relevant to the dive (e.g. changes in sea condition, surface visibility, tides). If necessary, the skipper has the authority to terminate the dive or suggest an alternative if considered unsafe or sea/weather conditions are considered unsuitable.
6. Vessel owners are responsible for ensuring any equipment used in provision of a diving service (e.g. compressor) is suitable and that maintenance, test certificates and training records are in date.

### Insurance

7. Dive boat owners will ensure that the vessel has valid Passenger and Third Party Liability insurance.
8. The dive boat is only insured for divers whilst they are onboard. Divers are responsible for ensuring they have adequate insurance cover for their diving activities.

### Vessel Communication

9. All dive boats will carry adequate and working communications equipment including VHF and will keep a listening watch on Channel 16 and any other agreed working VHF channel.
10. Dive boats will establish and maintain communication with any vessel(s) already on the dive site, identify current situation and agree diving/vessel manoeuvre procedures to be followed.
11. Dive boats to display correct dive signals (A-flag) when divers in water. Signals to be removed when vessel not involved in diving operation.
12. All vessels to proceed at a safe speed in areas where divers are in-water.
13. A watch will be kept at all times when in the vicinity of a dive site for surfacing divers and divers on surface. This should be particularly observed when putting engine into gear.
14. A safe distance will be maintained from the shot while the dive boat is on standby, bearing in mind both keeping clear of surfacing divers and a need to keep watch for divers and any other vessel traffic.

## **Diver Location**

15. When diving in tidal locations or in recognised navigation channels away from known wrecks sites and shot lines, divers will carry surface marker buoys (SMBs) or decompression bags. This is particularly important when undertaking long periods of in-water decompression.
16. The diver is responsible for informing the skipper of any intention to move away from the wreck and/or shot line and planned dive durations.
17. The skipper is responsible for informing the divers of any known hazards (e.g. navigation lanes and ferry routes). Divers are responsible for planning dives accordingly.
18. The skipper will communicate with OIC Harbours Operations Room at Scapa before diving the wreck of the Strathgarry in Hoxa Sound.

## **Emergencies**

19. Dive boat skippers are responsible for co-ordinating emergency procedures onboard the vessel and complying with agreed emergency communication channels. In the event of an emergency involving a diving incident, HM Coastguard should be immediately notified on Channel 16.
20. Dive boat skippers will maintain a log of contact details and next of kin for all passengers onboard.
21. Divers are responsible for keeping adequate logs of their dives to assist in the event of a diving incident.
22. Other dive boats in the area will remain on standby in the event of an emergency including a diving incident and assist where necessary.
23. Dive boat owners are responsible for ensuring all vessels carry a means of recovering casualties from the water and that dive boat skippers are familiar in techniques for retrieval of an injured or unconscious diver from the water.
24. Dive boat owners are responsible for ensuring all vessels carry O<sub>2</sub> administration equipment and that this is maintained as appropriate. Dive boat skippers will be trained in the use of O<sub>2</sub> administration equipment.

## **Wreck Protection**

25. ODBOA supports the national Respect our Wrecks Code of Practice and recognises the Orkney Voluntary Underwater Conservation Zone.
26. Due to the protected status of the wrecks of the German High Seas Fleet under the Ancient Monuments and Archaeological Areas Act 1979, divers may not carry crowbars or other salvage equipment when diving the wrecks of the Coln, Brummer, Dresden, Markgraf, Konig, Kronprinz Wilhelm and Karlsruhe.
27. ODBOA supports the location and discovery of new wrecks. Wreck location and recovery of any artefacts must be undertaken within the law and reported to the Receiver of Wreck. It is the responsibility of the individual divers to undertake all reporting and measures necessary under the law.
28. HMS Royal Oak, HMS Vanguard and HMS Hampshire are recognised wargraves and as such are now controlled wrecks under the Protection of Military Remains Act 1986. Diving is not permitted without a valid licence, and skippers will not allow diving on these wrecks without possession of such a licence. No crowbars or other salvage equipment may be carried.

[Return to main page](#)

# Appendix VII

Leaflet produced by Orkney Dive Boat  
Operators Association and Orkney  
Heritage.

A Voluntary Underwater Conservation Zone for Orkney Waters



ORKNEY  
DIVE  
BOAT  
OPERATORS  
ASSOCIATION

## What is the Voluntary Underwater Conservation Zone?

Orkney's waters contain a wealth of interesting and historically important wrecks. These need to be protected for future generations of divers to enjoy. The Voluntary Underwater Conservation Zone for wrecks in Orkney waters is a commitment by Orkney Dive Boat Operators Association (ODBOA) to help protect these wrecks and not to allow the irresponsible removal of souvenirs from them. The objective is to ensure that our maritime heritage can be conserved, shared and learnt from by all. ODBOA's policy is in line with the national Respect our Wrecks Code of Practice prepared by the Joint Nautical Archaeology Policy Committee, the British Sub-Aqua Club, Professional Association of Diving Instructors and the Sub-Aqua Association. This policy is supported by Orkney Islands Council.

Artifacts you find underwater may be of greater historical importance than you realise, and should ideally be left where they are. What is the point of removing objects from wrecks, only to have them end up hidden away in someone's back garden or garage? Sadly, as time passes, the objects deteriorate, the context from which they came is forgotten, and so the knowledge they would have given us is lost forever and the value of the wreck is depleted. It is far better that artifacts are reported and recorded as soon as they are found.

Researching the wreck's history can be as much fun as diving to the wreck itself. There are a number of sources of information and advice and these can be found listed under useful contacts. The Orkney Archives in the Orkney Library are an invaluable resource for researching wrecks in Orkney waters.

## What is the Law?

The seven remaining wrecks of the German High Seas Fleet are protected under the Ancient Monuments and Archaeological Areas Act 1979. This gives them the same legal protection as other archaeological monuments such as Stonehenge or Orkney's Skara Brae. It is a criminal offence to tamper with and remove artifacts from these wrecks. Further advice on the scheduled wrecks can be obtained from Historic Scotland.

There are a number of famous war graves in Orkney waters, in particular HMS Royal Oak and HMS Hampshire. These wrecks are the final resting place of many sailors who gave their lives to serve this country. HMS Royal Oak and HMS Vanguard are protected under the Orkney Harbour Bye-laws 1977 and all diving is prohibited. HMS Hampshire is a controlled wreck under the Protection of Military Remains Act 1986, as is HMS Royal Oak. Diving is only permitted with the permission of the Ministry of Defence and tampering and removal of artifacts is forbidden under this Act. ODBOA does not endorse the removal of souvenirs from known war graves at any time, under any circumstances.

Wrecks of historical importance may also be protected under the Protection of Wrecks Act 1973. Diving and salvage is prohibited on these sites without a licence. Orkney's waters do not contain any such wrecks at present, although there are eight in Scottish waters, including two 17th century ships off Shetland. Every year, more wrecks are protected under this Act, and some wrecks in Orkney's waters are prime candidates, such as the Sweda, an 18th century Swedish East Indiaman off North Ronaldsay.

Under the Merchant Shipping Act 1995, it is a legal requirement for all recovered wreck (a legal term covering most material recovered from the sea) to be reported to the Receiver of Wreck. The Health and Safety at Work Act 1974 also applies to any salvage work for commercial gain.

## Useful Contacts:

**Orkney Dive Boat Operators Association**  
c/o The Harbour, AJ & Co's Independent Ltd  
New Harbour Building, Stromness, Orkney  
Tel: 01856 85478

**Orkney Islands Council Harbour Department**  
Harbour Authority Building, 10/11a Orkney Street  
Tel: 01856 873332 Email: harbour@orkney.gov.uk

**Rescue Eye Enterprises**  
Over 1000 damaged wrecks collected under the sea - pictures of wrecks sent to the owner of the wreck. No commercial trading.  
P.O. Box 100, 10/11a Orkney Street, Stromness, Orkney  
Tel: 01856 873332 Fax: 01856 873332 Email: rescueeye@orkney.gov.uk  
Web: www.rescueeye.co.uk

**Archaeological Diving Unit**  
University of Exeter, P.O. Box 1111, Exeter  
Tel: 01392 421111 Email: adu@ex.ac.uk

**Secretary, Advisory Committee on Historic Wreck Sites**  
Department for Culture, Media and Sport, 1-4 Cockspur Street  
London SW1Y 9QW  
Tel: 020 7747 2096

**Receiver of Wreck**  
The Harbour and Quay Agency, Spring Place, 100 Commercial Road  
Southampton SO9 1AA  
Tel: 02380 209174 Email: ro@harbouragency.org.uk

**Historic Scotland**  
Langmuir House, Salisbury Place, Edinburgh EH6 7JX  
Tel: 0131 6663333

**National Monuments Record of Scotland**  
100 George Street, Edinburgh EH2 3JF  
Tel: 0131 667 1945

**Nautical Archaeology Society**  
1st Cambridge Road, Cambridge CB2 3RQ  
Tel: 01223 316494 Email: nas@nauticalarch.org.uk

**Nautical Archaeology Society (Scotland Co-ordinator)**  
100 Colinton Drive, Colinton, Edinburgh EH10 5DT  
Tel: 0131 637 4312

**Orkney Archives**  
Orkney House, 10/11a Orkney Street, Stromness  
Tel: 01856 873332

**Orkney Heritage**  
Orkney Islands Council, Department of Development and Economic  
Growth, 10/11a Orkney Street, Stromness  
Tel: 01856 873332 Fax: 01856 873332 Email: orkneyheritage@orkney.gov.uk  
Web: www.orkneyheritage.gov.uk

**British Sub-Aqua Club**  
10/11a Orkney Street, Stromness, Orkney  
Tel: 01856 873332 Web: www.bsac.org.uk

**PADI Professional Association of Diving Instructors**  
1st Floor, 10/11a Orkney Street, Stromness  
Tel: 01856 873332 Web: www.padi.com

**Sub-Aqua Association**  
10/11a Orkney Street, Stromness  
Tel: 01856 873332 Web: www.suba.org.uk

A number of these organisations also produce leaflets and guidance notes that may be useful.

# A Voluntary Underwater Conservation Zone for Orkney Waters

The Orkney Library and Archives

Abstract



**Stromness Museum**

From a purely physical perspective, and the subject of the story of *Manon*, it is an already-ruined preservation, and of equal degree. Many of the artists involved have the wealth of a royal household, and they have been asked to give the museum the language of choice. The museum has had a comprehensive renovation that the art world has called for the museum the language of choice. The museum has had a comprehensive renovation that the art world has called for the museum the language of choice. The museum has had a comprehensive renovation that the art world has called for the museum the language of choice.



Scapa Flow Visitor Centre  
and Museum, Lyness

[illegible]

### Scapa Flow - The Natural Harbour



The following table shows the number of people who have been
 convicted of a crime in the last 10 years, by age group and
 gender. The data is based on a sample of 10,000 people.



## Finding New Wrecks

**The Nautical Archaeology Society**



### The German High Seas Fleet



People like on 14th October 1938, Captain Gordon Fraser bought No. 44 and 47 into Scaja Floor through Kirk Scaja. When more than 90 yards from the shore, and on the surface at all times, he managed to become HMS Royal Oak, which sank with a loss of 833 lives. This brilliant manoeuvre earned him a medal back in Germany, and raised Winston Churchill to lead the coast-side of the Church of England. These letters, made out of 10-15 lines of cursive, were held the 40th issue, which was given through the south-west in Edinburgh in South America.

A memorial to the men lost on HMS Royal Oak can be found in St Magnus Cathedral, Kirkwall. A small memorial garden featuring a walk in memory can also be found at Scapa, in front of the Harbour Department Office.



Reprinted and revised by The Clarendon Press, Oxford, 1990. 200 pp.

## A Voluntary Underwater Conservation Zone



OSHKNEY  
DIVE  
BOAT  
OPERATORS  
ASSOCIATION



# Appendix VIII

## ScapaMAP Poster

Example of the type of poster which could be produced from the ScapaMAP multi-beam data.

# Scapa Flow Marine Archaeology Project

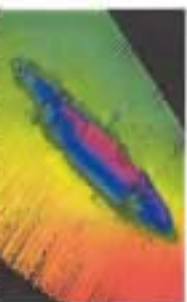
## Scapa Flow, Orkney, Scotland



1. 1986-1988 work. This shipwreck is a passenger liner, one of the 12 passenger liners that were sunk in Scapa Flow during the evacuation of German ships in 1945. The ship was sunk on 10 May 1945, and was the last of a series of 12 ships to be sunk in the flow. The ship was sunk by the British Royal Navy, and was the last of a series of 12 ships to be sunk in the flow.



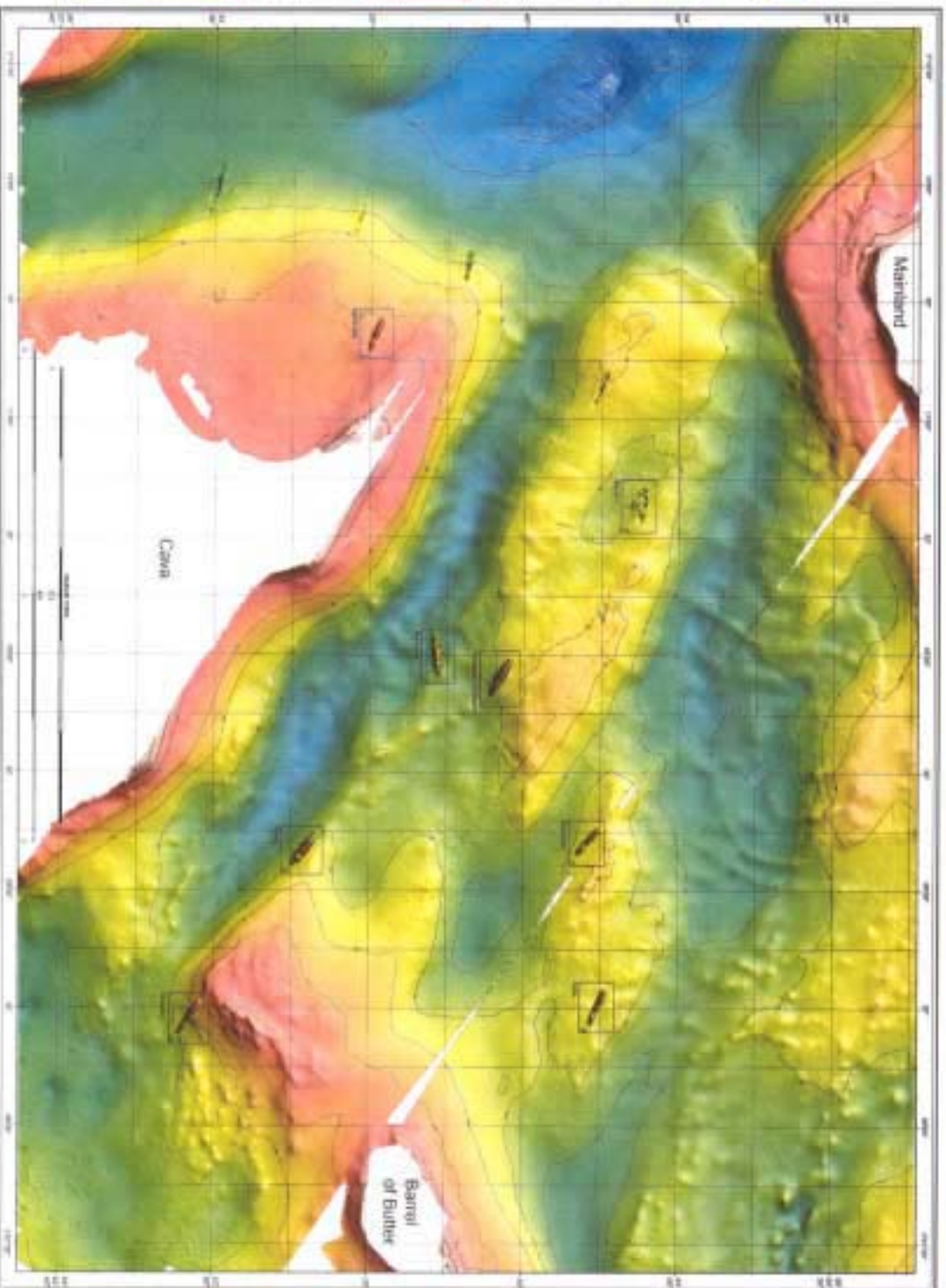
2. 1988-1989 work. This shipwreck is a passenger liner, one of the 12 passenger liners that were sunk in Scapa Flow during the evacuation of German ships in 1945. The ship was sunk on 10 May 1945, and was the last of a series of 12 ships to be sunk in the flow. The ship was sunk by the British Royal Navy, and was the last of a series of 12 ships to be sunk in the flow.



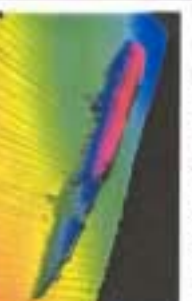
3. 1989-1990 work. This shipwreck is a passenger liner, one of the 12 passenger liners that were sunk in Scapa Flow during the evacuation of German ships in 1945. The ship was sunk on 10 May 1945, and was the last of a series of 12 ships to be sunk in the flow. The ship was sunk by the British Royal Navy, and was the last of a series of 12 ships to be sunk in the flow.



4. 1990-1991 work. This shipwreck is a passenger liner, one of the 12 passenger liners that were sunk in Scapa Flow during the evacuation of German ships in 1945. The ship was sunk on 10 May 1945, and was the last of a series of 12 ships to be sunk in the flow. The ship was sunk by the British Royal Navy, and was the last of a series of 12 ships to be sunk in the flow.



5. 1991-1992 work. This shipwreck is a passenger liner, one of the 12 passenger liners that were sunk in Scapa Flow during the evacuation of German ships in 1945. The ship was sunk on 10 May 1945, and was the last of a series of 12 ships to be sunk in the flow. The ship was sunk by the British Royal Navy, and was the last of a series of 12 ships to be sunk in the flow.



6. 1992-1993 work. This shipwreck is a passenger liner, one of the 12 passenger liners that were sunk in Scapa Flow during the evacuation of German ships in 1945. The ship was sunk on 10 May 1945, and was the last of a series of 12 ships to be sunk in the flow. The ship was sunk by the British Royal Navy, and was the last of a series of 12 ships to be sunk in the flow.



7. 1993-1994 work. This shipwreck is a passenger liner, one of the 12 passenger liners that were sunk in Scapa Flow during the evacuation of German ships in 1945. The ship was sunk on 10 May 1945, and was the last of a series of 12 ships to be sunk in the flow. The ship was sunk by the British Royal Navy, and was the last of a series of 12 ships to be sunk in the flow.



8. 1994-1995 work. This shipwreck is a passenger liner, one of the 12 passenger liners that were sunk in Scapa Flow during the evacuation of German ships in 1945. The ship was sunk on 10 May 1945, and was the last of a series of 12 ships to be sunk in the flow. The ship was sunk by the British Royal Navy, and was the last of a series of 12 ships to be sunk in the flow.



**Scapa Flow Marine Archaeology Project**  
The Scapa Flow Marine Archaeology Project is a joint venture between the Orkney Islands Council and the British Antarctic Survey. The project is aimed at identifying and recording the location of shipwrecks in Scapa Flow, and is part of a larger project to map the seabed of the flow.

**Background**  
The Scapa Flow Marine Archaeology Project is a joint venture between the Orkney Islands Council and the British Antarctic Survey. The project is aimed at identifying and recording the location of shipwrecks in Scapa Flow, and is part of a larger project to map the seabed of the flow.

**Objectives**  
The Scapa Flow Marine Archaeology Project is a joint venture between the Orkney Islands Council and the British Antarctic Survey. The project is aimed at identifying and recording the location of shipwrecks in Scapa Flow, and is part of a larger project to map the seabed of the flow.

**Methodology**  
The Scapa Flow Marine Archaeology Project is a joint venture between the Orkney Islands Council and the British Antarctic Survey. The project is aimed at identifying and recording the location of shipwrecks in Scapa Flow, and is part of a larger project to map the seabed of the flow.

**Results**  
The Scapa Flow Marine Archaeology Project is a joint venture between the Orkney Islands Council and the British Antarctic Survey. The project is aimed at identifying and recording the location of shipwrecks in Scapa Flow, and is part of a larger project to map the seabed of the flow.



# Appendix IX

## ScapaMAP Website

IXa      Project Information

IXb      Example of Details on Specific Wreck



•Dive Unit

### ScapaMAP: The Scapa Flow Marine Archeology Project

#### Contacts:

Brian Calder ([brc@ccom.unh.edu](mailto:brc@ccom.unh.edu)) [1]

Ian Oxley ([civio@civ.hw.ac.uk](mailto:civio@civ.hw.ac.uk)) [2]

Bobby Forbes ([b.forbes@hw.ac.uk](mailto:b.forbes@hw.ac.uk)) [3]

Rich Lear ([rich@reson.com](mailto:rich@reson.com)) [4]

Martin Dean ([mld@st-and.ac.uk](mailto:mld@st-and.ac.uk)) [5]

### Background

ScapaMAP (Scapa Flow Marine Archeology Project) is a multi-disciplinary, multi-institution, international project involving government agencies, industry and the academic community, designed to document a unique marine archeological area in the waters of Scapa Flow in the Orkney Islands of Scotland.

Scapa Flow ([Fig. 1](#)) is a shallow natural harbor off the north east coast of Scotland. Used as a sheltered anchor since at least the thirteenth century, it played a major role in both World Wars as a fleet base for the British Grand Fleet. At the end of World War I, it was also the internment site for the German High Seas Fleet during the Armistice negotiations. On Midsummer's Day (21 June) 1919, the British fleet left for exercises in the North Sea, leaving only two destroyers on guard. Acting on four day old reports in *The Times* that Armistice negotiations were about to fail and that the recommencement of hostilities was possible, Admiral von Reuter took the chance to make sure that the fleet would not fall into anyone's hands, and at 1030 hrs executed the pre-arranged order to scuttle the ships at anchor. Following the relay of the signal, the interned ships hoisted their battle ensigns along with the code flag 'Z' (Advance on the Enemy), and proceeded to abandon ship. With the sea-cocks open and internal water-tight doors removed, the British had no opportunity to stop the mass sinking except to tow some of the ships to shore and beach them. In all, 52 of the 74 interned ships (representing about 95% of the total tonnage) went to the bottom.

During the inter-war period, and up until the 1970's, many attempts to salvage the ships were made until only seven major ships now remain in the water: the cruisers Brummer,



Figure 1.

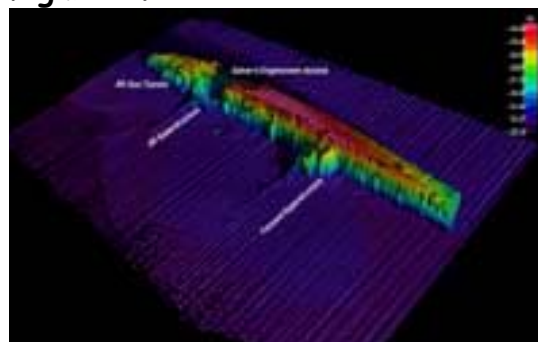


Figure 2.

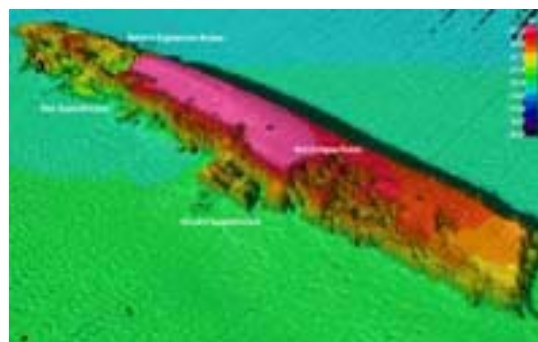


Figure 3.

Dresden, Köln and Karlsruhe, and the battleships König, Kronprinz Wilhelm and Markgraf. Today, along with the remains of the salvaging work on other ships and wreckage from other periods of Scapa Flow's naval history, the wrecks provide a major attraction for sport divers, with several thousand visitors per year. However, the wrecks were extensively weakened by later salvage work and over 80 years at the bottom, and many of them are in poor condition. In order to protect and monitor the wrecks for the future, ScapaMAP was initiated with the aim of constructing suitable base maps of the wrecks, recovery sites and other areas of interest in the Flow to aid in the interpretation, protection and monitoring of a significant local, national and international asset.

### Technology

In early 2001, the ScapaMAP Acoustic Consortium ([SAC](#)) was formed with the aim of augmenting the project's other work with acoustic remote sensing data. The visibility of the water, its depth and temperature make it extremely difficult to carry out extensive diver measurement of the ships. Consequently, the only way to quickly map all of the wrecks and surrounding area to reasonable accuracy is to use an acoustic instrument.

Previous work has used sidescan sonar and shallow water multibeam equipment to provide medium resolution bathymetry and high resolution acoustic backscatter for the area. SAC chose to use a new, dynamically focused, very high resolution multibeam echosounder---the [Reson 8125](#)---to provide the highest resolution data of the wreck and surrounding area to date.

The survey [system](#) provided by the SAC members consisted of the Reson 8125, a TSS POS/MV 320 attitude and navigation system, and a Racal Landstar DGPS receiver, installed aboard the [S/V Scimitar](#). The survey was carried out from 13--16 June 2001.

### Reconstructed Bathymetry

#### The Cruisers

The four remaining cruisers show a variety of states of decay. The Köln ([Fig. 2](#)) is probably the best preserved of the four, lying on its starboard side in about 35m of water. Careful inspection of the data shows the remaining portholes, superstructure, rear 6" guns and even lifeboat davits to be in

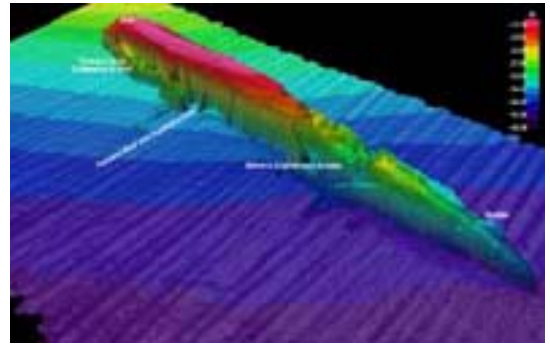


Figure 4.

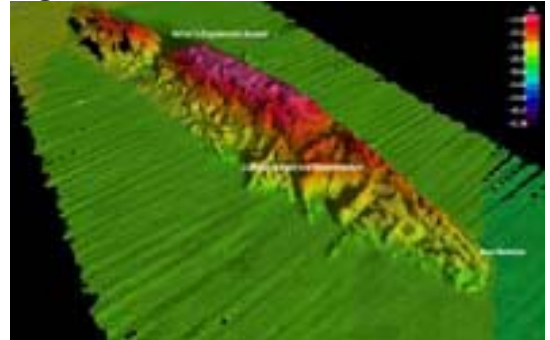


Figure 5.

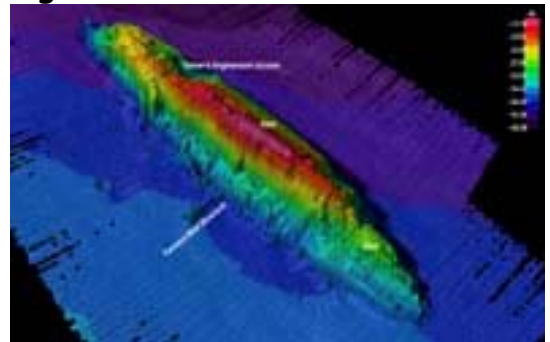


Figure 6.

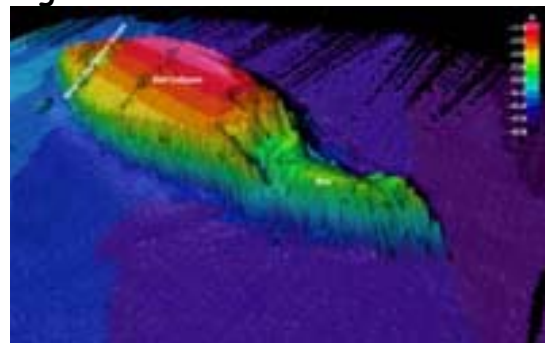


Figure 7.

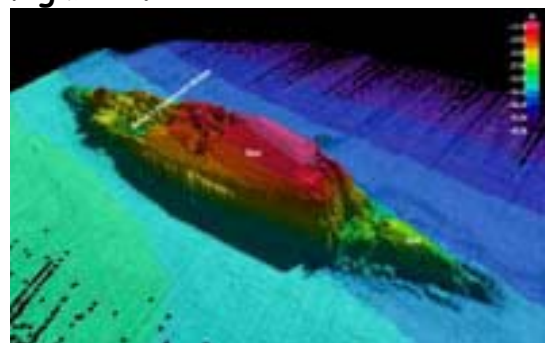
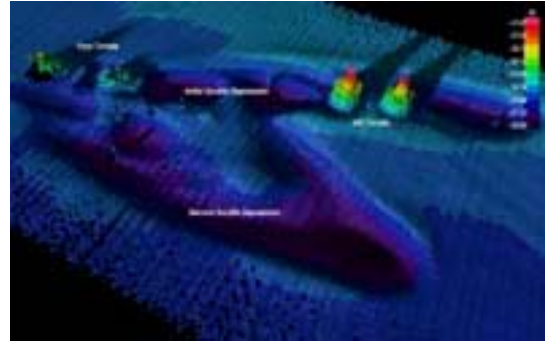


Figure 8.

place. Extensive damage has been done to the rear hull in order to salvage the engineroom non-ferrous materials, as with all of the remaining wrecks.

The Brummer ([Fig. 3](#)) and Dresden ([Fig. 4](#)) have both suffered significant upper hull damage, the Brummer's forward plates collapsing, while the Dresden's weather-deck has fallen out to port, putting its forward guns into the sediment.



**Figure 9.**

Of all the wrecks, the Karlsruhe ([Fig. 5](#)) is in poorest condition, principally due to extensive salvage work in the 1970's.

### **The Battleships**

The three remaining battleships have all turtled as they sank, mostly resting on the remaining superstructure, slowly crushing it with their own weight. The Kronprinz Wilhelm ([Fig. 6](#)) is mostly intact, except for the bow and engineroom sections, while the Markgraff ([Fig. 7](#)) and König ([Fig. 8](#)) are in poorer condition.

Also in the area are the remains of the Bayern ([Fig. 9](#)), at 28,000 tons the heaviest in the fleet. Prematurely over-pressured with compressed air during salvage attempts, the Bayern lifted off the ground too quickly, and left its four gun turrets behind before settling down, turned slightly towards the south east. Subsequent raising attempts were more successful, leaving behind only the turrets and some pieces of superstructure.

### **Contacts**

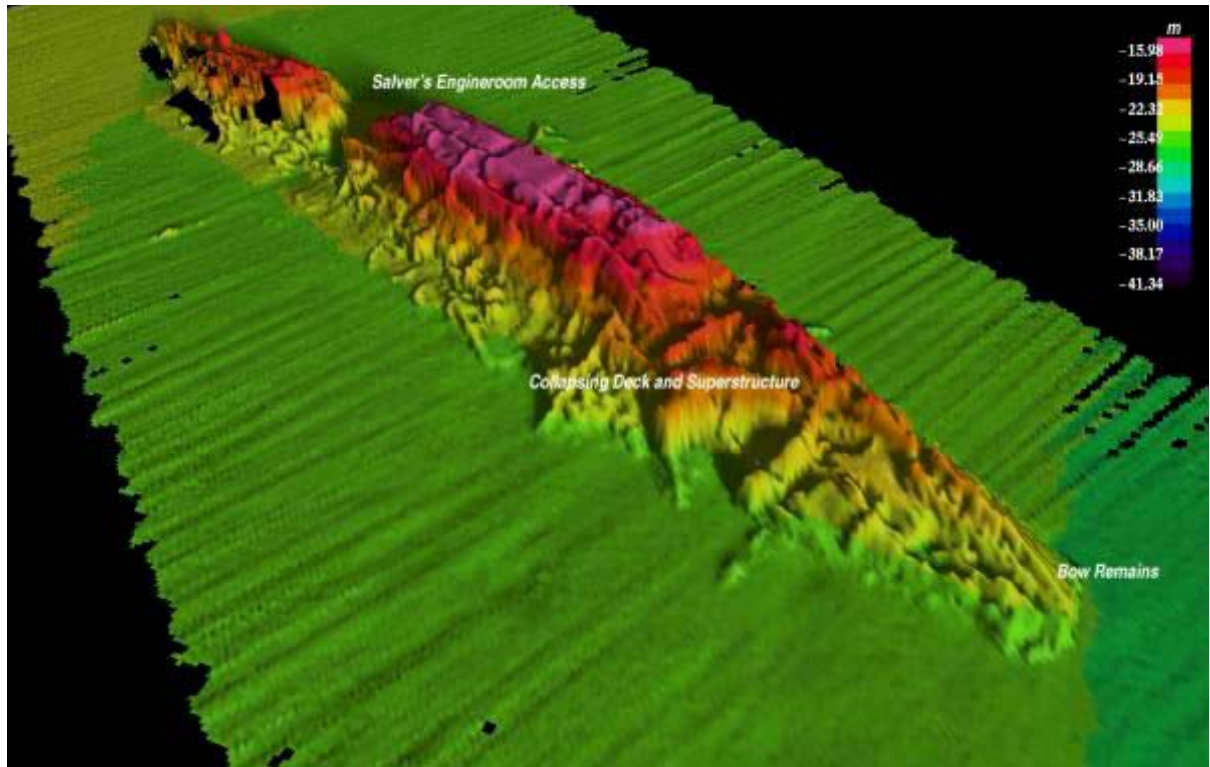
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### **Project Sponsors**

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## IXb Example of Details on Specific Wreck



The Karlsruhe is in poorest condition of all of the cruisers, and is situated on the west side of the isle of Cava, where currents are stronger. It is also the shallowest of the wrecks, in only 25m of water. The damage is extensive towards the stern of the ship where the wreck is almost broken into two pieces. A Königsberg II class cruiser, the Karlsruhe was built at Wilhelmshaven, launched on 31 January 1916 and scuttled at 1550 hrs on 21 June 1919. At 151m (496 ft) and armed with eight 5.9" guns, the Karlsruhe could make 27-28 kts at a sprint, even carrying 2.5" thick armour plating.

