



IHO Capacity Building Programme

IHO Report on Hydrography and Nautical Charting in The Republic of Vanuatu



December 2011

(published 4 April 2012)

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Abbreviations

ALB	Airborne Laser Bathymetry
AtoN	Aids to Navigation
BA	British Admiralty [Chart]
dwt	Dead Weight Tonnage
EEZ	Exclusive Economic Zone
ENC	Electronic Navigational Chart
ICZM	Integrated Coastal Zone Management
IHB	International Hydrographic Bureau
IHO	International Hydrographic Organization
IMO	[United Nations] International Maritime Organization
Lidar	Light Detection and Ranging
LOA	Length overall
MBES	Multi Beam Echo Sounder
MoU	Memorandum of Understanding
MSDI	Marine Spatial Data infrastructure
MSI	Maritime Safety Information
MSP	Maritime Spatial Planning
NtoM	Notice to Mariners
RHC	Regional Hydrographic Commission
RNC	Raster Navigational Chart
SBES	Single Beam Echo Sounder
SOLAS	[United Nations] Convention of the Safety of Life at Sea
ToR	Terms of Reference
TTW	Territorial Waters
UKHO	United Kingdom Hydrographic Office
UNCLOS	United Nations Convention on the Law of the Sea
UNEP	United Nations Environmental Programme
VHU	Vanuatu Hydrographic Unit
WMO	[United Nations] World Meteorological Organization

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Executive Summary

For historical reasons, nautical charting of Vanuatu is still produced by the United Kingdom, through the United Kingdom Hydrographic Office (UKHO) as the Primary Charting Authority (PCA).

Notwithstanding their modern appearance, the seven charts covering Vanuatu are based on old and generally imprecise survey information. A comprehensive chart updating programme is required if the chart coverage of Vanuatu is to meet national needs and international obligations.

There is no recognised Maritime Safety Information (MSI) infrastructure in place in Vanuatu to promulgate urgent navigational and meteorological warnings including urgent charting information or to feed new and updated information to the UKHO so that it can be incorporated into the existing charts, thereby keeping them up to date and fit for purpose.

The gathering and forwarding of new and relevant chart information must be actively encouraged under a national programme for chart improvement and maintenance. An urgent local review of existing charts is required to identify discrepancies and to provide up to date information to the UKHO. This should be supplemented by the establishment of a basic level in-country capability for hydrographic surveying.

The improvement of charts covering Vanuatu should be a matter of particular concern to the Government of Vanuatu. Every effort should be made to work with the UKHO, which is the producer of the only comprehensive collection of nautical charts and publications covering Vanuatu, with vital new and revised information to help improve these charts and keep them up to date.

The generally poor state of nautical charting in Vanuatu and the lack of a coherent MSI service to promulgate navigational and meteorological warnings, search and rescue information and other urgent safety-related information, including urgent information related to charts are most likely having an adverse impact on the Vanuatu economy as well as putting the safety of life at sea and protection of the marine environment at increased risk. This is because of the inherent risk of maritime incidents and the adverse effect on efficient and effective shipping operations, especially the ability of cruise ships and other larger vessels to operate safely in Vanuatu waters.

The appointment of a National Hydrographic Authority and a national Maritime Safety Information Coordinator is absolutely essential to support the UKHO and to ensure that the charts of Vanuatu are improved. This should also be supported by the establishment of a National Hydrographic Consultative Committee.

Vanuatu, as a State Party to the SOLAS Convention is required to ensure that appropriate paper charts and ENC's are available in accordance with Regulations 9 and 4 of Chapter V of that Convention. In this regard, Vanuatu does not appear currently to be meeting its treaty obligations.

Recommended Actions

The following recommended actions are provided for consideration by the relevant authorities:

- (1) **The Government of Vanuatu** should:
 - a. formally designate a **National Hydrographic Authority**, such as an officer from the Marine Department (in the absence of a Maritime Safety Administration), to be responsible for coordination and ensuring the provision of appropriate nautical charting services for Vanuatu in accordance with the requirements of the International Convention on the Safety of Life at Sea (SOLAS), and in accordance with the principles established by the IHO;
 - b. allocate regular funding and travel support for the **National Hydrographic Authority** to fulfil the duties of the Office and to represent Vanuatu in appropriate forums, and in particular, to attend relevant meetings of the SWPHC, SPC-SOPAC and IHO; and
 - c. ensure that a Maritime Safety Information (MSI) Coordinator position is established as soon as possible to fulfil Vanuatu's treaty obligations under SOLAS V/4 - *navigational warnings*.
 - d. authorise SPC-SOPAC and any other organisations, such as surveying and scientific organisations in Australia, France, New Zealand and the United States of America holding bathymetric or other relevant hydrographic data covering Vanuatu, including military organisations, to provide that data to the Primary Charting Authority (UKHO) for use in the compilation or revision of the existing charts of Vanuatu.
 - e. ensure the development and execution of:
 - i. **A National Maritime Safety Information Plan** – by ensuring that field checks are carried out on the current charts and publications and the results are forwarded promptly to the PCA (UKHO);
 - ii. **A National Hydrographic Survey Plan** – by seeking resources through foreign funding or assistance to complete the surveys listed and prioritised in the National Hydrographic Survey Plan in support of the National Charting Plan; and
 - iii. **A National Charting Plan** – by endorsing and proposing the chart improvement plan detailed in this report to the PCA (UKHO); and
 - f. seek assistance from regional neighbours such as Australia and New Zealand and from relevant international agencies, including SPC-SOPAC and international funding and aid agencies, to carry out chart improvement surveys in accordance with the **National Hydrographic Survey Plan**.
- (2) **The National Hydrographic Authority** should:
 - a. liaise with the Regional Team 5B at the UKHO to ensure that new navigationally significant information is forwarded and included in existing charts of Vanuatu;
 - b. apply, through the SWPHC, for training for the MSI Coordinator under the IHO Capacity Building Programme;
 - c. organise an urgent national programme of review of all the published charts of Vanuatu and inform the PCA (UKHO) of all detail that is incorrectly shown on these charts. Such a national programme should encourage all mariners and other interested parties to report discrepancies on existing charts together with as much information as possible on what should actually appear in the charts;
 - d. conclude an MoU or a Cooperative Arrangement with UKHO formalising the role of the National Hydrographic Authority and the UKHO as Primary Charting Authority for Vanuatu;
 - e. establish relations with the SWPHC, the IHO, the UKHO and SPC-SOPAC and represent Vanuatu in all relevant hydrographic activities and discussions;
 - f. enrol Vanuatu as an Associate Member of the South West Pacific Hydrographic Commission (SWPHC) by signing the Statutes of that Commission on behalf of Vanuatu; and
 - g. establish and chair a **National Hydrographic Consultative Committee** or forum that coordinates national hydrographic requirements including input to a National Charting Plan, a **National Hydrographic Survey Plan** and a **National Maritime Safety Information Plan**. This group should include representatives from all stakeholder sectors, including but not be limited to:

shipping, environmental protection, survey and mapping, national infrastructure development, coastal zone management, marine exploration, resource exploitation – minerals, fishing, maritime boundary delimitation, maritime transport, maritime defence and security, disaster management, tourism, and SPC-SOPAC.

- (3) **The Government of Vanuatu** should
- a. establish a basic level capability for hydrographic surveying by training existing government land surveyors in hydrographic surveying and providing at least one outfit of portable hydrographic surveying equipment. On-going funding will be required for the regular maintenance of the equipment and for the training and requalification of operators; and
 - b. engage an overseas hydrographic adviser to guide and assist the **National Hydrographic Authority** and the Vanuatu Department of Lands and survey during the establishment of an in-country hydrographic data gathering capability and to foster close liaison and possible support from recognized national hydrographic authorities in other countries.
- (4) **The Government of Vanuatu** should apply for membership of the IHO (application details are available in IHO publication M-2 – *The Need for National Hydrographic Services*), including allocating on-going funding for the annual subscription (about €35,000 per annum (this is based on a VU registered flag tonnage of approximately 2.4M tonnes)) and travel support for Vanuatu delegates to attend relevant IHO meetings.
- (5) **The SWPHC and the IHO** should monitor the further development of satellite bathymetry as a possible emerging technology that could help address the type of chart improvement issues being faced by Vanuatu.

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1 Introduction

The International Hydrographic Organization (IHO) is an intergovernmental technical organization, currently comprising 80 Member States. The IHO seeks to ensure that all States with coastlines and maritime interests provide adequate and timely hydrographic data, products and services, thereby advancing maritime safety and efficiency in support of the protection and sustainable use of the marine environment. The IHO is the recognised competent authority of the United Nations for hydrography and nautical charting. The International Hydrographic Bureau (IHB), based in Monaco, is the secretariat of the IHO.

The South West Pacific Hydrographic Commission (SWPHC) comprises all IHO Member States and a growing number of observer States from the South West Pacific region. The purpose of the Commission is to fulfil the objectives of the IHO through hydrographic cooperation and assistance between all the States and relevant authorities in the region. One of the roles of the SWPHC is to consider the capacity building requirements of States within the region and to make proposals to the IHO Capacity Building Sub Committee for capacity building assistance.

A proposal for a technical and advisory visit to Vanuatu to help assess the current status of charting and hydrography in the country and to provide advice to the government and to stakeholders on a way ahead was raised at the 9th meeting of the SWPHC in Honiara in 2009. As a result the SWPHC approved and funded a visit to Vanuatu to assess the current status of hydrography and to raise awareness in the country of the importance of hydrography and nautical charting.

In 2010 the IHO funded an officer (John Nasak SAVAKU (Ports & Harbours Department)) to attend a technical workshop on Maritime Safety Information (MSI) hosted in Sydney in November 2010 the Assistant Harbourmaster (Charly KALO (Ports & Harbours Department)) to attend a two-week introductory course in hydrographic surveying and chart production held in Port Moresby, Papua New Guinea.

Director Robert WARD from the IHB and Mr Bob WILSON, seconded from the United Kingdom Hydrographic Office (UKHO) carried out a hydrographic awareness and technical assessment visit to Vanuatu between 29 November and 3 December 2011.

This resulting report has been written with the express intention of assisting the government of Vanuatu to arrange and strengthen its hydrographic effort to meet its current and future needs and in turn, to meet its international maritime obligations under the UN Convention on the Safety of Life at Sea (SOLAS). The report comprises a description of the visit, a detailed analysis of the needs and current status of charting, major conclusions, a proposed chart improvement plan and a number of recommended actions for consideration by the relevant authorities.

2 Background

In the 19th and first half of the 20th century most surveys in Vanuatu waters were conducted by the colonial powers. In the last part of the 20th century, with an increasing number of Pacific Island States achieving independence, surveying activity by these powers progressively diminished. For example, the last dedicated surveying vessel from the UK stationed in the region left in the mid 1970's.

In 1984, 1986 and 1988 Australia carried out small scale (1:250,000) surveys of the Vanuatu Exclusive Economic Zone, together with some minor surveys at larger scales of anchorages and reef entrances. These surveys were

conducted as aid programmes under the Australian Defence Cooperation Program (DCP) and the Australian International Development Aid Bureau (AIDAB).

Under the DCP, Mr Martin SOKOMANU undertook the H4 hydrographic surveyor's course in Sydney in 1985 followed by Mr Enos TARI in 1986. Mr Willy NEMAN undertook a surveyor's assistant course in Sydney in 1986. These three personnel then formed the core of an indigenous hydrographic and charting capability known as the Vanuatu Hydrographic Unit (VHU), located within the Vanuatu Survey/Lands Department. It was envisaged that the VHU would provide a basic survey capability and would then call upon the expertise of the cartographers in the Department of Lands and Survey eventually to develop a local chart production capability as well as feed data to the UKHO, as the traditional and long-standing charting authority for Vanuatu.

In 1987, as part of the DCP, a hydrographic adviser from Australia was permanently attached to the unit. This resulted in steady progress, to the point where the VHU conducted various surveys which were incorporated into large scale official charts and plans. The VHU assessed any data and information that it obtained and forwarded in to the UKHO, which was, and still is the primary charting authority for Vanuatu. The data from Vanuatu was then incorporated in the charts produced by the UKHO. There were a total of four advisors posted to Vanuatu between 1987 and 1995.

In support of the establishment of the VHU, Australia provided a comprehensive outfit of surveying equipment including a boat. A 15m motor sailing boat was delivered in 1989 fitted with a deep water (ELAC) and a shallow water (Raytheon DE719 Odom) echosounder. A Trisponder electronic position fixing system and a side scan sonar, tide gauges, calculators and all related hydrographic requirements were also supplied by Australia. Geodetic equipment, such as theodolites and distance measurers were sourced from the Vanuatu Survey/Lands Department for field operations as required.

The VHU maintained a rolling forward plan for surveys and charting requirements. The national plan was endorsed at the Surveyor General level. This plan took into account the needs of national development and local shipping requirements and sought input from national stakeholders. The plan identified ports, harbours, anchorages and their approaches that required surveying together with areas under consideration for development such as new wharves and ports. For planning purposes, three surveys were envisaged each year. The last copy of the plan sent to Australia was dated 1989/90.

Steady progress was made until at least 1995 when the DCP ceased to support the Australian hydrographic adviser position. Up to that point the VHU had conducted various surveys which were incorporated into large scale official charts and plans. The unit suffered a steady decline from 1995 onwards. The reasons for this are unknown. The VHU no longer exists and there does not appear to have been any significant hydrographic activity conducted under the auspices of any Vanuatu government department for at least the last 10 years. The 15m survey boat allocated to the VHU was sold in the mid to late 1990's.

3 Technical Visit Programme

As a trained hydrographic surveyor and leader of the VHU in previous years, Mr Martin SOKOMANU, Department of Lands was contacted by the IHO to gain the necessary approvals and organise the visit. Unfortunately, Mr SOKOMANU was subsequently unable to complete the visit arrangements or to participate in the visit. In his absence and at short notice, Captain John MASCHKE, RAN, Australian Defence Adviser at the Australian High Commission in Port Vila contacted various local representatives in order that the visit could proceed. Meetings, in the form of workshops and individual discussions were arranged with as many hydrographic and nautical charting stakeholders as possible. The details of those invited to the various meetings are shown in Annex A - *List of Contacts*. Not all those in the list attended the meetings.

The national economic benefits of reliable charting and hydrography were presented to each meeting together with discussions on the current status of hydrography and charting in Vanuatu. From these meetings various options to improve the current situation were explored.

A concluding meeting of stakeholders was used to develop an initial list of charting priorities for Vanuatu. Stakeholders were invited to provide details of those areas in Vanuatu where the provision of adequate charts was a vital requirement to support current or anticipated activities.

Unfortunately, due to other commitments, all the relevant Vanuatu government ministers were unavailable during the period of the visit. An individual briefing was provided to Mr Jean SESE, Director-General of the Department of Foreign Affairs & External Trade. A variety of other commitments prevented meetings with other Departmental Secretaries.

4 General Assessment

The following is a general assessment of the situation in Vanuatu regarding hydrography and nautical charting services. A discussion of available options, several conclusions and recommended actions, supported by a number of Annexes and Appendices then follows.

4.1 National Hydrographic Awareness

The Government of Vanuatu and its Administration do not appear to be fully aware of the poor state of nautical charting in Vanuatu and its potentially adverse impact on economic growth, safety of navigation and protection of the marine environment.

There is little awareness of Vanuatu's treaty obligations under the UN Convention on the Safety of Life at Sea (SOLAS) Chapter V Regulations 9 and 4 to ensure that appropriate hydrographic and charting services are made available. Vanuatu became a State Party to this Convention on 28 October 1982.

There is no mechanism in place to determine local priorities for charting or for surveys or to communicate changing conditions or circumstances to the Primary Charting Authority (PCA) which is the United Kingdom Hydrographic Office (UKHO). The PCA (UKHO) published and maintains the nautical charts and publications that mariners require to navigate safely and effectively in Vanuatu waters.

An explanation of the many benefits that hydrography provides to a coastal State such as Vanuatu is contained in IHO Publication M-2 – *The Need for National Hydrographic Services*. Copies of M-2 were distributed during the visit. M-2 can be downloaded from the IHO website.

4.2 Maritime Safety Information

There is no Maritime Safety Information (MSI) organization in Vanuatu. This means that the existing charts published and maintained by the UKHO do not necessarily contain the latest navigationally significant information, nor are mariners arriving from overseas aware of new navigationally significant information before they arrive in Vanuatu.

The routine maintenance of charts and publications, to include changes in buoyage and wrecks for example, is as important as new survey data if charts are to be maintained to the standard required for safe navigation. This information has to come from the nation State and be passed to the PCA (UKHO) for action. In the case of Vanuatu, little if any local information has been provided since the latest charts were published. Corrections, based on local knowledge and information obtained by the UKHO, average only about one or two instances per year.

The following table shows the current publication date of charts covering the Republic of Vanuatu, together with a reference to the last notice to mariners (NtoM) that has been issued and the total number of NtoMs that have been applied to each chart since its publication. The table is correct to 17 February 2012.

BA Chart	Title	Year of Chart Publication (Last NtoM/Year)	NtoMs issued since Publication
1494	Efate and Plans Efate Port Havannah Forari Bay Port Vila	17 December 2009 (1071/2011)	1
1570	Efate to Espiritu Santo Épi island – Lamén Bay	10 December 2009	0
1575	Île Pentecôte to Torres Islands	10 December 2009	0
1576	Épi to Île Maré	15 April 1988 (2690/2011)	12

BA Chart	Title	Year of Chart Publication (Last NtoM/Year)	NtoMs issued since Publication
1577	Plans in Central Vanuatu Craig Cove Sulua Bay Port Sandwich & the Masekelyne Is Méténovor Bay Bangon Point to Mbong Naeun Point Port Stanley Umbeb Bay	17 December 2009	0
1581	Islands and Anchorages in Southern Vanuatu Anawamet Bay Dillon's Bay Potnarvin Lénakel Bay Anelghowhat Bay Waisisi Anatom	17 December 2009 (3086/2011)	1
1638	Plans in Northern Vanuatu Lésalav Bay Luganville Hog Harbour Lorup Bay Vanihé Bay & Lolowai Bay Malo to Mavéa Port Patteson	23 December 1988 (4708/2011)	8

Maritime Safety Information (MSI) consists of the promulgation of navigational and meteorological warnings, search and rescue information and other urgent safety-related information, including urgent information related to charts. IHO Publication S-53 - *Joint IMO/IHO/WMO Manual on Maritime Safety Information* provides detailed information about MSI.

The IHO funded an officer from Vanuatu to attend a technical workshop on MSI hosted in Sydney in November 2010. Despite this, there does not appear to be a national MSI coordinator designated in Vanuatu to collate and promulgate new and important navigation information through the relevant channels including the Worldwide Navigation Warning Service (WWNWS) implemented globally by the IMO, IHO and WMO. For all practical purposes, there is no effective communication between the maritime authorities in Vanuatu and the UKHO's chart compilers and maintainers in Regional Team 5 – the section responsible for producing and maintaining the charts of Vanuatu. This means that new information, such as changes in navigation aids or new port developments do not appear on the charts as updated information.

In addition to establishing a regular MSI service, the government of Vanuatu is strongly urged to organise a review of all the published charts of Vanuatu as soon as possible and to inform the PCA (UKHO) of all the differences from what is shown on the charts. The UKHO produces a Code of Practice giving guidance on the information required and the format in which it should be sent to UKHO. Digital and hard copies of the Code of Practice were passed to the relevant Vanuatu authorities during the IHO visit.

4.3 Hydrographic Surveying

In the period up until the mid-1970s the United Kingdom had a survey ship on station in the SW Pacific conducting surveys for chart production programmes, since this time large area medium scale to large scale survey operations have all but ceased. The Royal Australian Navy conducted small scale surveys in Vanuatu's EEZ during the 1980s whilst the Vanuatu Hydrographic Unit conducted a valuable survey data gathering programme at predominantly large scales until 1995 after which hydrographic surveying went into a steep decline. There is currently no national hydrographic capability in Vanuatu.

The Department of Lands and Surveys employs a number of land surveyors familiar with digital data manipulation, map making and geographic information systems (GIS). These surveyors, as was the case in the past, could easily learn additional skills in hydrographic data collection thereby providing a cost-effective, basic level of in-country hydrographic data gathering expertise.

SOPAC, the marine geoscience division of the Secretariat to the Pacific Community (SPC), has been conducting multibeam echosounder (MBES) surveys in support of scientific and environmental activities in many of the islands of the Pacific over the last ten years or more, including Vanuatu. While not achieving the IHO S-44 international standards of survey accuracy, much of the data is, most likely, suitable for inclusion in charts. No formal arrangement exists to ensure that this data is brought to the attention and made available to the relevant chart producers.

The recently signed Memorandum of Understanding (MoU) between the IHO and SPC seeks amongst other things to facilitate routine access to and use of data gathered by SOPAC for the improvement of charts in the region. However, the specific permission of the relevant coastal State is required before SOPAC can pass any data on to the relevant charting authority. The Vanuatu government should consider providing SOPAC with a standing authority to provide relevant navigationally significant data directly to the PCA (UKHO), keeping the relevant Ni-Vanuatu authorities informed when such information is transferred.

Several other organisations, notably the Australian Department of Defence, have conducted hydrographic surveys in a number of locations in the Pacific, including Vanuatu. This data has not always been forwarded to the PCA (UKHO). The government of Vanuatu, when granting permission for survey operations within its territorial waters should stipulate that one condition of this permission is for the final processed data set to be forwarded to the PCA (UKHO). Similarly the government should request that data arising from surveys within its Exclusive Economic Zone (EEZ) should similarly be forwarded. A review of hydrographic data is at Annex E - *Existing Hydrographic Data for Vanuatu*.

4.4 Nautical Charting

There is no nautical chart production facility or sales outlet in Vanuatu. Charts must be obtained from agents in Fiji or elsewhere in the world.

It was apparent during the IHO visit that a comprehensive chart updating programme is required if the existing chart coverage of Vanuatu is to meet national needs. The improvement of existing charts and plans should in the first instance incorporate islands and topographical features whose position is confirmed as being based on the WGS84 satellite datum. This will ensure compatibility of navigation by both global navigation satellite systems (GNSS) also popularly known as GPS and by more traditional means. Secondly, large scale plans that are no longer required should be withdrawn and replaced where required, by other plans that are needed.

The nautical charts of Vanuatu published and maintained by the UKHO on behalf of the government of Vanuatu have, with one exception, been modernised. This means that depths are shown in metres, modern chart symbols are used and the charts can be used directly with GNSS. However, because much of the data on which the charts are based is old and difficult to accurately determine in terms of satellite derived positions. Frequently a warning note is displayed on the charts such as the example below shown on chart BA1638 *Charts and Plans in Northern Vanuatu* which is based on survey data from 1943 and from the late nineteenth century.

CHART ACCURACY
Owing to the age and quality of the source information, some detail on this chart may not be positioned accurately. Particular caution is advised when navigating in the vicinity of dangers, even when using an electronic positioning system such as GPS.

The difference between GNSS derived positions and those plotted on some of the charts is likely to be significant and could lead ships into dangerous situations. Despite warnings placed on the relevant charts mariners are increasingly relying on GNSS for positioning in all parts of the world. In these circumstances, it is inevitable that incidents will occur in the future unless the Vanuatu charts are updated to be fully compatible with GNSS.

As a result of the technical visit, new topographic data for Vanuatu, referred to the satellite datum WGS84 was delivered to the PCA (UKHO). This should allow some remedial charting action to begin.

It is apparent that some of the existing charts and plans of Vanuatu are still being published when they do not cover areas being used by foreign-going vessels or other significant craft; indeed they may even tempt ships to enter areas that it would be wiser to avoid. Such charts and plans should be withdrawn and replaced with more general, but modern charts that would still allow for the safe conduct of inter-island traffic.

A modern and up to chart scheme for Vanuatu should be guided by the need for:

- the safe conduct of inter-island traffic,
- the safe passage of cruise ships in and around Vanuatu,
- charting of relevant ports and refuges, and
- general charting coverage of all areas referenced to the WGS84 datum.

The process of chart improvement to meet contemporary requirements relies on the availability of new and revised information both hydrographic and topographic. Much of this information can be collected relatively inexpensively by local authorities, stakeholder organizations and individuals and be forwarded to the PCA (UKHO). Other information is likely to exist locally that could be included in revised charts. However, it must be found and forwarded to the PCA (UKHO). Dedicated surveys will nevertheless be required for certain key areas.

The emerging technology of satellite bathymetry may offer a very cost effective way of providing at least reconnaissance level data to be used in those areas not critical for navigation. Satellite bathymetry may be able to provide at least indicative depths, together with suitable cautions, to be included on charts.

A comprehensive analysis of the existing charting situation in Vanuatu is contained in Annex F - *Charting Analysis of Vanuatu Waters*.

5 Consequences and Options

5.1 The Consequences of Doing Nothing

The absence of any in-country point of focus for coordinating the collection, assessment and dissemination of new navigational significant information means that charts cannot be kept up to date and therefore fully fit for purpose.

The lack of appropriate and up-to-date charts for the navigation of foreign-going vessels into Vanuatu's main ports of entry breaches the State's obligations set out in SOLAS Chapter V Regulations 9 and 4. The provision of appropriate hydrographic services in a State is examined as part of the IMO Member State audit scheme that is presently voluntary but is likely to become mandatory in about 2015. A consequence of failing an IMO Member State audit could result in a State being considered substandard in relation to meeting its SOLAS obligations.

The lack of appropriate charting services for foreign-going vessels may expose the Vanuatu government to financial liability in the event of a navigational incident. The Master of a vessel involved in a navigational mishap might contest that he or she was unable to do more, since no appropriate charts were available. This would be especially the case when a pilot was embarked. In the case of any resultant pollution, salvage or other remedial action, the Government of Vanuatu might then find itself solely responsible for reparation and clean-up costs.

The lack of appropriate charting for Vanuatu increases operating risks for ship owners. One result is that ship-owners may opt to employ less valuable (and inherently less efficient and robust) ships. This results in more costly freight charges through using inefficient ships and at the same time older ships tend to be more prone to accidents through mechanical failure and general levels of repair and maintenance. Poorer charting also reduces the number of ship operators prepared to operate their vessels in the area, thereby inhibiting competition.

Navigational incidents often result in widespread pollution. Vanuatu has limited resources to combat such incidents. Furthermore, a port may be closed or blocked for some time. These are further strong reasons for having good charts.

Cruise ships are most reluctant to operate vessels in areas where charting is poor or non-existent. This is because of the risks to the ship and the passengers and also the risk to the reputation of the operating company. The inability for cruise ships to visit many areas in Vanuatu because of poor charting represents a very significant missed economic opportunity.

5.2 Options for the Way Ahead

5.2.1 Bilateral Arrangements for the Production and Maintenance of Charts

It is vital that where there is no in-country chart production or maintenance facility, a coastal State must establish and maintain close liaison with its PCA. In the case of Vanuatu this is the UKHO. Subject to the continuing agreement of the UKHO, formalised through an MoU or Cooperative Arrangement, Vanuatu could rely on the UKHO to publish its charts in at least the short to medium term.

However, if the PCA (UKHO) is to publish and maintain charts of Vanuatu successfully there is a fundamental requirement for Vanuatu to ensure that the UKHO is provided with all the relevant information required for inclusion in charts covering Vanuatu. Currently, this is not happening.

The appointment of a National Hydrographic Authority and a national Maritime Safety Information Coordinator is absolutely essential to support the PCA (UKHO). This should also be supported by input from a National Hydrographic Consultative Committee. The gathering and forwarding of new and relevant chart information must be actively encouraged under a national programme for chart improvement and maintenance. This should be supplemented by a basic level in-country capability for hydrographic surveying.

5.2.2 National Hydrographic Authority

The IHO recommends that every coastal State should designate a National Hydrographic Authority responsible for coordinating hydrography and charting in the country. The role of the National Hydrographic Authority is to be the principal national and international point of contact and to act on behalf of the government to ensure that the State meets its international obligations that proper nautical charting services are available to mariners. The National Hydrography Authority is the first point of contact for in-country stakeholders and for maintaining relations with relevant international organisations. In the case of Vanuatu, these contacts would include the IHO, SWPHC, SPC-SOPAC, the PCA (UKHO) and other countries and agencies that might support hydrographic development and assistance in Vanuatu.

In circumstances such as in Vanuatu, a national Maritime Safety Administration would be the logical authority to be the National Hydrographic Authority. Such an arrangement is similar to that most recently put in place in Papua New Guinea and in the Solomon Islands, whereby the national Maritime Safety Administration has responsibility for the development and coordination of the provision of nautical charting services in those countries. Many other countries have adopted a similar arrangement. However, Vanuatu has yet to establish formally a national Maritime Safety Administration. In the meantime, the Marine Department appears to be fulfilling a number of the State obligations under SOLAS. So, as a principal hydrographic and maritime stakeholder, it seems logical that, in the interim, the Marine Department might be considered to take on the responsibility of ensuring that Vanuatu meets its SOLAS V hydrographic and charting obligations

5.2.3 National Hydrographic Consultative Committee

Ensuring that a State's charts contain all relevant information requires the support of all in-country stakeholders. Similarly, to ensure that the national charting coverage and associated services meet the needs of the all stakeholders requires wide input. For this reason, the IHO recommends the establishment of a National Hydrographic Consultative Committee to provide input to the hydrographic programme and setting national charting and surveying priorities. In this way, the stakeholders are in a position to assist in the continuing maintenance of the charts, longer term planning and perhaps also to the programme budget.

A National Hydrographic Consultative Committee should include representatives from all relevant stakeholder sectors, including, but not limited to:

- Shipping
- Environmental protection
- Survey and mapping
- National infrastructure development
- Coastal zone management
- Marine exploration
- Resource exploitation – minerals, fishing
- Maritime boundary delimitation (UNCLOS, others)

- Maritime transport
- Maritime defence and security
- Disaster management
- Tourism

All hydrographic stakeholders need to be involved in contributing to the Vanuatu national hydrographic program. This is not only to identify and prioritise national requirements, but also to contribute to the execution of the programme. This could be through help in-kind, such as the provision of boats, or personnel or through contributions to enlist contract support – for example for surveys of areas targeted for development. A key role for the stakeholders is to educate and encourage everyone to forward all relevant new or changed hydrographic information to the national coordinator for hydrography and charting.

The Chair and convener of the National Consultative Authority for Hydrography and Charting should be the National Hydrographic Authority.

5.2.4 National Maritime Safety Information Coordinator

The IHO recommends that every coastal State should designate a national MSI coordinator. In the absence of a Maritime Safety Administration, and assuming that the Marine Department assumes the role of National Hydrographic Authority, it is logical for that organisation also to be formally appointed as the national MSI coordinator. This would ensure that MSI services were the direct responsibility of the National Hydrographic Authority. This, in turn, would enable navigationally significant information to be collected efficiently and reliably and subsequently promulgated both through immediate warnings to shipping when warranted and through the incorporation of new or revised information in existing published charts.

5.2.5 Chart Improvement and Maintenance Programme

For coastal States that do not have an in-country chart production and maintenance capability, the IHO considers that an active national programme of information gathering is vital. This programme must encourage all mariners and other interested parties to report all discrepancies in the existing charts and to provide as much information as possible on what should actually be shown on the charts. For Vanuatu, such information can be reported directly to the PCA (UKHO) using a hydrographic note, or by any other mechanisms that alert the PCA (UKHO) that changes are required to existing charts. The method and format for providing the information is much less important than ensuring that the PCA (UKHO) is alerted in the first place. The UKHO produces a Code of Practice giving guidance on the information required and the format in which it can be sent to the PCA (UKHO).

As there is no in-country capability to undertake larger systematic surveys for chart improvement purposes, assistance should be sought from regional neighbours or by engaging survey assistance under commercial contract. Both the Australian and New Zealand navies have deployable survey teams that could undertake such work, subject to request and authorisation. The US Navy has similar teams that can also be requested through the U.S. Embassy in Port Moresby, Papua New Guinea. Requests for SOPAC hydrographic survey assistance should be channelled through SPC. If funding is available, there are a number of hydrographic surveying companies based in Australia and New Zealand that could undertake hydrographic surveys under contract. A prioritized surveying programme in support of a chart improvement programme for Vanuatu is set out in Annex G - *Proposals for Hydrographic Surveys in Vanuatu*.

The government of Vanuatu should, as early as possible, request from the appropriate authorities that all existing bathymetric data covering Vanuatu held by those authorities, such as SPC-SOPAC and various overseas military organisations, is made available to the PCA (UKHO).

5.2.6 Basic Level Capability for Hydrographic Information Gathering

For coastal States that do not have an in-country capability to conduct hydrographic surveys, the IHO recommends the establishment of a limited but sustainable hydrographic information gathering capability. As a minimum, this should take the form of a deployable hydrographic surveying capability. Such a capability allows reported dangers to be confirmed, as well as enabling the collection of relevant new or changed hydrographic information and even the initial survey of some previously unsurveyed areas. As has happened in the past, when the Vanuatu Hydrographic Unit was formed, land surveyors in the Vanuatu Department of Land and Surveys could learn the additional skills required for simple hydrographic surveys relatively easily, and could be supported by afloat resources from the Marine Department and coastguard as required. The tasking for this capability should be guided by the priorities set by the National Hydrographic Consultative Committee and the immediate MSI requirements of the National Hydrographic Authority.

There are limited opportunities for internationally recognised hydrographic training. A list of courses is contained in IHO publication C-47 - *Training Courses in Hydrography and Nautical Cartography, 6th Edition*. This can be downloaded from the IHO website. Short courses in the fundamentals of hydrographic data gathering are available through the IHO Capacity Building Programme and should be bid for through the South West Pacific Hydrographic Commission (SWPHC).

On the Job Training (OJT) may be available through the US NAVOCEANO Mobile Training Team program (NMTT). This would enable in-country training, thereby reducing travel and other expenses for participants. Cost depends on the length of the course and whether it can be provided under an aid programme. A pamphlet at Annex C contains information about NMTT training. Applications can be made by presenting the pamphlet to the Security Affairs Officer at the U.S. Embassy in Port Moresby Papua New Guinea. The Consulate or Embassy will determine whether US funding is available for the training. Additionally, training may be available from Australia under the Defence Cooperation Program or directly through liaison with the Hydrographer of Australia. It may be possible for an Australian Deployable Geospatial Support Team to deploy to Vanuatu and provide OJT in a similar way to the US NMTT program.

An in-country deployable hydrographic surveying capability could be established using a relatively simple and unsophisticated outfit of equipment costing approximately \$100K - \$150K plus on-going maintenance. Although some surveys may take longer using such equipment, the use of a single beam echo sounder and side scan sonar can be as equally effective as much more sophisticated and expensive technology such as multibeam echo sounders (MBES). This is especially true in shallow water, such as is the case for Vanuatu and its islands and anchorages.

Using portable equipment in craft of opportunity avoids the capital cost of dedicated boats and significantly reduces deployment/mobilisation expenses. Under such an arrangement, all hydrographic data collected would then be forwarded to the PCA (UKHO) for charting action.

5.2.7 Temporary Hydrographic Advisers

The IHO recommends that it is highly desirable to engage hydrographic advisers when an in-country hydrographic capability is being established. There are no local personnel in Vanuatu that have current hydrographic expertise. Personnel from the Department of Lands were trained by Australia about 20 years ago, but have not been given the opportunity to practice their skills. The participation of hydrographic advisers from overseas would assist in establishing an in-country hydrographic capability and would help foster close liaison and potential assistance from recognized hydrographic services in other regional countries. The support of advisers would require the allocation of suitable funding. Such advisers could be engaged under contract. Alternatively, established hydrographic offices in the region may be able to provide seconded officers for limited periods of time. This could be requested through under the auspices of the SWPHC or through bilateral discussions with regional hydrographic offices.

6 Technical Visit Conclusions

Based on discussions and the facts obtained, the following principal conclusions have been reached:

- (1) The current state of nautical charting and the lack of coherent MSI services are most likely having an adverse impact on the Vanuatu economy as well as putting the safety of life at sea and protection of the marine environment at increased risk.
- (2) The improvement of charts covering Vanuatu should be a matter of particular concern to the national government. Every effort should be made to work with the Primary Charting Authority (UKHO) to enable an effective charting service to be delivered.
- (3) The release of existing but hitherto unused bathymetric data to the Primary Charting Authority (UKHO) can provide a basis for the immediate improvement of some charts.
- (4) An urgent local review of existing charts is required to identify discrepancies and to provide up to date information to the PCA (UKHO).
- (5) The establishment of a recognised, albeit limited, in-country hydrographic capability to provide local input to the Primary Charting Authority (UKHO) to assist in the maintenance of the existing charts is important to enable the provision of appropriate and up-to-date nautical charts of Vanuatu.
- (6) Vanuatu, as a State Party to the SOLAS Convention must recognise and act upon its treaty obligations to ensure that appropriate paper charts and ENC's are available in accordance with Regulations 9 and 4 of

Chapter V of that Convention. In this regard, Vanuatu does not appear currently to be meeting its obligations. This is because there is no infrastructure or capability in place to provide information to the Primary Charting Authority (UKHO) so that the relevant charts can be kept up to date and fit for purpose.

- (7) The absence of up to date charts and a very limited MSI capability to satisfy the requirements of the SOLAS Convention, threaten the likelihood of Vanuatu passing the hydrography section of the IMO Member State audit scheme which is likely to become mandatory around 2015.

7 Recommended Actions

In order to provide an appropriate level of hydrographic surveying and nautical charting services in Vanuatu, it is recommended that the relevant authorities consider the following actions:

- (1) **The Government of Vanuatu** should:
- a. formally designate a **National Hydrographic Authority**, such as an officer from the Marine Department (in the absence of a Maritime Safety Administration), to be responsible for coordination and ensuring the provision of appropriate nautical charting services for Vanuatu in accordance with the requirements of the International Convention on the Safety of Life at Sea (SOLAS), and in accordance with the principles established by the IHO;
 - b. allocate regular funding and travel support for the **National Hydrographic Authority** to fulfil the duties of the Office and to represent Vanuatu in appropriate forums, and in particular, to attend relevant meetings of the SWPHC, SPC-SOPAC and IHO; and
 - c. ensure that a Maritime Safety Information (MSI) Coordinator position is established as soon as possible to fulfil Vanuatu's treaty obligations under SOLAS V/4 - *navigational warnings*.
 - d. authorise SPC-SOPAC and any other organisations, such as surveying and scientific organisations in Australia, France, New Zealand and the United States of America holding bathymetric or other relevant hydrographic data covering Vanuatu, including military organisations, to provide that data to the Primary Charting Authority (UKHO) for use in the compilation or revision of the existing charts of Vanuatu.
 - e. ensure the development and execution of:
 - i. **A National Maritime Safety Information Plan** – by ensuring that field checks are carried out on the current charts and publications and the results are forwarded promptly to the PCA (UKHO);
 - ii. **A National Hydrographic Survey Plan** – by seeking resources through foreign funding or assistance to complete the surveys listed and prioritised in the National Hydrographic Survey Plan in support of the National Charting Plan; and
 - iii. **A National Charting Plan** – by endorsing and proposing the chart improvement plan detailed in this report to the PCA (UKHO); and
 - f. seek assistance from regional neighbours such as Australia and New Zealand and from relevant international agencies, including SPC-SOPAC and international funding and aid agencies, to carry out chart improvement surveys in accordance with the **National Hydrographic Survey Plan**.
- (2) **The National Hydrographic Authority** should:
- a. liaise with the Regional Team 5B at the UKHO to ensure that new navigationally significant information is forwarded and included in existing charts of Vanuatu;
 - b. apply, through the SWPHC, for training for the MSI Coordinator under the IHO Capacity Building Programme;
 - c. organise an urgent national programme of review of all the published charts of Vanuatu and inform the PCA (UKHO) of all detail that is incorrectly shown on these charts. Such a national programme should encourage all mariners and other interested parties to report discrepancies on existing charts together with as much information as possible on what should actually appear in the charts;

- d. conclude an MoU or a Cooperative Arrangement with UKHO formalising the role of the National Hydrographic Authority and the UKHO as Primary Charting Authority for Vanuatu;
 - e. establish relations with the SWPHC, the IHO, the UKHO and SPC-SOPAC and represent Vanuatu in all relevant hydrographic activities and discussions;
 - f. enrol Vanuatu as an Associate Member of the South West Pacific Hydrographic Commission (SWPHC) by signing the Statutes of that Commission on behalf of Vanuatu; and
 - g. establish and chair a **National Hydrographic Consultative Committee** or forum that coordinates national hydrographic requirements including input to a National Charting Plan, a **National Hydrographic Survey Plan** and a **National Maritime Safety Information Plan**. This group should include representatives from all stakeholder sectors, including but not be limited to: shipping, environmental protection, survey and mapping, national infrastructure development, coastal zone management, marine exploration, resource exploitation – minerals, fishing, maritime boundary delimitation, maritime transport, maritime defence and security, disaster management, tourism, and SPC-SOPAC.
- (3) **The Government of Vanuatu** should
- a. establish a basic level capability for hydrographic surveying by training existing government land surveyors in hydrographic surveying and providing at least one outfit of portable hydrographic surveying equipment. On-going funding will be required for the regular maintenance of the equipment and for the training and requalification of operators; and
 - b. engage an overseas hydrographic adviser to guide and assist the **National Hydrographic Authority** and the Vanuatu Department of Lands and survey during the establishment of an in-country hydrographic data gathering capability and to foster close liaison and possible support from recognized national hydrographic authorities in other countries.
- (4) **The Government of Vanuatu** should apply for membership of the IHO (application details are available in IHO publication M-2 – *The Need for National Hydrographic Services*), including allocating on-going funding for the annual subscription (about €35,000 per annum (this is based on a VU registered flag tonnage of approximately 2.4M tonnes)) and travel support for Vanuatu delegates to attend relevant meetings.
- (5) **The SWPHC and the IHO** should monitor the further development of satellite bathymetry as a possible emerging technology that could help address the type of chart improvement issues being faced by Vanuatu.

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Annex A – List of Contacts

Hon. Ham Lini Vanuaroroa	Deputy Prime Minister & Minister of Trade, Commerce, Industry & Tourism
Mr George Borugu	A/ Director-General of Department of Trade, Commerce, Industry & Tourism
Mr Simeon Athy	Director General of Prime Minister's Office & Public Service of Vanuatu
Mr Clifford Bice	1 st Political Adviser to the Deputy Prime Minister & Minister of Trade, Commerce, Industry & Tourism
Hon. Alfred Carlot	Minister of Foreign Affairs & External Trade
Mr Jean Sese	Director-General of the Department of Foreign Affairs & External Trade
Mr Tony Tevi	Head of Maritime Affairs - Dept. of Foreign Affairs
Mr Markmon Batie	Maritime Affairs Manager
Mr Johnny Koanapo	Head, UN Division, Ministry of Foreign Affairs
Mr Alexander Samson	1 st Political Adviser to the Minister of Foreign Affairs & External Trade
Hon. James Nwango	Minister of Agriculture, Forestry & Fisheries
Mr Jeffrey Wilfred	Director-General of Department of Agriculture, Forestry & Fisheries
Hon. Steven Kalsakau	Minister of Lands, Geology, Mines & Rural Water Supply
Mr Joe Ligo	Director-General of the Department of Lands, Geology, Mines & Rural Water Supply
Mr Peter Pata	Acting Director of Department of Lands, Survey & Registry
Mr Martin Sokomanu	Surveyor-General
Mr John Makal	1 st Political Adviser to the Minister of Lands, Geology, Mines & Rural Water Supply
Hon. Moana Carcasses Kalosil	Minister of Finance & Economic Management
Mr George Maniuri	Director-General of the Department of Finance & Economic Management
Mr Tony Sewen	Acting Director - Dept. of Finance & Treasury
Mr Nik Soni	Treasury Advisor - Dept. of Finance & Treasury
Mr Gregoire Nimbtik	Director - Dept. of Strategic Planning, Policy and Aid Coordination
Mr Jerryson Lapi	Sector Analyst - Dept. of Strategic Planning, Policy and Aid Coordination
Hon. George Andre Wells	Minister of Internal Affairs
Mr George Bogiri	Director-General of the Department of Internal Affairs
Mr Daniel Bule	1 st Political Adviser to the Minister of Internal Affairs
Hon. Harry Lauko	Minister of Infrastructure & Public Utilities
Mr Morris Kaloran	Acting Director-General of the Department of Infrastructure & Public Utilities
Mr Yoan Marisua	1 st Political Adviser to the Minister of Infrastructure & Public Utilities
LTCOL Joshua Bong	Commissioner of Police
SUPT Tari Tamata	Acting DCP/Acting MARCOM (PMW)/JPOC CMDR
Mr Luke Peandi	Acting Director of Ports & Harbours
Mr Charlie Kalo	Acting Harbour Master
Mr Henry Brown Worek	Ships Principal Licencing Manager - Ports & Marine
Mr Ben Wotu	Director of Customs
Mr Moses Amos	Director of Fisheries
SUPT Francois Batick	Principal Immigration Officer
Mr Benuel Tarilongi	Director of Quarantine
Mr George Borugu	Director of Tourism
Mr Kalfau Kaloris	Vanuatu High Commissioner Designate to Australia
Mr Lami Sope	President, Shefa Province
Mr Roy Wilson	President of Shipping Association - Luganville

Mr Richard Coleman	CEO - Vanuatu Maritime College
H.E. Mr Jeff Roach	Australia High Commissioner
H.E. m. Michel Djokovic	French Ambassador
H.E. Mr Bill Dobbie	New Zealand High Commissioner
Mr Jimmy Nipo	Development Programme Coordinator – NZ High Commission
Mr Robert de Raeve	Head of EU Delegation
Ms Katherine Ruiz-Avila	Counsellor, AusAID Evaluation Section – AusAID, Port Vila
Mr Peter Kelly	Transport Sector Coordinator - Governance For Growth
Mr Paul Kaun	Government Systems Advisor - Governance For Growth
Mr Richard Mabbitt	Team Leader - Vanuatu Infrastructure Strategic Investment Plan
Mr Allen Faerua	Infrastructure Specialist - Vanuatu Infrastructure Strategic Investment Plan
Mr Jeremy Brown	Director - Jeremy Brown and Assoc
Mr Rishi Ram Adhar	Senior Project Officer - Asian Development Bank
Mr David Momcilovic	First Secretary - Aus AID, Port Vila
Mr Barry Amos	South Seas Shipping
Mr Mike Drake	Director of Marine Operations - Carnival Australia
Mr George Lolos	Councillor - Shefa Province
	General Manager - Famous Logistics
	General Manager - FR8 Logistics
	General Manager - Pacific Shipping Agencies
	General Manager - Port Services (Vanuatu) Ltd
	General Manager - Transam Vanuatu
	General Manager - Vila Agents Ltd
	General Manager - Dinh Shipping
	General Manager - Fresh Cargo
	General Manager - Ifira Shipping Agencies

Annex B – Typical Costs of Portable Surveying Equipment

An estimated breakdown of costs for the purchase of a self-contained outfit of hydrographic survey and data processing equipment is shown in the table below. Costs are based on a presentation made at the SWPHC Capacity Building Seminar, Port Moresby in March 2009. Funding would also be required for on-going maintenance of the equipment and for the training and re-qualification of operators.

EQUIPMENT AND SOFTWARE	Approximate Price USD
Single beam echo sounder - 200khz	7,500
Single beam echo sounder - dual 200 kHz+ 30khz.	9,800
Combined echo sounder and logger - 200 kHz.	13,500
Combined echo sounder and logger – 200 kHz +30khz.	optional (15800)
DGPS service, annually	1,700
Acoustic Tide Gauge	10,500
Post processing for DGPS, single frequency	12,000
Digital sidescan sonar	20,000
Hydrographic data processing software	6,500
Ruggedized laptop	5,000
Desktop PC for processing	2,250
Plotters	8,000
Accessories	5,000
Approximate total for equipment (echo sounder, sonar, tide gauge, data logger, GPS, plotter, post-processor)	110K-140K
Training in regional centre (inclusive of travel, etc.)	50,000

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Annex C – US NAVOCEANO Mobile Training Team Programme



NAVAL OCEANOGRAPHIC OFFICE

<https://www.navo.navy.mil>

NAVOCEANO Mobile Training Team and Tailored Maritime Geospatial Training

NMTT Tenets

The Naval Oceanographic Office (NAVOCEANO) Mobile Training Team provides tailored formal and on-the-job training to USA partners, friends and allies while simultaneously collecting maritime geospatial and environment (MGE) information to describe the coastal and littoral environment.

Information and knowledge from these surveys are used to generate in-country interoperable products for rapid, safe manoeuvrability of U.S. and host nation military vessels during joint combat operations and exercises, and Safety of Navigation (SoN) and Safety of Life At Sea (SOLAS) for commercial and military vessels during port and harbor egress and ingress.

NMTT Core Competencies

Using the host nation's personnel and vessel, NAVOCEANO provides professional personnel and state of the science commercial off-the-shelf equipment to conduct highly accurate MGE surveys.

With 80 hours of formal classroom training and up to 450 hours of practical field MGE, the program provides students with the fundamentals of MGE surveying through practical training in mathematics, computer science, physical sciences, geodesy, Global Positioning System (GPS) for navigation, hydrography, oceanography, meteorology, Geographical Information System (GIS) for nautical cartography, remote sensing and resource management.

Students

The NMTT is designed for three to five students and is open to both military and civilian personnel. At the end of the training period, students will receive a certificate of completion and will have the capacity to assist hydrographers and oceanographers in MGE surveys from a naval and international perspective.

Faculty

NMTT instructors and surveyors are highly qualified personnel with education and experience in the subjects they teach.

Skill Level

Prospective students must have successfully completed trigonometry, calculus and physics. In addition, students should have some knowledge and experience in maritime navigation and electronics.

Students from non-English speaking countries must have an English comprehension level of at least 70%. Classroom instruction in Spanish may be

provided for additional costs.

Requests for NMTT

Requests for NMTT should be sent to the Security Assistance Officer at the U.S. Embassy in the host nation. The course is listed in the Military Articles and Service Listing (MASL) under the title Hydrographic Management and Engineering Program and MASL number P-309027 or course identification number MTT-PNO.

Contact Information

Commanding Officer, Fleet Survey Team ATTN: Karen ALLAIN, IMSO
Stennis Space Center, MS 39522 Telephone: (228) 688-5844 Fax: (228) 688-5020

Annex D – Vanuatu’s Dependency on Hydrography and Charting

1. Introduction

The archipelago of Vanuatu is situated in the south-west Pacific Ocean approximately 2,300 km off the east coast of Australia, between New Caledonia, the Solomon Islands and Fiji. It comprises some 80 islands and islets extending over 800 km north to south. The administrative capital and commercial centre is Port Vila, located on Efate. The majority of the islands of Vanuatu are mountainous due to their volcanic origin, and there are three active volcanoes. Based on geographical locality, the country is divided into six provinces which are administered by local governments.¹

The four main areas of the Vanuatu economy are agriculture, tourism, offshore financial services, and cattle rearing; there is substantial fishing activity, although this industry does not bring in much foreign exchange. Exports include copra, kava, beef, cocoa, and timber. Imports include machinery and equipment, foodstuffs, and fuels. Mining activity is limited; although manganese mining ceased in 1978, there was an agreement in 2006 to export manganese already mined but not yet exported. The country has no known oil or gas deposits. Economic development is hindered by dependence on relatively few commodity exports, vulnerability to natural disasters, and long distances between islands in the archipelago and from main markets.

Vanuatu is widely recognized as one of the premier holiday destinations for scuba divers wishing to explore coral reefs of the South Pacific region. Tourism increased 17% from 2007 to 2008 to reach 196,134 arrivals by air. The number of ships operated by Carnival Australia and visiting Vanuatu is planned to rise over the next ten years. Ten years ago Carnival Australia carried approximately 35,000 passengers to Vanuatu, this figure is now around 350,000 and projected to rise to around 1 million by 2020. In addition other European cruise lines are planning to move to the more lucrative Pacific region. Cruise ship traffic is, therefore, set to predominate in the waters around Vanuatu.

Many international ship-management companies choose to register their ships under the Vanuatu flag. Vanuatu is a full member of the International Maritime Organization and applies its international conventions.²

2. Vanuatu's Islands

Vanuatu, formerly the New Hebrides, is an archipelago which includes the Banks and Torres groups of islands. It consists of about 80 mountainous islands and numerous islets plus rocks and shoals, forming an irregular Y-shape lying between 13°00'S and 21°10'S, and 166°00'E and 170°30'E.³ The islands are situated on a bank with depths from 600m to 700m lying in a NNW/SSE direction, with a deep channel between them and Nouvelle-Calédonie. The 13 major islands of the group are all high, well-watered and covered by extensive rain forests. They are primarily of volcanic origin, with a number of active volcanoes, and in the main are fringed with coral reefs. In this review the islands and waters of the archipelago are described under the geographical sections shown below. Matthew and Hunter Islands are not included in this review.

¹ http://www.faopacific.ws/Portals/167/programmes/trust%20funds/country_TF/Vanuatu_TF.pdf [accessed 21 February 2012]

² CIA Fact Book <https://www.cia.gov/library/publications/the-world-factbook/geos/kr.html> [accessed 24 October 2011]

³ NP61 p.167



Islands forming the Republic of Vanuatu

The islands of the Republic of Vanuatu rely heavily for their existence on the import of goods by sea. The islanders have throughout their history relied on the sea for sustenance; life in the modern world has made this reliance even more essential.

A short summary of each island and atoll forming the Republic of Vanuatu, taken primarily from Admiralty Sailing Directions (NP 61), is at Annex G Appendix 1 - *Analysis of Hydrographic Requirements - Island by Island*.

3. Ports and Harbours

The ports of entry into the Republic of Vanuatu are at Port Vila (17°45'S 168°18'E) on Efate operated by the Department of Ports and Marine Authority (Private Mail Bag 9046, Port Vila) and at Luganville (15°31'S 167°10'E), on Espiritu Santo operated by the Department of Ports and Marine Authority, PO Box 148, Luganville, Espiritu Santo, Vanuatu.

- **Port Vila (17°45'S 168°18'E)**, the capital and seat of government, is situated on the east side of Port Vila Bay. Port Vila is the principal port of the Republic of Vanuatu. It is capable of handling all types of vessels including tankers, Ro-Ro vessels, general cargo and cruise ships. Principal exports are copra, beef, cocoa and timber.⁴



⁴ NP61 pp.180-

Port Vila⁵

- **Luganville (Santo) (15°31'S 167°10'E)**, the administrative and commercial centre of Espiritu Santo, lies on the north side of Segond Channel. It is capable of handling all types of vessels including tankers, Ro-Ro vessels, container vessels, gas carriers, general cargo and cruise ships. The principal exports are copra, fish and beef. The population in 1999 was 10,738.⁶



Port at Luganville⁷

4. Inter-Island Communication Routes

Inter-island communication for both passengers and freight is primarily by sea using local cargo and ferry vessels. This service is supplemented by air services using an extensive network of island runways. Freight for Vanuatu enters the country through Port Vila or Luganville as shipment hub points and is then transhipped to other islands.

5. Cruise Ship Operations

Cruise ship operations in Ni-Vanuatu waters have grown steadily over the past decade. This growth, according to cruise ship operators, is set to continue over the next decade. An indication of the current state of operations can be seen from the data below obtained from Carnival Australia showing visits programmed for the period between June 2011 and March 2013. In addition, and over the same period, Carnival Australia ships will make six visits to Pentecost and two to Santo.

Ship	GRT	No of Passengers Carried	Port Vila	Anelghowaht Bay (Mystery Is)	Wala Bay	Champagne Bay
Pacific Jewel	70310	1915	40	26	17	8
Pacific Pearl	63500	1817	23	16	6	3
Pacific Sun	47000	1960	16	8	3	1
Pacific Dawn	70310	2020	56	19	7	7
Total Visits			135	69	33	19
Average Monthly Visits			6	3	2	1
Average Monthly Visitors			11949	6042	2885	1676

Carnival Australia - Ship Visit Analysis

⁵ Google Earth

⁶ NP61 p.213

⁷ Google Earth

The downturn in the European cruise market is likely to cause a redeployment of vessels to the South West Pacific which will see a further but indeterminate increase in cruise ship traffic.

In addition to major cruise ship operators a small number of what are termed 'boutique' cruise vessels, such as the *Island Passage* and *Lycianda*, operate throughout the Ni-Vanuatu islands obtaining access to less frequented bays and inlets away from the normal tourist areas.

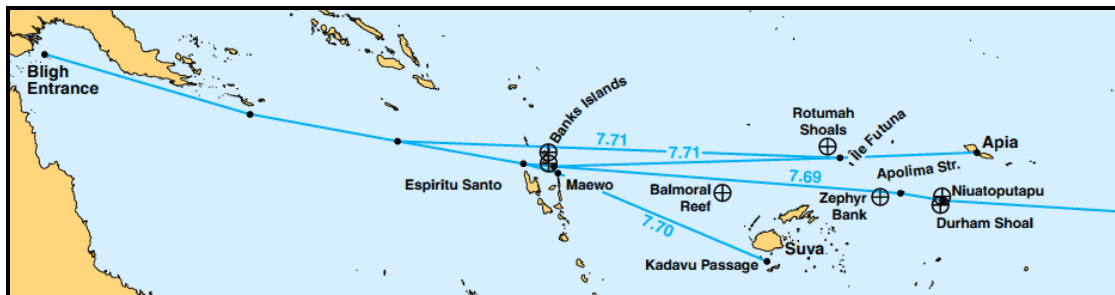
The *Island Passage* (500 grt)



The *Lycianda* (385 grt)

6. Shipping Routes including Navigable Channels

The main shipping routes through Vanuatu's waters pass north of Espiritu Santo and north or south of the Banks Islands as convenient. The routes, connecting the island groups to the east of Vanuatu with the Torres Strait, are shown in the diagram below; numbers in blue in the diagram refer to section numbers in NP 136 *Ocean Passages of the World*. Charted information indicates that these routes are free from offshore hazards.



Shipping Routes through Ni-Vanuatu Waters⁸

7. Vigias, Volcanic and Seismic Activity

Admiralty Sailing Directions and nautical charts warn the mariner of volcanic and seismic activity in the region. Active volcanoes are to be found on Tanna, Lopévi, Ambrym, Aoba and Vanua Lava. A submarine volcano is to be found in the vicinity of Gemini Seamounts and off the NE and E coasts of Épi. Vanuatu lies in a zone susceptible to earthquakes with a series of light to moderate earthquakes occurring in August 1965: WSW of Tanna; SW of Erromango; NW of Efate; close off the E coast of Malakula and off the W coast of Espiritu Santo. During periods of W winds, which occur usually only during the hurricane season, patches of discoloured water

⁸ NP136 p.161

are frequently observed in deep water W of the Vanuatu group of islands. These patches are caused by conglomerates of bright sand-coloured plankton which give a disconcerting impression of shoal water.⁹

Volcanic activity in the region is noted on BA charts as for example the area off the east coast of Epi where the chart note states that:

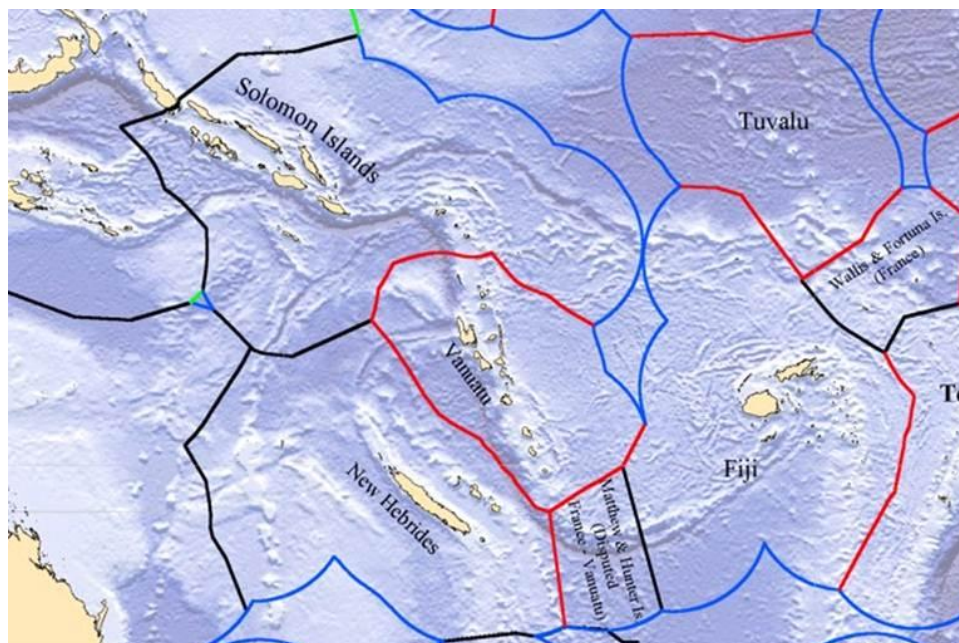
VOLCANIC ACTIVITY

In the areas centred on 16°41'S 168°23'E and 16°50'S 168°32'E recent submarine volcanic activity may have resulted in changes in the configuration of the seabed. Depths in these areas may differ considerably from those charted. For further details, see Admiralty Sailing Directions.

An Analysis of Isolated Reefs and Vigias within Vanuatu's EEZ is at Annex G Appendix 2.

8. Maritime Claims

Vanuatu claims a 12 mile territorial sea, a contiguous zone of 24 miles and an exclusive economic zone (EEZ) of 200 miles.¹⁰ The total EEZ area totals approximately 680,000 square kilometres an area over 600 times larger than its land area. As can be seen from the diagram below none of Vanuatu's maritime boundaries have as yet been agreed with its neighbours. Preliminary discussions for boundary negotiations are currently taking place.



Boundaries

- Agreed boundaries
- Median lines (not agreed)

Maritime zones

- Exclusive Economic Zones
- Exclusive Fishery Zones

Vanuatu's Maritime Boundaries

Vanuatu is conducting maritime boundary discussions with its neighbours and requires charts on the WGS84 satellite datum with modern mapping included to formulate its claim. Even those charts referred to WGS84 contain data that is not accurately positioned against this datum, see note from chart BA1575 below.

⁹ NP61 p.169

¹⁰ NP61 p.9

CHART ACCURACY

Owing to the age and quality of the source information, some detail on this chart may not be positioned accurately. Particular caution is advised when navigating in the vicinity of dangers, even when using an electronic positioning system such as GPS.

9. Defence including Coastguard

Vanuatu's Coastguard operates two 31.5m Pacific class patrol vessels, however, during the visit no specific defence or coastguard interest in hydrographic data or charting was identified.

10. Environment

It was not possible to assess any environmental requirement for hydrography during the visit.

11. Fishing

Fishing is either domestic or under licence to Chinese and/or Taiwanese vessels. The main fish caught is snapper which inhabits the area between the 100m and 700m isobaths which should be better surveyed and charted to assist in fisheries stocks management and development. The Department of Fisheries encounter difficulties with enforcing the licensing arrangement as monitored vessel positions are provided as WGS84 coordinates that often do not correspond with the charts where the charted details is related to less modern datums. This situation gives rise to significant issues with regard to licence enforcement and infringement.

There is an identified requirement to have reefs south of Malakula (BA 1575) adequately surveyed for local fishing.

12. Tourism and Coastal Recreational Amenities

In addition to the requirement for adequate surveys and charting required by cruise ships as discussed earlier in this section there is a need for inshore charting at larger scales for the numerous small craft operating in the tourism market in Vanuatu.

13. Education and Science

There do not appear to be any educational or scientific programmes sponsored by the Vanuatu government requiring or including the gathering of hydrographic data.

14. Planned Maritime Developments in Ni-Vanuatu Waters

There are only two identified maritime developments planned for Vanuatu. The first is cruise ship activity growth whilst the second is the export of limestone from the east side of Big Bay at Espiritu Santo. No major coastal zone construction works are planned.

Annex E – Existing Hydrographic Data for Vanuatu

1. General

Whilst there has been no national data gathering plan for at least a decade data gathering has been progressing under other programmes during this period. Unfortunately, due to a lack of hydrographic coordination and direct responsibility this data has not been provided to the PCA (UKHO). The following sections discuss the data available to the government of Vanuatu and via the government to the PCA (UKHO); the Vanuatu government is strongly recommended to either obtain the data and/or make arrangements for the transfer of the data to UKHO for the chart improvement programme.

2. National Data

An archive of national hydrographic data does exist and it has to be assumed that all data gathered under previous national survey campaigns has been incorporated into modern charting although this could not be verified.

3. Australia

The Australian Hydrographic Service (AHS) occasionally conducts surveys in Vanuatu. A check survey in Port Vila was conducted at the time of the IHO visit by the survey ships HMAS *Mermaid* and HMAS *Paluma*. Vanuatu should confirm with AHS that all survey data gathered in Vanuatu's waters by AHS has been forwarded to the PCA (UKHO) for chart action.

4. France

In discussions with Ni-Vanuatu government officials it was apparent that research cruises, including bathymetric data gathering, have been carried out by French research ships within Vanuatu's EEZ. Contained within a SOPAC report (EU EDF 8 - SOPAC Project Report 110 dated October 2008) is a list of French survey cruises. An abstract of these cruises, conducted under the auspices of L'Institut de recherche pour le développement (IRD) Nouméa (<http://nouvelle-caledonie.ird.fr/l-ird-dans-le-pacifique-sud/le-centre-ird-de-noumea>) and using MBES, is shown below. The list cannot be considered exhaustive as SOPAC's interest was only centred on Efate and it is recommend that contact is made with IRD to obtain bathymetric data collected in Vanuatu's EEZ.

Vessel	Dates	Cruise
RV Jean Charcot & RV L'Atalante	November 1985	SEAPSO 1 & 2
	July 1993	SOPACMAPS1
	July 1996	CALVA
	July 1996	PORMEA
	March 2000	ALAUF1
RV Alis	December 2003	TERRALIS

5. United States of America

The IHO team was informed that US military surveys had been conducted within Vanuatu's waters; however, this could not be verified by the Ni-Vanuatu authorities. The government of Vanuatu is strongly recommended to investigate the existence of such data through normal diplomatic channels.

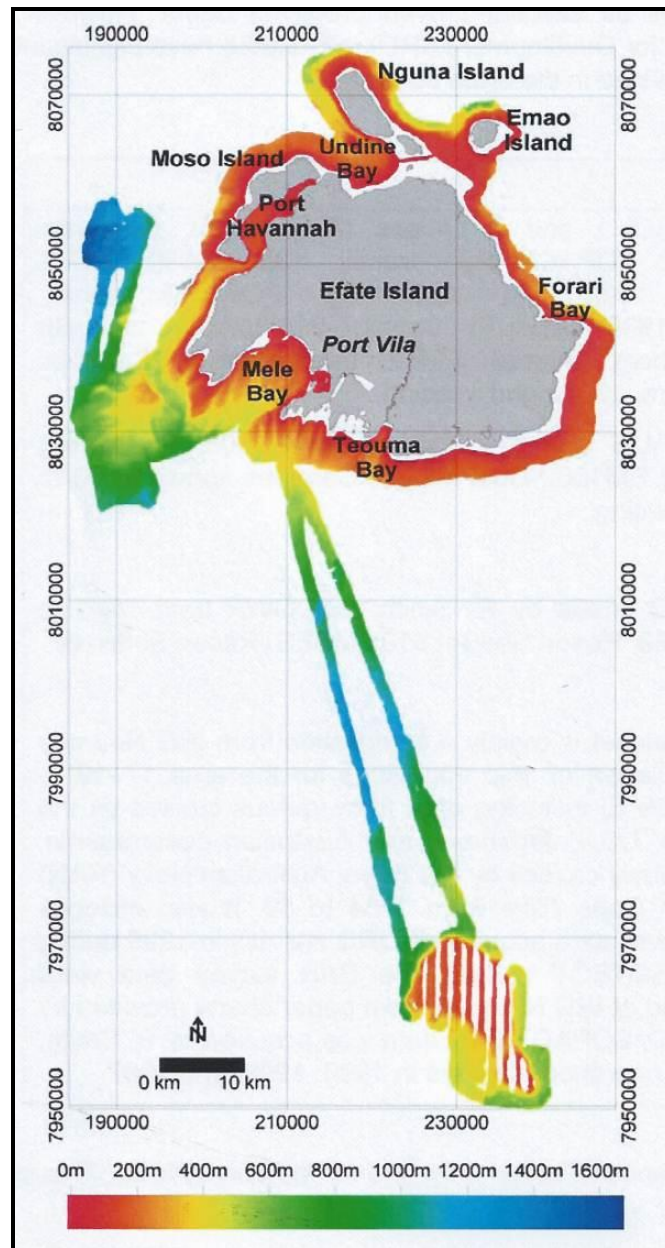
6. United Kingdom Hydrographic Office

The UKO has probably the most comprehensive hydrographic archive for Vanuatu. All survey data held by UKHO has been incorporated into the current published charts. This data is assessed further in this report.

7. SPC-SOPAC

A high-resolution bathymetric mapping survey of the seabed surrounding the island of Efate in Vanuatu was undertaken by the Pacific Islands Applied Geoscience Commission (SOPAC) as part of the SOPAC/EU project 'Reducing Vulnerability of Pacific ACP States', which called for an investigation of the nearshore seabed around the island of Efate using a multibeam echosounder (MBES). The survey was carried out in August 2003, resulting in the acquisition of over 600 line kilometres of MBES data. The survey achieved good coverage of the seafloor from the inshore area, starting from a minimum depth of 40 m, to an average offshore distance of 10 km, reaching water depths of some 2,000 m. A 15km by 15km area over a 100-150m plateau, situated approximately 80 km to the SSW of Mele Bay, was also surveyed. The total area surveyed is shown in the diagram below.

This data will be made available by SOPAC to update British Admiralty charts, subject to the permission of the Government of Vanuatu.



SOPAC Survey at Efate August 2003

8. Carnival Australia

The lack of modern surveys to support certain cruise ship operations by Carnival Australia in Vanuatu resulted in the company commissioning private surveys of anchorages and approaches. The surveys were conducted using SBES and sidescan sonar positioned using GPS. Following the IHO visit Carnival Australia has passed the data, summarized in the table below, to UKHO for charting purposes.

Place	Date	Survey Scale
Epi (Lamen Bay)	March 1998	1:4,000
Île Pentecôte (Homo Bay)	August 2002 & May 2006	1:5,000
Tanna Island (Lenakel)	December 2005	1:4,000
Tanna Island (Waisisi)	December 2005	1:5,000
Vanua Lava (Kwakea)	December 2005	1:5,000
Banks Group (Lorup Bay)	December 2005	1:7,500
Banks Group (Ravenga)	December 2005	1:7,500
Malakula (Wala Island)	October 2002	1:7,500

9. Summary of Current State of Surveys

The current state of surveys as summarized in IHO Publication C55 'Status of Hydrographic Surveying and Nautical Charting Worldwide' Third Edition (2004) updated 27 September 2011 is shown in the table below. Vanuatu's EEZ is approximately 828,000 square kilometres of which that >200m depth is approximately 107 times that of the area <200m which totals approximately 7,744 square kilometres. Given the imprecise delineation of the 200m contour and the incomplete knowledge of surveys undertaken in Vanuatu's waters outside of the 200m contour the figures in and for C55 are at best approximate. Given the research conducted by the IHO Team during its technical visit in December 2011 the figures have been revised and are shown in the right-hand column.

Area Code	Definition	C55 (%)	Revised Value (%)
A1	Area adequately surveyed (<200m)	5	6
A2	Area adequately surveyed (>200m)	50	52
B1	Area requiring resurvey at larger scale or to modern standards (<200m)	55	55
B2	Area requiring resurvey at larger scale or to modern standards(>200m)	0	5
C1	Area which has never been systematically surveyed (<200m)	40	40
C2	Area which has never been systematically surveyed (>200m)	50	48

IHO C-55 Vanuatu - Status of Hydrographic Surveys [Updated 16 May 2007]¹¹

¹¹ IHO C55 Region L p.11 http://88.208.211.37/iho_pubs/CB/C-55/C-55_Eng.htm [Accessed 23 Oct 2011]

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Annex F – Charting Analysis of Vanuatu's Waters

1. Vanuatu Chart Coverage

The Republic of Vanuatu does not have a chart production capability and relies historically on the UKHO to fulfil this function. The résumé of chart coverage for Vanuatu shown in IHO Publication C55 - *Status of Nautical Charting* (updated 16 May 2007) is shown in the table below. The figures in brackets show revised values as supplied by UKHO for this report.

Chart Type	% Covered by INT Charts	% Covered by RNCs	% Covered by ENCs
Small Scale:			
Offshore Passage	100 (100)	100 (100)	0 (100)
Medium Scale:			
Landfall, Coastal Passage	100 (100)	100 (100)	0 (100)
Large Scale:			
Approaches and Ports	100 (100)	100 (100)	0 (40)

IHO C55 Status of Chart Coverage

While C-55 shows that Vanuatu is well covered by charts, it must be noted that the quality of the data in those charts is old, often out of date and of variable accuracy.

2. British Admiralty Charts

For historical reasons the United Kingdom, through the United Kingdom Hydrographic Office (UKHO) remains the Primary Charting Authority (PCA) for Vanuatu. With one exception (BA1638 *Plans in Northern Vanuatu*) all charts are referred to WGS 84, however, a number of charts with which they are linked are on varying reference systems such that making the transfer of positions from chart to chart difficult and possibly inaccurate. The data from which the charts are compiled is noted as being in many cases old, imperfect and on undefined reference systems such that some charts carry the note:

CHART ACCURACY
Owing to the age and quality of the source information, some detail on this chart may not be positioned accurately. Particular caution is advised when navigating in the vicinity of dangers, even when using an electronic positioning system such as GPS.

The published charts and current state of maintenance is shown in the table below a fuller discussion of the charts and the data upon which they are based can be found in Appendix 1 to Annex G.

BA Chart	Title	Scale	Lasted Updated	Annual Sales 2010 (2011)
1494	Efate and Plans		Ed 5 17 Dec 2009	272 (100)
	Efate	150,000	NM - 1071/11	
	Port Havannah	50,000		
	Forari Bay	25,000		
	Port Vila	10,000		
1570	Efate to Espiritu Santo	300,000	Ed 4 10 Dec 2009	582 (166)
	Épi island – Lamén Bay	10,000	NM - Nil	
1575	Île Pentecôte to Torres Islands	300,000	Ed 2 10 Dec 2009	780 (219)
			NM - Nil	
1576	Épi to Île Maré	500,000	15 Jul 1994	239 (283)
			NM - 2690/11	
1577	Plans in Central Vanuatu		Ed 2 17 Dec 2009	274 (47)
	Craig Cove	20,000	NM - Nil	
	Sulua Bay	20,000		
	Port Sandwich & the Masekelyne Is	35,000		
	Méténovor Bay	37,500		
	Bangon Point to Mbong Naeun Point	50,000		
	Port Stanley	50,000		
	Umbeb Bay	75,000		
1581	Islands and Anchorages in Southern Vanuatu		Ed 2 17 Dec 2009	173 (38)
	Anawamet Bay	12,500	NM – 3086/11	
	Dillon's Bay	12,500		
	Potnarvin	12,500		
	Lénakel Bay	20,000		
	Anelghowhat Bay	25,000		
	Waisisi Bay	25,000		
	Futuna	50,000		
	Anatom	100,000		
1638	Plans in Northern Vanuatu		23 Dec 1988	74 (115)
	Lésalav Bay	12,500	NM – 4708/11	
	Luganville	20,000		
	Hog Harbour	25,000		
	Lorup Bay	25,000		
	Vanihé Bay & Lolowai Bay	25,000		
	Malo to Mavéa	50,000		
	Port Patteson	50,000		

Summary of UKHO Charting

A summary of islands and chart coverage is given at Annex G Appendix 1 – *Analysis of Hydrographic Requirements by Island*.

3. Proposed Chart Improvement

During the Technical Visit a careful review of the existing charting was undertaken with stakeholder representatives from the government of Vanuatu and marine operators. Further discussions revealed where new charting might be required. Areas covered do not necessarily meet modern needs whilst other areas charted at large scales, frequently based on inadequate data, are no longer required. From these discussions and from an

analysis of the current surveys and charting it is apparent that there is a case for chart improvement. Improvement of the existing charts and plans that are being proposed may require re-scheming. The following section details the key aspects of the proposed chart improvement plan with regard to existing charting.

4. Review of Current Charting and Improvement

	Retain current chart or plan with or without additional data.
	Delete current chart or plan and replace with a new chart or plan with or without additional data.
	Delete current chart or plan.

BA Chart		Title	Remarks
1494		Efate and Plans	
		Efate	Update incorporating SOPAC data and RAN data for Port Villa (2011)
		Port Havannah	Small cruise ship usage, update incorporating SOPAC data
		Forari Bay	Small cruise ship usage, update incorporating SOPAC data
		Port Vila	Update incorporating SOPAC data and RAN data for Port Villa (2011)
1570		Efate to Espiritu Santo	Incorporate Vanuatu Lands and Surveys data to refer islands and surveys to WGS84. Incorporate SOPAC data of Efate, seamount south of Efate and oceanic soundings in the area of the chart.
		Épi island – Lamén Bay	Cruise ship anchorage, retain as charted.
1575		Île Pentecôte to Torres Islands	Incorporate Vanuatu Lands and Surveys data to refer islands and surveys to WGS84. Incorporate SOPAC data in the oceanic areas of the chart.
1576		Épi to Île Maré	Incorporate Vanuatu Lands and Surveys data to refer islands and surveys to WGS84. Incorporate SOPAC data of Efate, seamount south of Efate and oceanic soundings in the area of the chart.
1577		Plans in Central Vanuatu	
		Craig Cove	Delete plan
		Sulua Bay	Delete plan
		Port Sandwich & the Masekelyne Is	Retain plan, modern survey required
		Méténovor Bay	Cruise ship anchorage, retain as charted. New survey required.
		Bangon Point to Mbong Naeun Point	Delete plan
		Port Stanley	Revise by incorporating Carnival Australia surveys
	Umbeb Bay	Delete plan	

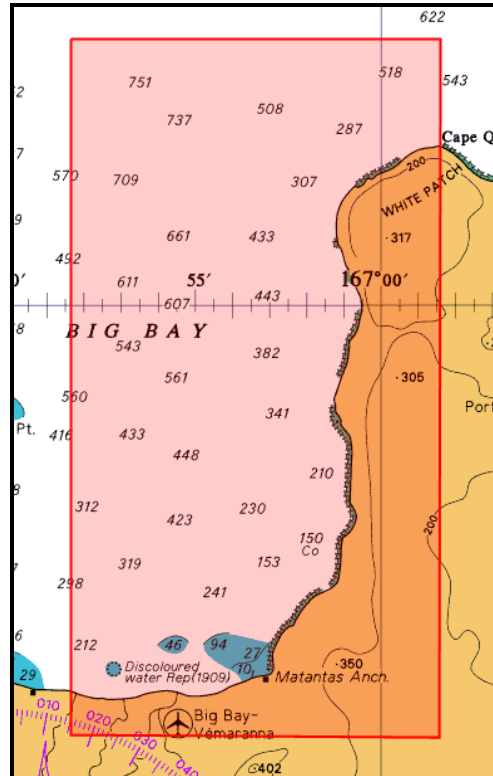
BA Chart		Title	Remarks
1581		Islands and Anchorages in Southern Vanuatu	
		Anawamet Bay	Delete plan
		Dillon's Bay	Delete plan
		Potnarvin	Delete plan
		Lénakel Bay	Lénakel Bay includes a jetty of vessels up to 500gt but anchorage and jetty exposed. Black Beach (19° 24'S 169° 14' E) is the preferred anchorage for all classes of ship. Incorporate survey data (2005) from Carnival Australia.
		Anelghowhat Bay	Retain, cruise ship anchorage. Requires new survey.
		Waisisi Bay	Incorporate survey data (2005) from Carnival Australia.
		Futuna	Delete plan
		Anatom	Retain, approach to cruise ship anchorage. Requires new survey.
1638		Plans in Northern Vanuatu	
		Lésalav Bay	Delete plan
		Luganville	Second port of Vanatu. Requires resurveying.
		Hog harbour	Hog Harbour (Champaign Bay) used by cruise ships. Revise by incorporating Carnival Australia data.
		Lorup Bay	Delete plan
		Vanihé Bay & Lolowai Bay	Delete plan
		Malo to Mavéa	Retain with revised limits. Bay West of Aese is not used and has the wreck of a US Navy floating dock in it, position unknown. Plan can be terminated N of 15° 30'S.
	Port Patteson	Delete plan	

7.1 Proposed New Charting

To meet the changing demands of shipping operating in Vanuatu's waters it is proposed that certain areas are covered by new charting. It is recognized, however, that to complete this charting programme new survey data will be required. New charting proposed is outlined below; chart/plan limits are shown in red

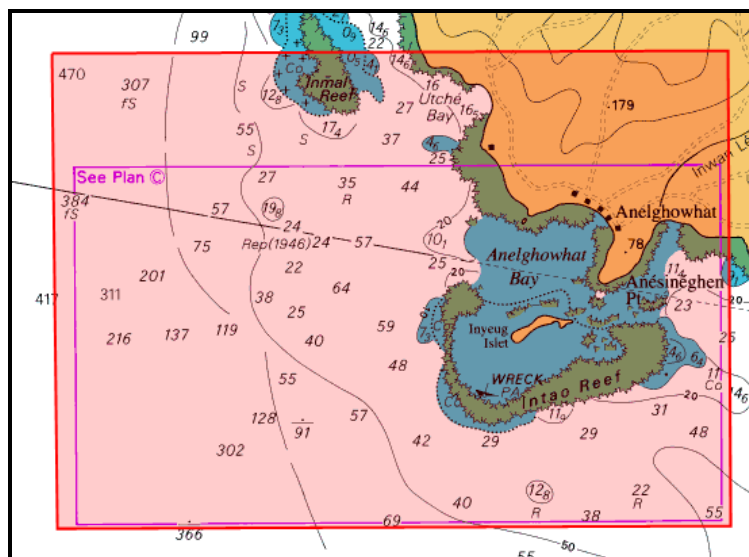
a. Espiritu Santo – Big Bay

Chart to support the export of limestone (1 million tonnes per annum) from the east side of Big Bay.



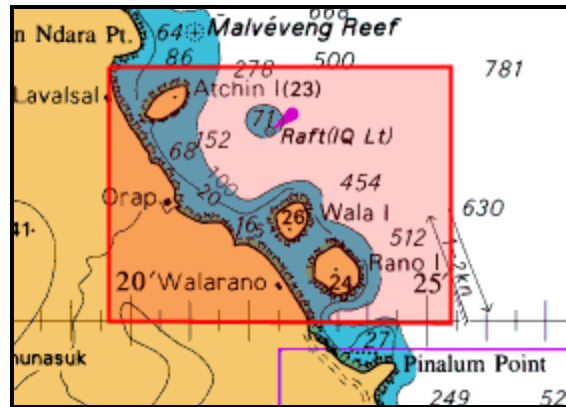
b. Anatom – Anelghowhat Bay and Approaches

Chart plan limits and scale of BA1581 to be increased to assist the improved navigation and anchoring of cruise ships.



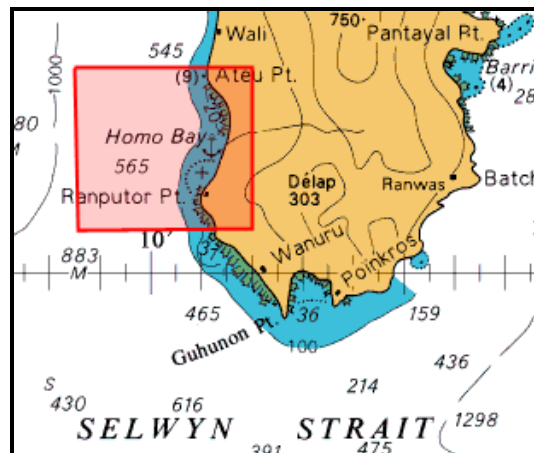
c. Malakula – Wala Island and Approaches

New large scale chart plan for the safe navigation and anchoring of cruise ships.



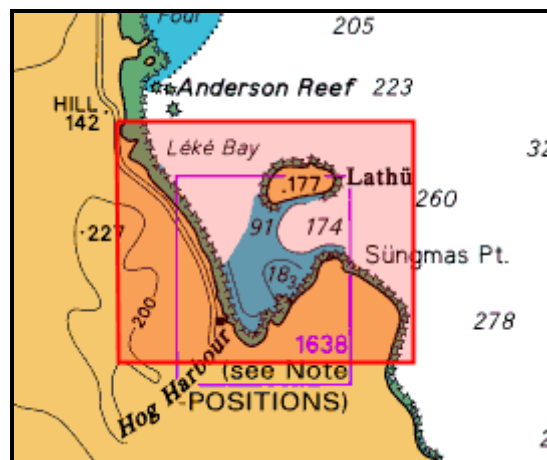
d. Île Pentecôte – Homo Bay and Approaches

New large scale chart plan for the safe navigation and anchoring of cruise ships.



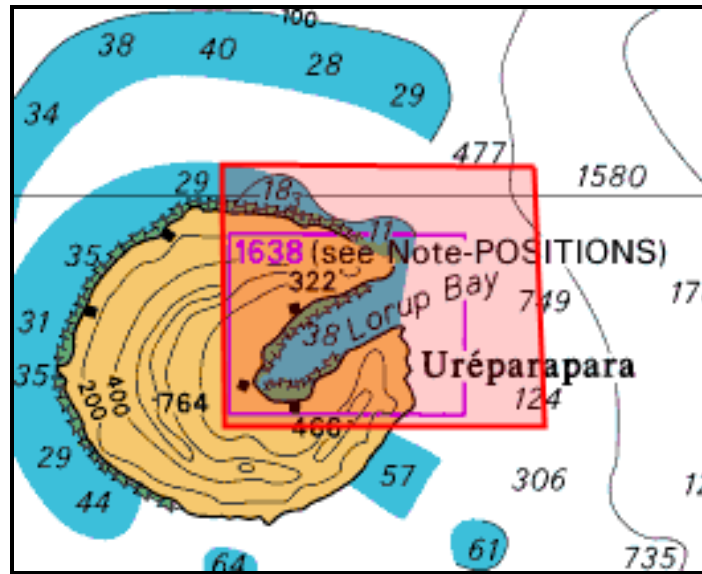
e. Île Pentecôte – Homo Bay and Approaches

Chart plan limits and scale of BA1638 to be increased to assist navigation and anchoring of cruise ships.



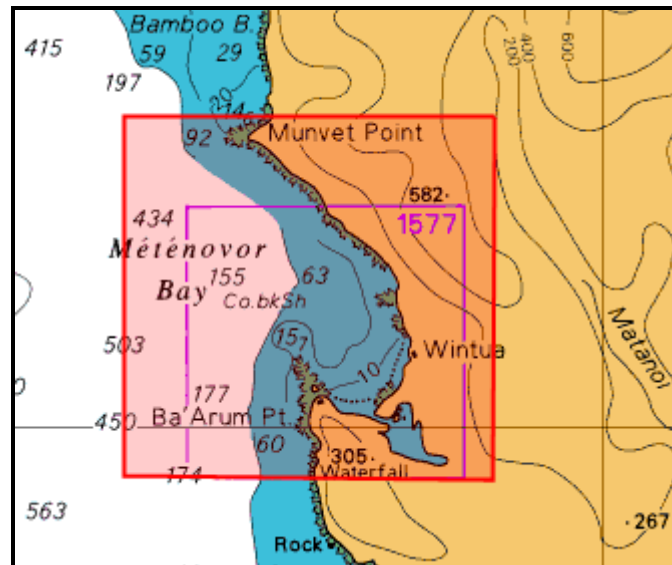
f. Unréparapara – Homo Bay and Approaches

Chart plan limits on BA1638 to be increased along with the chart scale for the improved navigation and anchoring of cruise ships.



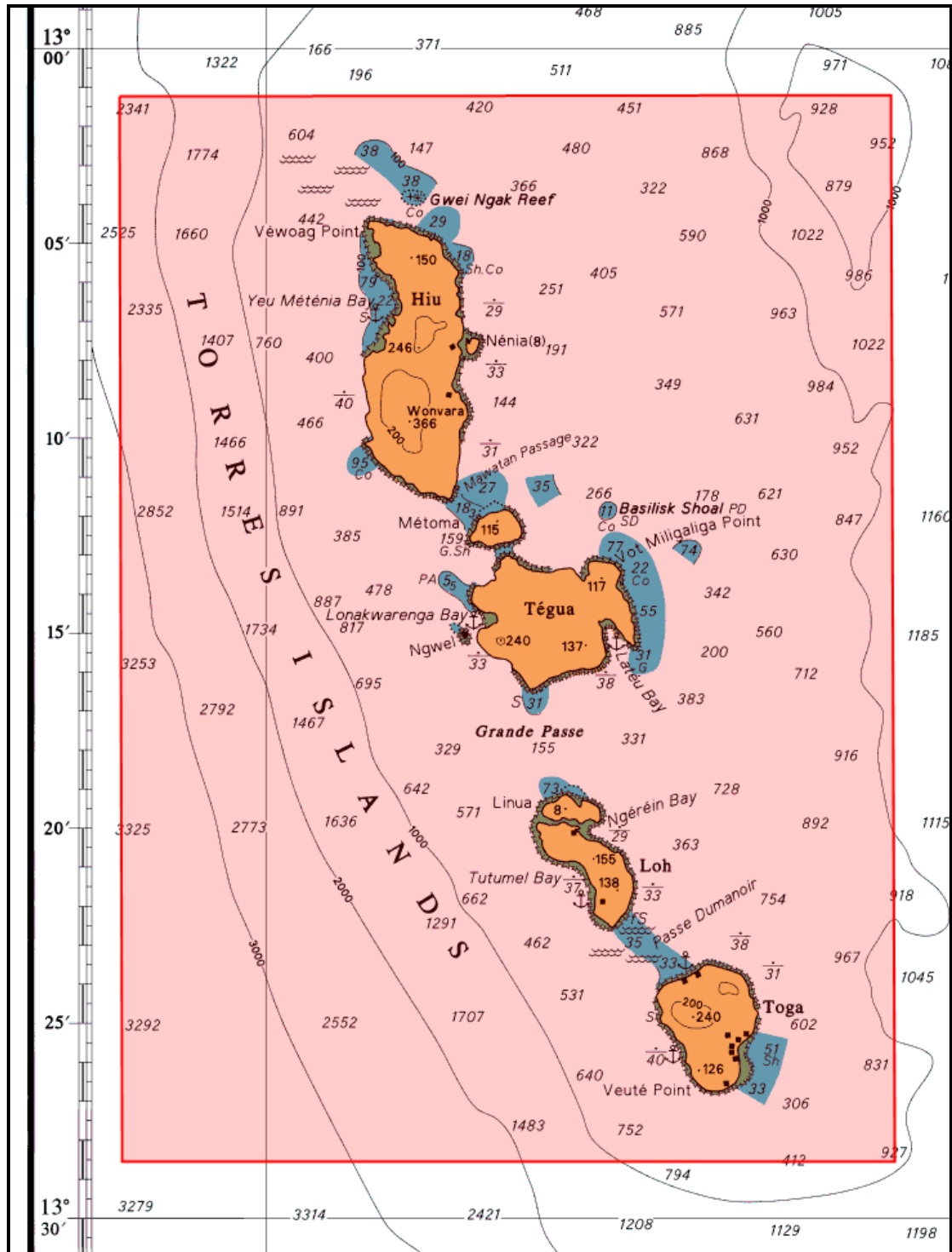
g. Unréparapara – Méténovor Bay and Approaches

Chart plan limits on BA1577 to be increased along with the chart scale for the improved navigation and anchoring of cruise ships.



h. Torres Islands

A new chart covering the Torres Islands at approximately 1:75,000 to 1:100,000 is required to support increased cruise ship, local and specialist marine based tourism. A plan of Yeu Méténia Bay may also be required.



Annex G – Proposals for Hydrographic Surveys in Vanuatu Waters

1. Introduction

Discussions with maritime stakeholders in Vanuatu highlighted the need for modern surveys to improve the current charting in support of the nation's economic development which at present is focussed on the development of regional growth through cruise ship activity. The New Zealand government, through LINZ, is taking a close interest in Vanuatu with the express intention of rectifying the survey situation and hence charting. The two major areas of concern affect the port at Luganville and various cruise ship destinations although it should not be forgotten that the coastal fringes of most of Vanuatu's islands are poorly surveyed or unsurveyed.

2. Ports and Harbours

Vanuatu has two major ports, Port Vila and Luganville, the former has been the subject of regular surveys the later has not. SOPAC and AHS surveys of Port Vila have yet to be used to update current charting; however, once this is done there will be no requirement for major resurvey for some time. Luganville's situation is completely opposite to Port Vila. Luganville port was last surveyed in 1943 by the US military, the approaches are worse as they have not been surveyed since 1892 and then at a small scale. Luganville is an urgent priority for surveys.

The minor harbours around Vanuatu require modern surveys but are of a much lower priority than those for Luganville and cruise ship destinations discussed further in this Annex.

3. Shipping Routes and Channels

The major shipping routes through Vanuatu's waters are charted mainly using AHS small scale surveys from 1986-89; the routes appear to be clear of dangers to surface shipping. Isolated dangers exist on the routes within the islands and are discussed further in the Annex under the heading 'Vigias'.

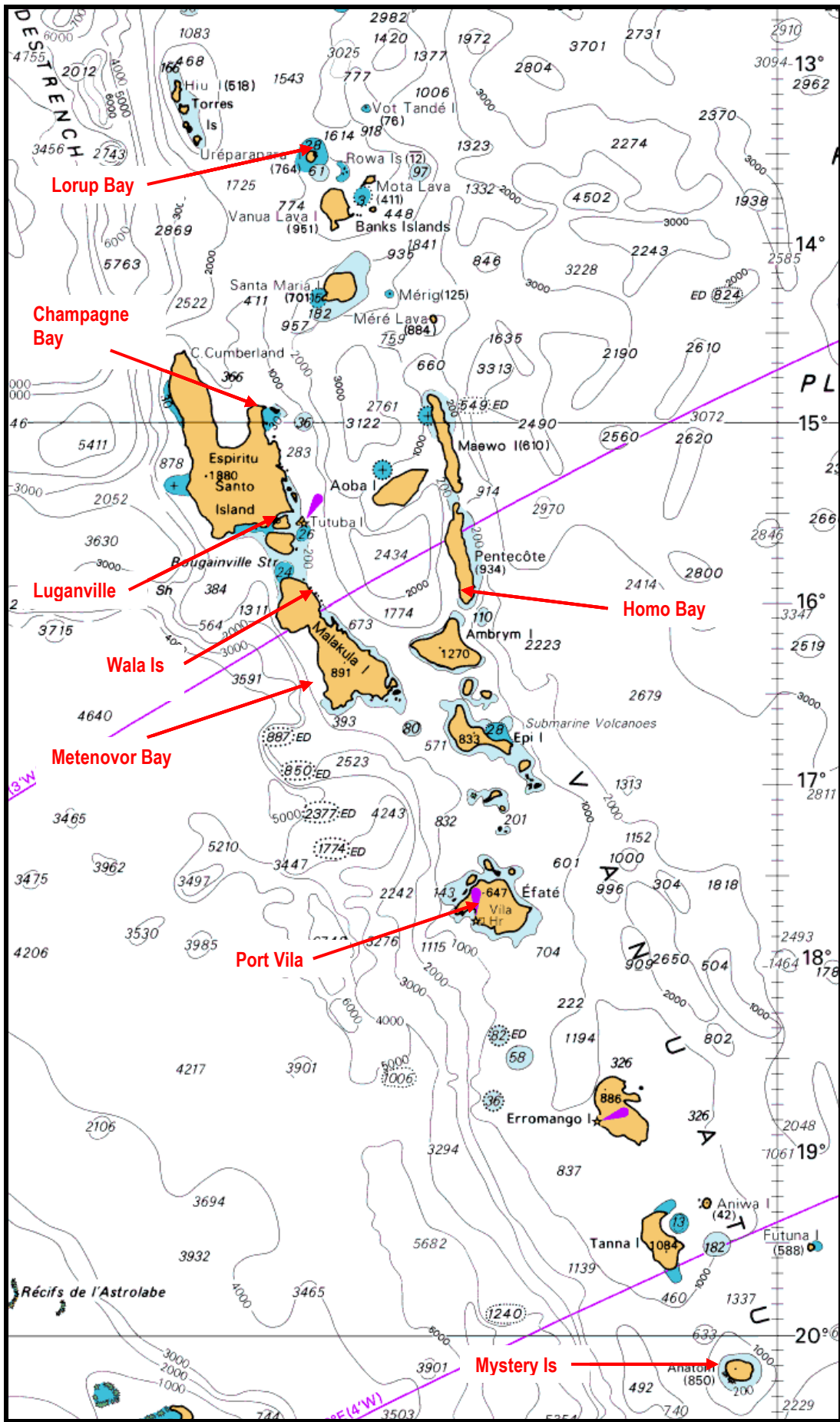
4. Cruise Ship Operations¹²

As one of the largest cruise ship operators in the region, Carnival Australia formally expressed concerns to New Zealand and Australia about poor nautical charts in the region, although it should be noted that the primary charting authority for Vanuatu is the UKHO. In August 2011, Representatives from Land Information New Zealand (LINZ) and the Australian Hydrographic Service (AHS) had a meeting with representatives from with Carnival Australia, to learn of the company's concerns regarding surveys and charting in Vanuatu for cruise ship operations. At the meeting Carnival Australia indicated their priority areas for hydrographic surveys. The areas identified reflect the company's priority areas, not those of the Government of Vanuatu; a listing of the surveys and accompanying graphic are included at the end of this section.

The high level assessment by LINZ of survey requirements, summarized in the table below, is based on UKHO charts provided by Carnival Australia, showing current and intended locations for Carnival Australia cruise ship visits. Additional surveys, commissioned by Carnival Australia, were supplied and used to assist the assessment. Whilst these surveys were not passed to UKHO at the time they have since been acquired by UKHO through separate direct discussion with Carnival Australia.

¹² Unreferenced LINZ Report *LINZ High Level Assessment of Carnival Australia Priorities for Hydrographic Surveying in Vanuatu* dated September 2011

Priority	Location BA Chart No.	Position	Preliminary Survey Requirement
1	Mystery Island (Inyeung Is) Anelghowhat Bay (Anatom) BA1581	20° 15'S 169° 46'E	<ul style="list-style-type: none"> • MBES • Corridor, 5 cables wide along lead line • Anchorage • Tender access / landing to Mystery Island • Position navigation aids • Ground control to reference existing chart in WGS84 i.e. position charted structures or CONSPIC features
2	Wala Island (Malakula Is) BA1570 BA1913	15° 58'S 167° 23'E	<ul style="list-style-type: none"> • MBES • Passage SW of island • Anchorage, SW. 5 cable square. • Tender access / landing location • Ground control to reference existing chart in WGS84 i.e. position charted structures or CONSPIC features on Malakula (adjacent island)
3	Pentecost Island (Homo Bay) BA1570	15° 58'S 168° 11'E	<ul style="list-style-type: none"> • MBES • 5 cable wide strip centred on Nangoi Village, includes anchorage & tender run • Ground control to reference existing chart in WGS84 i.e. position charted structures or CONSPIC features
4	Champagne Bay (Hog Harbour - Espiritu Santo) BA1638	15° 08'S 167° 06'E	<ul style="list-style-type: none"> • MBES • 5 cable corridor through 'Eastern Entrance' • Entire bay from Sungmas Point to western shore • Ground control to reference existing chart in WGS84 i.e. position charted structures or CONSPIC features
5	Luganville (Espiritu Santo) BA1638	15° 32'S 167° 10'E	<ul style="list-style-type: none"> • MBES • 5 cable corridor through Scorff Passage (to east) and Segond Channel • 2.5 cable corridor through Philiparr Passage (to south) • Entire area from line between Chapius Point to LPG Terminal & St Michal Point to Aore (15° 33'S, 167° 10'E) • Side Scan Sonar & Magnetometer UXO search of No Anchoring area • Position navigation aids • Ground control to reference existing chart in WGS84 i.e. position charted structures or CONSPIC features
6	Lorup Bay (Ureparapara) BA1638	13° 32'S 167° 21'E	<ul style="list-style-type: none"> • Multi-beam echo sounder (MBES) • Entire bay between Ngeye Vet Point to Ngeye Byo Point • Ground control to reference existing chart in WGS84 i.e. position charted structures or CONSPIC features
7	Metenovor Bay (Malakula Island) BA1577 BA1570	16° 28'S 167° 26'E	<ul style="list-style-type: none"> • MBES • 5 cable corridor from west • Entire bay between Ba Arum Point to Khavetei Point (incl. reef N of Ba Arum Point) • Ground control to reference existing chart in WGS84 i.e. position charted structures or CONSPIC features
8	Port Vila BA1494	17° 45'S 168° 18'E	<ul style="list-style-type: none"> • MBES • 3 cable corridor along leading line • Pontoon Bay between Ifira & Periki islands • Main wharf • Navigation aids • Ground control to reference existing chart in WGS84 i.e. position charted structures or CONSPIC features



5. Vigias

A vigia is defined in the IHO dictionary as 'a pinnacle, rock, or shoal the existence or position of which is doubtful, or a warning note to this effect on a chart', a number of vigias exist within Vanuatu's waters and given the seismic activity in Vanuatu's EEZ vigias are likely to remain a feature of navigation in this region. Vanuatu's vigias should be surveyed not only for the safety of surface navigation but to assist in the definition of fish habitats and fish migratory routes.

A SOPAC survey south of Efate conducted in August 2003 delineated a seamount that until then was simply a number of isolated and apparently unconnected shoal depths. Similar isolated depths may indicate the existence of further seamounts or prove to be false soundings. The SOPAC report following the 2003 survey states that French authorities have conducted surveys within Vanuatu's EEZ (see Annex E paragraph 4) which may provide more information on reported vigias or more that are currently uncharted.

It is recommended that Vanuatu request the assistance of SOPAC to conduct surveys in the areas shown in Appendix 2 to this Annex.

6. Island Assessment

The majority of surveys required within Vanuatu's waters are required to support SOLAS shipping and in particular the growing cruise ship industry and, therefore, these surveys should be conducted to full IHO Orders as set out in IHO Publication S44. The use of the emerging technology of satellite derived bathymetry (SDB) may provide a cost effective way of obtaining data for the general assessment of hydrography at and around the islands in Vanuatu. Any survey programme using SDB should be closely linked to environmental studies to gain the maximum value from the imagery purchased for this work. In place of SDB, or to supplement it should it be employed, it is recommended that an external agency such as SOPAC be engaged to conduct work to delineate the shallow waters around islands. A summary of the key elements of the analysis are set below whilst the full analysis is at Appendix 1 to this Annex.

- South islands (Anatom, Tanna, Erromango, Futuna, Aniwa); Shipping using these islands fall into two groups, inter-island vessels and cruise ships. The most urgent survey is required at Anatom (Anelghowaht Bay) with a lower priority at Tanna, both are in support of cruise ships. Anelghowaht Bay is the most important cruise ship destination after Port Vila. The remaining islands require delineation of the coastal waters as discussed in the introduction to this section.
- Efate to Espiritu Santo; Vanuatu's two major ports lie in the area along with a proposed development for limestone export from Espiritu Santo. The area is heavily used by cruise shipping of all sizes and inter-island traffic. The highest priority survey is considered to be Luganville. New surveys are also required at Big Bay (Espiritu Santo) and at various locations to support current and future cruise traffic.
- Banks Islands; With the exception of surveys at Mota Lava and Unréparapara in developing cruise ship destinations, the islands require surveys for the delineation of the coastal waters as discussed in the introduction to this section.
- Torres Islands. Currently these islands are only frequented by inter-island traffic the islands and only require surveys for the delineation of the coastal waters as discussed in the introduction to this section. Hui is a possible future cruise destination and will require surveys in support of this operation.

7. Maritime Boundaries

To delineate a state's maritime boundaries a first requirement is modern charting referred to WGS84. Whilst with one exception the charts of Vanuatu are referred to WGS84 it does not mean that the topography and bathymetry depicted on them is referred to the same datum. Vanuatu benefits from modern topographic mapping of all of its islands, reef areas and inter-tidal features referred to WGS84 and this should be incorporated into the current charting to support Vanuatu's claims and negotiations. Further hydrographic work will depend on the result of this initial work.

8. Environment

No requirement for surveys was identified during the IHO visit although such requirements may exist.

9. Diving Centre

Whilst tourism is a key element of the Vanuatuan economy only one dive centre has been noted for development, this is the Tongoa Wall on the northwest tip of Tongoa Island (Motu Malu Point), one of the Shepherd group.

10. Coastal Zone Development

No coastal zone development requiring hydrographic surveys was identified during the IHO visit.

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Appendix 1 – Analysis of Hydrographic Requirements - Island by Island

	Island	Survey Priority	Remarks
South Islands	Anatom (20°12'S 169°49'E) BA 1581 BA 1576	High	<p>Anatom is the southernmost island of Vanuatu and off its SW coast lies Anelghowhat Bay and Inyeung Islet, the former used as anchorage to disembark passengers to the latter. The waters surrounding Anatom Island are poorly or completely unsurveyed; the exception is Anelghowhat Bay and even here the chart carries a note warning of 'Less water reported (2011)' in the vicinity of the anchorage at Anelghowhat Bay. The plan of Anawamet Bay on the N coast of Anatom is based on data over 100 years old.</p> <p>Anelghowhat Bay is the most popular destination for Carnival Australia being the closest to the east coast of ports of Australia and requires an urgent modern survey to update BA1581. Anawamet Bay is visited infrequently by coastal patrol vessels and domestic copra transport ships every 3-5 months, propose delete plan. The waters around Anatom require surveying to modern standards.</p> <p><i>BA 1581 Islands and Anchorages in Southern Vanuatu.</i> Chart of Anatom based on survey data from 1853 at a scale of 1:73,000 with a plan of Anelghowhat Bay from RAN surveys of 1984 at between 1:12,500 and 1:24,000 and a plan of Anawamet Bay on survey data between and 1853 and 1906 at scales between 1:7,500 and 1:30,000.</p> <p><i>BA 1576 Epi to Ile Mare.</i> The charted waters surrounding Anatom are based on surveys between 1853 and 1894 at scales between 1:70,000 and 1:145,000. <i>BA 1581 Islands and Anchorages in Southern Vanuatu.</i> Chart of Anatom based on survey data from 1853 at a scale of 1:73,000 with a plan of Anelghowhat Bay from RAN surveys of 1984 at between 1:12,500 and 1:24,000 and a plan of Anawamet Bay on survey data between and 1853 and 1906 at scales between 1:7,500 and 1:30,000.</p> <p><i>BA 1576 Epi to Ile Mare.</i> The charted waters surrounding Anatom are based on surveys between 1853 and 1894 at scales between 1:70,000 and 1:145,000.</p>
	Futuna (19°32'S 170°13'E) BA 1581	Low	<p>Although the limited survey data on the coast of Futuna is very old it indicates that the island is steep-to and that there is probably very little shoal water around the island. The island is visited by copra ships and local vessel traffic</p> <p><i>BA 1581 Islands and Anchorages in Southern Vanuatu.</i> Chart of Futuna based on survey data between and 1853 and 1906 at scales between 1:7,500 and 1:30,000. Propose delete plan.</p> <p><i>The waters around Futuna require surveying to modern standards.</i></p>

	Island	Survey Priority	Remarks
South Islands	Tanna (19°29'S 169°21'E) BA 1581 BA 1576	Medium	<p>The limited survey data on the Tanna coast indicates that there is shoal water up to three miles offshore and at present ships would be advised to remain at least 3 miles offshore when passing the island. Tanna would become a important cruise ship destination given adequate surveys and charts.</p> <p>Lénakel Bay includes a jetty of vessels up to 500gt but anchorage and jetty exposed. Black Beach (19° 24'S 169° 14' E) might be a more appropriate port or refuge, unknown French studies have looked at options for landing on Tanna. Lénakel Bay was surveyed in 2005 on behalf of Carnival Australia, the survey data has been passed to UKHO for chart action.</p> <p>Waisisi was also surveyed in 2005 for Carnival Australia and although the site is considered unsuitable for cruise ships the survey data has been passed to UKHO to update the current plan on BA1581.</p> <p>BA 1576 Epi to Ile Mare. Chart of Tanna based on RAN surveys between 1984 and 1988 at a scale of 1:250,000 with additional French data dated 1968 at 1:870,000.</p> <p>BA 1581 Islands and Anchorages in Southern Vanuatu. Plans of Lenakel on imperfect miscellaneous data and Waisisi on surveys dated 1853 to 1906 at scales between 1:7,500 and 1:30,000.</p> <p><i>Should Tanna be used as a cruise ship destination then the waters around Tanna require surveying to modern standards.</i></p>
	Aniwa Island (19°15'S 169°36'E) BA 1576	Low	<p>The limited survey data on the Aniwa coast indicates that there is 'shoal' water extending up to 2.5 SE of the island, this shoal water may extend further around the island.</p> <p>BA 1576 Epi to Ile Mare. The charted waters surrounding Aniwa are primarily based on surveys between 1853 and 1894 at scales between 1:70,000 and 1:145,000 with additional French data dated 1968 at 1:870,000.</p> <p><i>Remain at present chart scales. Remote sensing should be considered as reconnaissance data for further survey programmes if necessary.</i></p>
	Erromango (18°49'S 169°09'E) BA 1576 BA 1581	Low	<p>Sparsely populated, is 26 miles long with an average width of 12 miles. There are no good harbours but anchorage may be obtained in Dillon's Bay on the W coast and Polénia Bay on the E coast. These anchorages are open and generally uncomfortable due to the swell which sets into them. The waters surrounding Anatom Island are poorly or completely unsurveyed; the exceptions are Dillon's Bay (now known as William's Bay, similarly Sowki Bay on the NW coast is now known as Elizabeth Bay) and Potnarvin which were surveyed in 1966 at slightly larger scales than charted. The island is only visited by local vessels.</p> <p>BA 1576 Epi to Ile Mare. Chart of Erromango based on RAN surveys between 1984 and 1988 at a scale of 1:250,000 with additional French data dated 1968 at 1:870,000.</p> <p>BA 1581 Islands and Anchorages in Southern Vanuatu. Plans of Dillon's Bay and Potnarvin on a 1966 surveys at 1:10,000.</p> <p><i>Remote sensing should be considered as reconnaissance data for further survey programmes if necessary.</i></p>

	Island	Survey Priority	Remarks
Efate to Espiritu Santo	Efate (17°41'S 168°22'E) BA 1494	Medium	<p>Efate is one of the most important islands in the Republic of Vanuatu having the two excellent harbours of Port Vila (17°45'S 168°18'E) the site of Vanuatu's main commercial port and Port Havannah (17°35'·0S 168°13'·5E) which is used a cyclone haven. Port Vila, the capital of Vanuatu, lies on the SW side of the island. There are a number of islands and reefs off its NW and N coast forming Port Havannah and Undine Bay. BA1494 stills carries a warning note regarding wartime mines in Undine Bay. Surveys of the coastal waters surrounding Efate are small scale (1:145,000 to 1:250,000) and mainly from surveys conducted in 1890.</p> <p>Extensive surveys of Port Vila, Port Havannah and the bays and waters surrounding Efate were conducted in 2003, this data has yet to be charted or received by UKHO. Once received this data, and that of the AHS, will allow full improvement of the charting of Efate.</p> <p>Dependent upon the assessment of the SOPAC and AHS data no further surveying may be required in the immediate term.</p> <p>BA 1494 Éfaté and Plans. The chart of the main island is based on RAN surveys between 1984 and 1988 at a scale of 1:250,000 with additional data dated 1890 at 1:145,000.</p> <p>BA 1494 contains plans of Port Vila based on relatively modern survey data at various scales, Port Havannah from US Government charts dated 1949 and Forari Bay from a French Government survey dated 1960 at 12,500. The approaches to Forari Bay are from nineteenth century surveys.</p>
	Épi (16°44'S 168°17'E) BA 1570	Low	<p>Épi is a densely wooded, mountainous and almost entirely volcanic island; its coast is a succession of white sandy beaches and rocky points interspersed with black sandy bays where there are breaks in the narrow fringing reef and which affords several anchorages and landings. The island is populous, especially on the W coast. The island is visited both by cruise ships and local vessels.</p> <p>BA 1570 Épi to Espiritu Santo. The charted waters surrounding Épi are based on surveys between 1890 and 1894 at scales between 1:70,000 and 1:145,000 with small scale (1:250,000) additions in the late 1980s. A plan of Lamén Bay on the NW point of Épi is based on a survey commissioned by Carnival Australia in 1998 at a scale of 1:4,000</p> <p><i>The waters around Épi require surveying to modern standards. Remote sensing should be considered as reconnaissance data for further survey programmes if necessary.</i></p>
	Shepherd Islands (16°57'S 168°34'E) BA 1570	Low	<p>The Shepherd Islands consist of a volcanic group of seven islands and several islets and rocks off the SE coast of Épi. Visited by local vessels only.</p> <p>BA 1570 Épi to Espiritu Santo. The charted waters surrounding these islands and Cook reef are based on surveys between 1890 and 1894 at scales between 1:70,000 and 1:145,000 with no modern additions.</p> <p><i>Remote sensing should be considered as reconnaissance data for further survey programmes if necessary.</i></p>

	Island	Survey Priority	Remarks
Efate to Espiritu Santo	Émaé (17°04'S 168°22'E) BA 1570 BA1577	Low	<p>Émaé and the islands of Mataso (17°15'S 168°25'E), Étarik (17°16'S 168°27'E), and Makura (17°08'S 168°25'E) form a small group due S of Épi. Cook Reef (17°03'S 168°16'E), lying close off the W coast of Émaé, is a dangerous atoll which dries in many places; the sea breaks heavily on its weather side but its lee side is not easily distinguished unless the light is favourable. There is an inaccessible shallow lagoon within Cook reef. Used intermittently by local vessels and by fishermen.</p> <p>BA 1570 Épi to Espiritu Santo. The charted waters surrounding these islands and Cook reef are based on surveys between 1890 and 1894 at scales between 1:70,000 and 1:145,000 with no modern additions.</p> <p>BA 1577 Plans in Central Vanuatu contains a plan of Sulua Bay on the NW cost of Émaé based on a survey from 1974 at 1:12,500 Intermittent local traffic, plan can be deleted.</p> <p><i>The channels separating these islands are deep and the islands relatively steep-to, therefore, whilst the charts are based on old data it is not thought necessary to conduct anything other than perhaps surveys by remote sensing around these islands.</i></p>
	Malakula (16°14'S 167°29'E) BA 1570 BA 1577	Medium	<p>With a length of 52 miles and a breadth between 4.5 and 23 miles Malakula is one of the larger islands in Vanuatu. Off its SE point lay the Maskelyne Islands (16°31'S 167°49'E) a group of comparatively low islands on extensive coral reefs through which is narrow but navigable passage. There are several inlets and bays on the island's coast but no commercial ports or harbours. Carnival Australia is investigating anchorages north of Port Stanley off Wala Island and on the west of the island at Méténovor. The former requires both a modern survey and a new plan. The scale and limit of the plan for Méténovor should be increased.</p> <p>BA 1570 Épi to Espiritu Santo. Charting of the coastal waters surrounding these islands is based on surveys between 1890 and 1894 at scales between 1:70,000 and 1:145,000 with a few large scale modern additions.</p> <p>BA 1577 Plans in Central Vanuatu contains several plans of areas of Malakula:</p> <p>Port Stanley surveyed in 1966 at 1:25,000 and charted at 1:50,000 – This is a dedicated port of entry which has been surveyed on behalf of Carnival Australia.</p> <p>Bangon Point to Mbong Naeun Point surveyed in 1966 at 1:50,000 and charted at 1:50,000. Difficult to determine usage.</p> <p>Port Sandwich and the Maskelyne Islands surveyed between 1883 and 1893 at scales from 1:12,000 to 1:73,000 and charted at 1:35,000 Port Sandwich Is a good cyclone refuge with a jetty planned for construction. Modern survey required</p> <p>Umbeb Bay surveyed between 1891 and 1893 at 1:73,000 and charted at 1:75,000 Difficult to determine usage.</p> <p>Méténovor Bay surveyed in 1974 at 1:30,000 and charted at 1:37,500. Difficult to determine usage.</p> <p><i>Port Sandwich requires a modern survey as do the inshore waters around Malakula. Remote sensing should be considered as reconnaissance data in the inshore waters for further survey programmes if necessary.</i></p>

	Island	Survey Priority	Remarks
Efate to Espiritu Santo	Ambrym (16°14'S 168°06'E) BA 1570	Low	<p>Ambrym is 23½ miles in length from W to E and 16½ miles from N to S; it is mountainous and densely wooded. There are no ports or natural harbours and few anchorages. The coastal waters are imperfectly or unsurveyed, however, from data available it is apparent that the island is steep-to.</p> <p>BA 1570 Épi to Espiritu Santo. The charted waters surrounding Ambrym are based on surveys between 1890 and 1894 at scales between 1:70,000 and 1:145,000 with no modern additions.</p> <p>BA 1577 Plans in Central Vanuatu contains plan Craig Cove on the W coast of Ambrym; surveyed between 1883 and 1893 at scales from 1:12,000 to 1:73,000 and charted at 1:20,000. Craig Cove used only by local traffic only; propose delete Craig Cove plan.</p> <p><i>Whilst the waters around Amrym require surveying to modern standards it is probably not a high priority and remote sensing should be considered as reconnaissance data for further survey programmes if necessary.</i></p>
	Île Pentecôte (15°44'S 168°11'E) BA 1570	Medium	<p>Île Pentecôte is 34 miles in length and 6½ miles wide lying almost N/S; it is separated from Ambrym by the Selwyn Strait. The island is everywhere densely wooded and is dominated for three-quarters of its length by a chain of mountains. There are no ports or natural harbours and few anchorages. The coastal waters are imperfectly or unsurveyed, however, from data available it is apparent that the island is steep-to. The island is considered to be a desirable cruise ship location with Homo Bay on the SW coast selected as a possible anchorage.</p> <p>BA 1570 Épi to Espiritu Santo. The charted waters surrounding Île Pentecôte are based on surveys between 1890 and 1894 at scales between 1:70,000 and 1:145,000 with some small scale modern additions.</p> <p><i>A new survey of Homo bay is required to develop the modern charting required by cruise ship operators. Whilst the waters around Île Pentecôte require surveying to modern standards it is probably not a high priority and remote sensing should be considered as reconnaissance data for further survey programmes if necessary.</i></p>
	Aoba (15°23'S 167°50'E)	Medium	<p>There is little data with which to assess the coastal waters of Aoba (now called Anbae), however, there are indications of shoal areas offshore (NW coast).</p> <p>BA 1570 Épi to Espiritu Santo. With the exception of late nineteenth century sketch surveys of Vanihé Bay and Lolowai Bays the coastal waters of Aoba are unsurveyed.</p> <p>BA1638 Plans in Northern Vanuatu. Plan of Vanihé Bay and Lolowai Bay is based on surveys from 1860 to 1905, the approach is unsurveyed. The plan should be withdrawn.</p> <p><i>The waters around Aoba require surveying to modern standard. Given the indications of shoal water around the island the survey should be a priority with regard to coastal waters surveys in Vanuatu. Remote sensing should be considered as reconnaissance data for further survey programmes if necessary.</i></p>

	Island	Survey Priority	Remarks
Efate to Espiritu Santo	Maéwo (15°09'S 168°07'E) BA1570	Low	<p>The best waterfalls in Vanuatu are located on Maéwo; however, large cruise ships are unable to visit. Asanvari Bay on the SW tip of the island is visited by smaller exclusive cruise ships and yachts. There is little data with which to assess the coastal waters of Maéwo, however, there are indications of shoal areas offshore (W coast).</p> <p>BA 1570 Épi to Espiritu Santo. The coastal waters of Maéwo are unsurveyed.</p> <p><i>The waters around Maéwo require surveying to modern standard, however, from the information available it is probably not a high priority and remote sensing should be considered as reconnaissance data for further survey programmes if necessary.</i></p>
	Espiritu Santo & Malo (15°11'S 166°55'E) BA 1575 BA 1638	High	<p>Espiritu Santo is the second most important island in Vanuatu. The W coast is abrupt, rising in vertical cliffs from the sea. An area of shoals lies between 3½ and 6 miles off the coast WNW of Remarkable Point. Dangerous rocks lie 6 miles WNW and 1¼ miles NW, respectively, of the point. Tetawoia Reef (6.4m) extends 1½ miles WSW from the coast close N of Nokuku. The E coast of Espiritu Santo from Naoruré Point to abreast Lathi, 32 miles N, is only partially surveyed. The second largest port in Vanuatu, Luganville, is located on the SE point of Espiritu Santo.</p> <p>There are three areas of interest for surveys and charting on Espiritu Santo; the main port at Luganville, Hog Harbour (Champagne Bay) for cruise ship operation and the east side of Big Bay where it is planned to extract and export up to planned for 1million tonnes of limestone per annum.</p> <p>The only systematic survey of Luganville was conducted in 1943 by the US military; its approaches are poorly surveyed. As the second port of Vanuatu this is an unacceptable situation and surveys are required as a matter of urgency. Hog Harbour, despite the current age of the survey, is used as regular cruise ship anchorage; however, this should not be seen as a reason not to bring this area to a modern survey and charting standard. A new location for both surveys and charts is in Big Bay. The entire inshore waters of Big Bay are effectively unsurveyed. The timescale for limestone extraction operations is unknown; however, the survey should be completed well in advance to allow the production of charting to support operations.</p> <p>BA 1575 Île Pentecôte to Torres Islands. The coastal waters of Espiritu Santo are imperfectly surveyed. The majority of surveys being conducted during or before World War 2. Those since have been small scale SBES surveys.</p> <p>BA 1638 Plans in Northern Vanuatu. The plan of the approach to Luganville and that covering from Malo to Mavea are based on US Government surveys of 1943. There is no large scale plan of the berths at Luganville. There is a plan of Hog Harbour, situated on the NE coast, at a scale of 1:25,000 based on a survey from the late nineteenth century. The bay west of Aésé island, which has the uncharted wreck of a US Navy floating dock in it, is not now used. The plan can be terminated north of 15°30'S.</p> <p><i>An urgent resurvey of Lugainville and approaches is required. A new survey at Hog Harbour is required to support a new and enlarged larger scale plan of this bay. The waters around Espiritu Santo require surveying to modern standard, however, from the information available it is difficult to assess a priority and remote sensing should be considered as reconnaissance data for further survey programmes if necessary.</i></p>

	Island	Survey Priority	Remarks
Banks Islands	Méré Lava (14°28'S 168°02'E) BA 1575	Low	<p>Méré Lava rises to a conical peak 1016 m high, and appears to have been at one time an active volcano. An islet, 23 m high, lies 2 cables off the NE extremity of the island; elsewhere it is steep-to. An anchorage for small vessels is afforded off the lee side of the island. Landing can be effected on a small beach at the NE extremity where there is a mission station.</p> <p>BA 1575 Île Pentecôte to Torres Islands. The coastal waters of the island are imperfectly surveyed. The only systematic survey being undertaken in the late 1980s at a scale of 1:250,000; the remaining depths shown are taken from miscellaneous lines of sounding.</p> <p><i>Given the steep-to nature of the coast surveying for Méré Lava is set at a low priority.</i></p>
	Santa Maria & Mérig (14°17'S 167°30'E) BA 1575 BA 1638	Low	<p>Santa Maria now called Gaua. Landing is difficult on the E and S sides of Santa Maria but is good in the various small coves where the fringing reef, through which there are boat passages, break the swell. There are no ports or harbours. Unlike other islands in the group there appears to be extensive 'shallow' waters areas around the coast none of which have been systematically surveyed.</p> <p>BA 1575 Île Pentecôte to Torres Islands. The coastal waters of the island are imperfectly surveyed. The only systematic survey being undertaken in the late 1980s at a scale of 1:250,000; the remaining depths shown are taken from miscellaneous lines of sounding.</p> <p>BA 1638 Lésalav Bay is only used by local traffic and given the extreme age of the surveys it is proposed that the plan should be deleted.</p> <p><i>The waters around Santa Maria require surveying to modern standard, however, from the information available it is difficult to assess a priority and remote sensing should be considered as reconnaissance data for further survey programmes if necessary.</i></p>
	Mota (13°51'S 167°41'E) BA 1575	Low	<p>There is no anchorage off Mota but small vessels occasionally lay out an anchor on the reef and so ride for a short time. Landing is difficult as the coastline is cliffy with a narrow fringing reef but can be made near the mission station at Vévéro on the NW side of the island. There appears to be extensive 'shallow' waters areas around the coast none of which have been systematically surveyed.</p> <p>BA 1575 Île Pentecôte to Torres Islands. The coastal waters of the island are imperfectly surveyed. The only systematic survey being undertaken in the late 1980s at a scale of 1:250,000; the remaining depths shown are taken from miscellaneous lines of sounding.</p> <p><i>The waters around Mota require surveying to modern standard, however, from the information available it is difficult to assess a priority and remote sensing should be considered as reconnaissance data for further survey programmes if necessary.</i></p>

	Island	Survey Priority	Remarks
Banks Islands	Vanua Lava (13°51'S 167°28'E) BA 1575 BA 1638	Low	<p>Vanua Lava, the largest of the group, has a volcanic mountain range running nearly throughout its whole length. The island is everywhere densely wooded and its coast is rocky throughout and indented by small bays. On the E side of the island the mountain range slopes steeply with deep ravines, leaving a considerable area of low swampy land between its lower slopes and the coast; several islands and detached reefs lie within 10 miles of the coast. Port Patteson lies on the E coast of the island</p> <p>BA 1575 Île Pentecôte to Torres Islands. The coastal waters of the island are imperfectly surveyed. The only systematic survey being undertaken in the late 1980s at a scale of 1:250,000; the remaining depths shown are taken from miscellaneous lines of sounding.</p> <p>BA 1638 Plans in Northern Vanuatu. A plan of Port Patteson is included, however, the survey data on which the 1:50,000 plan is based comes from late nineteenth century surveys and it is proposed that it is deleted.</p> <p><i>The waters around Vanua Lava, particularly Port Patteson, require surveying to modern standard, however, from the information available it is difficult to assess a priority and remote sensing should be considered as reconnaissance data for further survey programmes if necessary.</i></p>
	Mota Lava (13°41'S 167°39'E) BA 1575	Medium	<p>Mota Lava rises in its N part to a rounded mountain 411 m high; the S part, extending to the low Wongyanit Point, the SW extremity, is dominated by a rocky bluff 243 m high. Mélé Bay (13°40'·5S 167°38'·3E), on the NW side, affords an indifferent anchorage. Landing is fairly good through a boat channel in the fringing reef at the head of Mélé Bay.</p> <p>Mélé Bay on the NW coast of Mota Lava is a planned cruise ship anchorage.</p> <p>BA 1575 Île Pentecôte to Torres Islands. The coastal waters of the island are imperfectly surveyed. The only systematic survey being undertaken in the late 1980s at a scale of 1:250,000; the remaining depths shown are taken from miscellaneous lines of sounding.</p> <p><i>The waters around Mota Lava require surveying to modern standard, however, from the information available it is difficult to assess a priority and remote sensing should be considered as reconnaissance data for further survey programmes if necessary.</i></p>
	Rowa Islands (13°37'S 167°31'E) BA 1575	Low	<p>The Rowa Islands are low, sandy and wooded, lying on an atoll 5 miles long. Ro, the northernmost is inhabited and on it is a mission station; the southernmost, terminates at its S end in a bank of sand. The weather side of the atoll dries to a considerable extent and is always marked by breakers. The lee side is calm and therefore dangerous although the sea breaks on the SW and NW horns which are bold and easily seen. Temporary anchorage may be obtained in a bight on the W side of the atoll in depths from 9 to 13 m.</p> <p>BA 1575 Île Pentecôte to Torres Islands. The coastal waters of the island are imperfectly surveyed. The only systematic survey being undertaken in the late 1980s at a scale of 1:250,000; the remaining depths shown are taken from miscellaneous lines of sounding.</p> <p><i>Surveys of the Rowa Islands can be considered a low priority; however, the shallow water may make it an ideal area for remote sensing surveys.</i></p>

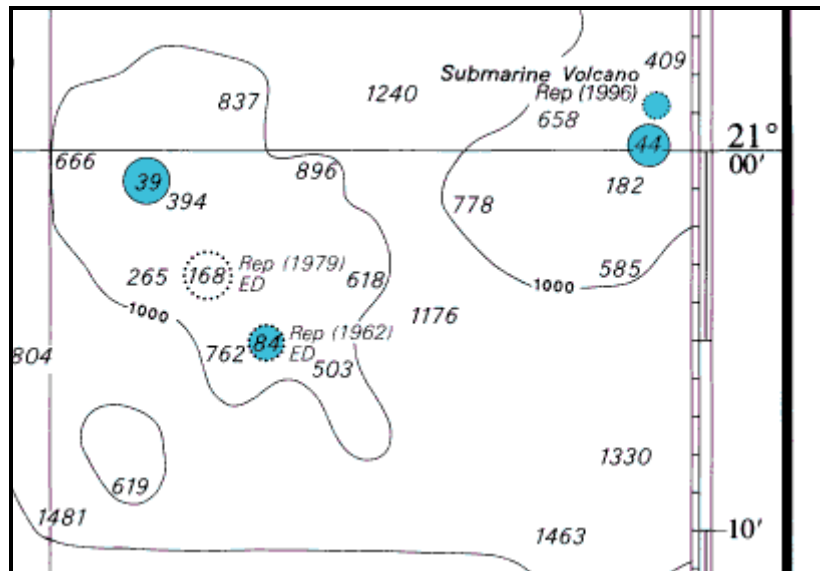
Island	Survey Priority	Remarks
<p>Unréparapara (13°32'S 167°19'E)</p> <p>BA 1575</p> <p>BA 1638</p>	<p>Medium</p>	<p>This circular island is above water portion of a volcano with a large central crater, the E face of which has been blown out; it has no offshore dangers. Heavy squalls are experienced off this island. Temporary anchorage may be obtained in depths from 33 to 46 m off the W and NW sides of the island where the bottom shelves gradually. The island is visited by small cruise ships (approx. 50 passengers per vessel)</p> <p>Lorup Bay, a deep inlet on the NE side of Unréparapara, provides excellent shelter from the prevailing winds but is open NE; Lorup Bay is virtually unsurveyed and should be used with caution</p> <p>BA 1575 Île Pentecôte to Torres Islands. The coastal waters of the island are imperfectly surveyed. The only systematic survey being undertaken in the late 1980s at a scale of 1:250,000; the remaining depths shown are taken from miscellaneous lines of sounding.</p> <p>BA 1638 Plans in Northern Vanuatu. A plan of Lorup Bay is included; however, the limited survey data on which the plan is based comes from late nineteenth century surveys. The majority of the sea area covered by the plan is unsurveyed. Carnival Australia has supplied new survey data to UKHO for Lorup Bay and the plan should be updated using this data. Further surveying may be required although it is difficult to determine at this time.</p> <p><i>Dependent upon the suitability of the carnival Australia data to support the new chart plan for Lorup Bay additional surveying may be required. The waters around Unréparapara require surveying to modern standard, however, from the information available it is difficult to assess a priority and remote sensing should be considered as reconnaissance data for further survey programmes if necessary.</i></p>
<p>Vot Tandé (13°16'S 167°38'E)</p> <p>BA 1575</p>	<p>Low</p>	<p>The northern most of the Banks Islands. It is composed of two rocks, 64 m high, the summit being covered with trees. A vertical rock, 15 m high, lies close off the NE side of the islet.</p> <p>BA 1575 Île Pentecôte to Torres Islands. The coastal waters of the island out to the 100m contour have been delineated to the N of the island.</p> <p><i>The remaining area within the 100m contour should be surveyed to determine shoal depths.</i></p>

	Island	Survey Priority	Remarks
Torres Islands	Toga (13°25'S 166°41'E)	Low	The island is flat-topped, steep and bluff in most places.
	Loh (13°21'S 166°38'E)	Low	The island is saddle-shaped giving the appearance of two islands from SW and NE. Linua lies close N of Loh on the fringing reef.
	Tégua (13°15'S 166°37'E)	Low	The SW side of which is bold.
	Métoma (13°12'S 166°35'E)	Low	The smallest island in the group
	Hiu (13°08'S 166°33'E)	Medium	Hiu rises in a densely wooded plateau to Wonvara, elevation of 366 m, 2¼ miles from its S end, whence it slopes gradually in terraces towards the N end. Carnival Australia stated that this might prove a suitable cruise ship location if the surveying and charting was improved.

Appendix 2 – Analysis of Isolated Reefs and Vigias within Vanuatu’s EEZ

Southwest of Anatom

Lat	Long	Depth	Remarks
20° 59'S	170° 18' E	Unknown	Submarine Volcano reported 1996
21° 03'S	170° 05' E	168 m	Reported 1979 - Existence Doubtful
21° 05'S	170° 07' E	84 m	Reported 1962 - Existence Doubtful

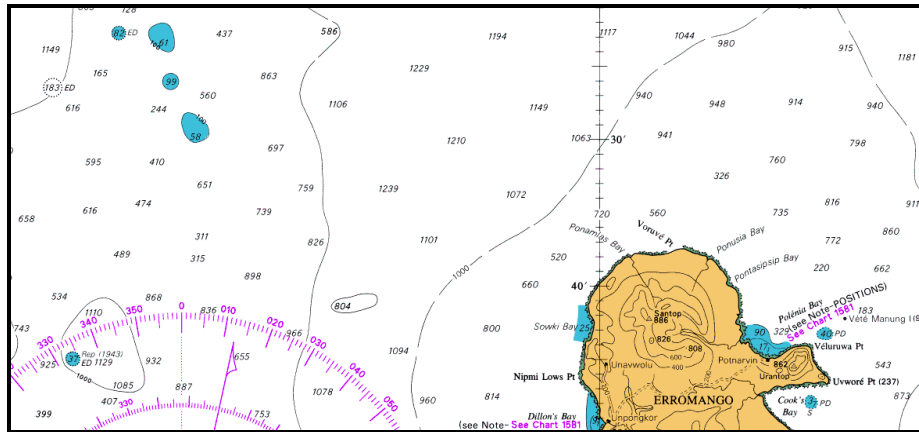


Southwest of Anatom ¹³

¹³ BA1576 Épi to Île Maré

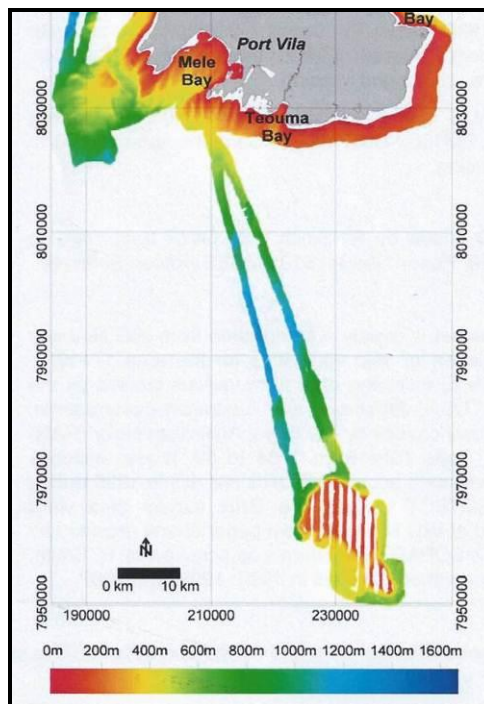
Erromango Northwestwards

Lat	Long	Depth	Remarks
18° 45'S	168° 23' E	37 m	Reported 1943 – Existence Doubtful
18° 26'S	168° 21' E	183 m	Existence Doubtful – note shoal depths E of this shoal
18° 23'S	168° 26' E	82 m	Existence Doubtful – note shoal depths E and SE of this shoal



Erromango Northwestwards¹⁴

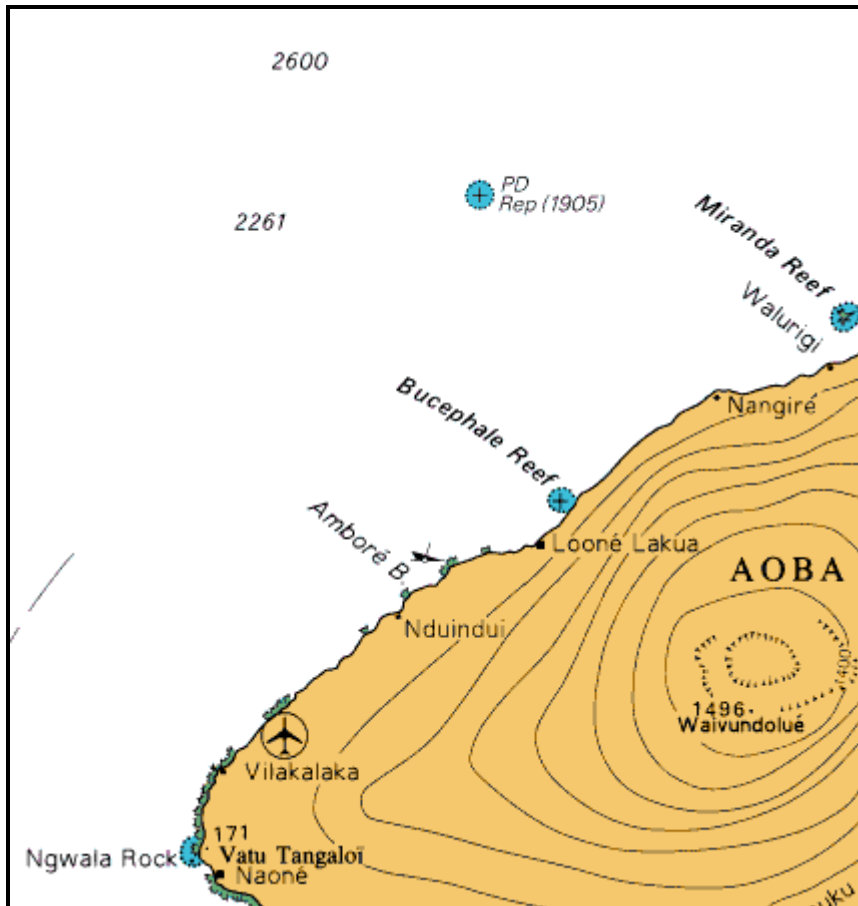
This area was surveyed in August 2003 by SOPAC, however, as can be seen from the graphic below not all of the seamount was sounded over and shoaler depths, including those charted, may exist.



¹⁴ BA1576 Épi to Île Maré

Aoba Northwestward

Lat	Long	Depth	Remarks
15° 16' S	167° 45' E	Awash	Reported 1905 – Position Doubtful



Aoba Northwestward ¹⁵

¹⁵ BA 1575 Île Pentecôte to Torres Islands

Appendix 3 – Proposed National Hydrographic Survey Programme

National Hydrographic Survey Plan

The chart modernisation plan proposed in this paper will require new hydrographic data; modern topographic data was provided to the IHO team and has since been transferred to the PCA (UKHO). Some bathymetric data is either already available but not yet published or should be acquired under a hydrographic data gathering programme.

A summary of survey requirements is provided in the table below. Budgetary estimates are provided for use in developing aid requests only, where estimates are not provided the survey area is either imprecise or the survey may not be required due to the availability of existing data. Survey details are shown after the table.

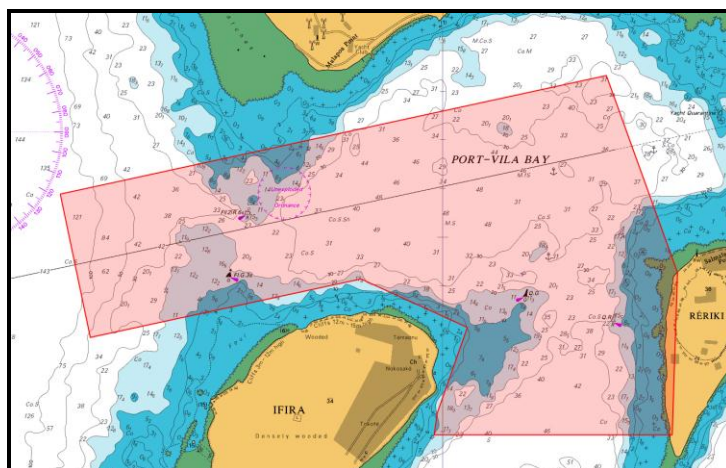
Survey	Area km ²	Budgetary Cost (£)
Port Vila	2	Uncosted
Luganville	180	280,000
Anatom - Anelghowaht Bay and Approaches	24	95,000
Malakula - Wala Island and Approaches	Unknown	Uncosted
Île Pentecôte – Homo Bay and Approaches	Unknown	Uncosted
Espiritu Santo – Hog Harbour and Approaches	17	75,000
Espiritu Santo – Big Bay and Approaches	110	SOPAC
Unréparapara – Lorup Bay	12	65,000
Malakula – Méténovor Bay	17	75,000
Shepherd Islands - Tongoa wall	Unknown	Uncosted

Ports

- **Port Vila**

Survey Requirement. This survey is identified in the LINZ paper discussed at Annex G paragraph 4; it is the least important of the eight surveys outlined in the document. It is possible that the need for this survey is negated by SOPAC's survey of 2003 and the subsequent AHS work.

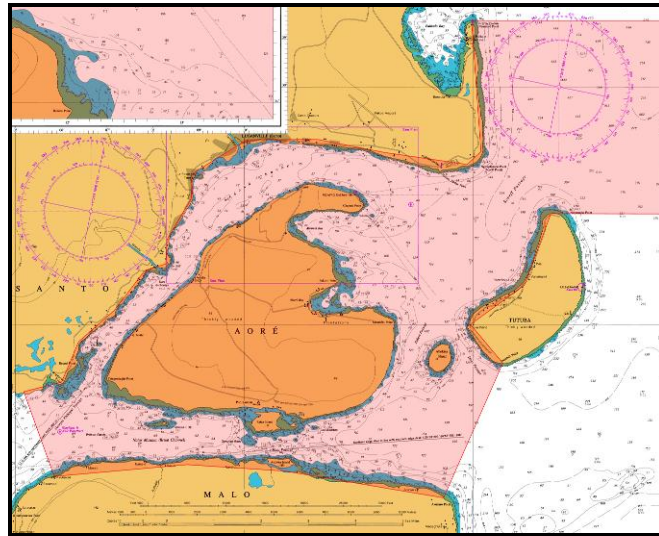
Survey Costs. Uncosted due to the probability that the survey is not required.



- **Luganville**

Survey Requirement. The main port area and the entrances from the south (Georges Philippar Passage), from the east (Scorff Passage) and from the south-east (Faber and Dives passages) has not been surveyed since 1943 whilst the areas outside of this were surveyed in 1892. None of these surveys support modern port usage. The cruise ship survey specifications at Annex G paragraph 4 specify a smaller area; however, whilst survey assets are in place a much fuller survey should be conducted to bring the chart of the port to a modern standard. The survey should be to IHO Order 1a to 100m contour and IHO Order 2 thereafter. The survey area is approximately 180 km².

Survey Costs. Approximately £280,000

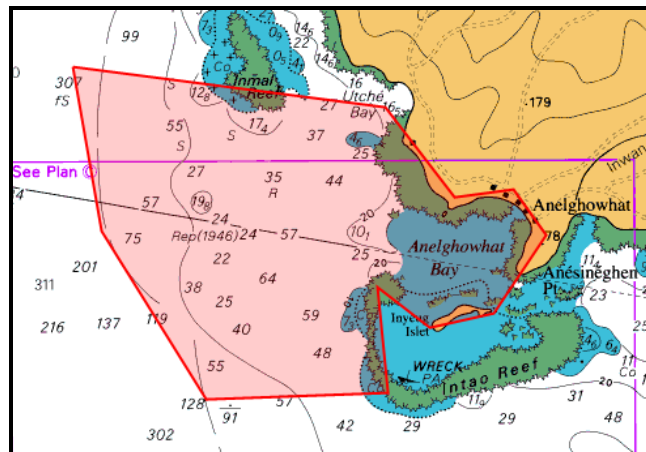


Bays and Anchorages

- **Anatom - Anelghowhat Bay and Approaches**

Survey Requirement. To survey to IHO Order 1a (MBES) the anchorage and approaches west of Anelghowhat Bay for the safe anchorage of large cruise ships and the safe transfer of passengers to/from Inyeung Island. The seaward limit of the survey area should be the 100m contour. The survey area is approximately 24 km².

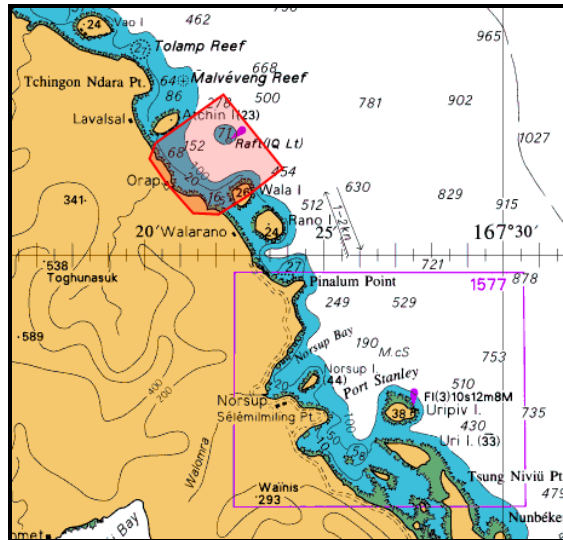
Survey Costs. Approximately £95,000



- **Malakula - Wala Island and Approaches**

Survey Requirement. To survey to IHO Order 1a (MBES) the anchorage and approaches north of Wala Island for the safe anchorage of large cruise ships. Whilst the survey limits are approximate the seaward limit of the survey area should be the 100m contour.

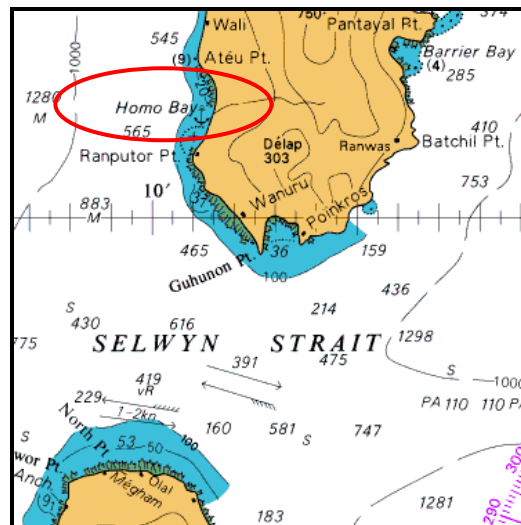
Survey Costs. Approximately Uncosted



- **Île Pentecôte – Homo Bay and Approaches**

Survey Requirement. To survey to IHO Order 1a (MBES) the anchorage and approaches to Homo Bay for the safe anchorage of large cruise ships. The survey area is undefined, imprecise information.

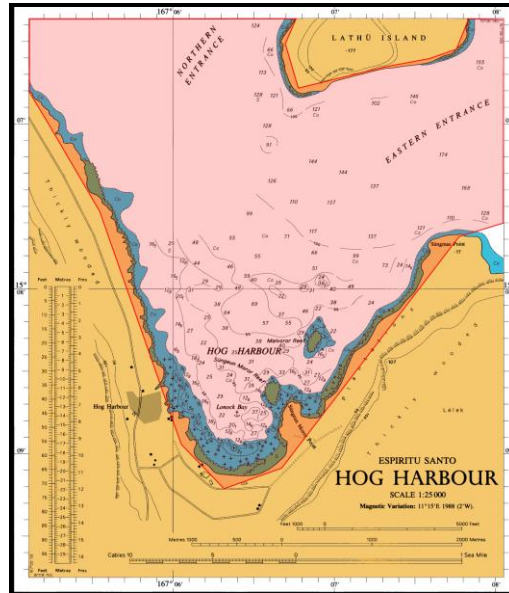
Survey Costs. Approximately Uncosted



- **Espirito Santo – Hog Harbour and Approaches**

Survey Requirement. To survey to IHO Order 1a (MBES) out to the 100m contour then Order 2 in the anchorage and approaches to Hog Harbour (Champagne Bay) for the safe anchorage of large cruise ships. The survey area is undefined as the current limits of the plan on BA1638. The survey area is approximately 17km².

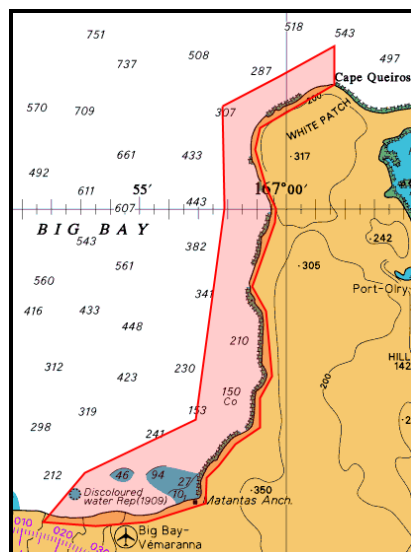
Survey Costs. Approximately £75,000



- **Espirito Santo – Big Bay and Approaches**

Survey Requirement. To survey to IHO Order 1a (MBES) out to the 100m contour then Order 2 in the approaches to Big Bay for the use of ships export limestone. The survey area is defined as the probable limits of a new chart of Big Bay. The survey area is approximately 110km².

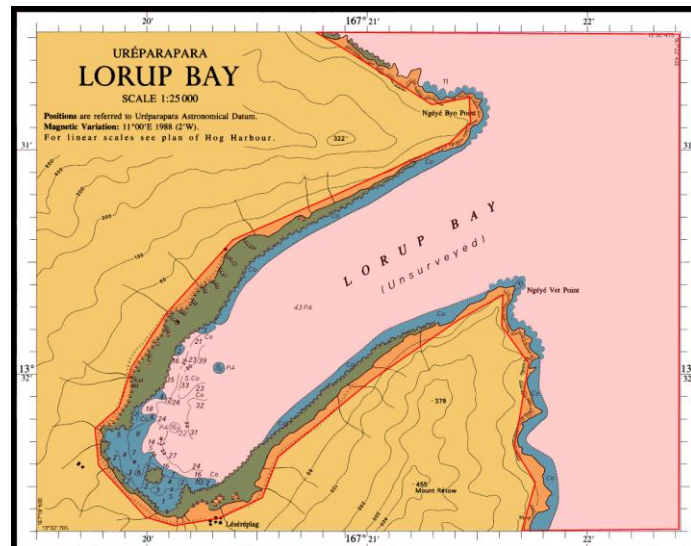
Survey Costs. Uncosted, possible SOPAC or external source survey.



- **Unréparapara – Lorup Bay**

Survey Requirement. To survey to IHO Order 1a (MBES) out to the 100m contour then Order 2. Survey required for cruise ship usage. It should be noted that survey data exists for this bay and thus the survey limits may require adjustment. The survey area is approximately 12km².

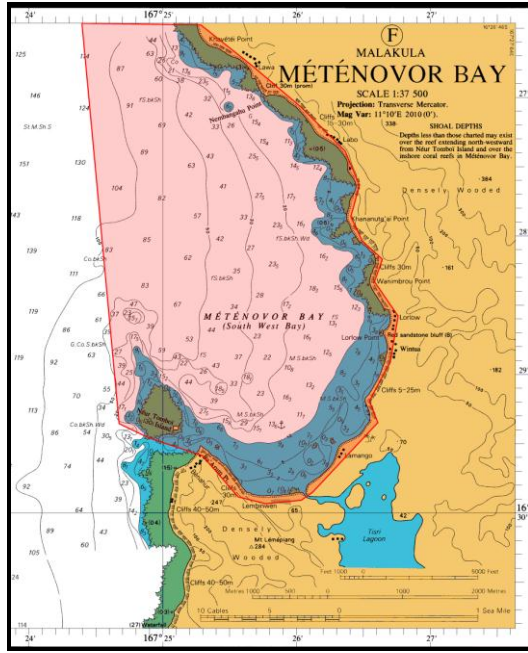
Survey Costs. £65,000.



- **Malakula – Méténovor Bay**

Survey Requirement. To survey to IHO Order 1a (MBES) out to the 100m contour then Order 2. Survey required for cruise ship usage. The survey area is approximately 17km².

Survey Costs. £75,000.



- **Shepherd Islands – Tongoa Wall**

Survey Requirement. To survey to IHO Order 1b out to the 100m contour. The survey is required for the development of a tourist diving centre at Tongoa.

Survey Costs. Uncosted, imprecise survey limits.

