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Figure 1. South West Pacific Region

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Requirement for Hydrographic Surveying and Nautical Charting for Small Island Developing States within the South West Pacific Region

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Key words: hydrographic, services, development

1. INTRODUCTION

Strong hydrographic services are vital to Small Island Developing States (SIDS) for the facilitation of national trade, economic growth, border control, defence and national wellbeing. Notwithstanding foreign aid, these States depend on the marine environment for their economic survival with regard to exploration of marine resources, whether these resources are fisheries, minerals or tourism. All too often, SIDS focus on maritime boundary delineation over other equally important areas of hydrographic significance and importance to their developing economies such as maritime trade and its associated infrastructure, including port development, maritime environmental protection and nautical charting.

Furthermore, hydrographic services are overlooked, and marginalised, through a lack of understanding of what hydrographic services can provide. The nature of hydrographic services, and their products, is so fundamental to maritime nations that they are also overlooked as a source of foundation or base line data on which to base marine management policies and action.

The development and practice of hydrographic surveying has been vital to national development and the global economy, especially for maritime countries. As the title implies, SIDS are maritime in nature and are placed within the marine environment. The provision of hydrographic data is essential for the proper management of the marine environment and achieving a strong economy within these States.

Recent visits by international agencies undertaken to review the state of hydrographic surveying and nautical charting in Kiribati, Solomon Islands and Vanuatu in 2011 and 2012 have highlighted the importance and requirement for hydrographic surveying and nautical charting within the SW Pacific region. The agencies that conducted the reviews in Kiribati and Vanuatu include the International Hydrographic Organization (IHO) and United Kingdom Hydrographic Office (UKHO) in late 2011 and Land Information New Zealand during 2012¹.

¹ This paper follows on from an International Hydrographic Organization (IHO) and United Kingdom Hydrographic Office (UKHO) visit in late 2011 to Kiribati and Vanuatu, and a South West Pacific Hydrographic Commission (SWPHC) meeting held early 2012 in the Solomon Islands. The author attended the 2011 meetings held by the IHO and UKHO in Vanuatu.

A South West Pacific Hydrographic Commission (SWPHC) meeting was held in early 2012 in Solomon Islands that highlighted the situation regarding the poor state of nautical charting, and the urgency for updating hydrographic surveys within the region.

2. CURRENT SITUATION

2.1 Reliance on Maritime Transport and Seaborne Tourist Trade

All SIDS in the SW Pacific region are highly reliant upon maritime transport, that is, shipping, international, regional and local inter-island, to ensure that food, fuel and other essential goods reach people living within the various countries that are generally archipelagic States.

Many of these economies have also become extremely reliant upon the cruise ship trade that has been increasing steadily over the past few years. For example, Vanuatu currently has about 200 cruise ships per year visiting Port Vila, Luganville and a number of other relatively remote areas around Vanuatu. The loss of this maritime trade would be catastrophic for the SW Pacific countries' economies if the lack of hydrographic surveys and up-to-date hydrographic and nautical information made it unsafe for regional and international shipping to navigate safely in SW Pacific waters. The poor state of hydrographic surveys and nautical charting within the South West Pacific SIDS places the operations of cruise ships and other commercial shipping in jeopardy.

While the use of aviation transport for movement of goods has increased, aircraft can only use areas where suitable airfields are established. The use of aircraft to transport goods is very expensive due to the limited weight that aircraft can carry and the expense of aviation fuel and aircraft maintenance. It is normally only used for goods that are highly perishable and relatively small in size and weight.

Maritime transport has the ability to move large amounts of cargo to many places between and within the SW Pacific islands at reasonable cost and relatively quickly. However, to be able to use this economical mode of transport, reliable nautical charts and hydrographic information is required to allow safe navigation.

2.2 State of Nautical Charting in SW Pacific Region

The current state of hydrographic surveys and nautical charting within the South West Pacific places the operations of cruise ships and other commercial shipping, and general national development in jeopardy². Commercial shipping operations have considerable impact on the economies of such countries. Strong and properly supported national hydrographic services

² Discussions between CAPT J.W. Maschke, RAN (Defence Adviser South Pacific) and Mr. Mike Drake (Director, Marine Operations, Carnival Australia) during 2011 at Port Vila

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are required to ensure that not only nautical safety is maintained, but also the economic development of these countries is facilitated.

International practice now requires the full feature detection and/or full bottom coverage. Some aid-driven projects are undertaking this type of coverage, but these surveys cover relatively small areas for specific purposes such as government vessel anchorages or channel surveys into limited areas. Coordinated hydrographic survey and nautical charting programs are required to ensure that economic development and maritime safety are allowed to progress.

Survey data shortfalls of coverage of hydrographic surveys and nautical charting in the SW Pacific region are common. The IHO has identified that there are still large gaps adjacent to major international shipping routes in the SW Pacific and adjacent waters. The IHO has identified that in some coastal waters of Australasia and Oceania, modern surveys, metrication and datum shift to WGS 84 are all urgent requirements in locations due to increased cruise ship operations³.

As an example, a review of the state of charting in Vanuatu found that the charting coverage for the archipelago was based on “old and generally imprecise survey information”⁴ mainly from military surveys conducted during World War 2. For Vanuatu and similar SW Pacific countries, a comprehensive chart updating programme is required if the chart coverage of many SW Pacific countries is to meet national needs and international obligations.

Many governments have still to put in place an effective organisation for the establishment of a hydrographic service, a hydrographic survey programme, a nautical charting programme, promulgation of information of importance to safe navigation and the protection of the environment, either as navigational warnings or as inputs to those hydrographic offices with responsibility for charting. While many of the SW Pacific countries’ principle charting authority is the United Kingdom, they are still required to provide hydrographic data and information as it is collected or provided. This allows chart portfolios for these countries to be updated.

Table 1 shows the state of nautical charting for selected SW Pacific countries as at August 2011. There has been little change since these percentages were published⁵. From the percentages, it appears that the region is doing reasonably well with regard to nautical charting. However, when ‘Unsurveyed’ and ‘Resurvey’ percentages are combined, an entirely different picture emerges. Under the label of ‘Resurvey’, the majority of nautical charting and surveys conducted in the region were conducted very early on in the history of

³ See IHO Capacity Building Publication C-55, *Status of Hydrographic Surveying and Nautical Charting Worldwide*, August 2011.

⁴ IHO Capacity Building Programme, *IHO Report on Hydrography and Nautical Charting in The Republic of Vanuatu*, December 2011. IHO, 4 April 2012.

⁵ To the knowledge of the author, some hydrographic surveys have been conducted within the region associated with ongoing aid agreements and by cruise ship operators.

the development of the SW Pacific region. As such, the methods used for hydrographic survey were either by lead line or by single beam echo sounder. These methods, while still useful, are out-dated (especially lead line surveys). Full bottom coverage or full feature detection in accordance with IHO standards⁶ cannot be attained unless single beam echo sounding is combined with side scan sonar sweeping, or by swathe sounding methods such as multi-beam sonar.

Depths < 200m	Unsurveyed	Resurvey required to meet modern standards	Unsurveyed & Resurvey
Australia	45%	20%	65%
Fiji	25%	70%	95%
Kiribati	80%	20%	100%
New Caledonia (France)	00%	00%	00%
New Zealand	00%	30%	30%
Papua New Guinea	72%	0%	72%
Solomon Islands	60%	30%	90%
Tonga	00%	90%	90%
Tuvalu	60%	30%	90%
Vanuatu	40%	55%	95%

Table 1: Coverage of nautical charting for selected SW Pacific countries. (IHO Publication C-55 dated 17 Aug 2011)

⁶ See IHO Special Publication S-44, *Standards for Hydrographic Surveys, 5th Edition, February 2008.*

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2.3 Lack of hydrographic surveying expertise

To enable the collection, processing and collation of hydrographic data that is suitable for inclusion into the national nautical chart portfolio, qualified hydrographic surveyors are required to ensure the integrity of the data. Many of the hydrographic surveyors trained to IHO Category B level, i.e. survey technician level, by Australia during the 1970s and 1980s have not maintained their skills and have moved on to other areas. This has been a result of a number of factors including lack of funding of national hydrographic units and lack of will and understanding of the importance of hydrographic surveying to developing island states.

3. UNDERSTANDING OF REQUIREMENT

3.1 Prioritisation of Requirements

From experience and observation, many countries' understanding of the requirement for hydrographic survey and nautical charting becomes clouded by their desire to bring their country's development up as quickly as possible to that of other more developed nations within the region. This desire causes the fundamental understanding of hydrographic surveying and nautical charting, and what it can do for the development of their country, to be lost in the myriad of other competing priorities such as sovereignty, economic issues related to establishing an industrial or manufacturing base, being part of the international community through international treaties and convention, and so on. Unless a maritime country has a fundamental understanding of hydrographic surveying then the economic development of such a country may be stifled.

Ojinnaka (1997) stated:

“For a nation to make maximum utilisation of her marine resources, her waters must be properly charted and the charts regularly updated. Unfortunately due to the different disciplines involved, the highly specialised techniques required, the high cost of marine operations and the apparent lack of awareness of the importance of these charts, it has been difficult for most developing nations of the world to pay serious attention to the charting of their waters.”⁷

This statement very succinctly describes the situation regarding hydrographic services of SIDS within the SW Pacific region. It also means that the understanding of hydrographic

⁷ Ojinnaka, O.C., 1997. *Charting the Waters of the Developing Nations with a focus on Nigeria*. The Hydrographic Journal, No.85, July 1997, The Hydrographic Society, London, 1997, p.3. The lack of hydrographic and nautical charting capability in developing countries severely restricts their economic development. Ojinnaka describes this problem in global sense while particularly focusing on Nigeria.

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services and what they can do for the country is essential in order to prioritise development activity.

3.2 The importance of hydrographic services

The importance of hydrographic services to SIDS cannot be over-estimated. The development of maritime ports and landings within SIDS that rely on maritime transport for at least 90% of all imports can only occur through hydrographic surveys. Many other activities upon which SIDS rely, such as maritime boundary delineation, border control, environmental protection, maritime resource development, et cetera, are highly reliant upon the provision of hydrographic services including hydrographic survey and nautical charting.

The increase in cruise ship operations within the SW Pacific over the past decades has highlighted the need for hydrographic surveys in remote areas of the SW Pacific. The cruise ship operators are not just satisfied to travel to the main cities of the small island States of the SW Pacific as they once were due to the charming natures of such population centres as Port Vila, Suva, and Noumea. The operators now seek to take their passengers to places that are naturally picturesque, unspoilt by progress and provide unique opportunities to see and meet local people that have not been overly influenced by external influences and tourist development. These places are generally in remote areas where infrastructure is limited and either the area is unsurveyed or has had limited hydrographic surveys conducted. This creates significant issues for maritime safety, especially where cruise ships carrying up to 3 000 passengers with drafts of up to 12-15 metres may wish to operate.

Economic development within a SIDS can be significantly stifled if hydrographic surveys are not conducted for nautical charting to allow safe movement of maritime trade internationally, regionally and locally. As mentioned above, at least 90% of all imports into SW Pacific SIDS is carried by ship. Of these imports, a significant amount is then transported by local shipping within the country to the inhabitants living usually in very remote areas. Without adequate hydrographic services and safe nautical charts, the movement of goods would be inhibited through the uncertainty and risk associated with moving through unsurveyed or poorly surveyed waters. Without the goods transported by shipping, infrastructure cannot occur, thus impeding the development within the country, which, in turn, affects development regionally. Strong hydrographic services are vital to SIDS for the facilitation of national trade, economic growth, border control, defence and national wellbeing.

3.3 Lack of Equal Focus

All too often, SIDS focus on maritime boundary delineation over other equally important areas of hydrographic significance and importance to their developing economies such as

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maritime trade and its associated infrastructure, including port development, maritime environmental protection and nautical charting.

Competing interests within the government of the state generally cause this lack of focus. For example, as a result of the small size of populations within SIDS, the responsibilities for the maritime environment are broken up between many government ministries. The author has observed that within some SIDS, there are up to five ministries conducting business directly related to hydrographic surveying and nautical charting policy, either with only one or two staff with minimal knowledge of the subjects or with no knowledge of the subjects at all. The situation then arises that the ministry with the most ‘clout’ or ability to garner the most funding takes control of the hydrographic or nautical charting policy. There is a strong need for a semi-autonomous coordinating body within a SIDS to ensure that all priorities are acknowledged and focus is placed in the appropriate areas requiring attention.

4. USE OF HYDROGRAPHIC DATA

4.1 Uses of Hydrographic Data and Products

While there is an understanding of what hydrographic products are, it is considered that there is a possible lack of understanding of what hydrographic services can provide. Apart from opening up areas within small island countries for development, there are a myriad of uses for hydrographic data and information. These include:

- Planning
- Conduct of Operations
- Border Control and Law Enforcement
- Maritime and Coastal Development
- Maritime Safety

A more comprehensive list of uses is at Annex A. However, the broad list above covers all aspects that contribute to the overall economic development and wellbeing of SIDS.

4.2 Capability development

Hydrographic data and information is an essential source of foundation or base line data on which to base management policies and action. Many coastal States lack the capacity to plan and implement a prioritised survey programme, including top priority routine re-survey of unstable areas along shipping routes and in the approaches to ports, due to a lack of such data and information upon which to implement significant development projects or programmes.

However, to be able to obtain such data and information, a state must have the capability to conduct hydrographic surveys and publish that data in the form of nautical charts or other

required hydrographic information. This implies that SIDS require some type of hydrographic service, either through a generic hydrographic unit/service or through an aid program, or a combination of both. The latter occurs in Papua New Guinea through a bilateral agreement for Australia to conduct hydrographic surveys on a biennial basis.

The IHO also assists in capability development through the auspices of regional hydrographic commissions such as the SW Pacific Hydrographic Commission. This allows discussion on capability development issues within a region and allows a forum for SIDS to seek assistance in hydrographic matters affecting their country.

4.3 Aid assistance

When problems are highlighted, SW Pacific countries are very enthusiastic and very focused on maritime safety and hydrography and there is a significant level of support and enthusiasm for improving maritime safety. Unfortunately, the cost of establishing hydrographic services and providing nautical charting is prohibitive for small countries within the region. There is potential for aid donors to assist SIDS within the SW Pacific by provision of funds or expertise to assist in establishing hydrographic services and nautical charting. It is notable that two of the largest SWP countries within the region, Australia and New Zealand, already assist in these areas, as do other countries such as the United Kingdom and France.

However, there is sometimes a tendency for countries to request assistance when it is possible for the country to undertake some of the work themselves. Countries can help themselves by passing on as much hydrographic information as possible to their Principal Charting Authority (PCA). Many SW Pacific SIDS nautical charting requirements are provided by PCAs. For example, the United Kingdom Hydrographic Office has responsibility for a number of SW Pacific countries charting requirements. In many cases, countries are not passing hydrographic data or information on to the PCA for nautical charting action, which could save precious aid funding for higher priority hydrographic programs or activities.

4.4 Use of independent advisers

It is highly desirable to engage hydrographic advisers when an in-country hydrographic capability is being established. There are generally no local personnel that have current hydrographic and nautical charting expertise. A number of personnel were trained by the Australian Defence Force about 20 years ago, but have not been given the opportunity to practice their skills for various reasons including lack of funding or equipment. 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, and they may be engaged under contract. Alternatively, established hydrographic offices in the region may be able to provide seconded

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officers for limited periods, or people with extensive experience in the areas of hydrographic surveying and nautical charting could be contracted to be advisors. This could be requested through under the auspices of the SWPHC or through bilateral discussions with regional hydrographic offices.

4.2 Maritime Safety Infrastructure

Very little Maritime Safety Information (MSI) infrastructure is available within many SIDS that is able to promulgate urgent navigational and meteorological warnings including urgent charting information. There is generally no formal mechanism to provide new and updated information to the Principal Charting Authorities (PCA), such as the UKHO, for incorporation into the existing charts to keep them up-to-date and fit for purpose. This requirement is essential to maintain navigational safety for ships, cargo and cruise ships, operating in SW Pacific regional waters. A data collection plan, plus establishment of a small hydrographic service capable of collecting and collating hydrographic information, is required. This will allow the passing of hydrographic and other essential navigational information to the relevant PCA for inclusion in the particular SIDS charts.

The generally poor state of nautical charting in SW Pacific waters and the lack of a coherent MSI services to promulgate navigational and meteorological warnings, search and rescue information and other urgent safety-related information, including chart correction information, is probably having an adverse impact on SIDS economies. It would also place 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.

5. INTERNATIONAL ORGANISATIONS, INTERNATIONAL TREATIES AND CONVENTIONS

5.1 Membership and Ratification⁸

Many SW Pacific countries have ratified and signed a number of international conventions and treaties including the Safety of Life at Sea Convention (1974) (SOLAS) and the UN Convention on the Law of the Sea (1982), and have membership and associate membership of some international organisations including the International Maritime Organization (IMO) and International Hydrographic Organization (IHO)⁹. However, due to the cost and requirement to maintain such membership, many of the countries let their membership lapse.

⁸ See Annex B for list of SW Pacific countries' membership within IMO and IHO

⁹ Due to the nature of this paper, the author has focused on the IHO due to its specific relevance to hydrographic survey and nautical charting capability building activities in the SW Pacific region.

The sections of the SOLAS and UNCLOS Conventions that are relevant to hydrographic surveying and nautical charting in the SW Pacific are shown at Annex B. The excerpts showing the requirement for hydrographic services, nautical charting and a maritime safety infrastructure should be noted to the extent that many of the SW Pacific SIDS may be in danger of lapsing from their responsibilities related to the two conventions.

5.2 International Hydrographic Organization (IHO)

Many SIDS within the SW Pacific region are members of the International Hydrographic Organization including Australia, Fiji, France (New Caledonia), New Zealand, Papua New Guinea and Tonga. The Cook Islands, Kiribati, Niue, Palau, The Solomon Islands and, recently, The Republic of Vanuatu are associate members of the South West Hydrographic Commission and Vanuatu continues to seek the assistance of the IHO. This situation is difficult because the IHO is not an aid donor or giver. As a capacity builder, the IHO provides advice and assistance for developing countries to develop their hydrographic and nautical charting expertise. IHO advice and influence allows countries to develop their hydrographic and nautical charting capacity through facilitating support from other IHO member countries.

With regard to nautical charting, the United Kingdom as a PCA produces and maintains a number of national nautical chart portfolios within the SW Pacific region – all countries that have the United Kingdom as a PCA must do is provide all relevant topographical, maritime and hydrographic information and data to ensure the charts are updated. This situation is beneficial as the upkeep and maintenance of nautical charts can be very costly; those countries using a PCA significantly gain by this essentially free service. However, by becoming a member of the IHO, a greater degree of assistance could occur through aid given by various other aid donor countries within the region.

5.3 Safety of Life at Sea Convention (SOLAS):

Countries that are a party to the Safety of Life at Sea Convention (SOLAS), are obliged to provide hydrographic services in accordance with Regulations 9 of Chapter V of that Convention.

It is important for SW Pacific SIDS to meet their treaty obligations, which require that *“Contracting Governments undertake to arrange for the collection and compilation of hydrographic data and the publication, dissemination and keeping up to date of all nautical information necessary for safe navigation.”* and *“In particular, Contracting Governments undertake to co-operate in carrying out, as far as possible, the following nautical and hydrographic services, in the manner most suitable for the purpose of aiding navigation:*

....¹⁰”. Further, the SOLAS Convention, Chapter V, Regulation 20 states: “*Nautical publications - All ships shall carry adequate and up-to-date charts, sailing directions, lists of lights, notices to mariners, tide tables and all other nautical publications necessary for the intended voyage.*”

It is thought that many vessels, apart from international ships, operating within internal archipelagic waters do not carry up-to-date charts due to the lack of hydrographic data and information. It has also been observed that countries do not pass this data and information on to their PCAs thus making charts out-of-date. This also means that shipping would not be able to travel safely except if they are following exactly along a route, without deviation, that has been travelled safely before. In other words, they are travelling on ‘local knowledge’ only. However, if all of the local knowledge was brought together in a uniform and routine manner, then all of this information could be used to update navigation charts. An advisory or coordinating person or organisation is required for this to happen, which many SW Pacific SIDS do not have.

5.4 United Nations Convention on the Law of the Sea (UNCLOS) (1982)

UNCLOS has articles showing the requirement for hydrographic survey and nautical charts by coastal States, such as SIDS. Article 24, paragraph 2 States: “*The coastal State shall give appropriate publicity to any danger to navigation, of which it has knowledge, within its territorial sea.*” Essentially, coastal States are required to publish notice of any dangers to navigation within their territorial sea. This is difficult in most SW Pacific SIDS due to the lack of hydrographic services. Excerpts from UNCLOS are shown at Annex B.

6. STATUS OF MARITIME SAFETY INFORMATION

The absence of any in-country point of focus within many SIDS for coordinating the collection, assessment and dissemination of new navigationally significant information means that charts cannot be kept up to date and therefore fully fit for purpose. It also jeopardises safety of life at sea and search and rescue operations.

The lack of appropriate and up-to-date charts for the navigation of foreign-going vessels into main ports of entry breaches the State’s obligations set out in SOLAS Chapter V Regulations 9 and 4. The IMO Member State audit scheme for hydrographic services in a State is currently voluntary but is likely to become mandatory in about 2015. If a State failed such an audit as an IMO Member State, it could result in the State being considered substandard in relation to meeting its SOLAS obligations, and may affect the operations of foreign-going vessels within its waters.

¹⁰ Safety of Life at Sea Convention 1974, Chapter V, Regulation 9 – Hydrographic Services

The areas in which local inter-island trading vessels, tourist vessels, larger international cruise ships, and cargo vessels operate are remote and poorly surveyed. Also, the lack of appropriate charting services for foreign-going vessels may expose some SW Pacific SIDS 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 if a pilot were embarked. In the case of any resultant pollution, salvage or other remedial action, the State might then find itself solely responsible for reparation and clean-up costs. The State may in future be liable for claims following a major navigational incident if it can be proved that the lack of hydrographic survey or lack of up-to-date navigational safety information resulted in the incident or was a major factor in causing the incident. This especially so in areas where cruise ships currently operate within the SW Pacific.

Cruise ship size has been increasing over the past few decades, with consequent passenger and crew number increases. There are ships currently operating with up to 3000 passengers and crew embarked¹¹. Any major navigational incident, such as a collision, grounding or sinking of vessels requiring SAR operations may be severely hampered or denied due to the inability of rescue vessels to reach survivors in these remote areas. This, in turn, may result in significant loss of life and consequent litigation resulting from the lack of hydrographic survey and nautical charting that is required following ratification of conventions and treaties such as SOLAS and UNCLOS.

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 the risk to the reputation of the operating company. The inability for cruise ships to visit many areas SW Pacific waters because of poor charting represents a very significant missed economic opportunity.

It should also be noted that there is very little formal Maritime Safety Coordination organisation within the maritime jurisdictional areas of many SW Pacific countries. This lack of navigational safety information and maritime safety infrastructure, partly due to lack of hydrographic surveying and nautical charting and political interference¹², may adversely affect search and rescue operations.

The lack of appropriate charting increases operating risks for ship owners. This may result in ship-owners opting to employ less valuable (and inherently less efficient and robust) ships. This situation results in more costly freight charges through using inefficient ships and at the

¹¹ It has been observed by the author that a vessel carrying up to 2500 passengers has operated within Vanuatu waters in the past two years.

¹² This is mainly due to the lack of political focus and lack of understanding regarding hydrographic surveying and nautical charting, plus a possible lack of understanding regarding the State's responsibilities under the SOLAS and UNCLOS conventions.

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. Most SIDS have 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.

6. DETERMINATION OF MARITIME DELINEATION

There are a number of SIDS within the SW Pacific that are currently involved in a sovereignty disputes. Without hydrographic surveys to measure and identify maritime baselines and turning points, the maritime boundaries cannot be determined and stated appropriately. This places a State at a distinct disadvantage, especially if the country with which they are in dispute has measured their baselines and turning point positions by formal hydrographic surveys. Countries that have properly measured their baselines and turning points can argue authoritatively, and with positive knowledge, that their maritime boundaries and turning points are correct.

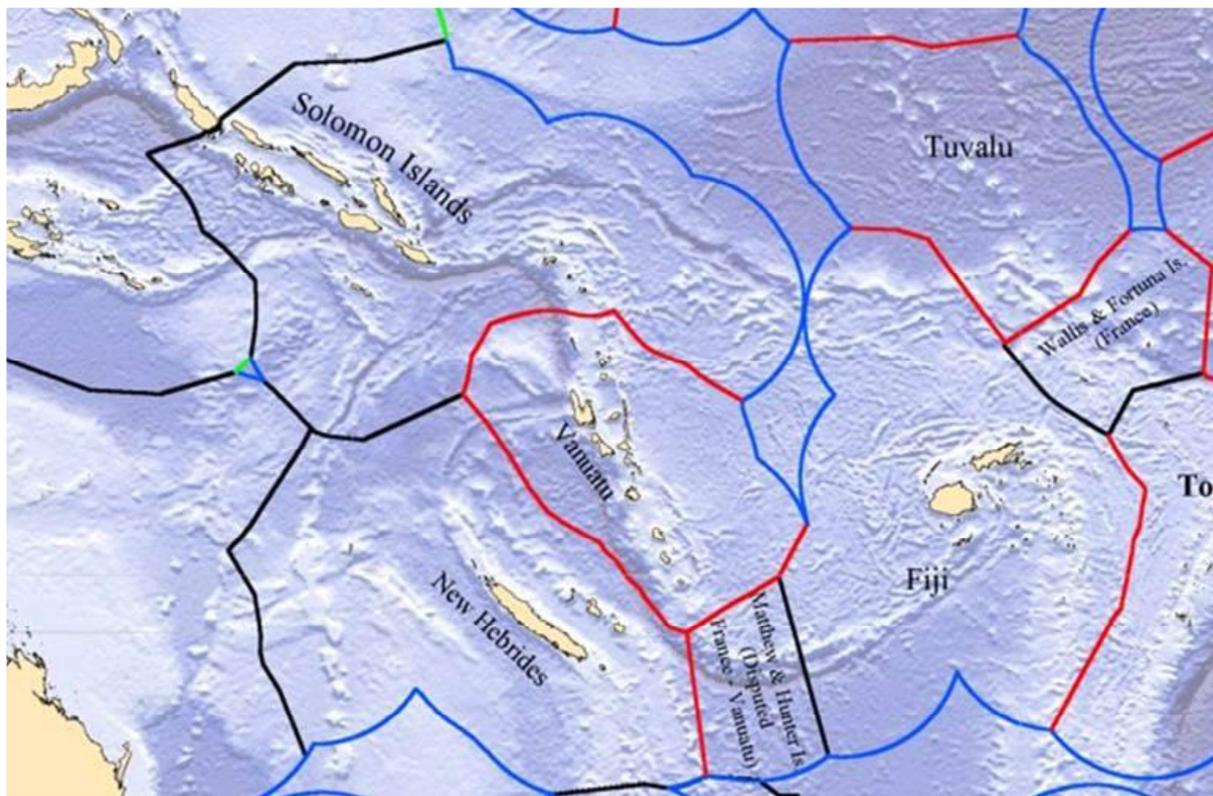




Figure 2. Vanuatu's Maritime Boundaries

For example, Vanuatu is currently involved in a sovereignty dispute regarding the Matthew & Hunter Island Group with France, and has further matters regarding maritime boundary delineation under discussion with the Solomon Islands and Fiji, lodged with the International Law of the Sea Tribunal. There is currently a lack of knowledge by Vanuatu regarding maritime boundaries between Vanuatu, France (New Caledonia), Fiji and Solomon Islands, and while some of the disputes may be related to indigenous inhabitation of some islands, sovereignty cannot be proved without definitive hydrographic data regarding maritime delineations.

Vanuatu claims a 12-mile territorial sea, a contiguous zone of 24 miles and an exclusive economic zone (EEZ) of 200 miles. 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 yet been agreed with its neighbours. Preliminary discussions for boundary negotiations are currently taking place.

7. BENEFITS

The benefits to be derived from formal hydrographic surveys and up-to-date nautical charts are many. They include:

- Maritime safety enhanced through knowledge of navigational hazards, which in turn provides confidence in navigating the waters within the SW Pacific.
- Tourism, especially cruise ship tourism, strongly benefits from hydrographic surveys as it allows cruise ships to reach tourist attractions around the SW Pacific safely. This in turn brings greater financial benefits to the national and local economies.
- National economic development and trade benefits from hydrographic surveys and good nautical charts. They facilitate maritime trade, internally, regionally and internationally. Surveys are able to identify new, efficient and safer shipping routes that, in turn, promotes the use of larger more modern vessels.
- Hydrographic surveys and nautical charting support environmental protection as they enable identification of sensitive marine areas and assists in identification and formulation of maritime boundaries around such areas.
- Maritime security depends upon accurate nautical charts and hydrographic information for enforcement operations related to border control encompassing international crime, fisheries, quarantine and immigration.
- Humanitarian aid and natural disaster relief operations relies upon accurate charts to assist in recovery effort following cyclones, earthquakes, volcanic eruptions and tsunamis. The

hydrographic information and associated charts also assists in pre-planning for relief operations and assessment of potential impact areas.

- Maritime transport infrastructure and development of port facilities and shipping routes is highly dependent upon hydrographic surveys and accurate nautical charting to ensure safety of shipping and assist in identification of sites for port facilities.

8. WAY AHEAD

The key requirement is government support - both moral and, to a degree, financial. This then leads the way for others to help find the additional resources to make things happen. However, it needs to be a partnership that involves an engaged government.

States should make use of the assistance that can be provided by the IHO. Having membership of the IHO allows formal reviews and advice to be given to the State on how best to develop their hydrographic services and nautical charting. Even, becoming an Associate Member of the IHO can provide benefits through being able to attend SW Pacific Hydrographic Commission meetings, where attendees can discuss issues relating to their only particular circumstances.

Whatever situation that a SWP state is currently in, they should ensure that they engage with their PCA and regional hydrographic and maritime safety bodies, plus undertake their nautical charting responsibilities in accordance with international protocol related to membership of international bodies and ratification of international conventions and treaties.

8.1 Recommendations

SWP SIDS that have no formal hydrographic services, either for the coordination of hydrographic surveys, nautical charting or maritime safety services should consider the following recommendations:

- Formal designation of National Hydrographic Authorities responsible for coordination and ensuring the provision of appropriate nautical charting services 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.
- Allocate regular funding and travel support for the National Hydrographic Authority to fulfil the duties of the Office and to represent the country in appropriate forums, and in particular, to attend relevant meetings of the SWPHC, SPC-SOPAC and IHO.
- Establish Maritime Safety Information (MSI) Coordinator positions to fulfil treaty obligations under SOLAS V/4 - *navigational warnings*.
- Ensure the development and execution of national Hydrographic Survey Plan, National Charting Plan, Maritime Safety Information Plan and 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 and new surveys within significant areas required to facilitate maritime trade and cruise ship operations.

- SW Pacific SIDS should 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.
- Overseas hydrographic advisers should be sought to guide and assist the National Hydrographic Authority and the National Lands Department 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.
- SWP SIDS 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 (based on registered flag tonnage) and travel support for National delegates to attend relevant IHO meetings.

9. CONCLUSION

The state of nautical charting and hydrographic surveying within the SW Pacific region is generally poor. This has been due to a lack of understanding of the need for hydrographic services as required under international agreement through ratification of UNCLOS and SOALS. Furthermore, competing internal requirements within many SIDS have allowed the focus on the requirement to be shifted inappropriately, diverting attention and funding to areas that may not have the most economic impact. An overall focus should be in place regarding hydrographic surveying and nautical charting, such that a considered and fair prioritisation of requirements is made allowing a balanced approach to all requirements in terms of funding.

The SIDS within the SW Pacific region should strive to establish or improve their hydrographic surveying and nautical charting situation. To not do this may stifle their economic development and cause the loss of significant economic opportunities through such enterprises as cruise ship operations. While sovereignty may impact on the national pride, and which can be argued about effectively if appropriate hydrographic data and information is available, the economic wellbeing of a SIDS is considered to be more fundamental. Without initial and continued hydrographic surveying and up-to-date nautical charting, the economic wellbeing of a maritime state cannot be optimised.

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USES OF HYDROGRAPHIC PRODUCTS

There are a myriad of uses of hydrographic data and information. These include:

- **Planning:**

- Strategic
- Operational
- Anti-pollution
- Environmental
- Hydrographic Survey
- Shipping Route
- Navigation Aid Positioning
- Maritime Development
- Beach Protection
- Resource Development

- **Conduct of Operations:**

- Search and Rescue
- Oil Spill Containment
- Hydrographic Survey
- Protection of Sensitive Areas
- General Navigation
- Oil, gas and mineral exploration

- **Border Control and Law Enforcement:**

- Identification and Establishment of Marine Jurisdictional Areas (such as territorial sea baselines, exclusive economic zones, special marine zones, marine park limits, harbour limits, etc.)
- Fisheries
- Immigration
- Crime Prevention (State and International)

- **Maritime and Coastal Development:**

- Marine Research and Development
- Capability Development
- Transport Infrastructure
- Port and Harbour Infrastructure

Fisheries

- **Maritime Safety:**

Shipping Operation Safety Analyses

Nautical Charting

Notices to Mariners

Value Adding to Existing Data Sets

Archiving and Databasing

Operational Training for Hydrographers and Mariners

Supplementation of Topographic Mapping

INTERNATIONAL ORGANISATIONS, INTERNATIONAL TREATIES AND CONVENTIONS RELATED TO HYDROGRAPHIC SURVEYING AND NAUTICAL CHARTING

Many SW Pacific countries have ratified and signed a number of international conventions and treaties, and have membership and associate membership of some international organisations. The organisations and conventions that are relevant to the SW Pacific include:

- **International Maritime Organization (IMO):**

The IMO is the United Nations agency responsible for the safety and security of shipping and the prevention of marine pollution by ships. There are 12 SW Pacific countries that are member states of the IMO, including: Australia, Cook Islands, Fiji, France, Kiribati, Marshall Islands, New Zealand, Papua New Guinea, Solomon Islands, Tonga, Tuvalu and Vanuatu.

Adherence to the SOLAS Convention is provided through oversight by the IMO as one of its responsibilities for facilitating safety at sea, and through development of international regulations that are followed by all shipping nations. The above nations have ratified the SOLAS Convention, and, as such, are expected to comply with the articles of that Convention.

- **International Hydrographic Organization (IHO):**

Many SW Pacific neighbours are members of the IHO and the SW Pacific Hydrographic Commission (SWPHC) including Australia, Fiji, France (New Caledonia), New Zealand, Papua New Guinea and Tonga. The Cook Islands, Kiribati, Niue, Palau, The Solomon Islands and, recently, The Republic of Vanuatu are associate members of the SWPHC. As a capacity builder, the IHO provides advice and assistance for developing countries to develop their hydrographic and nautical charting expertise. IHO advice and influence allows countries to develop their hydrographic and nautical charting capacity through facilitating support from other IHO member countries.

By becoming a member of the IHO, a greater degree of assistance to SIDS through aid given by various aid donor countries within the region.

- **Safety of Life at Sea Convention 1974:**

A State that is a party to the Safety of Life at Sea Convention (SOLAS), is obliged to provide hydrographic services in accordance with Regulations 9 of Chapter V of that Convention as follows:

“Chapter V Regulation 9 - Hydrographic services

1. *Contracting Governments undertake to arrange for the collection and compilation of hydrographic data and the publication, dissemination and keeping up to date of all nautical information necessary for safe navigation.*

2. *In particular, Contracting Governments undertake to co-operate in carrying out, as far as possible, the following nautical and hydrographic services, in the manner most suitable for the purpose of aiding navigation:*

2.1. *to ensure that hydrographic surveying is carried out, as far as possible, adequate to the requirements of safe navigation;*

2.2. *to prepare and issue nautical charts, sailing directions, lists of lights, tide tables and other nautical publications, where applicable, satisfying the needs of safe navigation;*

2.3. *to promulgate notices to mariners in order that nautical charts and publications are kept, as far as possible, up to date; and*

2.4. *to provide data management arrangements to support these services.*

3. *Contracting Governments undertake to ensure the greatest possible uniformity in charts and nautical publications and to take into account, whenever possible, relevant international resolutions and recommendations.*

4. *Contracting Governments undertake to co-ordinate their activities to the greatest possible degree in order to ensure that hydrographic and nautical information is made available on a world-wide scale as timely, reliably, and unambiguously as possible.”*

- **United Nations Convention on the Law of the Sea (UNCLOS) (1982):**

Excerpts of a few UNCLOS articles showing the requirement for hydrographic survey and nautical charts are below:

- Excerpt of **Article24 - Duties of the coastal State**

2. The coastal State shall give appropriate publicity to any danger to navigation, of which it has knowledge, within its territorial sea.

- Excerpt from **Article47- Archipelagic baselines**

1. An archipelagic State may draw straight archipelagic baselines joining the outermost points of the outermost islands and drying reefs of the archipelago provided that within such baselines are included the main islands and an area in which the ratio of the area of the water to the area of the land, including atolls, is between 1 to 1 and 9 to 1.

8. The baselines drawn in accordance with this article shall be shown on charts of a scale or scales adequate for ascertaining their position. Alternatively, lists of geographical coordinates of points, specifying the geodetic datum, may be substituted.

9. The archipelagic State shall give due publicity to such charts or lists of geographical coordinates and shall deposit a copy of each such chart or list with the Secretary-General of the United Nations.

- Excerpt from **Article 48 - Measurement of the breadth of the territorial sea, the contiguous zone, the exclusive economic zone and the continental shelf**

The breadth of the territorial sea, the contiguous zone, the exclusive economic zone and the continental shelf shall be measured from archipelagic baselines drawn in accordance with article 47.

- Excerpt from **Article 75 - Charts and lists of geographical coordinates**

1. Subject to this Part, the outer limit lines of the exclusive economic zone and the lines of delimitation drawn in accordance with article 74 shall be shown on charts of a scale or scales adequate for ascertaining their position. Where appropriate, lists of geographical coordinates of points, specifying the geodetic datum, may be substituted for such outer limit lines or lines of delimitation.

2. The coastal State shall give due publicity to such charts or lists of geographical coordinates and shall deposit a copy of each such chart or list with the Secretary-General of the United Nations.

- Excerpt of **Article 94 - Duties of the flag State**

1. Every State shall effectively exercise its jurisdiction and control in administrative, technical and social matters over ships flying its flag.

3. Every State shall take such measures for ships flying its flag as are necessary to ensure safety at sea with regard, *inter alia*, to:

(a) the construction, equipment and seaworthiness of ships;

(b) the manning of ships, labour conditions and the training of crews, taking into account the applicable international instruments;

(c) the use of signals, the maintenance of communications and the prevention of collisions.

4. Such measures shall include those necessary to ensure:

(a) that each ship, before registration and thereafter at appropriate intervals, is surveyed by a qualified surveyor of ships, and has on board such charts, nautical publications and navigational equipment and instruments as are appropriate for the safe navigation of the ship;

5. In taking the measures called for in paragraphs 3 and 4 each State is required to conform to generally accepted international regulations, procedures and practices and to take any steps that may be necessary to secure their observance.

7. Each State shall cause an inquiry to be held by or before a suitably qualified person or persons into every marine casualty or incident of navigation on the high seas involving a ship flying its flag and causing loss of life or serious injury to nationals of another State or serious damage to ships or installations of another State or to the marine environment. The flag State and the other State shall cooperate in the conduct of any inquiry held by that other State into any such marine casualty or incident of navigation.

- **Excerpt from Article 242 - Promotion of international cooperation**

2. In this context, without prejudice to the rights and duties of States under this Convention, a State, in the application of this Part, shall provide, as appropriate, other States with a reasonable opportunity to obtain from it, or with its cooperation, information necessary to prevent and control damage to the health and safety of persons and to the marine environment.

BIOGRAPHICAL NOTES:

John Maschke is 'kailoma', a person of mixed race comprising Aboriginal and German. He is identified with the Nyoongar people of South Western Western Australia. He retired with the rank of Captain from the Royal Australian Navy (RAN) in April 2012 after 38 years service and is a Certified Professional Hydrographic Surveyor Level 1. He currently owns and operates JWM Consultancy, a hydrographic surveying and maritime policy consulting company, and is an external director of Ocean Logistics Limited, a maritime logistics company based in Port Vila. He was the Australian Defence Adviser South Pacific during 2009-2012 based in Vanuatu. While in the RAN, he was a charge hydrographic surveyor and worked in many places around the Australian coast and the South-West Pacific region, including Fiji, Papua New Guinea and Solomon Islands. During his long career, he gained experience in many areas such as hydrographic surveying, geospatial policy, international relations, ship and survey management, and map and chart production. He was a member of the IHO S-44 Working Group responsible for the writing of *IHO Standards for Hydrographic Surveys, 5th Edition* and has represented the Australian Department of Defence in a number of bilateral and multilateral geospatial agreement negotiations. He was the project manager during 2003-05 for the mapping of Solomon Islands, Timor Leste and Vanuatu. He has had command of five RAN hydrographic ships (HMA Ships FLINDERS, LEEUWIN, MELVILLE, MERMAID and PALUMA), and was seconded to the Royal Fiji Military Forces Naval Division in 1983 as relief Commanding Officer of HMFS RUVE.

John gained a Masters of Arts degree in Maritime Policy from the University of Wollongong in 2000. He has presented papers to various conferences and had some papers published relating to maritime and hydrographic policy. He has the distinction of having a charted shoal named after him (Maschke Shoal) and is a Fellow of the Surveying and Spatial Sciences Institute. He is a past and inaugural Chair of the Surveying and Spatial Sciences Institute Hydrography Commission. As a member of the Australasian Hydrographic Society, he is the current Chair of the East Australian and South West Pacific Regions and Chair of the Education Awards Panel, and a long-term member of the Australian Institute of Management.

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