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Paper for Consideration by IRCC

Hydrography Risk Assessment – a novel approach to prioritising hydrographic surveys to improve maritime safety

Submitted by:	NZ
Executive Summary:	The aim of this paper is to propose a 4 step systematic process that is evidence based, founded on risk and employs spatial analysis techniques to help prioritise hydrographic surveys and other mitigations to improve maritime safety in developing coastal states and regions.
Related Projects:	IHO CB Strategy

Introduction / Background

1. Maritime safety has been a major concern in the SW Pacific for many years now. In recent years there have been a number of high profile domestic shipping incidents which have resulted in significant loss of life or grounding.

2. Very large cruise liners now operate in the SW Pacific which carry thousands of passengers and hundreds of crew. The cruise industry in the region is growing exponentially and is forecast to carry one million passengers by 2017.

3. Many charts in the SW Pacific region have not been maintained with new hydrographic surveys for more than 100 years and consequently do not meet the needs of contemporary shipping which require ENC for mandatory carriage of ECDIS.

4. The problem that coastal states and aid programmes wish to solve is how to prioritise chart improvements including new hydrographic surveys which cost millions of dollars both within coastal states and across the region.

5. In 2011, Land Information New Zealand (LINZ - the New Zealand Hydrographic Authority) signed an MOU with the NZ Ministry of Foreign Affairs & Trade (MFAT New Zealand Aid) to improve navigational and maritime safety within the region. The overarching goal is to achieve accurate and adequate charting coverage in the SW Pacific.

6. New Zealand Aid would fund two projects: for LINZ to publish ENCs where NZ is the Primary Charting Authority (PCA) and for LINZ to develop a prototype hydrography risk assessment methodology and test this as a proof of concept in the Republic of Vanuatu. Thereafter to roll out the risk assessment methodology to other Pacific Island Countries (see Annex A).

Methodology

7. To develop the risk assessment methodology, LINZ approached a marine consultancy with maritime domain and risk analysis expertise (Marico Marine NZ). They were tasked to review existing risk assessment methodologies that may be suitable for the specific needs of LINZ and if no “off-the-shelf” methodology was available, to develop a new process based on international endorsed practice.

8. The IMO Formal Safety Assessment (FSA) was chosen as the concept to adapt to the needs of a hydrography prioritisation process. Importantly, this is an approach founded on real data, hence it is evidence based. This 5-step methodology is marine related, proactive, logical, structured and comprehensive.

9. There are four key components that the methodology needs to take into account, that when combined provide the evidence required to promote one area over another for maritime safety chart improvements. These are *risk, ship types & sizes, economic growth and environmental status*.

10. The SOLAS shipping traffic information is provided from satellite AIS data. The availability of data from this technology is a recent development and provides actual ship tracks which are augmented and edited from information gathered from the in-country visit. Augmentation is necessary because satellite data refresh periods are about every 6 hours. Domestic shipping routes are included to represent all shipping types and sizes.

11. A simple flow chart of the risk assessment methodology (see Annex A) incorporating 4 steps was produced to guide the risk assessment team. Like the IMO FSA methodology, a fifth step is for the decision-makers to take their decision(s) for charting improvements on the evidence provided by the other steps.

Risk = Frequency (Likelihood) x Consequence

12. Early in the design of the methodology it was decided to use GIS risk terrain modelling (RTM), weighted overlay analysis, to provide spatial analysis to compute the risk results. This allows a multitude of different datasets to be layered, with each layer using a common underlying risk matrix of assessment criteria. The geography in each layer is categorised into cells, on which the calculations are undertaken.

13. The risk model is created in the GIS which, including the traffic layer, comprises 30 layers of likelihood & consequence risk factors. The layers of information include locations of key economic production, mangroves, coral, tourist areas, aquaculture, protected sites, chart quality, aids to navigation, key port infrastructure and bathymetry. Each of these layers is the consequence components of risk.

14. Shipping traffic (SOLAS & domestic) make up one layer, which forms the frequency (likelihood) component of risk. Thus, without shipping activities present, which could have an impact on any of the consequence layers in the event of an accident, the risk is either negligible or zero in those cells of each layer where ship tracks are not present. With shipping activities present, the nature and consequence of any accident in any layer is set by the risk criteria. Thus geographic areas having a combination of ship traffic density (which might be of a particular vessel type or size) as well as areas of high environmental utility, or where the coastal economy is tourism reliant, will show up as areas of increasing risk.

15. The use of GIS to display areas of risk spatially over an area provides an easily interpreted output for this type of risk assessment. The final result is a simple heat map showing areas of comparative risk which is easily understood by a wide audience.

16. All the GIS layers and the risk result can be made available online via a simple spatial viewer for key decision makers to query further. Thus, complex information is presented in context, in an easily accessible way for developing coastal states, donors and assisting nations to come to a decision on priorities and funding of chart improvements.

Vanuatu Proof of Concept

17. The Vanuatu hydrography risk assessment commenced at Step 1 of the methodology: the in-country data gathering visit which occurred in September 2012. This step is arguably the most important in the process as accurate, comprehensive and appropriate data is key to a robust risk analysis and final result. Satellite AIS shipping data was sourced from exactEarth to provide the shipping traffic which was then available in draft format for the visit.

18. It was necessary to travel to the regions to gather information and identify hazards first hand from the provincial government offices. Whilst every effort is made to obtain data from central government departments it is always the case that information is incomplete or has to be checked. Very often significant new information came to light which proved pivotal in determining the final risk assessment results.

19. Important to the success of the data gathering is the support and assistance of MFAT in-country Post in raising awareness early and advising key contacts. Good research prior to the visit is essential to ensure a productive visit. It is absolutely vital that appropriate government officials accompany the visit team to the island groups, to arrange meetings, transport and advise on local/regional maritime and hydrographic matters.

20. Step 2, the GIS risk assessment commences once the information and data has been gathered. The likelihood and consequence layers are populated, risk criteria are evaluated and the risk model with underlying risk matrix is initiated.

21. The Economic analysis at Step 3 uses information gathered from research and the visit. This is a specialist task and requires a subject matter expert - an economist with knowledge of the maritime domain.

22. Step 4 is the publication and distribution of the detailed report and final risk assessment results. The GIS deliverables which include the shipping traffic information plus likelihood and consequence layers are posted on the on-line spatial viewer, available to all.

Outcome

23. The Vanuatu risk assessment results (see Annex A) clearly identified the priority areas for chart improvements which allowed the government to approach donors to discuss funding for hydrographic surveys and other mitigations to improve maritime safety.

24. Donor interest is high as the risk assessment is evidence based on real data and actual vessel tracks.

25. In response to recent developments in Vanuatu, New Zealand Aid is now funding SPC SOPAC to carry out hydrographic surveys in the port of Luganville, Espirito Santo and areas important to the cruise industry. LINZ and UKHO have worked together to prepare the survey specification and the deliverables will be rendered to UKHO as PCA for Vanuatu in due course.

26. New Zealand Aid has prepared a concept note to complete hydrography risk assessments for all SW Pacific countries over the next 2-3 years.

27. Risk assessments for the Cook Islands and the Kingdom of Tonga are currently underway. The results are due by June 2014.

Benefits

28. Implementing a risk based approach to prioritise hydrographic surveys to improve maritime safety would provide the following benefits:

- Evidence based using real data - robust, independent and able to stand scrutiny
- Has an economic and cost/benefit component which is a necessity to attract donor programmes
- The risk assessment heat map is simple and easy to interpret
- GIS gathers the attention of key decision makers in a powerful and irresistible way
- Meets the objectives of the IHO CB strategy for a prioritised, national survey and charting plan
- A significant increase in the profile of the IHO CB strategy
- A significant contribution to maritime safety

Action Required of IRCC

29. IRCC is invited to:

    a. **note** the report

    b. **consider** the methodology as tool for CB activities

    c. **make recommendations** as appropriate to the IEHC5 and to the RHCs

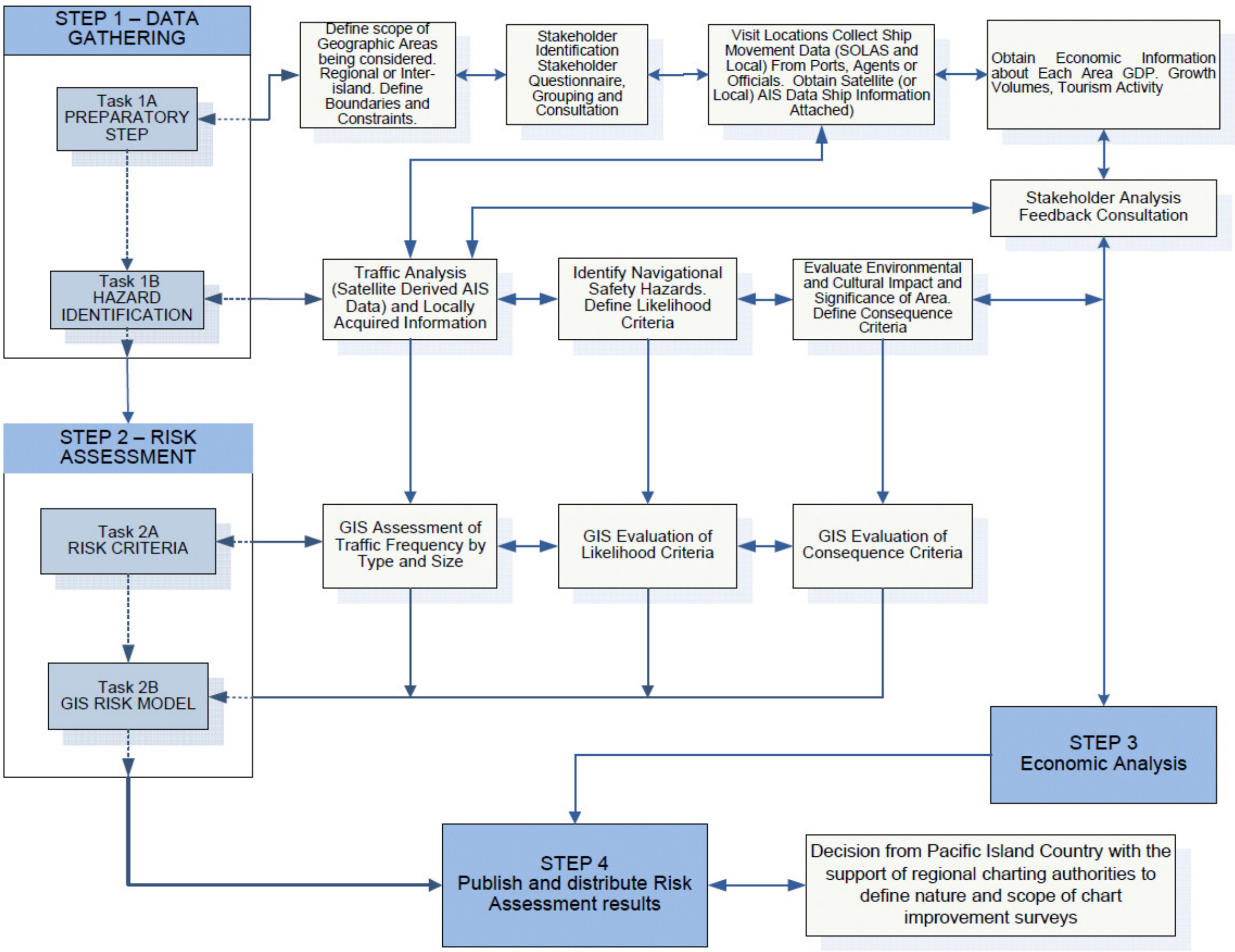
    d. **take** any other action as appropriate

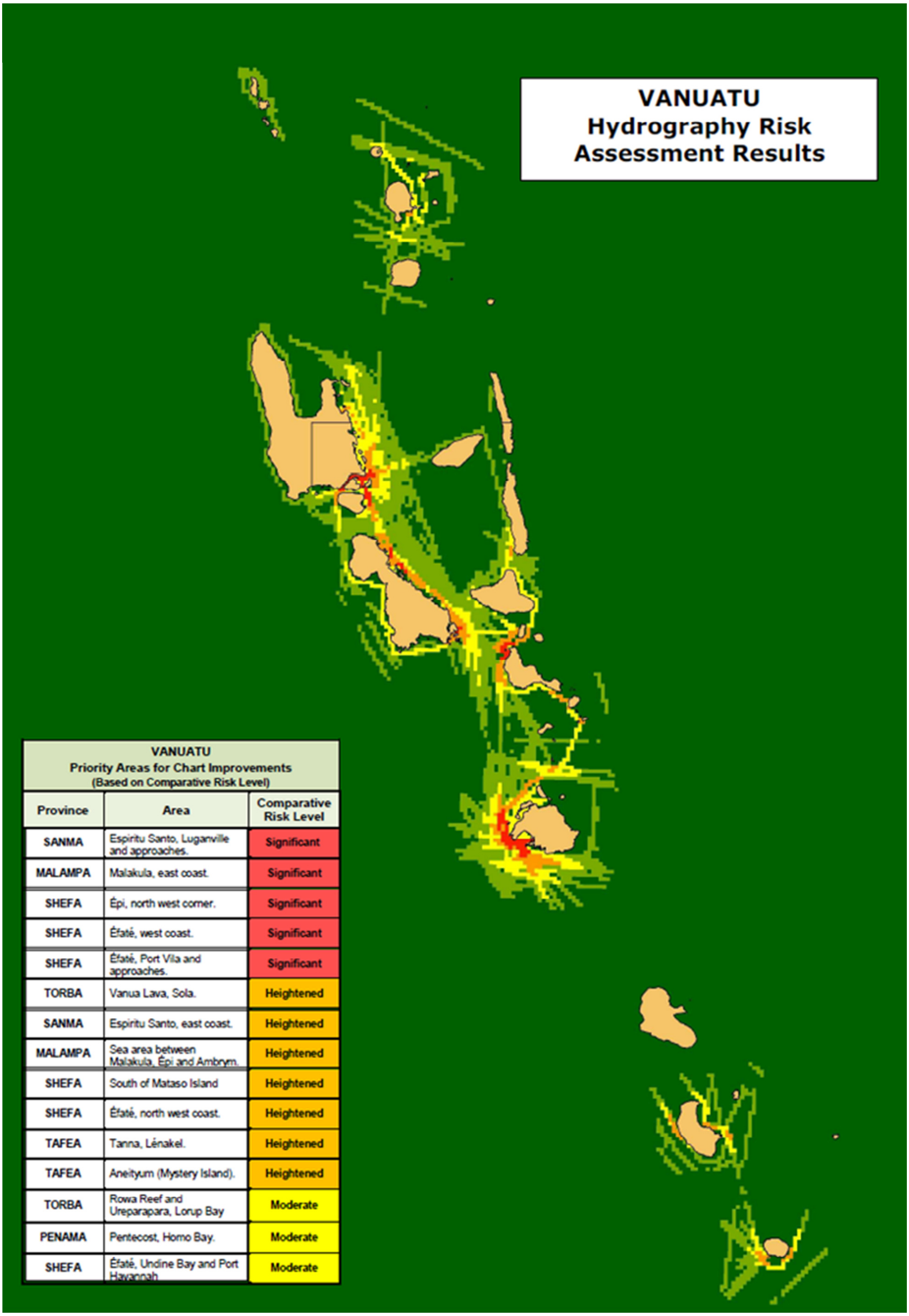
Annex A:

30. Supporting material:

    - Flow chart of the risk assessment methodology
    - Vanuatu risk assessment results heat map
    - SW Pacific study area

FLOW CHART OF RISK ASSESSMENT METHODOLOGY FOR SW PACIFIC





VANUATU
Priority Areas for Chart Improvements
(Based on Comparative Risk Level)

Province	Area	Comparative Risk Level
SANMA	Espiritu Santo, Luganville and approaches.	Significant
MALAMPA	Malakula, east coast.	Significant
SHEFA	Épi, north west corner.	Significant
SHEFA	Éfaté, west coast.	Significant
SHEFA	Éfaté, Port Vila and approaches.	Significant
TORBA	Vanua Lava, Sola.	Heightened
SANMA	Espiritu Santo, east coast.	Heightened
MALAMPA	Sea area between Malakula, Épi and Ambrym.	Heightened
SHEFA	South of Mataso Island	Heightened
SHEFA	Éfaté, north west coast.	Heightened
TAFEA	Tanna, Lénakel.	Heightened
TAFEA	Aneityum (Mystery Island).	Heightened
TORBA	Rowa Reef and Ureparapara, Lorup Bay	Moderate
PENAMA	Pentecost, Homo Bay.	Moderate
SHEFA	Éfaté, Undine Bay and Port Havannah	Moderate

S W Pacific study area – Vanuatu, Cook Is and Tonga