XXV FIG Congress
KUALA LUMPUR 2014
"Engaging the Challenges, Enhancing the Relevance"
16 - 21 JUNE 2014, MALAYSIA

Hydrography, Nautical Charts, Marine Spatial Data Infrastructure and Blue Economy for the "World We Want"

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Director, IHO

OUTLINE

- Introduction
- Hydrography – What is it?; Uses & Benefits; Who is responsible for it?
- Nautical Charting
- The Role of the IHO
- Marine Spatial Data Infrastructure (MSDI)
- Blue Economy
- Conclusion

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What Is Hydrography?

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What Is Hydrography?

***Hydro*: Water**

***Graphy*: Writing**

***Hydrography*: Charting of bodies of water such as seas, oceans and inland waters (lakes, rivers)**

Hydrography - (Definition)

Hydrography *is the branch of applied sciences which deals with the measurement and description of the physical features of oceans, seas, coastal areas, lakes and rivers, as well as with the prediction of their change over time, for the primary purpose of safety of navigation and in support of all other marine activities including economic development, security and defence, scientific research, and environmental protection.*

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Hydrography is ….

- measuring and describing the physical features of oceans, seas, coastal areas, lakes and rivers

for :

safety of navigation

protecting the marine environment

other marine activities including

economic development

security and defence

scientific research

Hydrography Involves

- The collection of hydrographic data
- The production of nautical charts and publications
- The dissemination of Maritime Safety Information (MSI)

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The collection of hydrographic data:

Hydrographic Surveying by the Surveyors

- *survey ships*

- *survey boats*

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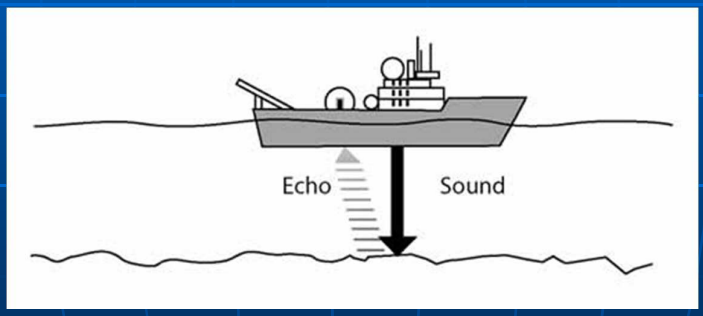
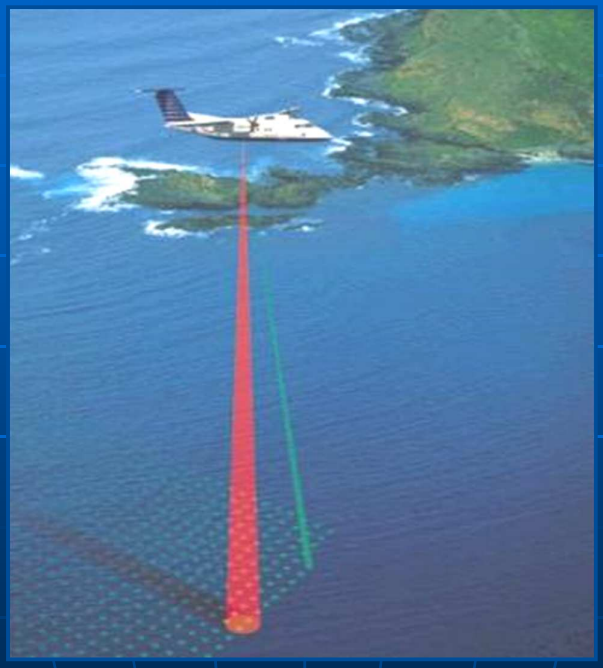
Hydrographic surveying ....

- *echo sounder*

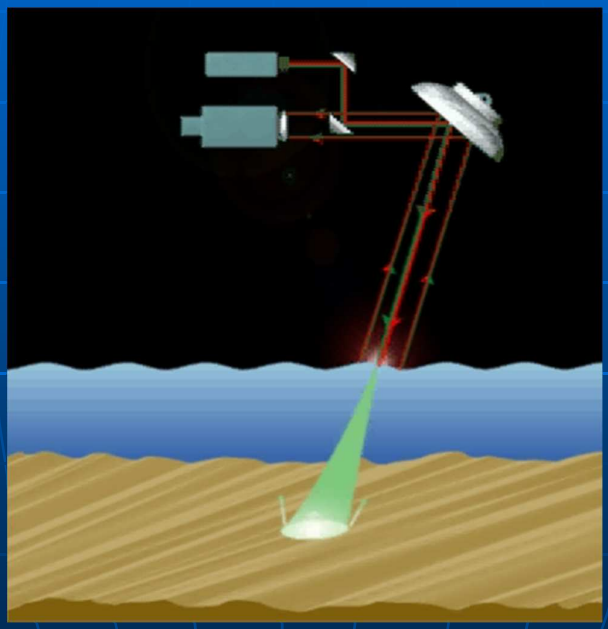


- *multi-beam echo sounder*

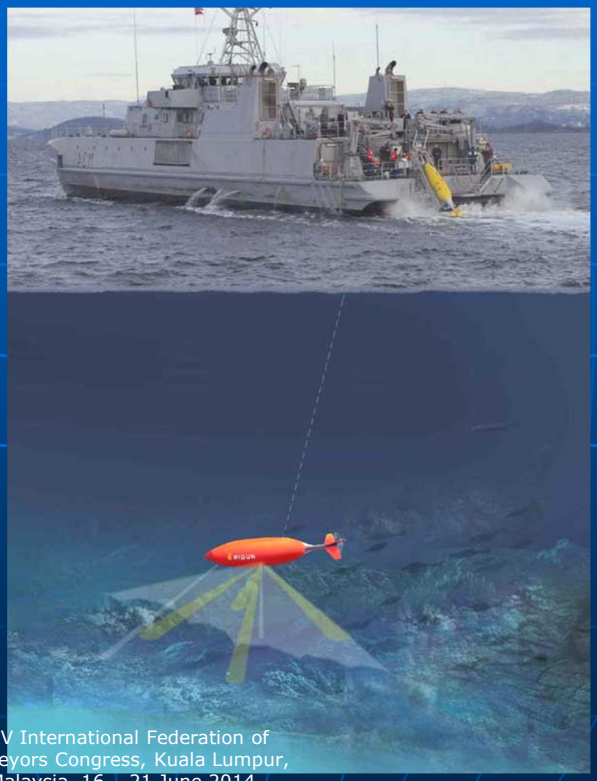
- **LiDAR – Light Detection And Ranging**



Satellite Derived Bathymetry

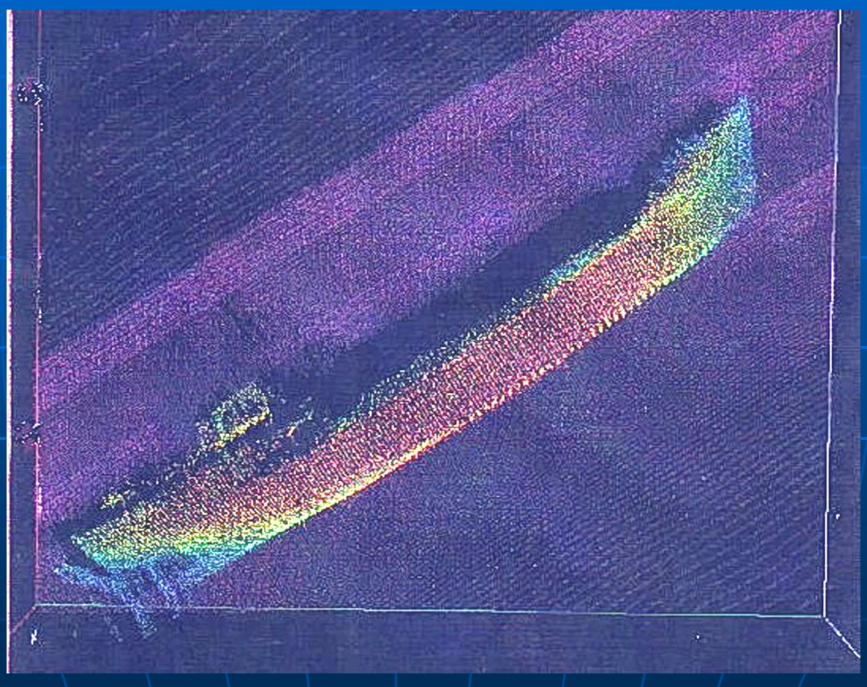


- **Sonar - SOund Navigation And Ranging**

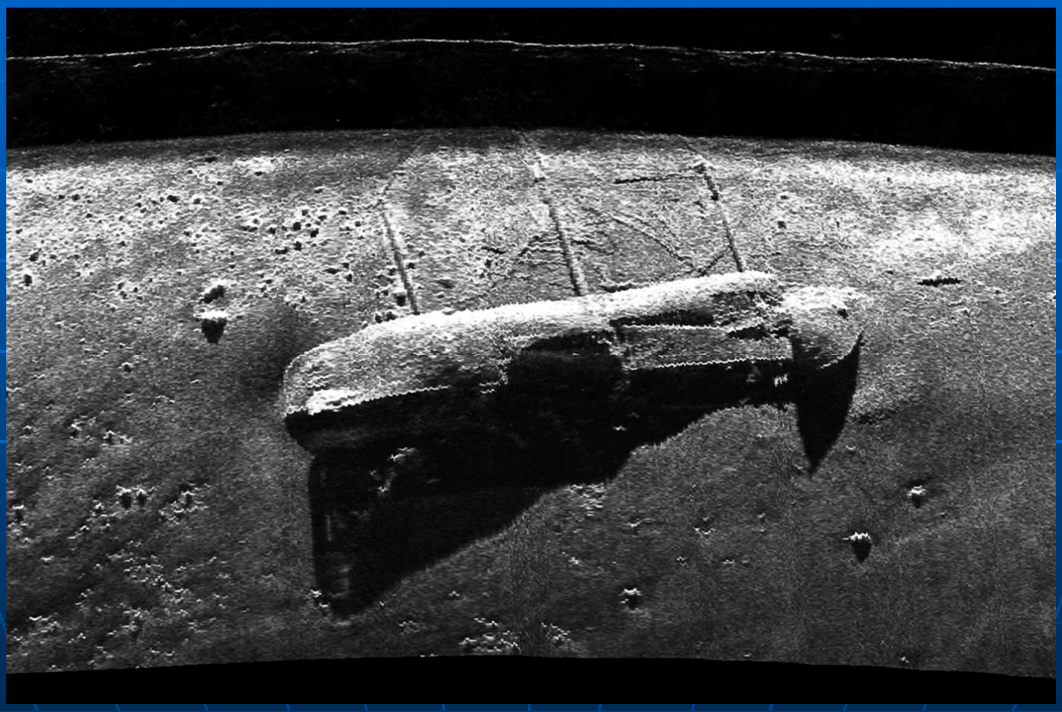


- **Side Scan Sonar**

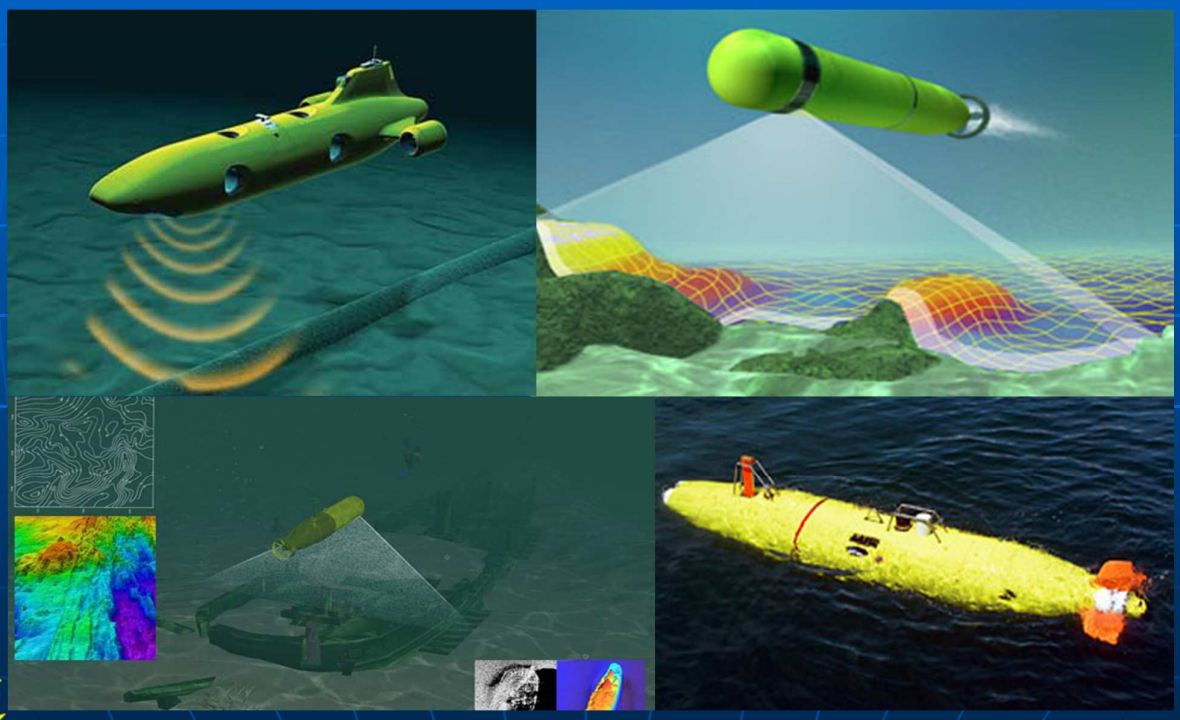
Seafloor searching



Seafloor searching



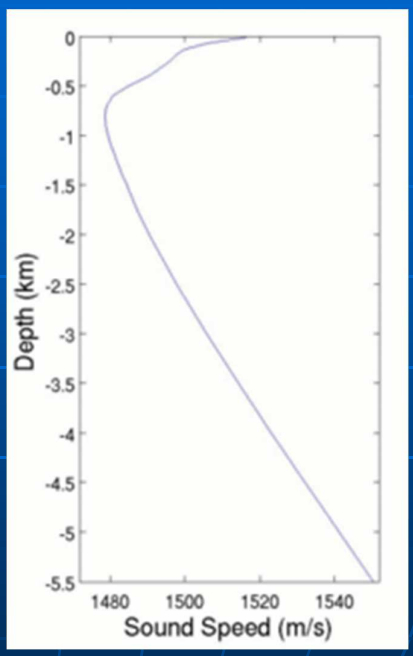
Autonomous (Unmanned) Underwater Vehicle



Calibration ....

sound velocity

- temperature
- salinity
- depth



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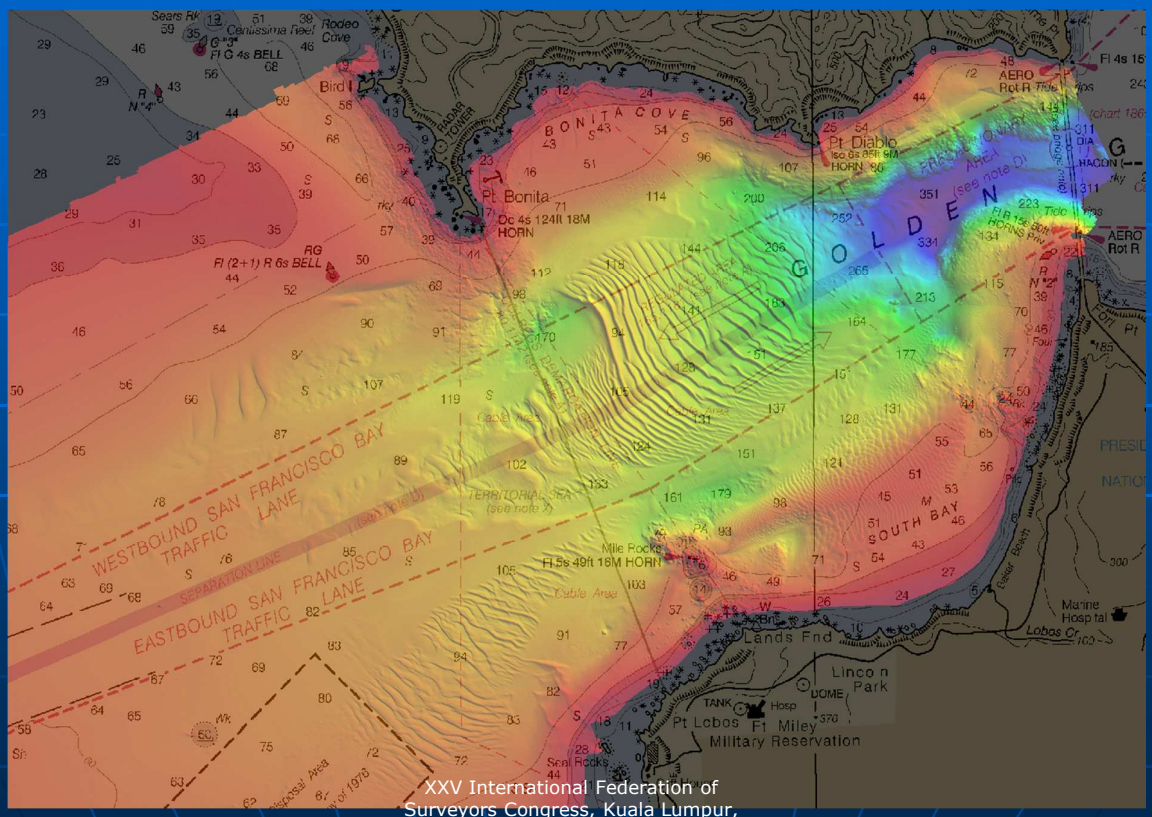
Tides ….

Hydrographic survey is a great pleasure! However, you should enjoy the water…

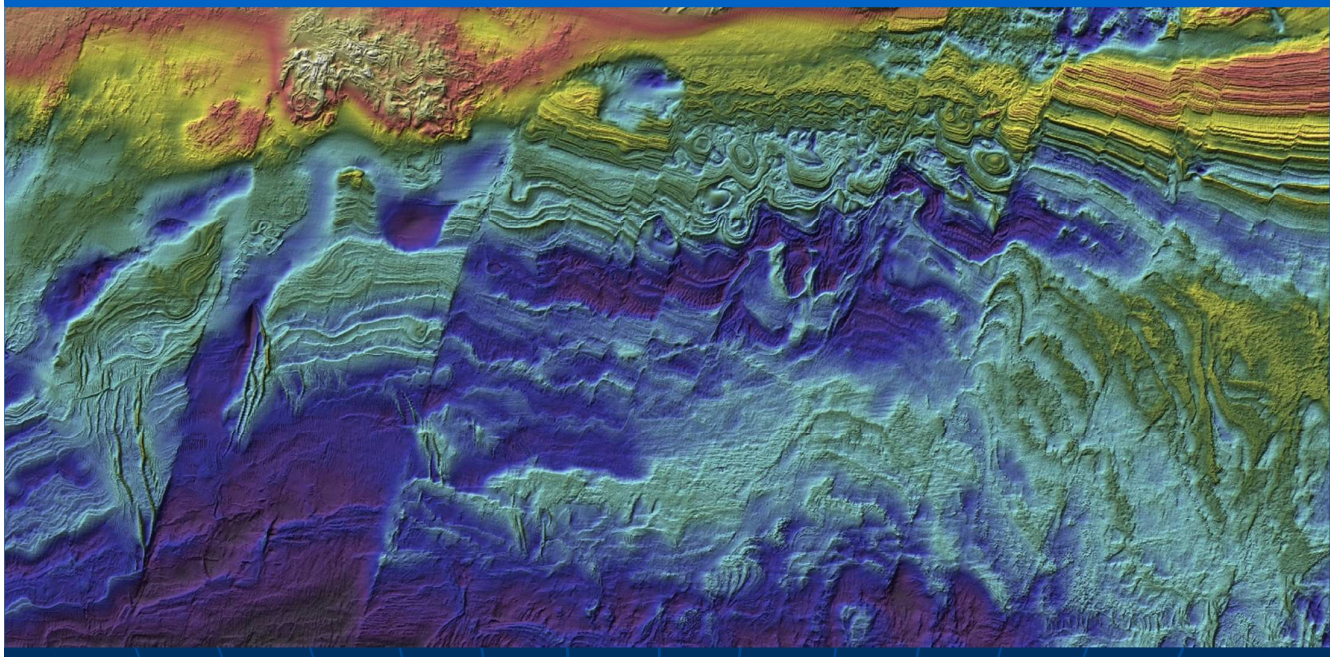
Hydrographic survey is a great fun!
But, you should like the winter…

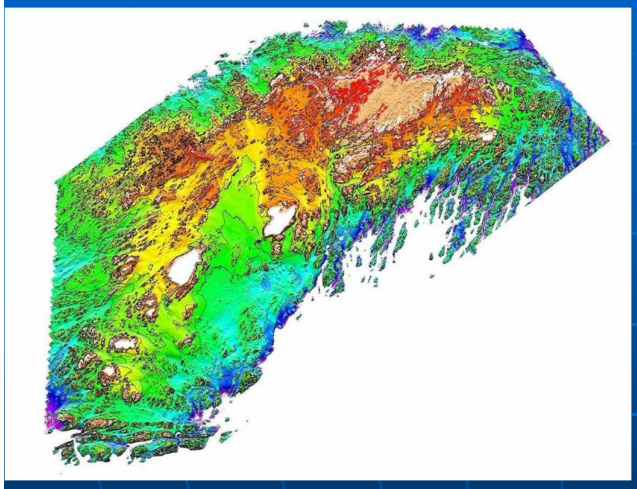
Hydrographic survey is a great joy!
Also, you should like summer…

MBES Survey: Approaches to San Francisco Bay



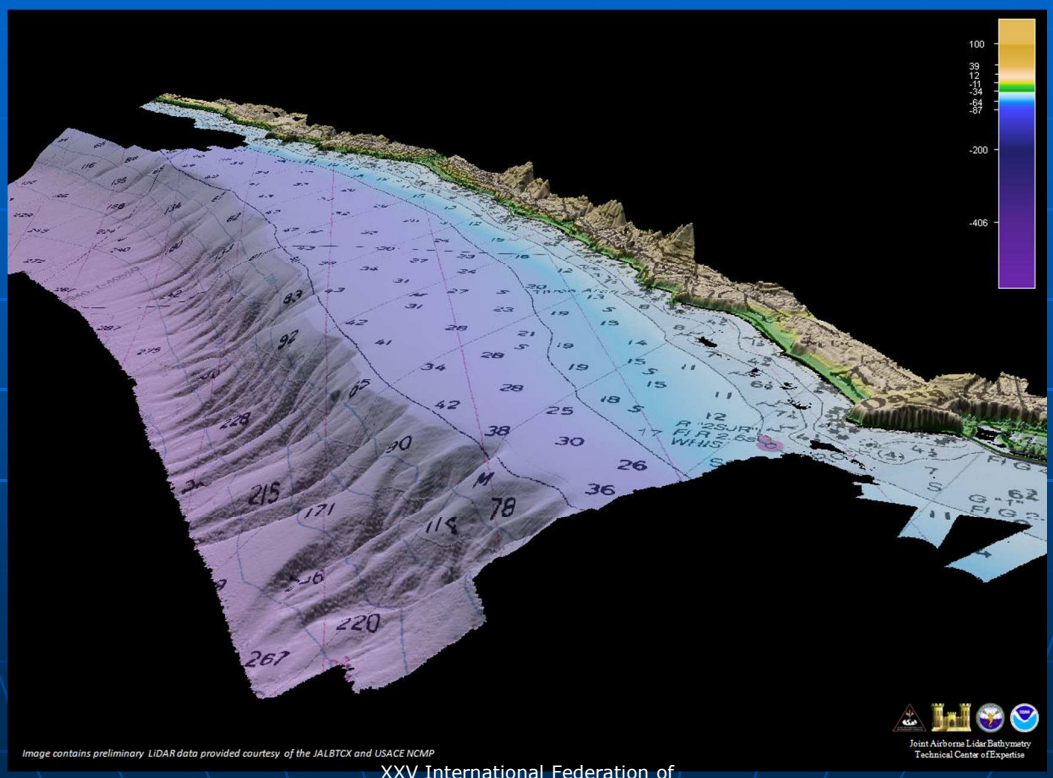
MBES Survey: Plastische and Bruchtekton



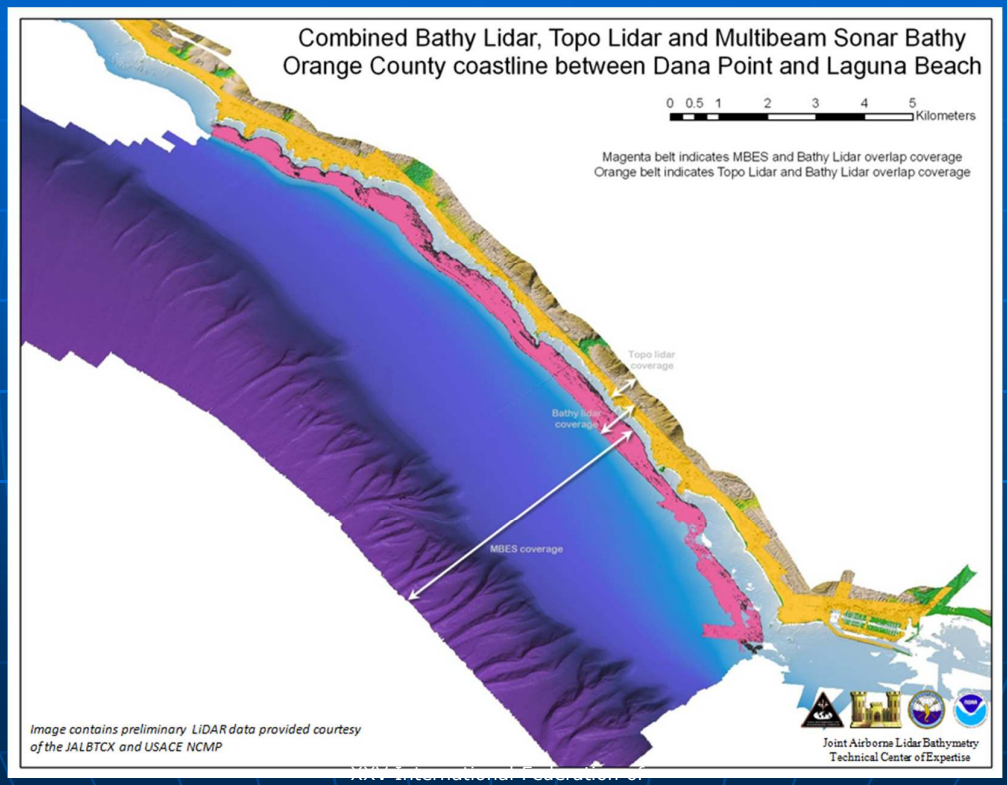


- North of Vega, Norwegian Sea
- Shallow, complex and hazardous areas

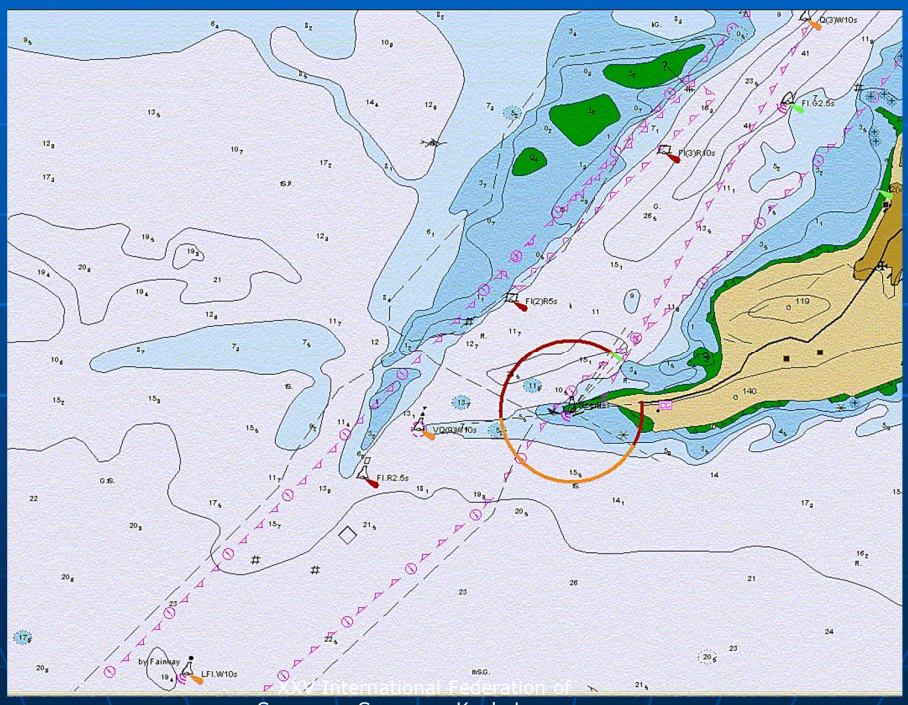
Hydrographic Survey Products



Hydrographic Survey Products



Nautical Charting



The production of nautical charts:

by the Nautical Cartographers

What is Nautical Chart?

- Nautical charts are special purpose maps specifically designed to meet the requirements of marine navigation, showing amongst other things depths, nature of the seabed, elevations, configuration and characteristics of the coast, dangers, and aids to navigation.
- Nautical charts provide a graphical representation of relevant information to mariners for executing safe navigation.

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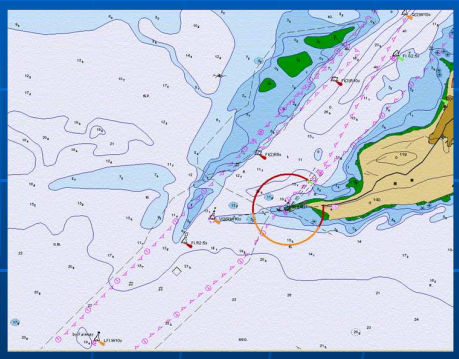
- Nautical charts are available in analogue form as paper charts, or digitally as electronic charts(ENC).



- The requirements for the carriage of nautical charts are laid down in SOLAS Chapter V.

SOLAS

(Convention on the Safety of Life at Sea)

Chapter V

Regulation 2, which defines the nautical chart,

Regulation 19, which specifies the equipment (including charts) to be carried on different types of ships,

Regulation 27, which specifies the requirement to keep charts and publications up to date.

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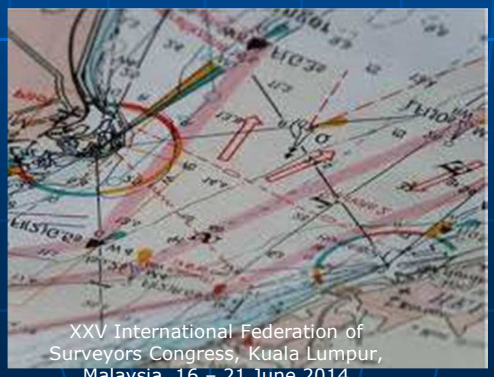
What is ENC ?
(Electronic Nautical Chart)

ENC is a vector chart, issued by or on behalf of a Governmental body that complies with the IHO ENC Product Specification that is part of the chart data transfer standard known as S-57. Any other vector chart data is unofficial and therefore does not meet the SOLAS chart carriage requirements



The chart developers' point of view

From the good old days of paper charts …

… to the brave new world of navigation information systems!

The chart developers' point of view

Three areas of concern for the IHO:

- ENC availability
- Standards maintenance
- Implementation issues

ENC availability

Adequate ENC coverage:

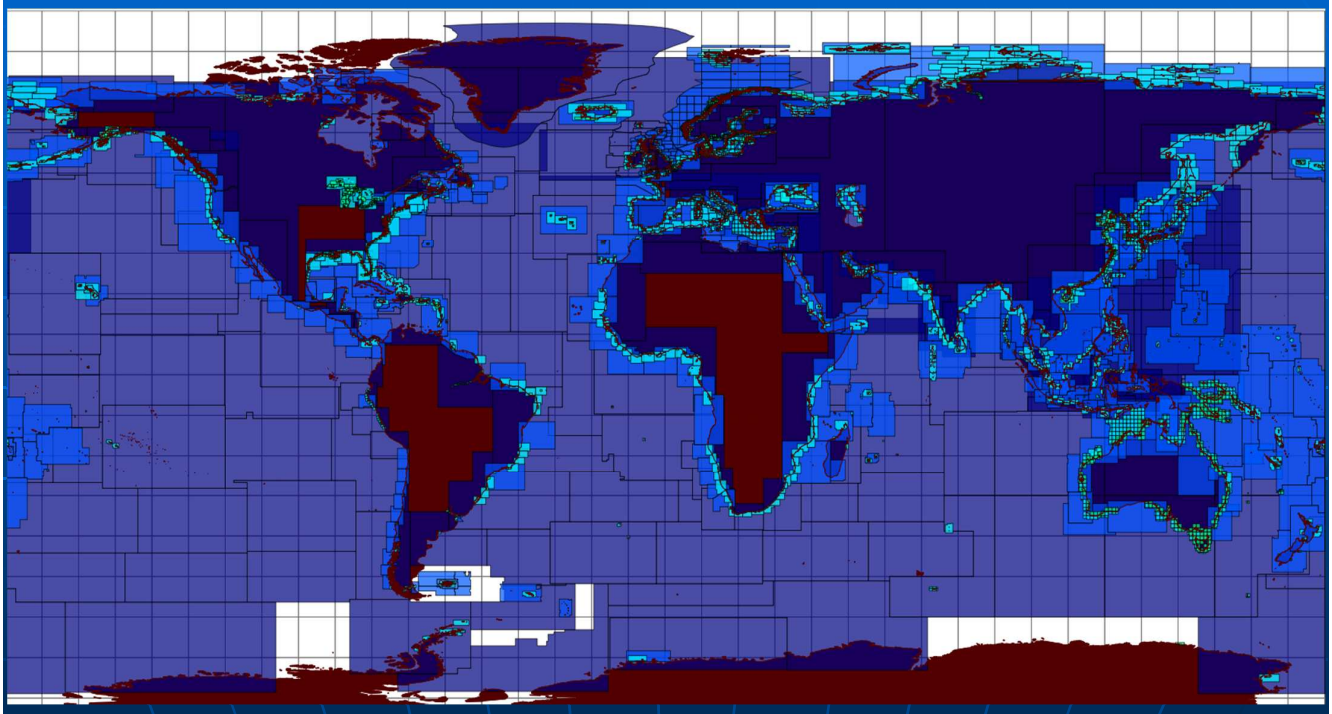
- *… equivalent to the best available paper chart coverage of either a Hydrographic Office providing global coverage or the Hydrographic Office of the Coastal State.*

2008 - NAV54

ENC availability

Comparison of ENCs with corresponding paper charts for international voyages					
	May 2008	May 2009	May 2010	May 2011	May 2012
Small scale ENCs (planning charts)	>90%	~100%	~100%	~100%	~100%
Medium scale ENCs (coastal charts)	60%	77%	84%	88%	~94%
Large scale ENCs (top 800 ports)	60%	84%	91%	94%	~96%

IHO ENC Worldwide ENC Catalogue



What is ECDIS ?

(Electronic Chart Display and Information System)

IMO Resolution MSC.232 (82) :

Electronic Chart Display and Information System (ECDIS) means a navigation information system which, with adequate back up arrangements, can be accepted as complying with the up-to-date chart required by regulation V/19 & V/27 of the 1974 SOLAS Convention, as amended, by displaying selected information from a system electronic navigational chart (SENC) with positional information from navigation sensors to assist the mariner in route planning and route monitoring,

and if required display additional navigation-related information.

ENC, ECDIS, E-NAVIGATION

- **Safe navigation is key to Safety of Life at Sea**
- **IMO developed "SOLAS chapter V" to regulate key elements**
- **IMO Maritime Safety Committee (MSC) and "Safety of Navigation Sub-Committee" are working on this topic**
- **Electronic Navigation is a key strategy, identified by IMO**
- **ECDIS will be mandated to force the use of Electronic Navigation on SOLAS class ships**

TIMETABLE FOR ECDIS CARRIAGE REQUIREMENTS

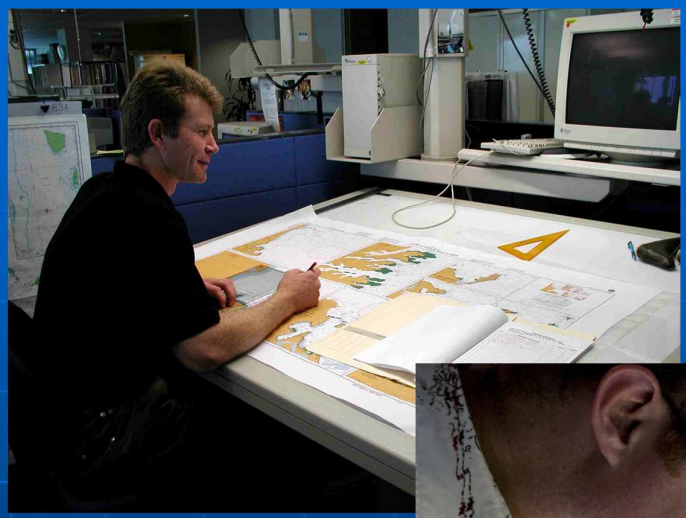
Ship type	Size	New ship	Existing ship
Passenger ships	≥500 gross tons	1 July 2012	No later than 1st survey after 1 July 2014
Tankers	≥3,000 gross tons	1 July 2012	No later than 1st survey after 1 July 2015
Dry cargo ships	≥50,000 gross tons	1 July 2013	No later than 1st survey after 1 July 2016
	≥20,000 gross tons (new ships) 20-50,000 gross tons (existing ships)	1 July 2013	No later than 1st survey after 1 July 2017
	≥10,000 gross tons (new ships) 10-20,000 gross tons (existing ships)	1 July 2013	No later than 1st survey after 1 July 2018
	3-10,000 gross tons	1 July 2014	No retrofit requirements to existing ships <10,000 gross tons

- **Electronic Navigational Charts (ENCs) are key to ECDIS**
- **With ENCs vector cartography is the agreed basic data feed for electronic navigation**
- **With vector cartography is allowing data driven warnings and alarms to support safe navigation**
- **IHO confirmed to IMO adequate ENC coverage by 2012**

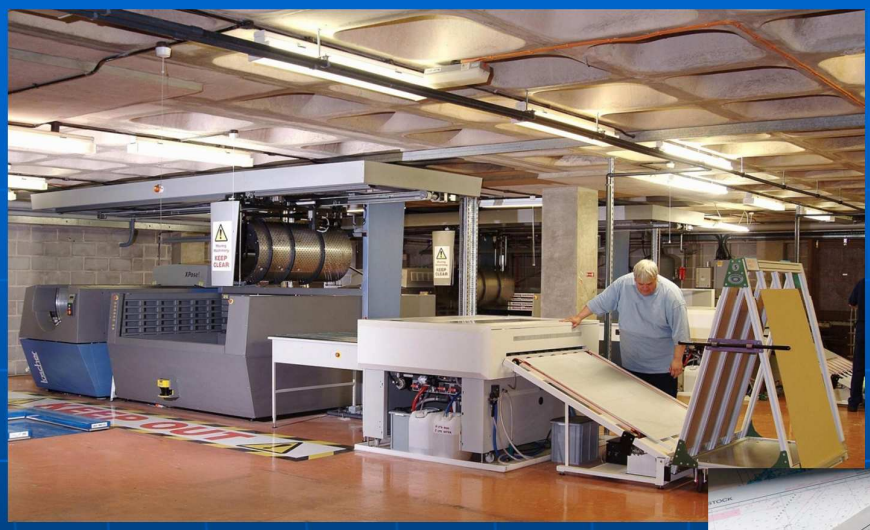
Processing the data ....

Making a chart ....

- *paper charts*
- *electronic charts*



- *Quality control*
- *Validation*



- *Printing*
- *Distribution*

The dissemination of Maritime Safety Information (MSI)

* Nautical Publications
* Navigational Warnings
* Notice to Mariners

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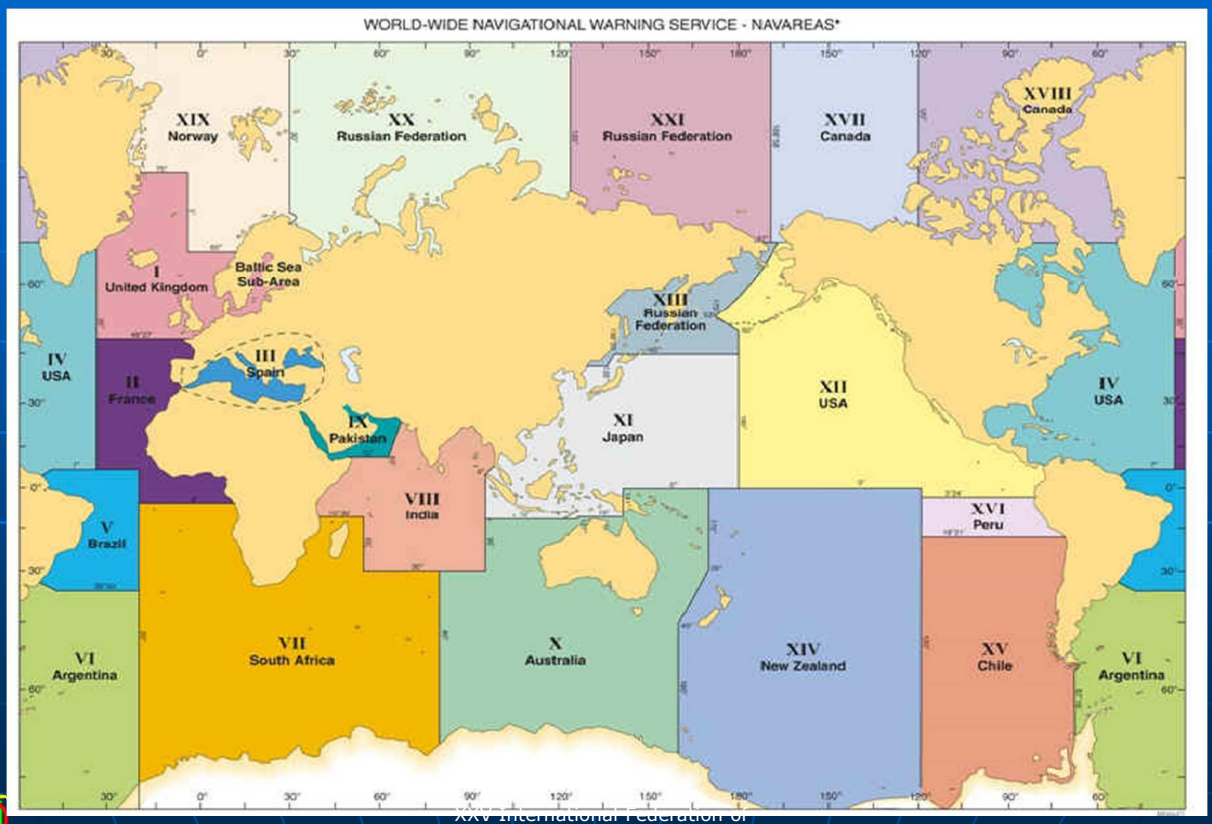
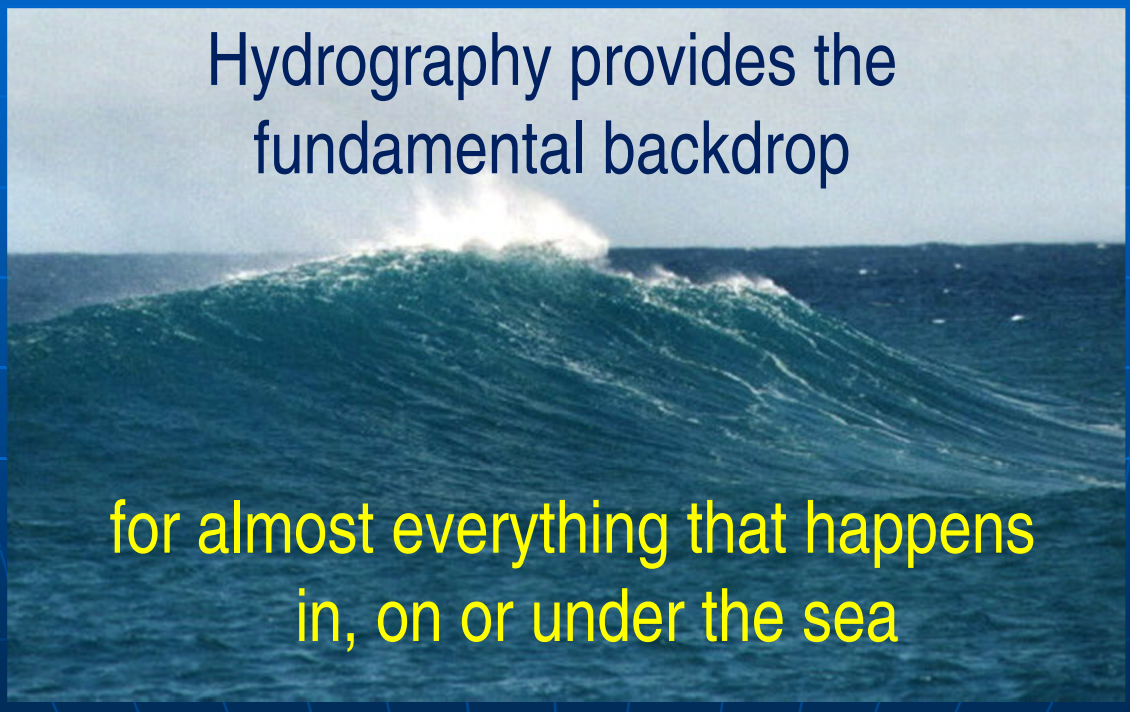
- **Nautical Publications**

- **tide tables**
- **sailing directions**
- **lists of lights and radio signals**

Navigational Warning Areas (NAVAREA)





… without hydrography -

- no ship sails

… without hydrography -

- no port is built

… without hydrography -

- no offshore infrastructure is developed

… without hydrography -

- no environmental plan is implemented

… without hydrography -

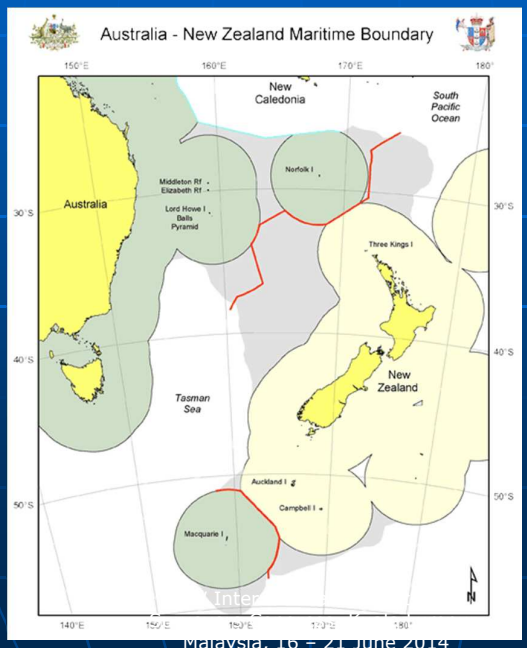
- no shore is defended, no island protected

… without hydrography -

- no rescue is attempted

… without hydrography -

- no maritime boundary is delimited



Hydrography supports :

- Safety of navigation
- Protection of marine environment
- National infrastructure development
- Coastal zone management
- Marine exploration
- Resource exploitation – minerals, fishing
- Maritime boundary delimitation (UNCLOS, others)
- Maritime defence and security
- Disaster management

Inadequate hydrography means:

- risk of marine accidents increases
  - environmental pollution
  - loss of life
- shipping lacks confidence in ports and routes
- international trade is limited
- missed economic opportunities
- environmental impacts
- potential liability and litigation

- **What is the cost of:**
  - under-developed ports?
  - using complex and hazardous shipping routes?
  - lack of fundamental planning data for the coast and seas?
  - imprecise disaster planning models?
  - limited sea room for patrol vessels?

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Cost versus Benefit Studies

- Australia (1992)
  Canada (1992)
  APEC (2002)
- different analysis approaches:
  - " *what would happen if the charts weren't there ?*"
  - " *what if no further hydrography took place ?*"
- **Cost vs Benefit ratios greater than1:10 !**

High resolution maps/charts :

- **Moon and Mars - 100%**
- **Oceans, seas and coastlines~ 10%**

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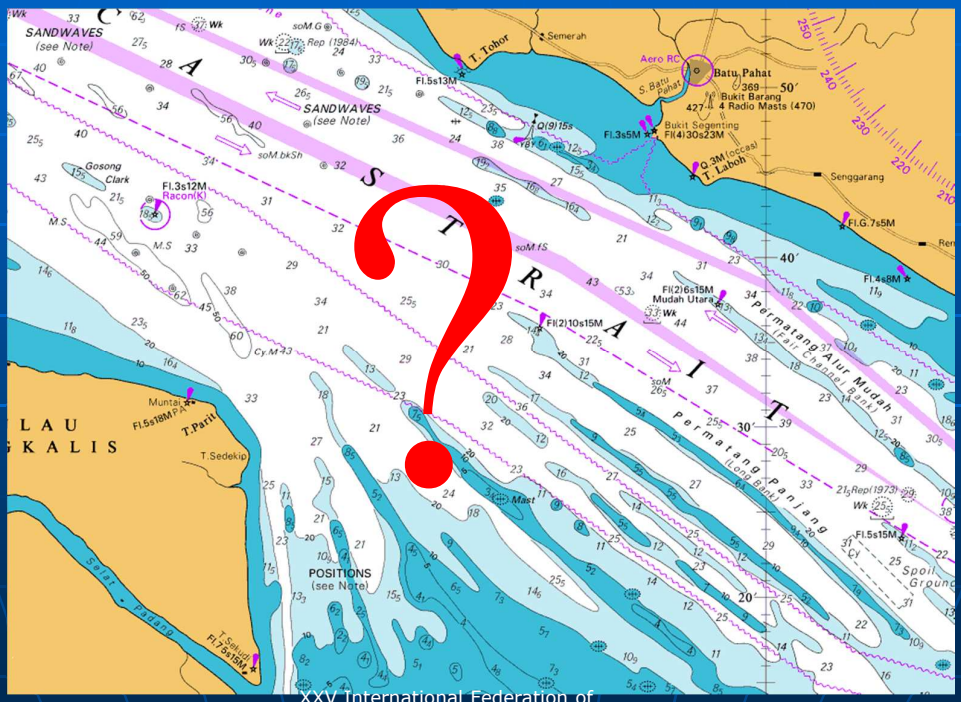
Who is responsible for Hydrography?



– Hydrographic Services –

International Obligations

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SOLAS (Convention on the Safety of Life at Sea)
Chapter 5 regulations 9 and 4

Each State must ensure that :

- hydrographic surveys are carried out
- appropriate nautical charts and other nautical publications are available and up to date
- Maritime Safety Information (MSI) is promulgated

Meeting Governmental Obligations

SOLAS V/9 and V/4 can be satisfied:

- directly via government
- through bi-lateral cooperation with other States
- using commercial support providers
  - in whole or in part

Overall responsibility and obligation to ensure that a national hydrographic service is provided remains with the Government

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Role of the IHO

INTERNATIONAL HYDROGRAPHIC ORGANIZATION (IHO)

- intergovernmental consultative and technical organization
- established in 1921
- to support safety of navigation and the protection of the marine environment

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IHO Mission

… international *standards*

… global coordination

… capacity building and aid programme

IHO Mission

… to facilitate the provision of adequate and timely hydrographic information

… for world-wide marine navigation and other purposes

… through the co-ordination of the endeavours of national hydrographic offices

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History of IHO

1908	International Congress of Navigation, St Petersburg
1912	International Maritime Conference, St Petersburg
1919	International Hydrographic Conference, London
1921	IHB established by 24 nations in Monaco
1970	International Convention: established
2005	Protocol of Amendments to the IHO Convention
2014	…awaiting majority of Member States' approval to new amendments

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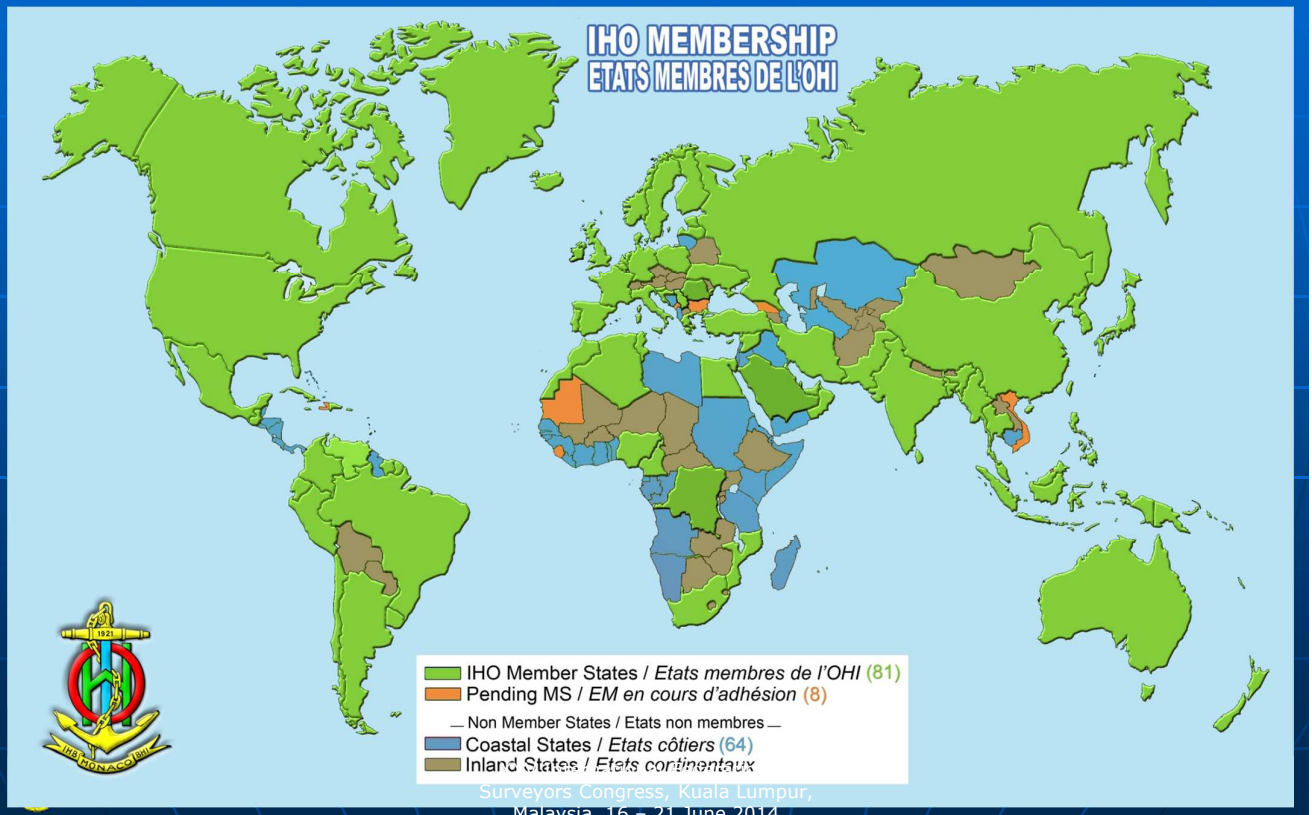
IHB DIRECTING COMMITTEE

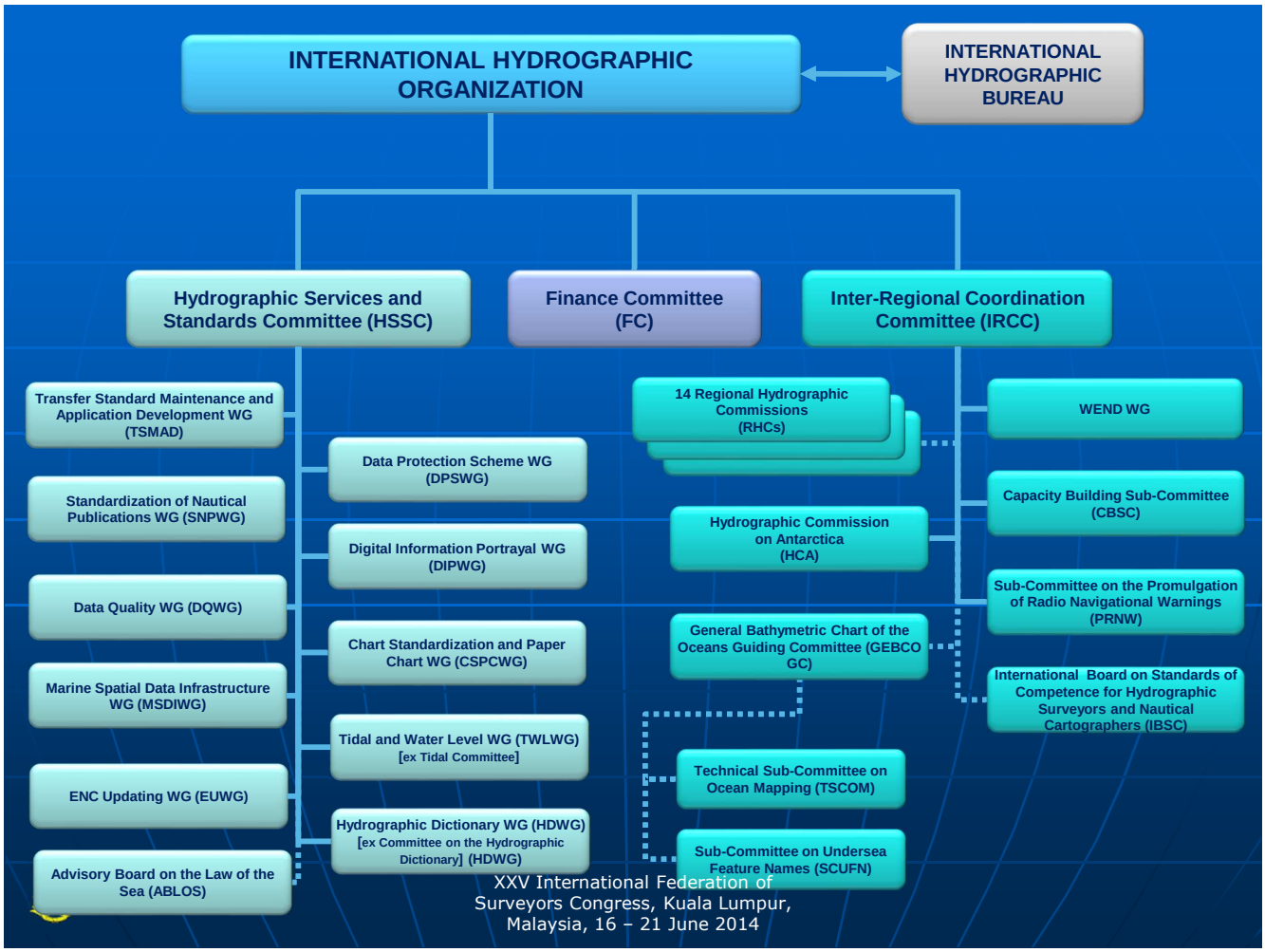
INTERNATIONAL HYDROGRAPHIC CONFERENCE (Monaco)

IHO Member States – 2014



IHO Member States – 2014 (82 MS)

ALGERIA
ARGENTINA
AUSTRALIA
BAHRAIN
BANGLADESH
BELGIUM
BRAZIL
CAMEROON
CANADA
CHILE
CHINA
COLOMBIA
CROATIA
CUBA
CYPRUS
DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA
DEMOCRATIC REPUBLIC OF THE CONGO
DENMARK
DOMINICAN REPUBLIC
ECUADOR
EGYPT
ESTONIA
FIJI
FINLAND
FRANCE
GERMANY
GREECE
GUATEMALA
ICELAND
INDIA
INDONESIA
IRAN (ISLAMIC REPUBLIC OF)
IRELAND
ITALY
JAMAICA
JAPAN
KUWAIT
LATVIA
MALAYSIA
MAURITIUS
MEXICO
MONACO
MONTENEGRO
MOROCCO
MOZAMBIQUE
MYANMAR
NETHERLANDS
NEW ZEALAND
NIGERIA
NORWAY
OMAN
PAKISTAN
PAPUA NEW GUINEA
PERU
PHILIPPINES
POLAND
PORTUGAL
QATAR
REPUBLIC OF KOREA
ROMANIA
RUSSIAN FEDERATION
SAUDI ARABIA
SERBIA
SINGAPORE
SLOVENIA
SOUTH AFRICA
SPAIN
SRI LANKA
SURINAME
SWEDEN
SYRIAN ARAB REPUBLIC
THAILAND
TONGA
TRINIDAD AND TOBAGO
TUNISIA
TURKEY
UKRAINE
UNITED ARAB EMIRATES
UNITED KINGDOM
URUGUAY
UNITED STATES OF AMERICA
VENEZUELA
BULGARIA
MAURITANIA
SIERRA LEONE
BRUNEI DARUSSALAM
HAITI
VIET NAM
GEORGIA



International Hydrographic Bureau (IHB)

- **Secretariat of the IHO**
- 15 technical standards
- 10 associated guidelines
- 18 other publications
- Direct support to 40 bodies (Committees, WGs and RHCs)
- Conference organisation
- External representation
- bi-lingual website

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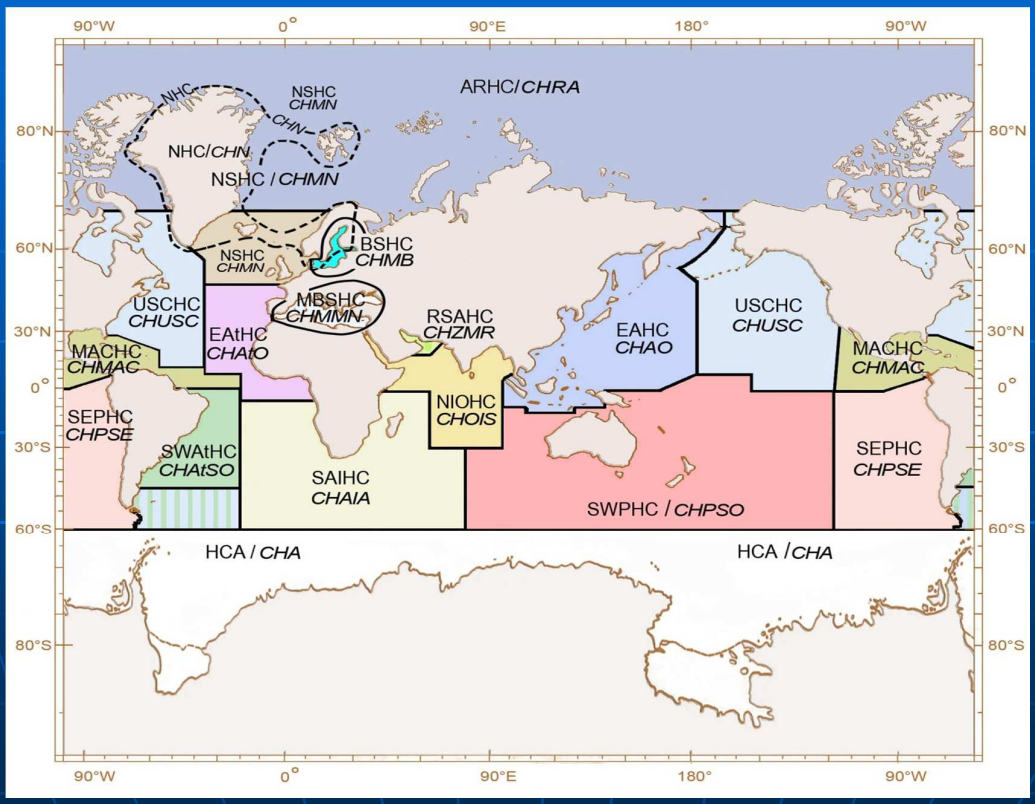
Regional Hydrographic Commissions



Regional Hydrographic Commissions

- **regional co-ordination of**
  - nautical information
  - hydrographic surveys
  - production of nautical charts and documents
  - training
  - technical cooperation
  - hydrographic capacity building projects

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IHO
Capacity Building Program

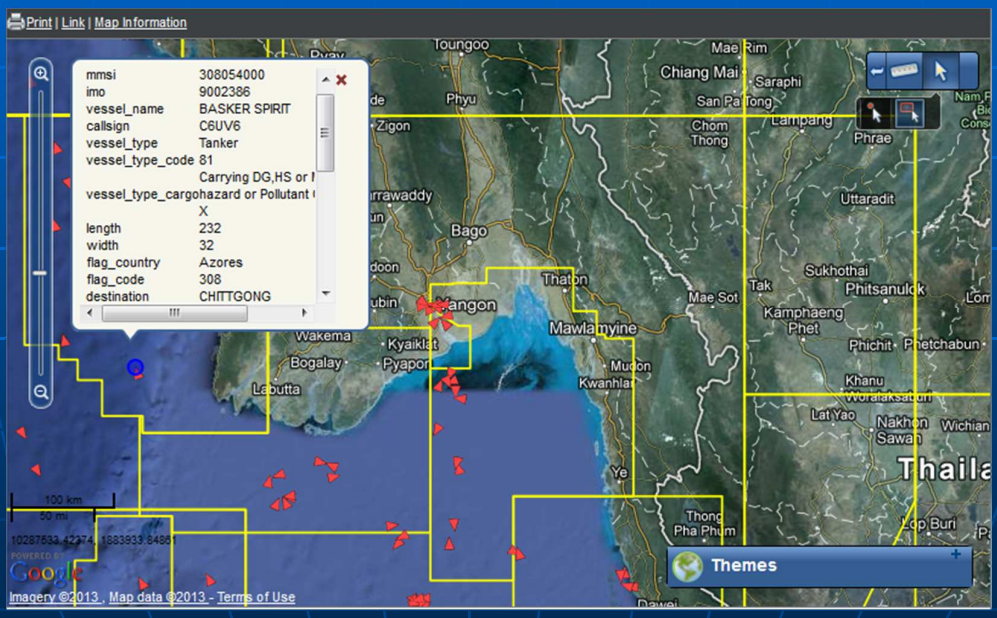
IHO CAPACITY BUILDING FUND

Fund supports:

- Technical Assistance
- Training and Education
- Financial Assistance
- Start-up Projects

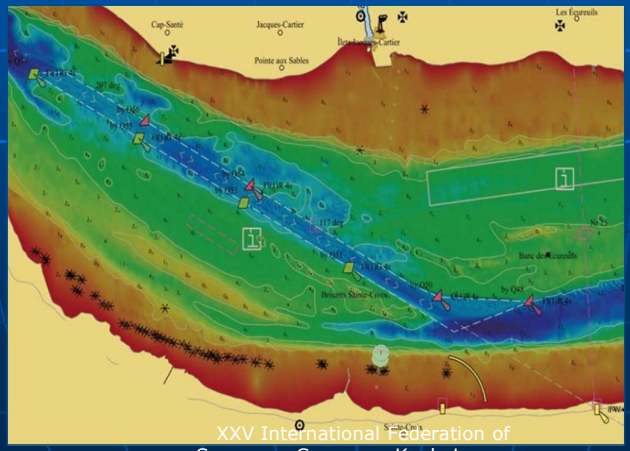
- Proposals submitted via Regional Hydrographic Commission

Marine Spatial Data Infrastructure (MSDI)



What is SDI?

SDI is a term used to summarise a range of activities, processes, relationships and physical entities that, taken together, provide for integrated management of spatial data, information and services.



What is the MSDI ?

MSDI is the component of an SDI that encompasses marine geographic and business information in its widest sense and could typically include:

Seabed topography (bathymetry)
Geology and geomorphology
Marine infrastructure (e.g. wrecks, offshore installations, pipelines and cables)
Administrative and legal boundaries
Areas of conservation and marine habitats
Physical oceanography
Maritime transport and ports

Why is MSDI important?

*Stimulates organisations to make data accessible
*Improves data management practises
*Increases market exposure for information
*Generates economic benefits
*Allows better use of public funds
*Eliminates organisational isolation
*Enables co-operation and working together
*Improves security and reduces risk
*Brings cost savings
*Stimulates access to additional resources and funding

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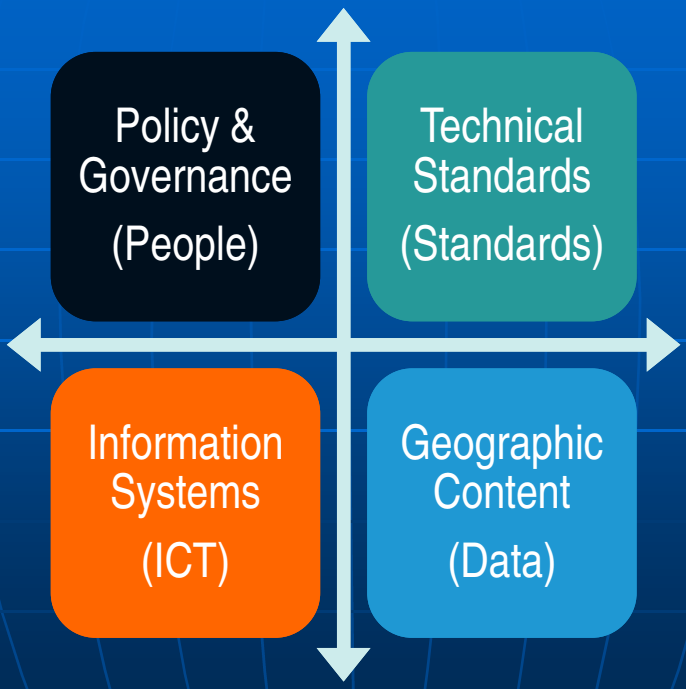
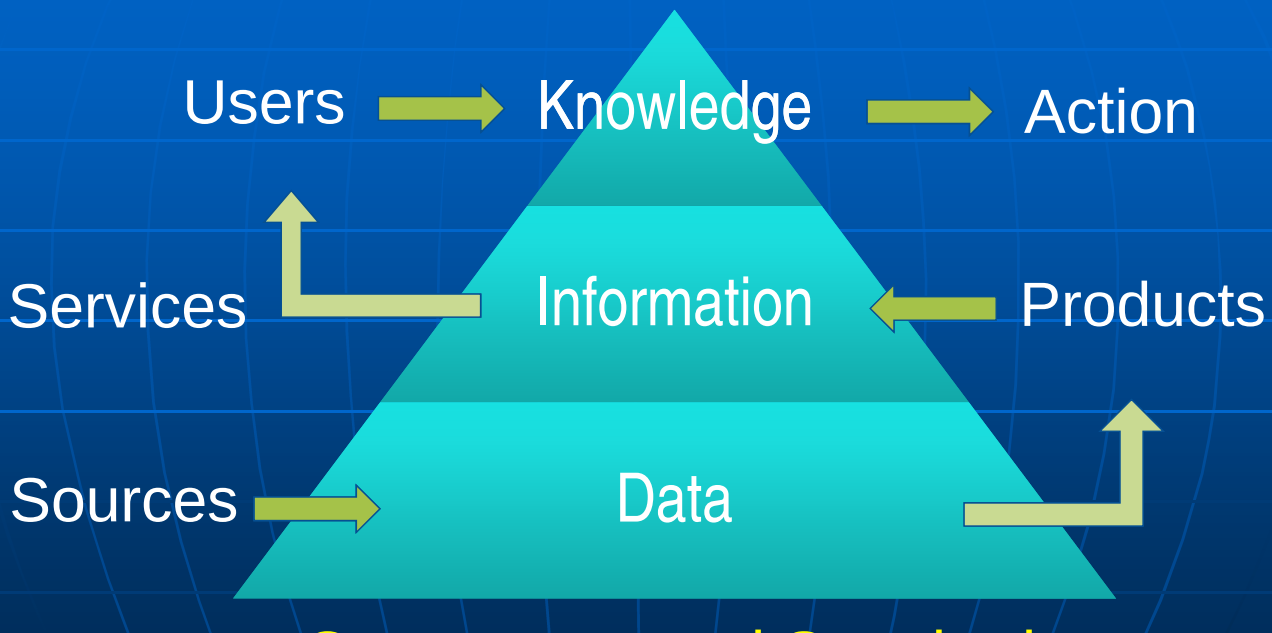
Key MSDI Components



Data - Information - Knowledge

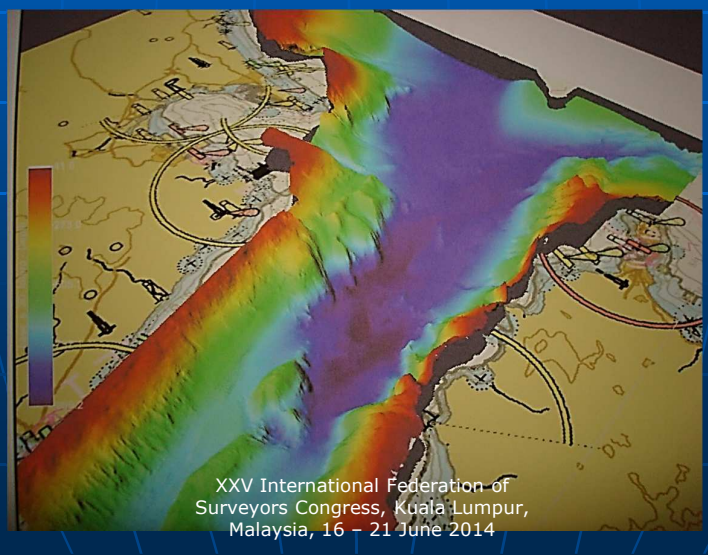


Data Management Approaches

1) Process Management
Driven or Product Centric

2) Data Management
Driven or Data Centric

Easy access to high precision / density bathymetry is a joint requirement emerging for both navigational and non-navigational applications



Wider Use of Hydrographic Office Data

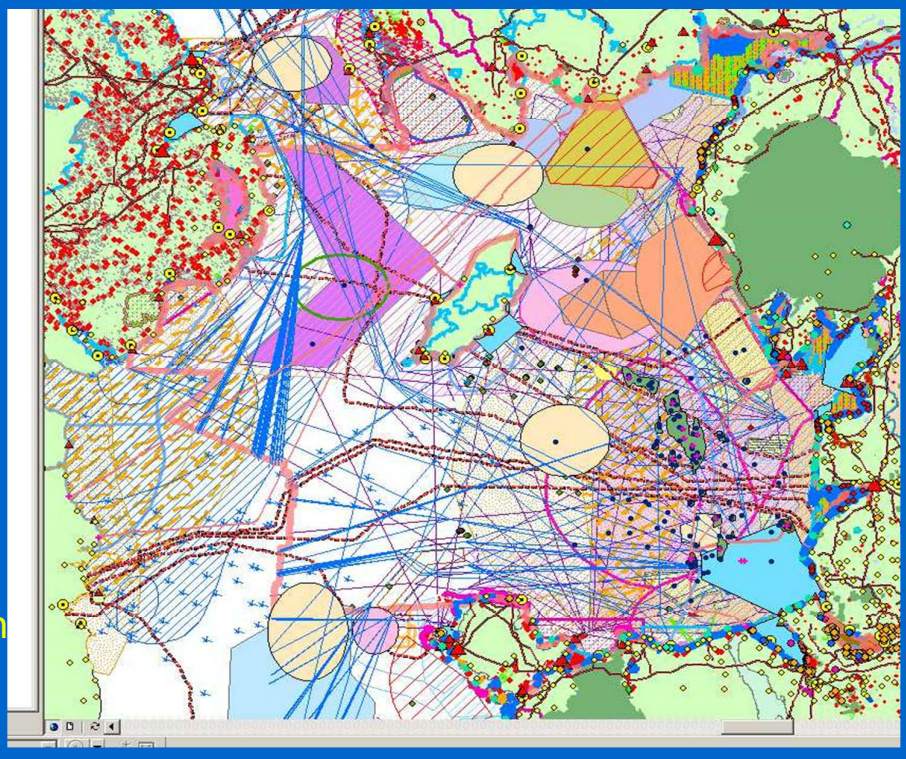
- Marine Spatial Planning (MSP)
- Integrated Coastal Zone Management (ICZM)
- Strategic Environmental Assessment (SEA)
- Shoreline Management Plans (SMP)
- Emergency Response
- Offshore Renewable Energy
- Aggregates Extraction
- Oil and Gas
- Infrastructure Development (e.g. Ports and harbours)
- Economic Development (e.g. Tourism)
- E-Navigation

Presentation_project.mxd - ArcMap - ArcEditor

Economic activity in the Irish Sea and coastal hinterland

Source: Defra Irish Sea Planning Pilot - 2006

- Land Use
- Tourism
- Oil &Gas
- Mariculture
- Coastal Defence
- Ports & Navigation
- Military Activities
- Culture
- Conservation
- Dredging & Disposal
- Submarine Cables



- Fishing
- Renewable Energy
- Marine Recreation
- Mineral Extraction

MSDI & Hydrographic Office

e-Navigation & Marine Spatial Planning

Implementation of the following concepts rely on MSDI:

- **E-Navigation:** IMO concept defined as "The harmonized collection, integration, exchange, presentation and analysis of marine information on-board and ashore by electronic means to enhance berth to berth navigation and related services for safety and security at sea and protection of the marine environment."
- **Marine Spatial Planning:** UNESCO-IOC concept defined as "a public process of analyzing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic, and social objectives that are usually specified through a political process."

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Key Elements of Good Data Management

- Capture once, use many times
- Manage data as close to source as possible
- Minimise work on input
- Maximise work on outputs (multiple products and services)
- Interoperability of systems, standards and specifications
- Data Exchange and Sharing using agreed standards and protocols
- Implement data strengthening with stakeholders

Marine Spatial Data Infrastructure

- Outcome
  - land-sea integration is more an organizational issue than a technical issue
- Issues
  - dominant role of land mapping agencies in the development of Spatial Data Infrastructures
    - HOs needs to be more active in national, regional and worldwide forums

Blue Economy

for the "World We Want"

Blue Economy

The term "*blue economy*" is being heard more and more. It is an expression used to describe all the economic activity associated with the oceans, seas, harbours, ports, and coastal zones.

Underpinning all that activity, is hydrography.

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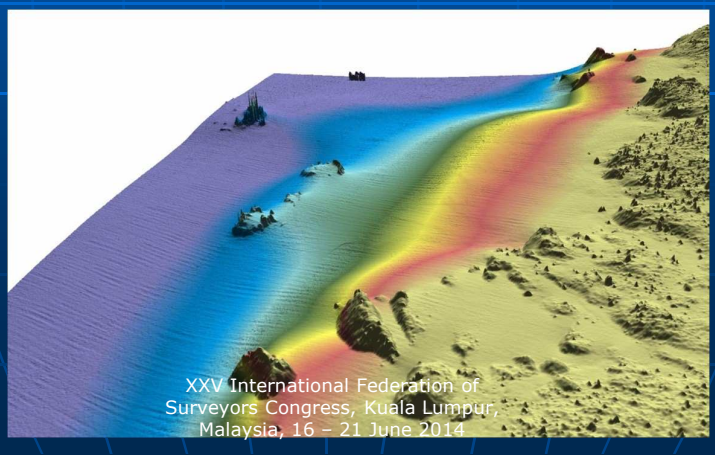
Blue Economy

Every human activity conducted in, on or under the sea depends on knowing the depth and the nature of the seafloor, the identification of any hazards that might exist and an understanding of the tides and the currents.



Blue Economy

Obtaining and disseminating this hydrographic knowledge is the role of the world's hydrographers.

Blue Economy

Their work is the most fundamental of all the enablers required to develop and sustain the *Blue Economy*.

The Potential of the Blue Economy

The seas and oceans, including the seabed and the sub-seabed, represent a vast repository of food, mineral resources, energy, water, bio-medicines, and infrastructure that in turn creates wealth for individuals and for nations.

Blue Economy

Aquaculture
Biomedicine
Boats and Shipbuilding
Cables and pipelines
Coastal Zone management
Defence and Security
Desalination and water treatment
Marine recreation
Ocean energy and minerals

Blue Economy

*Ocean science and observation
*Port operations
*Robotics and submarines
*Shoreline development
*Telecommunications
*Tourism
*Very large floating platforms
*Weather and climate science

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Blue Economy

Each of these important and growing maritime sectors provides jobs and creates wealth.

But each depends, in some way or another on hydrography as its enabler.

Some Facts about Blue Economy

Well over 95% of the world's intercontinental data and telephone traffic passes through undersea cables.

Some Facts about Blue Economy

75% of the world's oil supplies and 55% of the world's gas supplies are transported by sea.

Offshore wind farms are increasingly cost competitive with fossil fuel and nuclear sources.

Some Facts about Blue Economy

The Oceans already provide at least 15% of animal protein for about 3 billion people, aquaculture (farming) of fish and aquatic plants is worth more than $106 billion, the fishing industry provides livelihood to more than 540 million people.

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Some Facts about Blue Economy

Cruise ship passengers spend at least $100 each for each day ashore. That's over a quarter of a million dollars from a typical cruise ship for every day in a port.

Some Facts about Blue Economy

Port economic activity usually generates at least one other indirect job for each new job. For high tech industries, this multiplier effect can reach up to 5 or 6.

Some Facts about Blue Economy

Economic studies show that the cost: benefit ratio for national investment in hydrography and nautical charting is always positive and can be better than 1:10.

Some Facts about Blue Economy

For most ships, 30cm extra depth of navigable water allows at least 2,000 tonnes more cargo to be carried.

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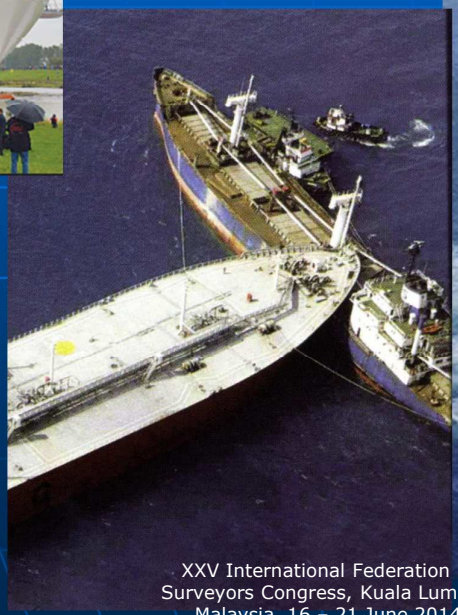
Hydrography supports the Blue Econmy :

- Safety of navigation
- Protection of marine environment
- National infrastructure development
- Coastal zone management
- Marine exploration
- Resource exploitation – minerals, fishing
- Maritime boundary delimitation (UNCLOS, others)
- Maritime defence and security
- Disaster management

... Safety of Navigation



... Transport

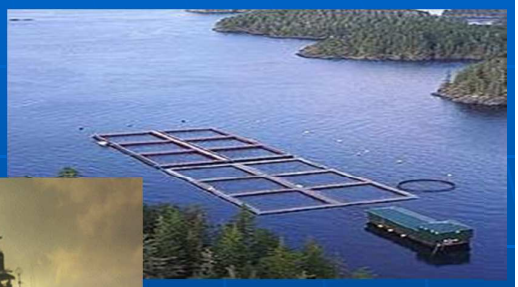
>98% goods by volume

... Tourism

- a growing market
- larger ships
- new destinations

... Natural resources

- fishing
- seabed



... Security and defence

*Maritime patrol and military operations

*Fishery protection

*Surveillance

*Disaster Relief

*Search and Rescue(SAR)

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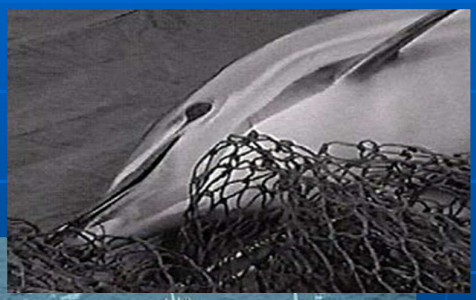
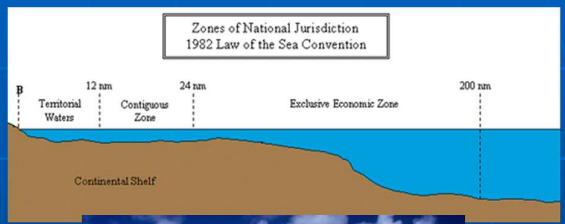
... Protection of the marine environment

- dumping
- oil spill
- industrial pollution



... Coastal zone management

- resource management
- industrial pollution
- port development
- areas of national jurisdiction



... Natural disaster management

*inundation modelling

*sea level rise

*tsunami

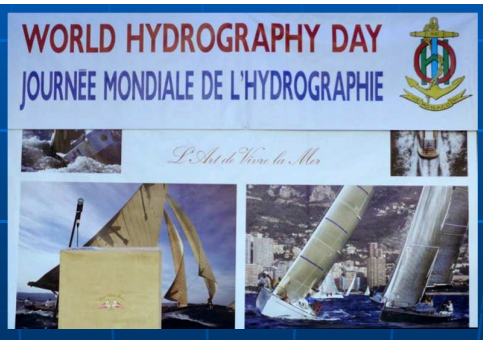
*relief planning

IHO and the Blue Economy

WORLD HYDROGRAPHY DAY - 21 JUNE 2013

On 21st June each year the International Hydrographic Organization celebrates World Hydrography Day. World Hydrography Day is an opportunity to increase public awareness of the vital role that hydrography plays in everyone's life.

Hydrography - underpinning the Blue Economy



WORLD HYDROGRAPHY DAY - 21 JUNE 2014

Hydrography - much more than just nautical charts

Blue Economy
WORLD HYDROGRAPHY DAY- 2014

Many of the world's hydrographic offices will be organising awareness raising events focussing on the Blue Economy.

They will be emphasising the vital contribution that hydrographers and related professions in both the government and the commercial sectors make to the Blue Economy.

Conclusions

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* Hydrography is increasingly being recognized as a fundamental pre-requisite to the development of successful and environmentally sustainable human activities in the seas and oceans.

* Hydrography is underpinning the Blue Economy which provides jobs and creates wealth for the World We Want.

The Blue Economy is much more than the traditional core activities of fishing, maritime trade and passenger ships. To make the best use of hydrographic information for the Blue Economy related activities, it is important to make it easily available through interconnected digital geo-referenced databases accessible via web-based interfaces which are known as Marine Spatial Data Infrastructures (MSDI).

- The Hydrographic Office (HO) is an important part of the National Geo-Spatial Data Infrastructure (MSDI)

- The Land-Sea Interface is critical to the Blue Economy is the creation of reliable data which supports the sea-to-land transition

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- the realm of nautical cartographer and terrestrial mapper have traditionally been dealt with completely separately
- the land-sea interface is no longer the obstruction it once was
- this critical boundary is now possible to chart much better for all users

XXV FIG Congress
KUALA LUMPUR 2014
"Engaging the Challenges, Enhancing the Relevance"
16 - 21 JUNE 2014, MALAYSIA

Thank you for your attention

For more information : **www.iho.int**

IHO Contact : **info@iho.int**

http://www.youtube.com/watch?v=CEJHG9_KGA8&feature=youtu.be

IHO
Capacity Building Program

Capacity Building

The IHO has defined Capacity Building as:

The process by which the Organization assesses the status of current arrangements and assists States to achieve sustainable development and improvement in their ability to meet hydrographic, cartographic and maritime safety obligations with particular reference to UNCLOS, SOLAS and other international instruments.

Capacity Building Sub Committee

Objectives:

- continuously assess hydrographic surveying, nautical charting and nautical information status in nations and regions where hydrography is developing
- establish and maintain close relationships with national agencies and international organizations, to identify funding and technical assistance
- cooperate with Regional Hydrographic Commissions

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Capacity Building Strategy

- Awareness
  Raise priority of Hydrography
- Assessment
  Identify and prioritize problems
- Analysis
  Identify Projects based on national/regional priorities
- Action
  Implementation of Activities. Follow-up

Phases of Hydrographic Capacity Building

- **Preliminary**
  - Raise awareness
- **Phase One**
  - Collection and circulation of nautical information needed to maintain existing charts and publications
- **Phase Two**
  - Capacity to conduct hydrographic surveys, data gathering and processing
- **Phase Three**
  - Production of charts and publications

IHO CAPACITY BUILDING FUND

Fund supports:

- Technical Assistance
- Training and Education
- Financial Assistance
- Start-up Projects

- Proposals submitted via Regional Hydrographic Commission

International Hydrographic Organization

Latest Institutional Education and Training Program developments

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New Courses :

- MSI training on establishment of MSI structure and basic MSI procedures (MACHC, SAIHC)
- Chart production training course (Mozambique, Brazil)

Workshops/Seminars:

2012

- Development of a Regional Marine Spatial Data Infrastructure (MSDI) (NOIHC, SAIHC)
- Ports and Shallow Water Bathymetry Technical Workshop (SWPHC)

Workshops/Seminars:

2013 (planned)

- S100 Seminar (9 students from EAHC)
- Advanced Chart production (NIOHC)
- Regional Workshop on HPD (ENC-production) (SEPHC, SWAtHC)
- Workshop on Port and Shallow Water Surveys, (RSAHC)

Short Courses :

Maritime Safety Information Courses

2011

- Niteroi, Brazil

2010

- Sydney, Australia
- Walvis Bay, Namibia

Technical Visits :

- Technical visits are an important issue for IHO CB.
- 5 to 6 visits are being paid unsually every year.
- It is the preliminary phase in raising awareness.
- In 2012 eleven visits were scheduled.
- In 2013 technical assessments are scheduled for Tonga, Cook Is., Eritrea, Sudan.

International Hydrographic Organization

Standardization procedures put in place to improve effectiveness in the provision of Capacity Building

Capacity Building – Management

General conditions:

- Steadily growing number of projects have to be managed;
- A broad variety of projects are submitted;
- Growing expenditure from the CB Fund has to be organized.

Regional CB Coordinators

In all Regional Hydrographic Commissions (RHCs) where CB is required, the RHCs installed a CB Coordinator to

- assist the Chairman of the RHC;
- assure continuity;
- closely cooperate with the CBSC, preferably as a member.

Capacity Building - Assessment

Technical Visits between 2007 and 2012:

- 18 assessment missions;
- 44 visited countries;
- Conducted by RHCs or IHB.

Capacity Building - Provision

- 45 different training opportunities;
- 5 RHCs have received 70% in terms of activities;
- 700 participants from about 60 MS and 60 non MS have attended trainings;
- 20 IHO MS (25%) and 6 non MS have hosted these events.

Capacity Building - Provision

More active RHCs have a better chance of being supported;

Sharing CB events with other RHCs add value;

Standardization of trainings will facilitate CB provision;

Host countries are a strong component of the CB process.

CB Procedures :

The following 5 Procedures to improve CB assessment, provision and accountability are currently in place:

1. PROCEDURE AND MODEL FOR SUBMITTING REQUEST OF SUPPORT TO THE CBSC
2. PROCEDURE TO BE FOLLOWED BY RHCs BEFORE SUBMITTING REQUESTS
3. REVIEWING PROCESS TO BE FOLLOWED BY THE CBSC SECRETARY PRIOR TO INCLUDE REQUEST.
4. EVALUATION PROCEDURE OF SUBMISSIONS.
5. PERFORMANCE ASSESSMENT.

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CB Procedures :

A new Procedure 6 is under development, dealing with

PROJECT EXECUTION

- Timeline
- Selection process
- Funding
- Travel arrangements
- Host responsibilities (Guidelines provided)

Planned Developments 2013-2017

- Streamline and ease the secretarial work including the development of a Management Plan Data Base;
- Further improve the procedures;
- Facilitate and speed up the process from submission to execution of projects;
- Install more standardized and modular courses.

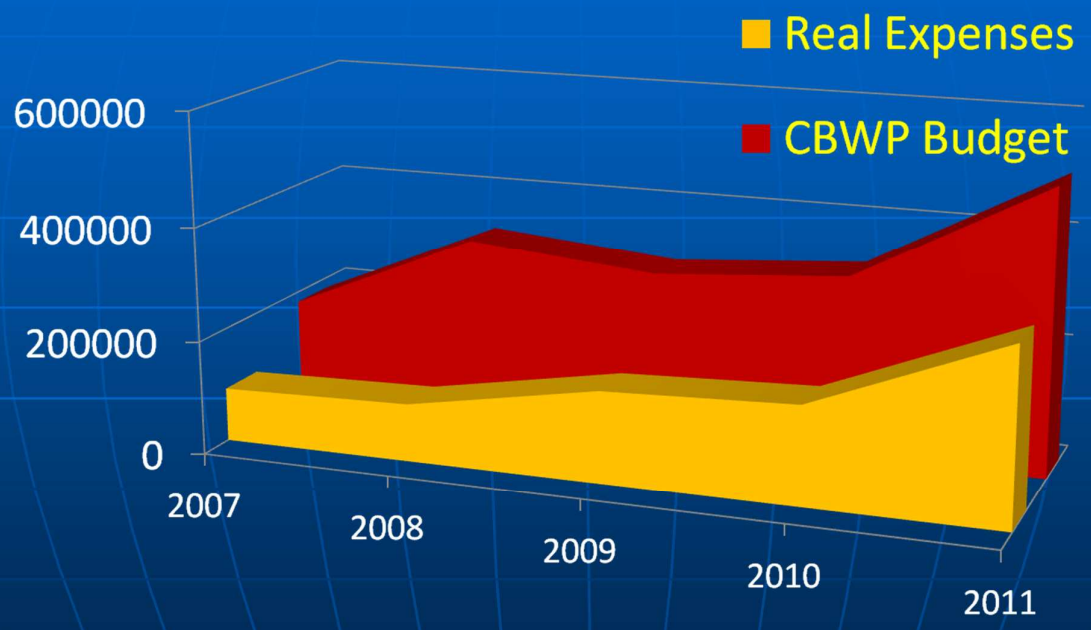
Planned Developments 2013-2017

- Identify measures to improve the long-term effects of CB- projects;
- Check whether e-learning or self-learning can be used to some extend;
- Monitor the provisions in place for raising the Awareness of the need for hydrography;
- Further improve PR measures.

International Hydrographic Organization

Experiences in dealing with funding agencies

Capacity Building Fund



CB Fund analysis

- The available funds have been rising steadily;
- The CB WP Budget has been rising as well, now allocating all available funds into the WP;
- The real expenses have been rising as well, the allocated budget is not used completely;
- The balance is quite constant;
- It is important to have a basic fund reserved for unexpected projects

Funding Agencies :

- IHO CB Fund (small, no funding agency)
- Republic of Korea provision for CB
- Nippon Foundation (Japan)
- Bilateral support from Member States
- New Funds possibly available in the future
- Industry involvement to be extended

International Hydrographic Organization

Status of joint co-operation projects

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Joint Projects :

Joint IMO/IHO Training Projects:

- 2-weeks Regional Training Course on Hydrographic Survey and Introduction to Chart production.
  SWPHC, NIOHC (partial)
- 2-weeks Regional Training Course on Hydrographic Survey and Introduction to Chart production.
  EAtHC, SAIHC, NIOHC (partial) [in french]
- 2-weeks Regional Training Course on Basic ENC and ENC Production.
  MACHC

planned in 2013: two courses

Joint Projects :

Contribution of the Republic of Korea:

- Contribution to the IHO CB Fund
- IHO-ROK Programme

Contribution of Japan:

- The Japan Capacity-Building Project
- Nippon Foundation - GEBCO Training Project

Conclusions

- **Hydrography is essential part of the Maritime Safety and MSDI**
- **The IHO is recognised as the competent International Organization on hydrographic and nautical charting issues.**
- **Hydrography is a fundamental enabler and economic multiplier in the sustainable development of the Blue Economy**

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Protecting the Marine Environment

Hydrography Support:

- Nautical charting (navigation)
- Port and harbour maintenance (dredging)

- *Safety in navigation and avoiding wrecks*
- *Safe transportation of hazardous materials*
- *Safe transportation of officers enforcing coastal zone and marine policies*
- *Safe transportation of hazardous materials*

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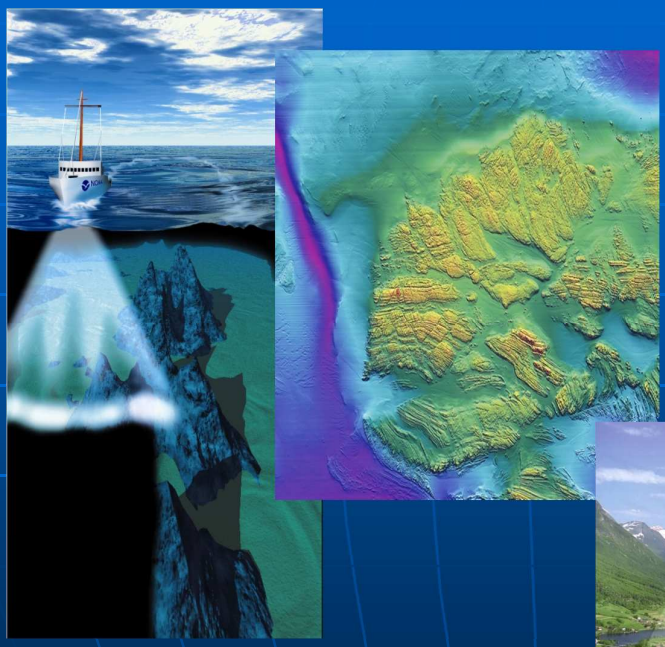
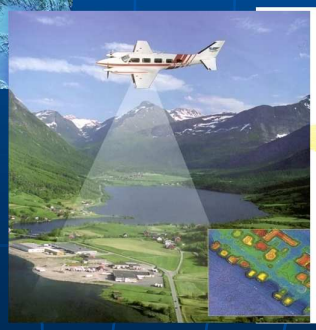
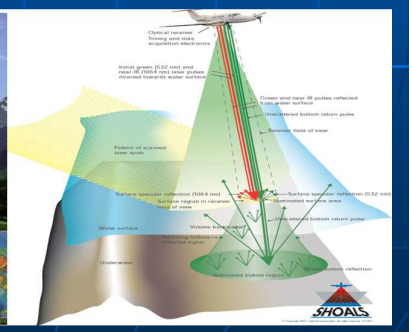
Fugro Hydrographic Charting Services

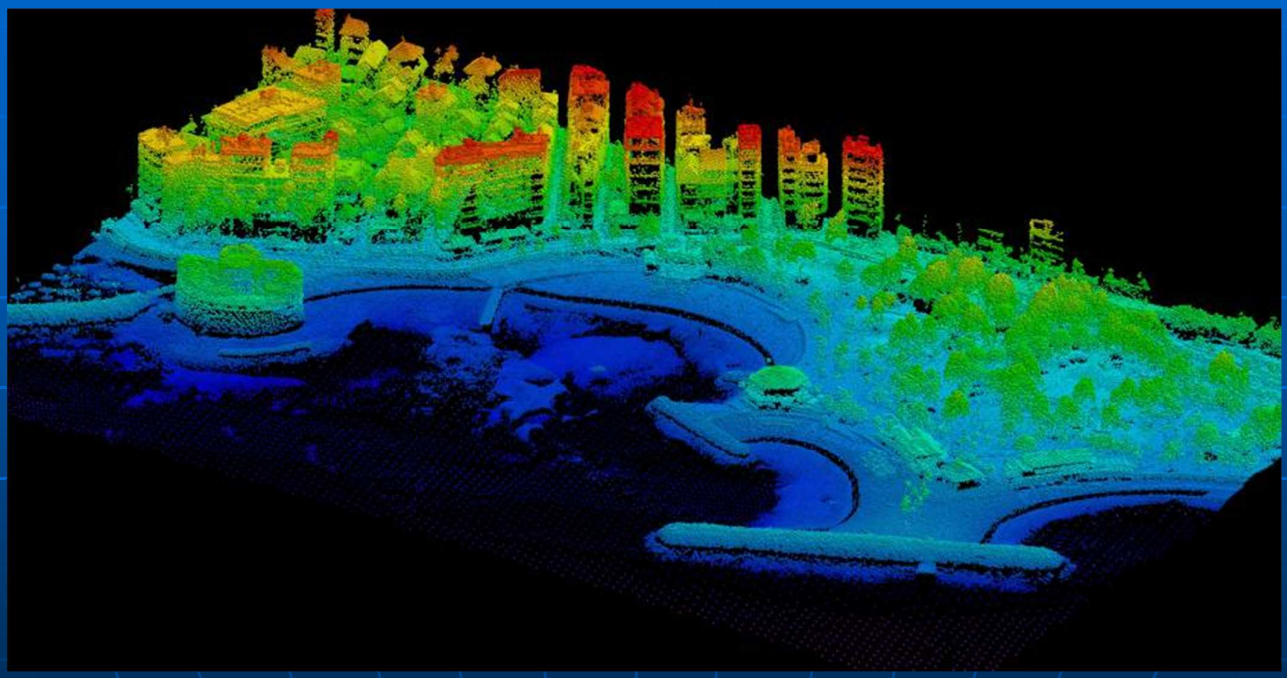






- Services
  - Hydrographic Surveying
  - LiDAR Surveying
  - Marine Geophysical Surveying
- Product Lines
  - Positioning software
  - Positioning signals

Combined LADS and RIEGL data sets in France

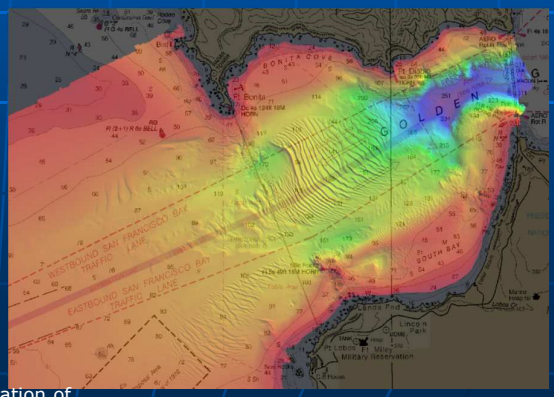


LADS Mk 3 and RIEGL VQ-820-G data over Mourillon for SHOM

The Land-Sea Interface

- critical to the Blue Economy is the creation of reliable data which supports the sea-to-land transition

- ….in other words coastal environmental data



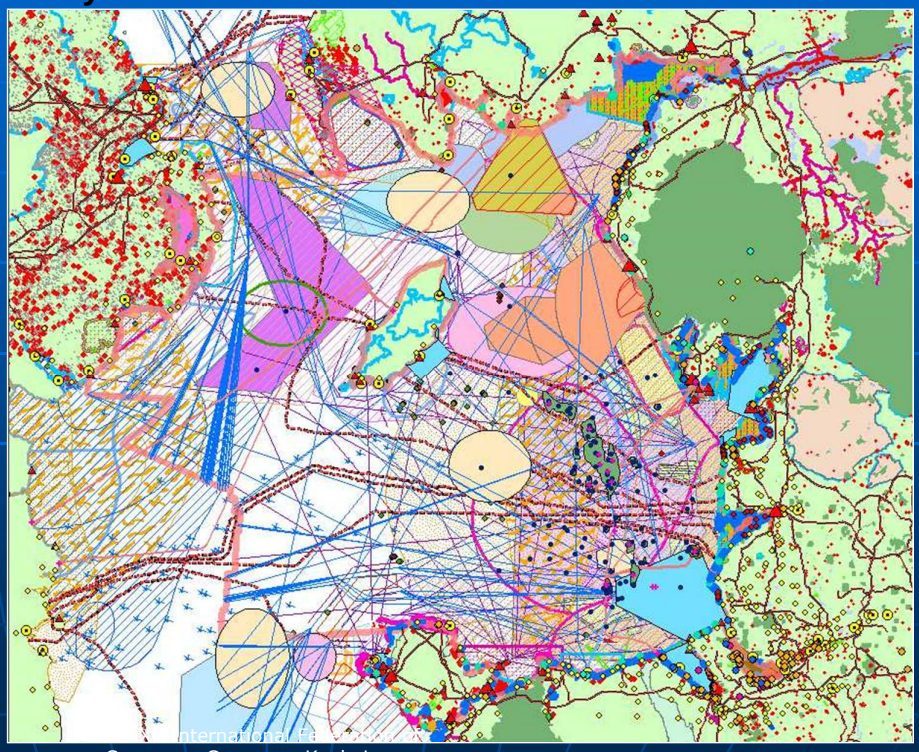
The Land-Sea Interface

- there remains a legacy approach to survey specification
- the realm of nautical cartographer and terrestrial mapper have traditionally been dealt with completely separately
- the land-sea interface is no longer the obstruction it once was
- this critical boundary is now possible to chart much better for all users

Stakeholders

Economic activity in the Irish Sea and coastal hinterland

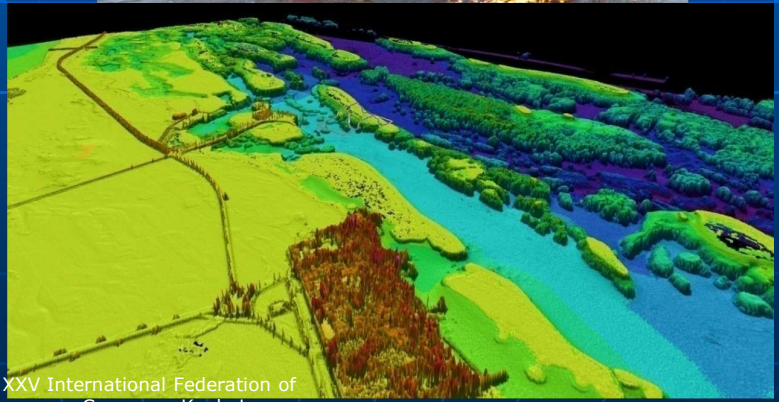
- Land Use
- Tourism
- Oil & Gas
- Mariculture
- Coastal Defence
- Ports & Navigation
- Military Activities
- Culture
- Conservation
- Dredging & Disposal
- Submarine Cables
- Fishing
- Renewable Energy
- Marine Recreation
- Mineral Extraction



Source: Defra Irish Sea Planning Pilot – 2006

Integrated Geospatial Data Acq

- **Modern survey companies have excellent tools at their disposal**
- **Providing the**

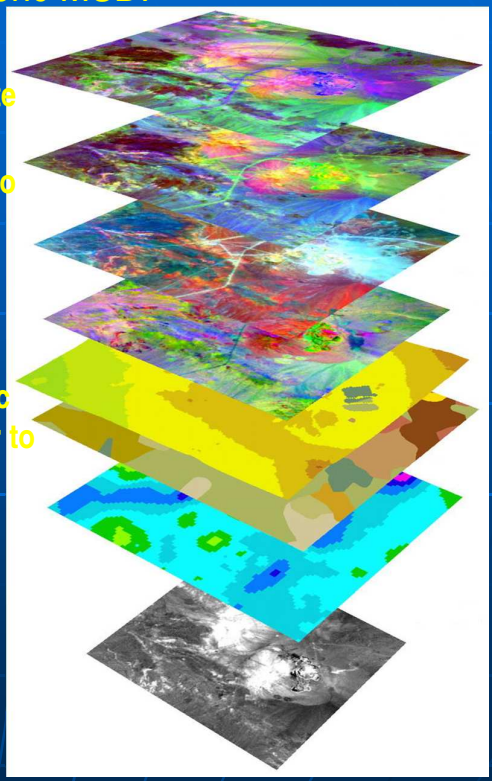


Integrated Geospatial Data Acquisition

- **Data collected from non-surveying third parties needs to be very carefully**

Fuelling the Associated Generic MSDI

- **National Marine Spatial Data Infrastructures (MSDI) should ideally address the needs of as many legitimate stakeholders as possible**
- **Some of the layers will contain information pertinent to the nearshore or land-sea interface**
- **Focus on customer needs, as in data acquisition prioritizing, also aids in the design of the national GIS and therefore the MSDI subcomponent**
- **Data stored in such a way leads to a myriad of specific products which are actually easier for the stakeholder to access and build**

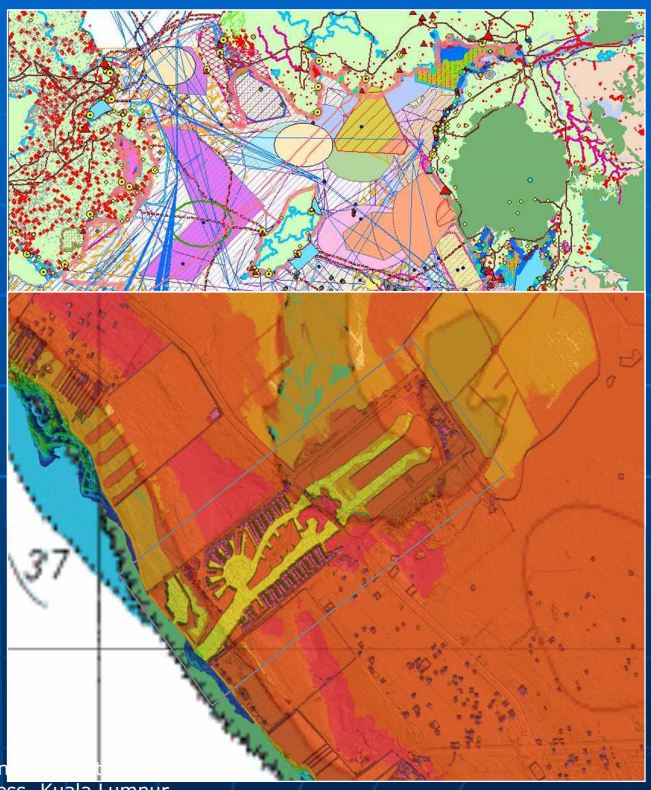


Conclusion

- There has been a huge increase in reliance on the sea:
  - as a means of transportation;
  - as a source of energy of various types;
  - as a source of food and nutrients;
  - as the carrier medium for the globally vital Blue Economy input to the world's overall trade volume.
- As seaborne trade has increased, so has the importance of overcoming historic shortfalls in effective geospatial data collection across the land-sea interface
- Growth both in trade and the size of vessels now carrying this trade has been alarming
  - placing increasing pressure on existing infrastructure
  - logistic operations of even the largest port complexes

Conclusion

- Hydrographic surveys need to be planned to support this level of business
  - to overcome the traditional land-sea boundary issues
  - to meet the needs of a greater number of stakeholders
- This can be achieved with appropriate use of today's technology
  - utilized by cartographers with a greater awareness of potential stakeholder investment
- Encourage adoption of a more holistic survey planning paradigm

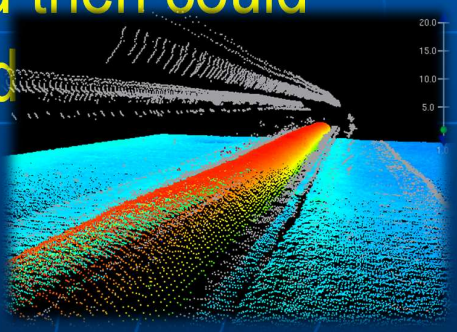


Increased use of AUVs

- AUV benefits as a survey platform
  - Smaller crews
  - Less human input once underway
  - Multiple compact sensors e.g. **SAS**, MBES, Still Camera, Pipetracker, ADCP
  - Stable, acoustically quiet
- AUV challenges as a survey platform
  - Demand for payload space
  - Greater endurance = more power
  - Multiple AUVs for 24hr operations
  - Data processing after vehicle recovery
  - Robust in-mission survey QC
  - Disk space requirements
  - NEED FOR ONBOARD PROCESSING

Synthetic Aperture Sonar (SAS) benefits

- More efficient pipeline inspection surveys
- If dataset resolution is good then could this remove the need for vid
- Image Mosaic
  - + Bathymetry
  - + Still HD Photos



What is our view of Ocean Mapping?

- Data collection within the Ocean cube
  - Surface
  - Subsurface
  - Ocean Floor
  - And the water column
- All geo-referenced and formatted to an international mapping standard
- Sharing throughout the community

What is GEBCO?

The General Bathymetric Chart of the Oceans (GEBCO):

- Aims to provide the most authoritative, publicly-available bathymetric datasets for the world's oceans
- Maintains and makes available a gazetteer of undersea feature names

GEBCO operates under the joint auspices of the International Hydrographic Organization (IHO) and Intergovernmental Oceanographic Commission (IOC) of UNESCO

GEBCO's organisational structure

- GEBCO consists of an international group of experts led by a Guiding Committee consisting of 5 IHO-appointed members; 5 IOC-appointed members; Sub-committee Chairs and the Director of the IHO-DCDB

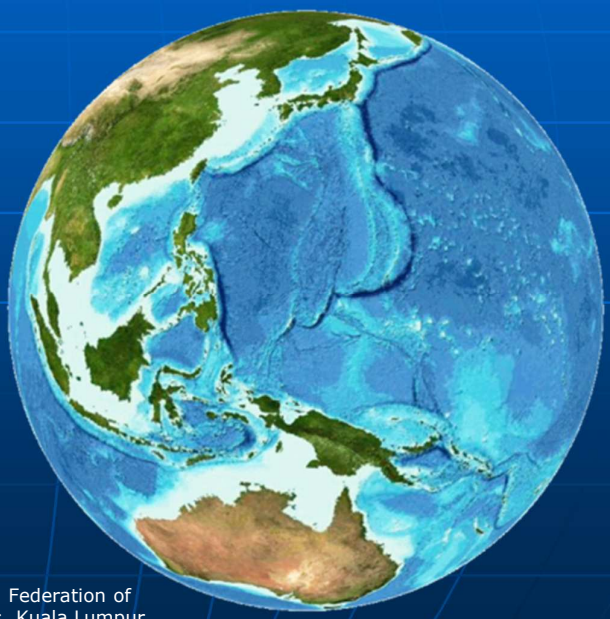
- It has 3 sub-committees and working groups:
  - Sub-Committee on Undersea Feature Names (SCUFN)
  - Technical Sub-Committee on Ocean Mapping (TSCOM)
  - Sub-Committee on Regional Undersea Mapping (SCRUM)
  - Working groups on Outreach, Metadata and the IHO-IOC GEBCO Cook Book

www.gebco.net/about_us/committees_and_groups/

GEBCO's products

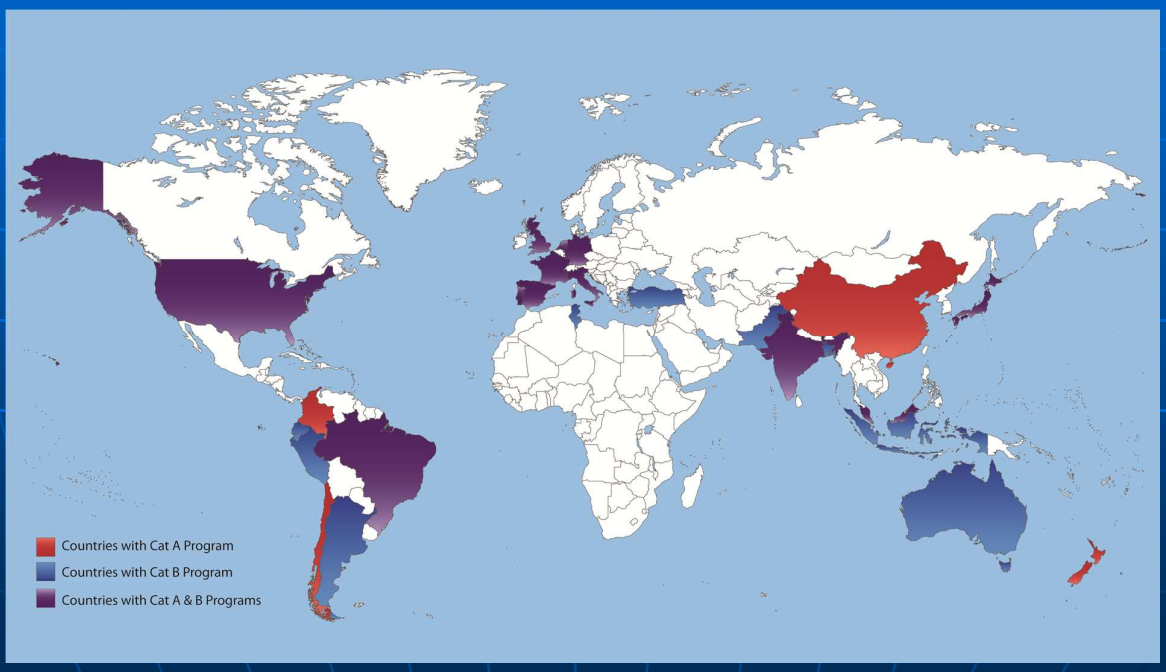
FREELY-AVAILABLE bathymetric data sets and products:

- Global gridded bathymetric data sets
- Global set of digital bathymetric contours
- GEBCO Gazetteer of Undersea Feature Names
- GEBCO Digital Atlas
- GEBCO world map
- Web Map Service (WMS)
- IHO-IOC GEBCO Cook Book



- www.gebco.net/data_and_products/

Recognized Hydrographic Programs (end of 2013)



World Wide Navigational Service (WWNWS)

- WWNWS-SC monitors and guides IHO/IMO WWNWS including 21 NAVAREA Coordinators.
- Close liaison maintained with WMO for WWMIWS and METAREA Coordinators.
- Responsible for proposing new methods to enhance the provision of navigational warnings to mariners at sea and providing appropriate guidance to concerned IHO Member State Representatives.

XXV International Federation of Surveyors Congress, Kuala Lumpur, Malaysia, 16 – 21 June 2014

IHO
Capacity Building Program

Capacity Building

The IHO has defined Capacity Building as:

The process by which the Organization assesses the status of current arrangements and assists States to achieve sustainable development and improvement in their ability to meet hydrographic, cartographic and maritime safety obligations with particular reference to UNCLOS, SOLAS and other international instruments.

Capacity Building Sub Committee (CBSC)

Objectives:

- continuously assess hydrographic surveying, nautical charting and nautical information status in nations and regions where hydrography is developing
- establish and maintain close relationships with national agencies and international organizations, to identify funding and technical assistance
- cooperate with Regional Hydrographic Commissions

Capacity Building Strategy

- Awareness
  Raise priority of Hydrography
- Assessment
  Identify and prioritize problems
- Analysis
  Identify Projects based on national/regional priorities
- Action
  Implementation of Activities. Follow-up

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Phases of Hydrographic Capacity Building

- **Preliminary**
  - Raise awareness
- **Phase One**
  - Collection and circulation of nautical information needed to maintain existing charts and publications
- **Phase Two**
  - Capacity to conduct hydrographic surveys, data gathering and processing
- **Phase Three**
  - Production of charts and publications

IHO Capacity Building Fund

Fund supports:

- **Training and Education**
- **Technical Assistance**
- **Financial Assistance**
- **Start-up Projects**

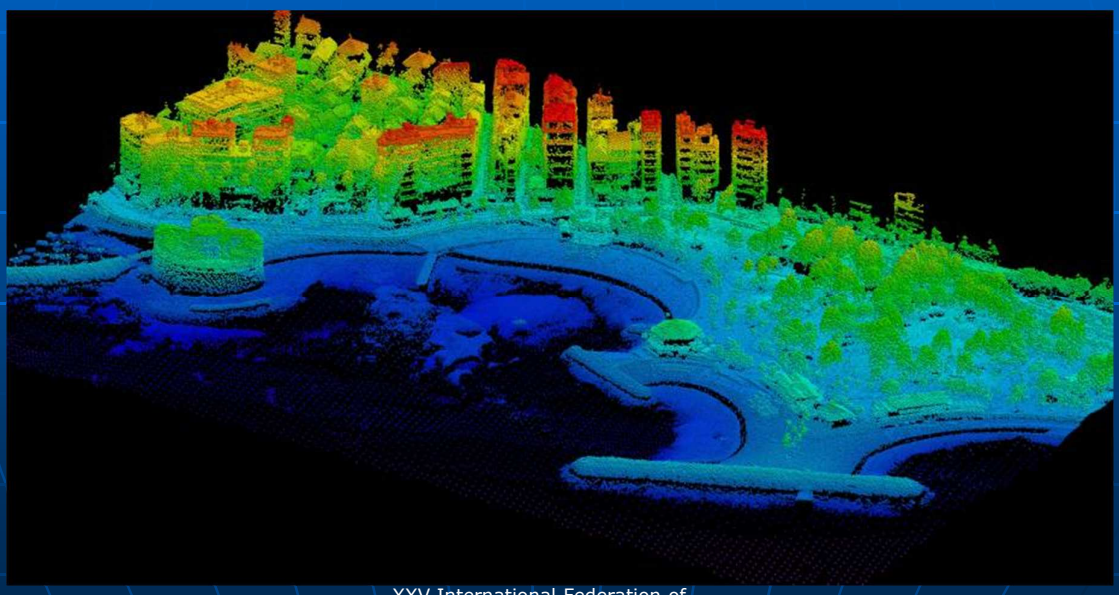
- Proposals submitted via Regional Hydrographic Commissions

IHO Capacity Building Fund

*IHO CB programme is funded by IHO Budget and also supported by some Member States (Japan and Republic of Korea) and some NGOs (Nippon Foundation).

***IHO needs more fund and contribution** for implementing IHO CB Program effectively in order to improve safety of navigation at sea and protect the marine environment.

Marine Spatial Planning & Management



Current issues and impact of technological developments

- Data processing
- Data production / Bathymetry management
- Law of the sea
- Marine Spatial Data Infrastructure

Current issues … Data processing

- Outcome: impressive technological advances
  - High resolution (cm) / high density
  - Multiplier effect of AUV/ASV
  - Big data capability
- Issues
  - Quality control / Processing time
  - Impact on standards
    - Standards for hydrographic surveys
    - Standards of competence for hydrographic surveyors
  - Coverage remains the fundamental issue seen from the IHO

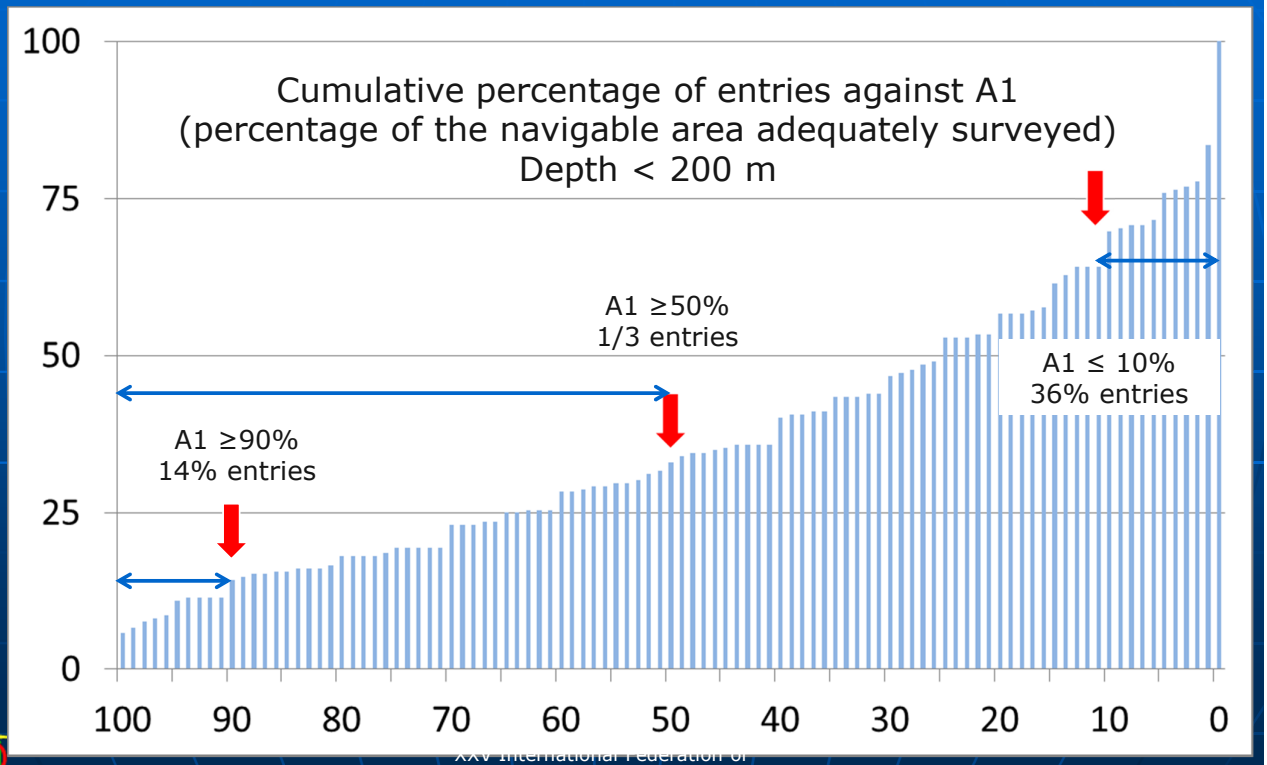
Coverage remains the fundamental issue …

Areas unsurveyed or requiring better data (0-200m deep)

- Caribbean >80%
- W. Africa >80%
- Polar regions > 95%
- Australia ~ 65%
- Greece ~ 65%
- USA ~ 40%
- UK ~ 30%
- France ~ 19%
- Germany ~ 3%

(source: IHO C-55)

Coverage remains the fundamental issue …

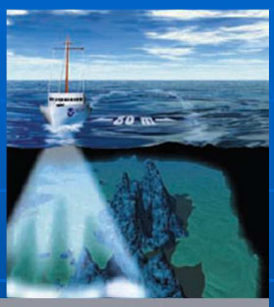


Coverage remains the fundamental issue …

35% reduction in government fleet in 25 years

(International Hydrographic Conference 2012)

=> Much less effort for the benefit of developing countries!



Country	Number of survey vessels	
	1984	2014
France	7	4,5
Germany	6	5
Japan	6	5
Netherlands	3	2
UK	12	5
USA	15	5

Coverage remains the fundamental issue …

Way forward

- Raise awareness / increase IHO membership
  - 5 of the 9 Flag States with a tonnage above 30 million GRT are not members of the IHO
- Risk assessment / prioritization
- Alternative “stop gap” techniques
  - Crowd-sourcing
  - Satellite-derived bathymetry
  - …
- Promote regional cooperation / partnership
- Capacity building strategy

Current issues … Data production & Bathymetry management

- Outcome
  - Switch to database driven production environment
  - HPD seems to be “the” solution
- Issues
  - Experience sharing
  - Customized / on-the-shelf solutions
  - “Ping to chart” time
  - Sustainability of “open” data
  - Towards e-navigation

Current issues … Data production & Bathymetry management

- Towards e-navigation
  - New generation Electronic Navigational Charts (ENC)
    - Dynamic ENC
    - High resolution bathymetry
  - Maritime service portfolios (Standardization of shore-based functions and services)
    - Common data structure based on S-100
    - Chart / layers

Current issues … Law of the sea

- Outcome
  - Benefits of using modern GIS tools
- Issues
  - Impact on technical guidance
    - On-going revisions of IHO Publication C-51 – *Manual on Technical Aspects of the United Convention on the Law of the Sea - 1982*
  - S-100 based product specification *Maritime limits and boundaries* (S-124)
    - Draft edition expected for review at HSSC-6

Current issues … Marine Spatial Data Infrastructure

- Outcome
  - land-sea integration is more an organizational issue than a technical issue
- Issues
  - dominant role of land mapping agencies in the development of Spatial Data Infrastructures
    - HOs needs to be more active in national, regional and worldwide forums
  - Capacity building strategy: revise the 3-phase approach?

Miscellaneous

- Upcoming IHO stakeholders' events
  - 5th Extraordinary International Hydrographic Conference (6-10 Oct. - Monaco)
    - Industry Exhibition
    - Information Session (2 half-days, 7-8 Oct.)
  - IHO session at Hydro 14 (28-30 Oct. – Aberdeen, UK)
- Submissions to the International Hydrographic Review welcome
  - www.iho.int > Standards & Publications > International Hydrographic Review

Raise awareness on Hydrography

Remember 21 June!

- Start of Summer (northern hemisphere)
- European Music Day
- World Hydrography Day