LiDAR

My favourite tool in the bag

2011

St Kitts & Nevis

Lt Cdr Rupert Forester-Bennett RN (ret'd)

December 5th to 11th 2011

Pelydryn

MACHC

INTERNATIONAL HYDROGRAPHIC ORGANIZATION
MESO AMERICAN & CARIBBEAN SEA HYDROGRAPHIC COMMISSION

Content

- Collection of geospatial data – reasons
- Overcoming the ‘White Ribbon’
- Not just about heights
- Cost comparison against traditional methods
- Many and varied uses
- Sharing the investment

Collection of Geospatial data

- International Trade and Economy
- Ecological Protection
- Disaster mitigation & management
- International Boundaries (UNCLOS)

Collection of Geospatial data

International Trade and Economy

- Sea-Land Links
- Leisure and tourism
- Port and marina development
- Fishing industries

Hydrographic data, information, charts, advice

Collection of Geospatial data

Marine Mapping & Ecological Protection

- Flood defences, inundation mapping
- Protection of environment and aquaculture
- Climate change

Hydrographic data, information, charts, advice

Collection of Geospatial data

Disaster Mitigation & Management

- Modelling
- Response planning
- Early warning systems

Hydrographic data, information, charts, advice

Collection of Geospatial data

United Nations Conventions

SOLAS

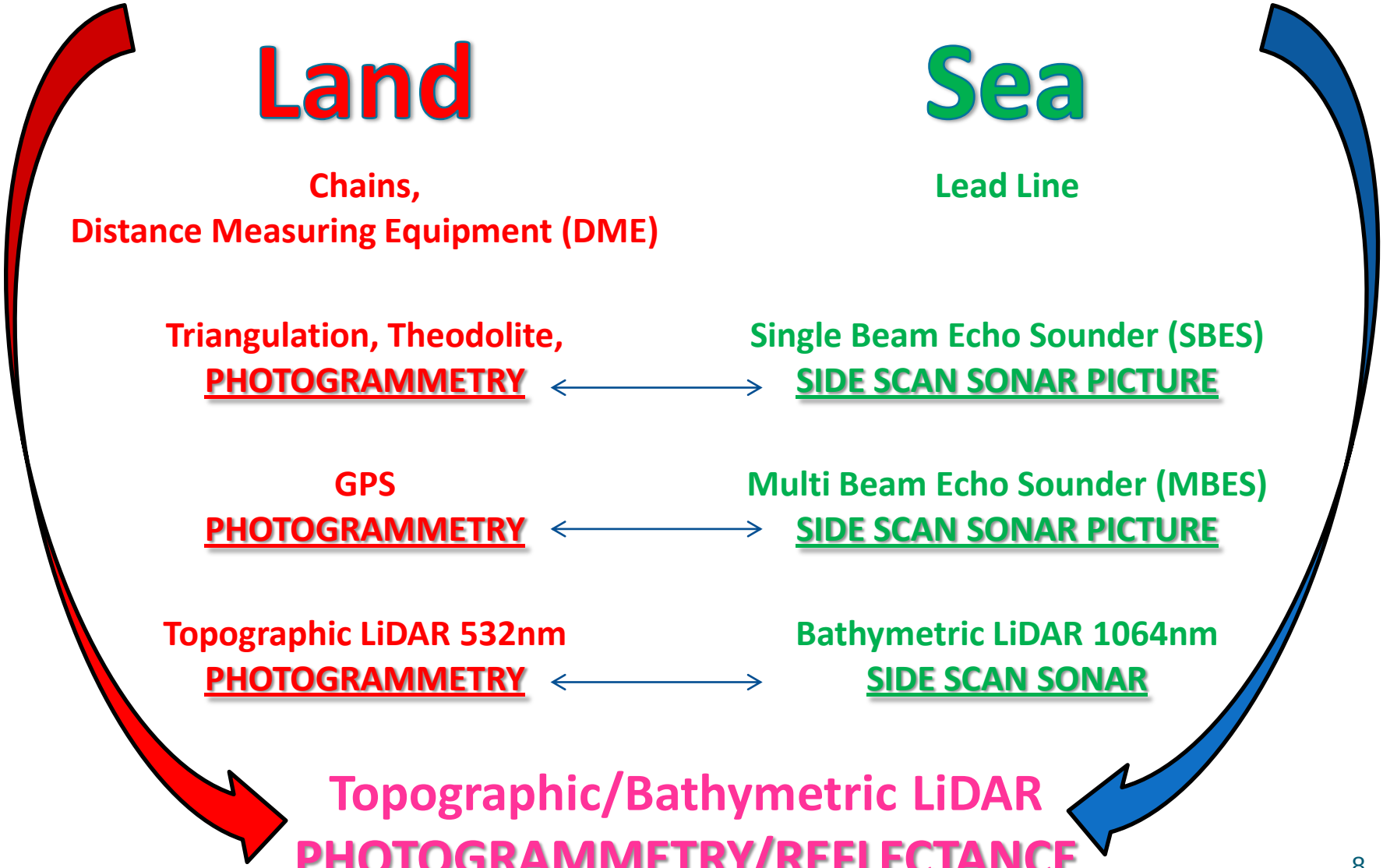
- Navigation aids
- Pilotage

UNCLOS

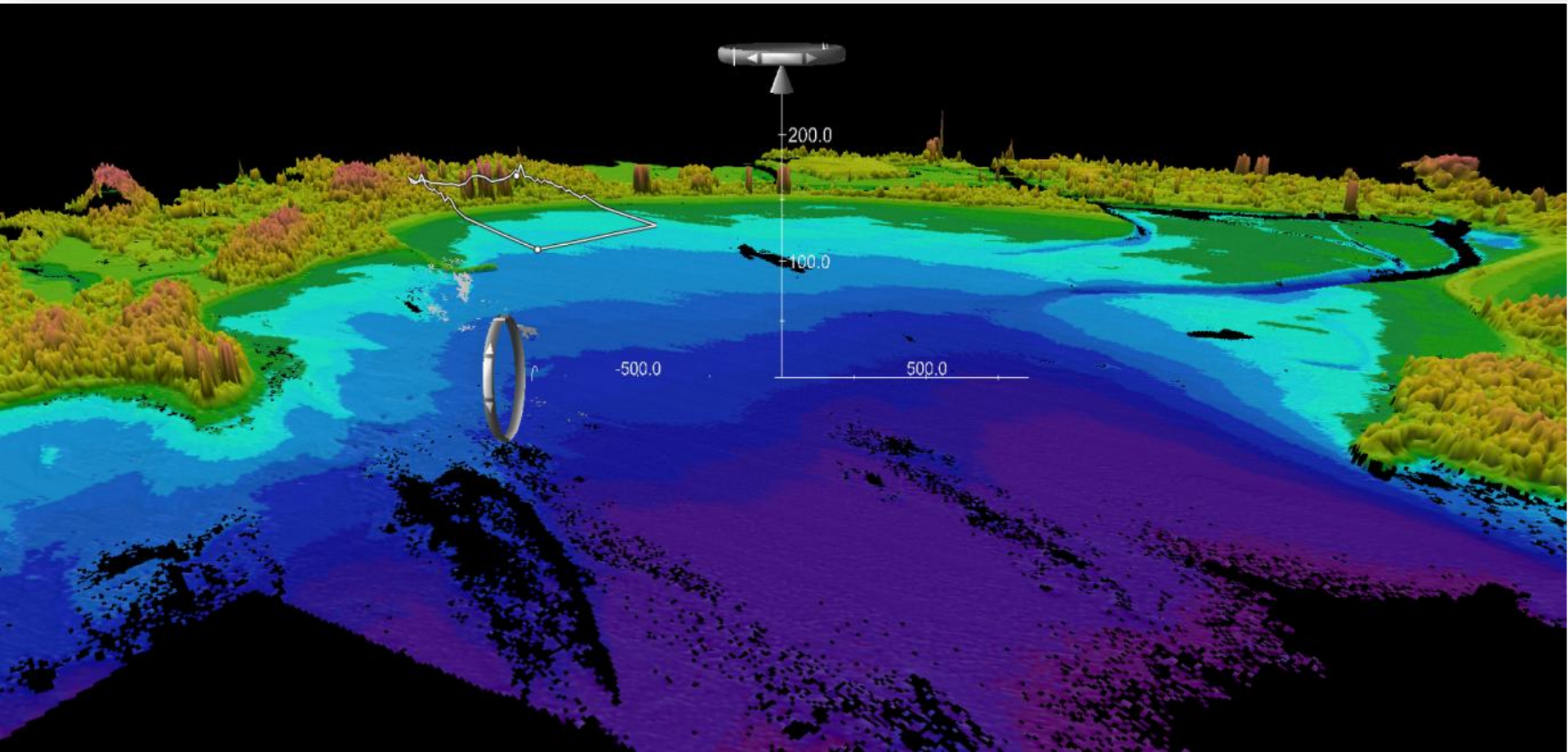
- Sub-Sea Territorial Rights
- Continental Shelf

Hydrographic data, information, charts, advice

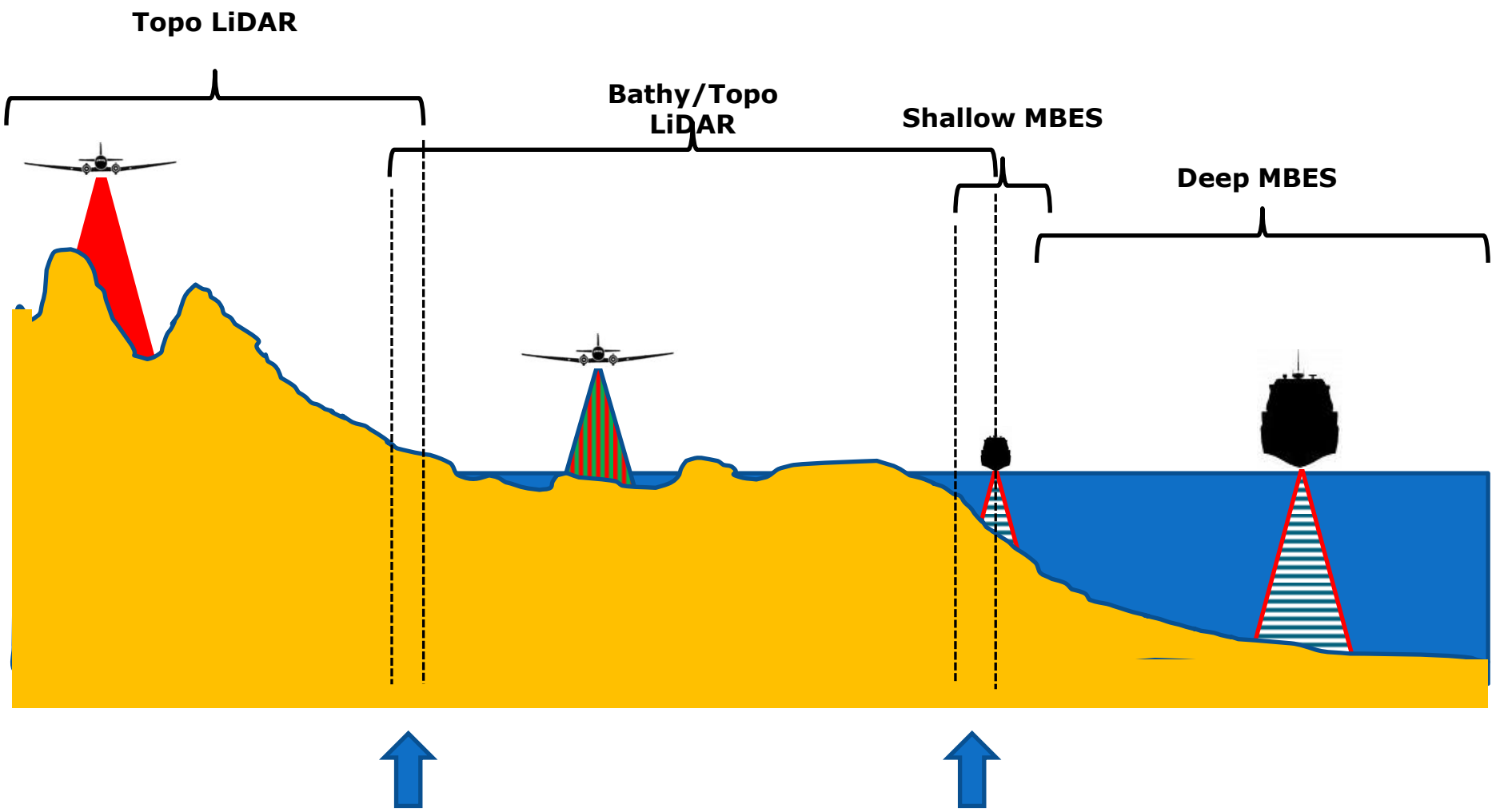
Data Collection Techniques



What does this mean in Practice?



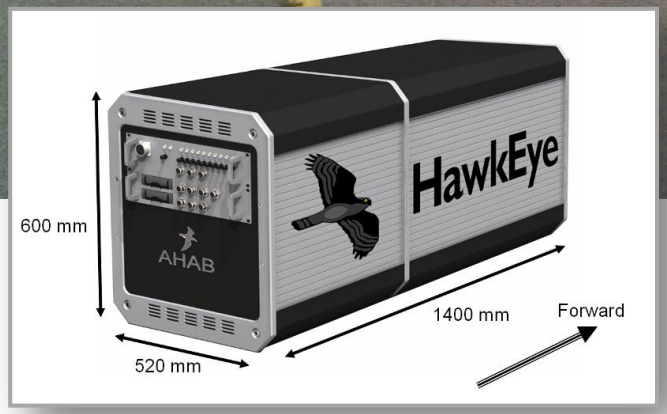
Overcoming The White Ribbon



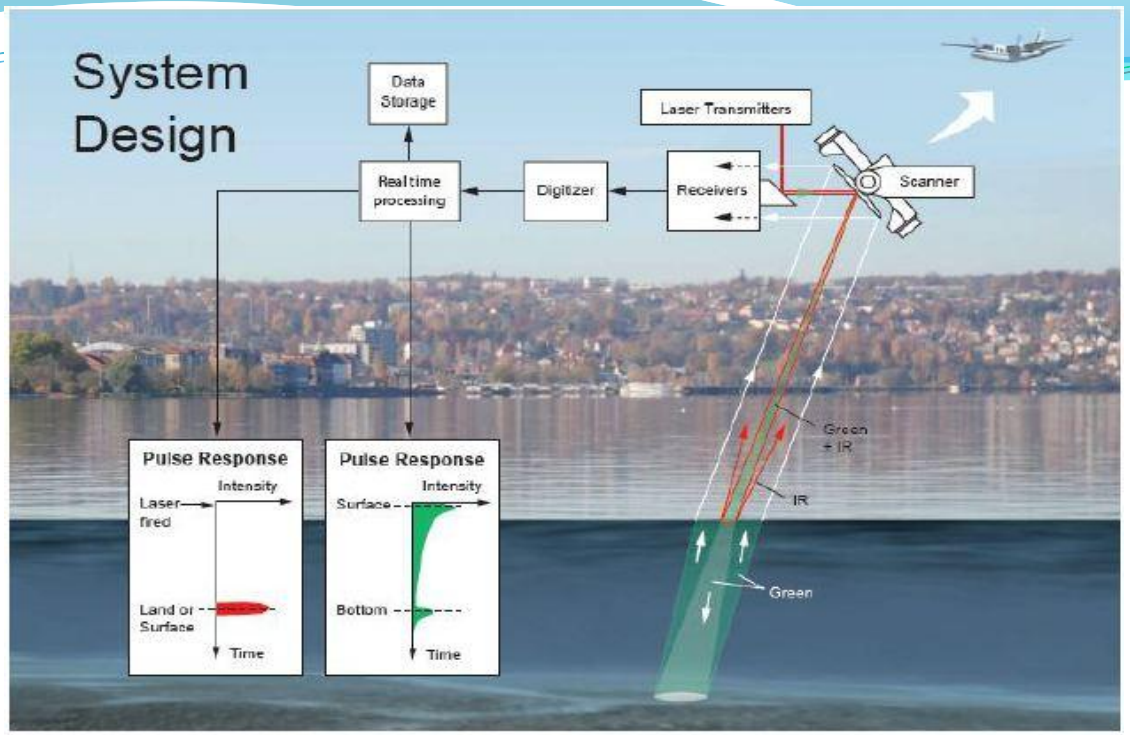
Bathy/Topo LiDAR overlaps <u>both</u> ways

Aircraft

- Small
- Local



Pelydryn

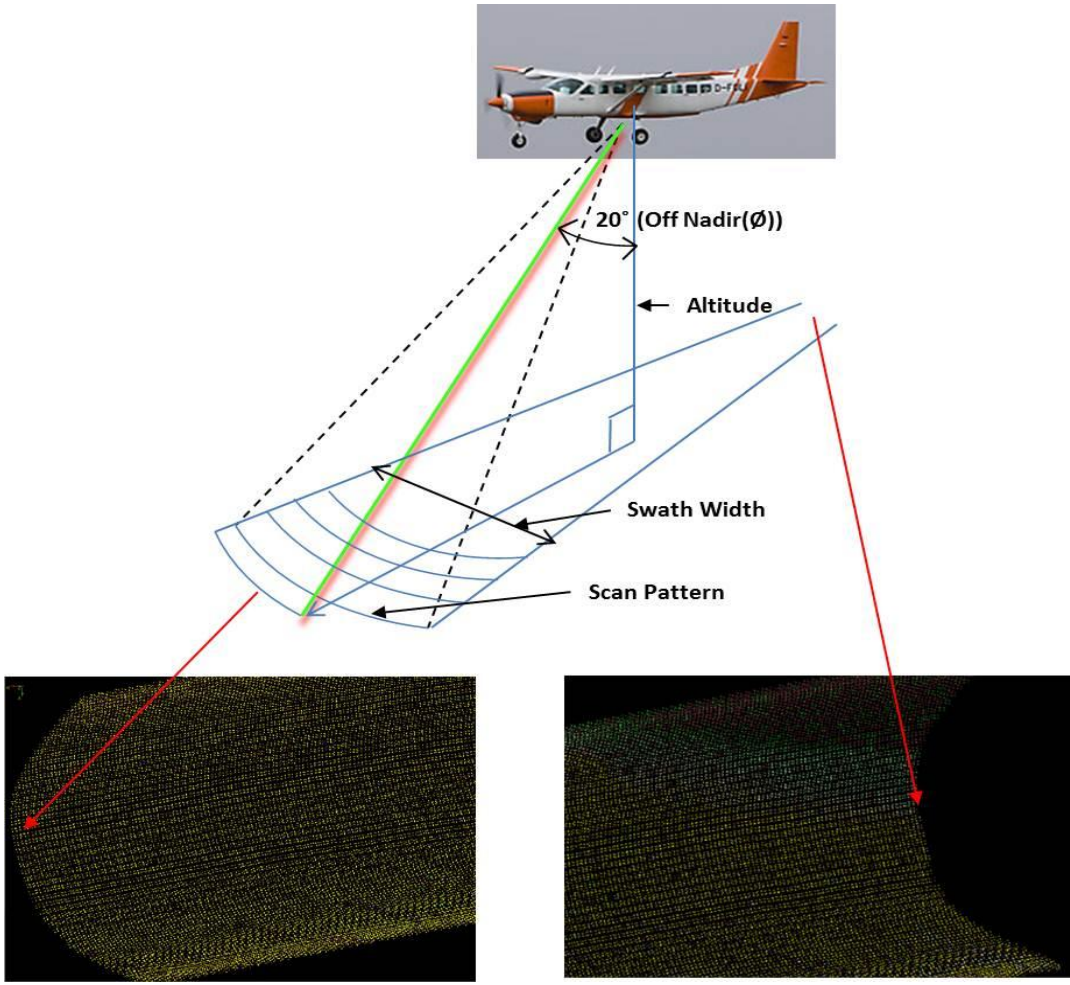


- **The depth of water <u>and</u> height of land is measured by laser pulses of two wavelengths; Green (532nm) and Infra-Red (IR) (1064nm)**
- **The green beam penetrates the water, whereas the IR laser is reflected at the surface. The time difference between the green (bottom) and the IR (water surface) laser reflections is used to calculate the depth.**

Pelydryn

Scan Pattern

- Both lasers are scanned in a pattern on the water surface.
- The scanning mirror of the LiDAR allows the effects of motion in the platform to be compensated for directly.
- The scanning mirror compensates for pitch and roll by adjusting the direction in which the laser beams are transmitted, ensuring that they are transmitted ahead of the aircraft at an off-nadir angle of 20˚ and scan left and right either side of the line of advance of the aircraft.
- The result is a generally evenly spaced pattern of transmissions and returns covering the seabed.

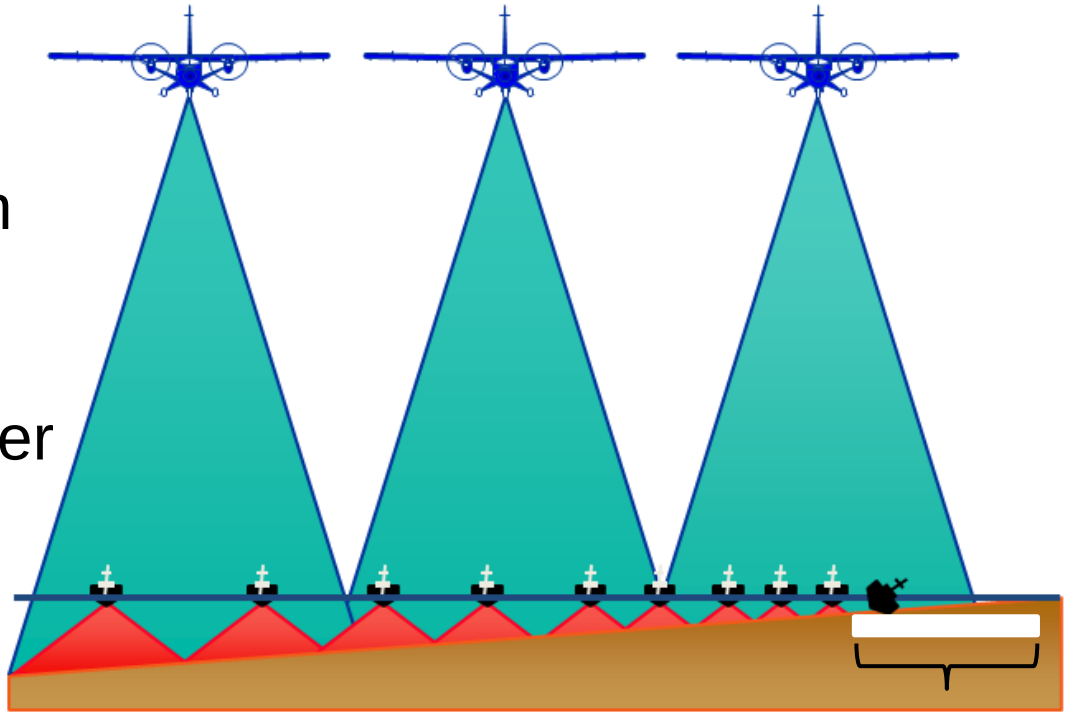


Pelydryn

Advantages/Disadvantages

Boat operations suffer from:

- reduced swathe width
- slow progress
- dangerous waters
- dependence on Mother ship
- high cost/km^2



White Ribbon
(Unsurveyed)

Advantages/Disadvantages

Bathy LiDAR suffers from:

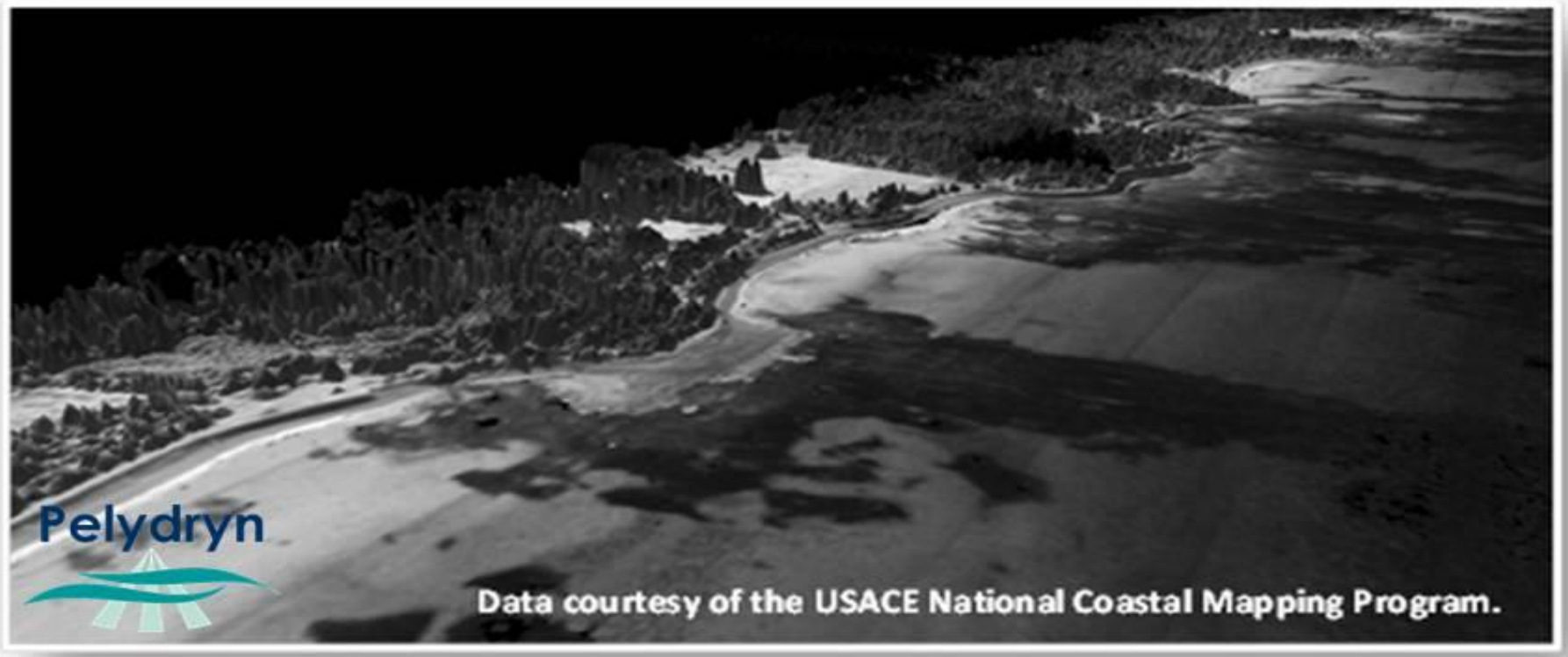
- Water Clarity – Secchi Disc
- Scale of Operation

Not Just about heights - Photography

- The HawkEye II B is fitted with a uEye IU-2250-C / M camera
- Imagery is used to assist in data cleaning
- **Orthophotos** are available at a **resolution of 25cm** when flown at 400m altitude
- Imagery will also observe
  - ambient sea conditions and phenomena (eddies and over falls)
  - Areas of vegetation and vegetation type
  - Extent of Rocks and Reefs

Not Just about heights - Reflectance

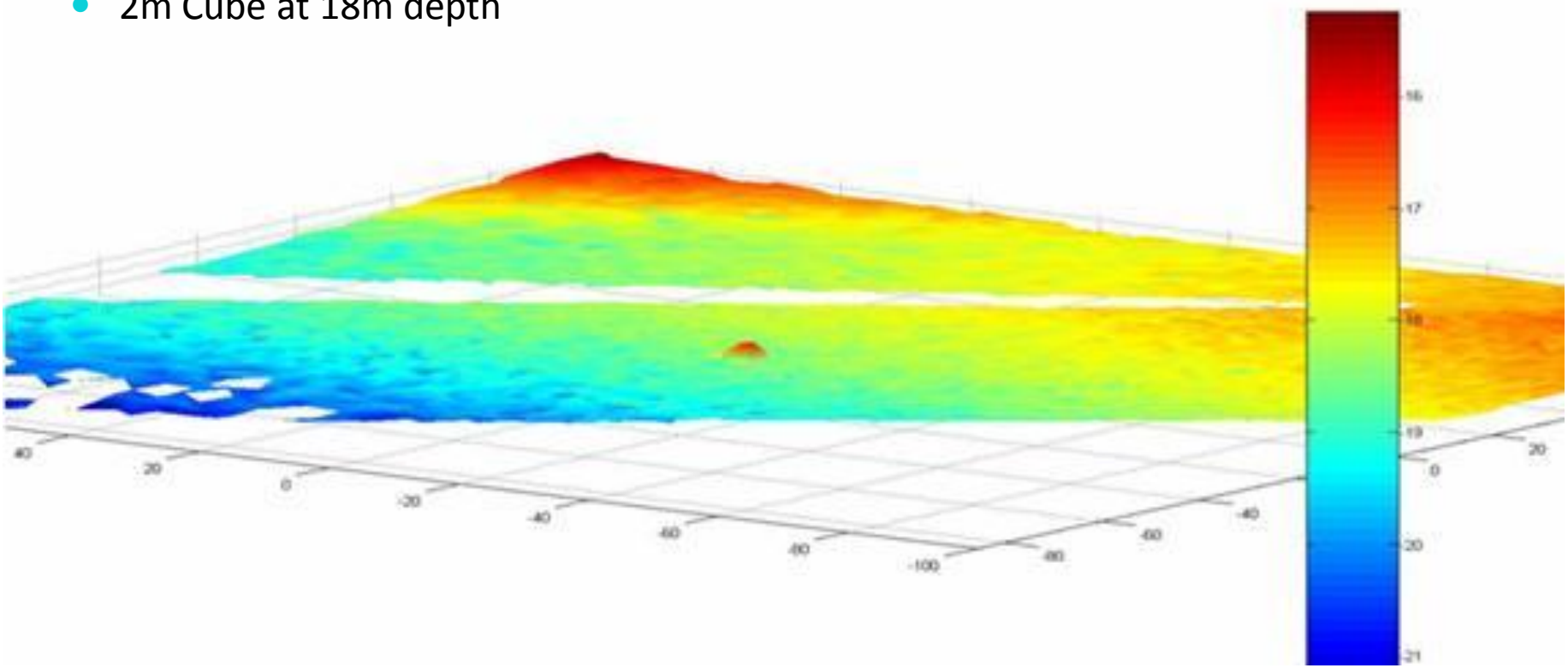
- **Bathymetric data can be processed to produce images of reflectance to aid bottom type classification**



Not just about heights – coastal modeling

Not just about heights - Object detection

- 2m Cube at 18m depth



- HEIIb meets the object detection requirement of >2m in up to 40m depths

Pelydryn

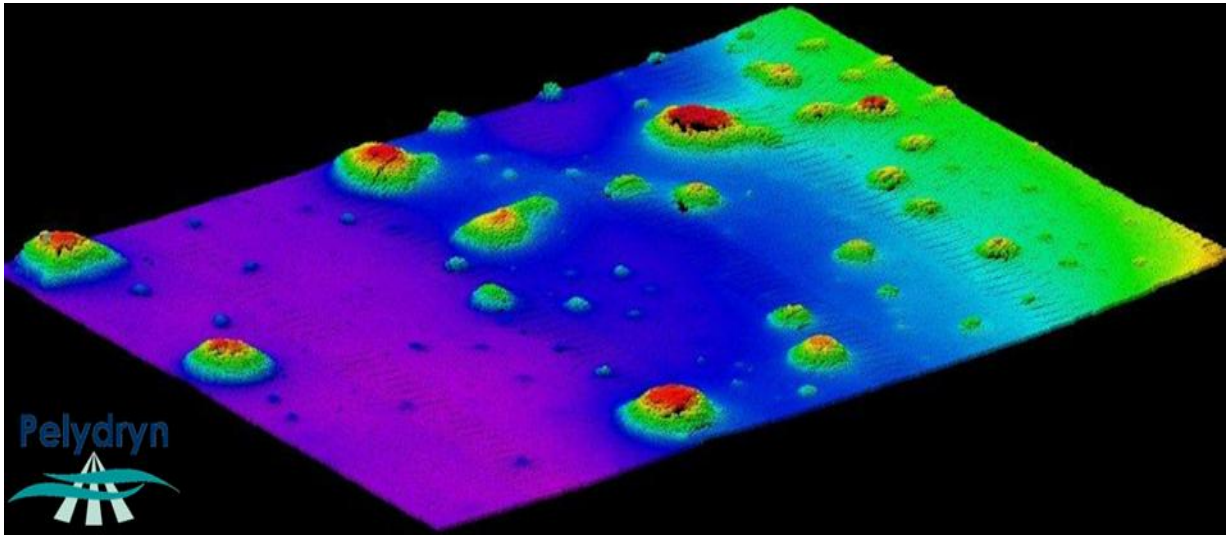
Speed and Cost

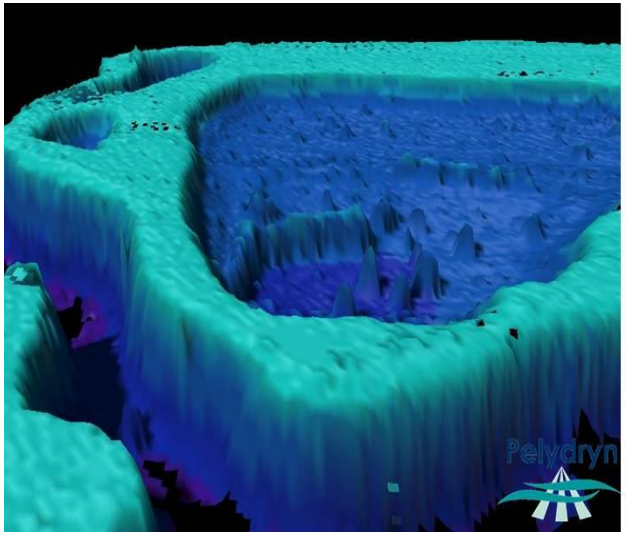
Figures are for guidance, and vary according to local factors	MBES	ALB
Average cost per 1 km^2 of survey	3	1
Average cost of a 350 km^2 survey	3	1
Average time for a 350 km^2 (days)	35	2

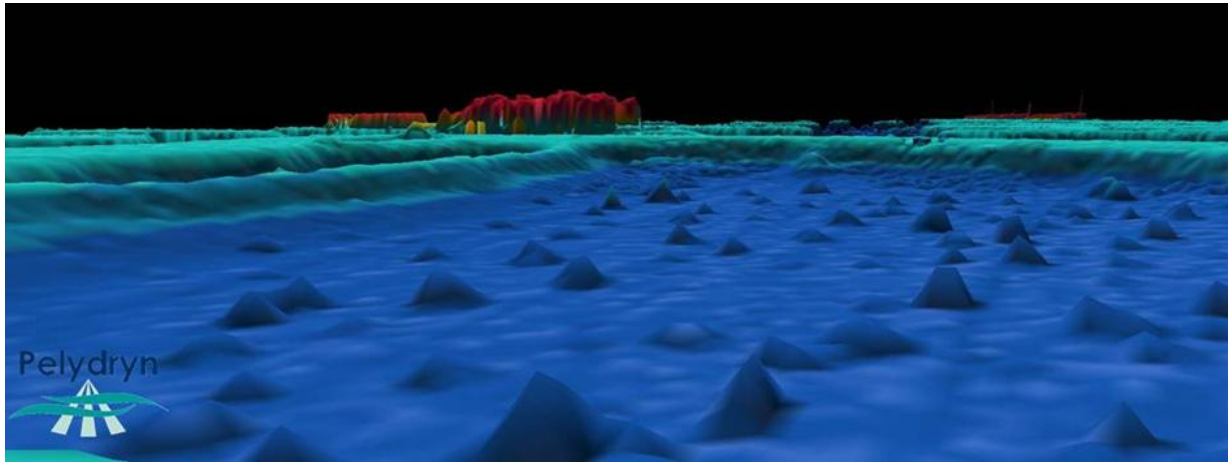
Current uses of combined Topo/bathy data

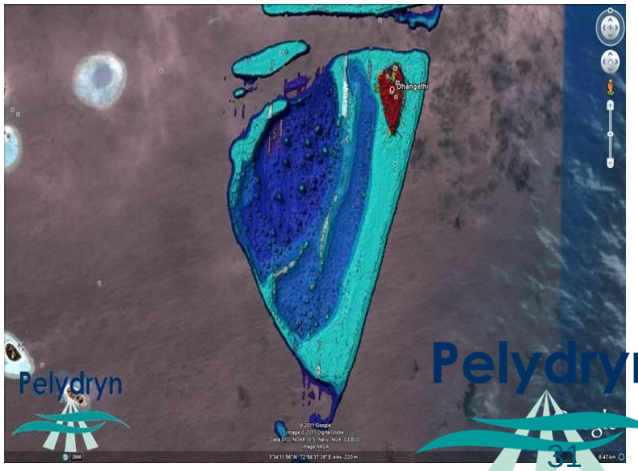
Maldives: Ministry of Transport, Housing and the Environment

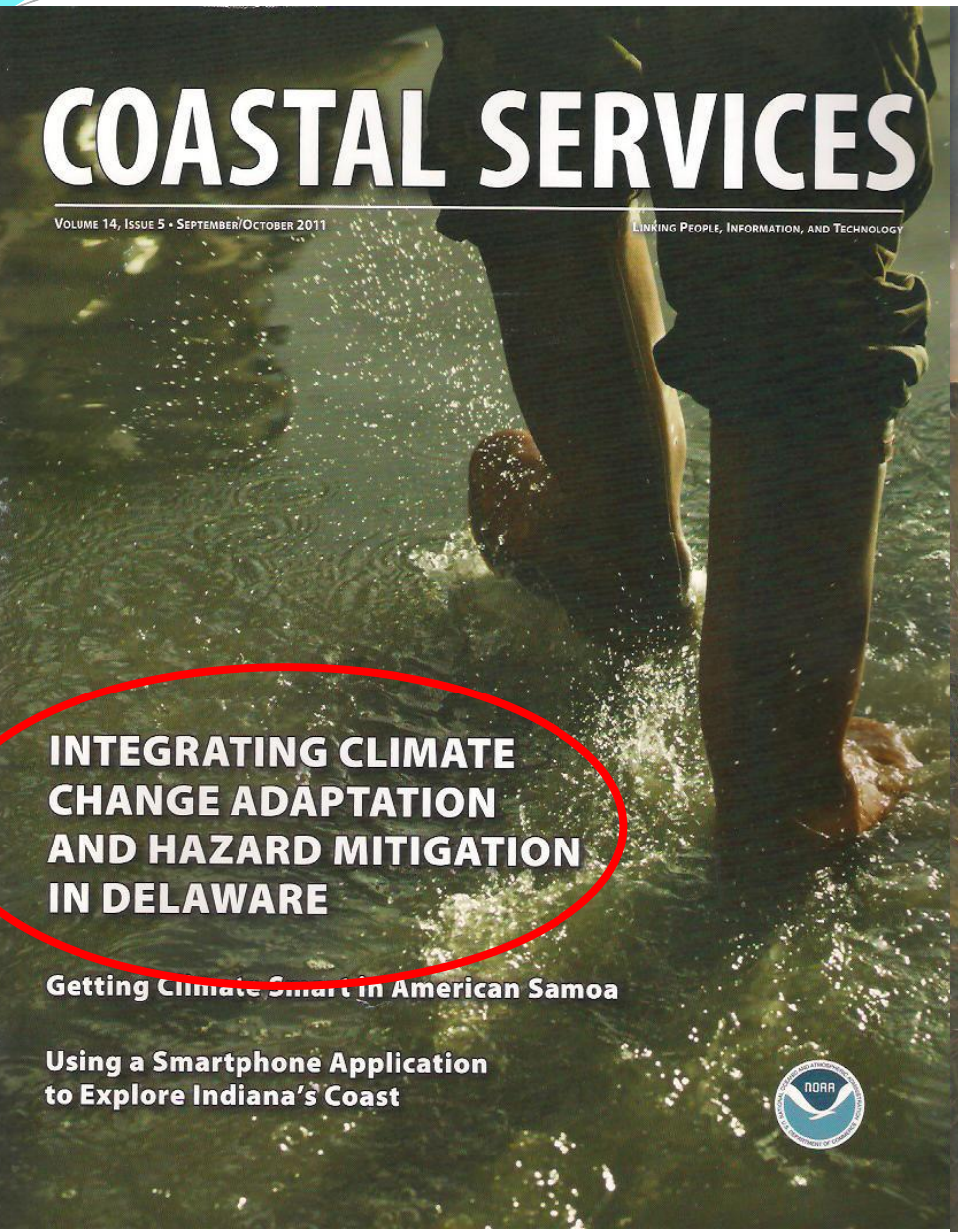
Climate Change / Sea Level Rise / Tsunami / Storm Surge Mitigation

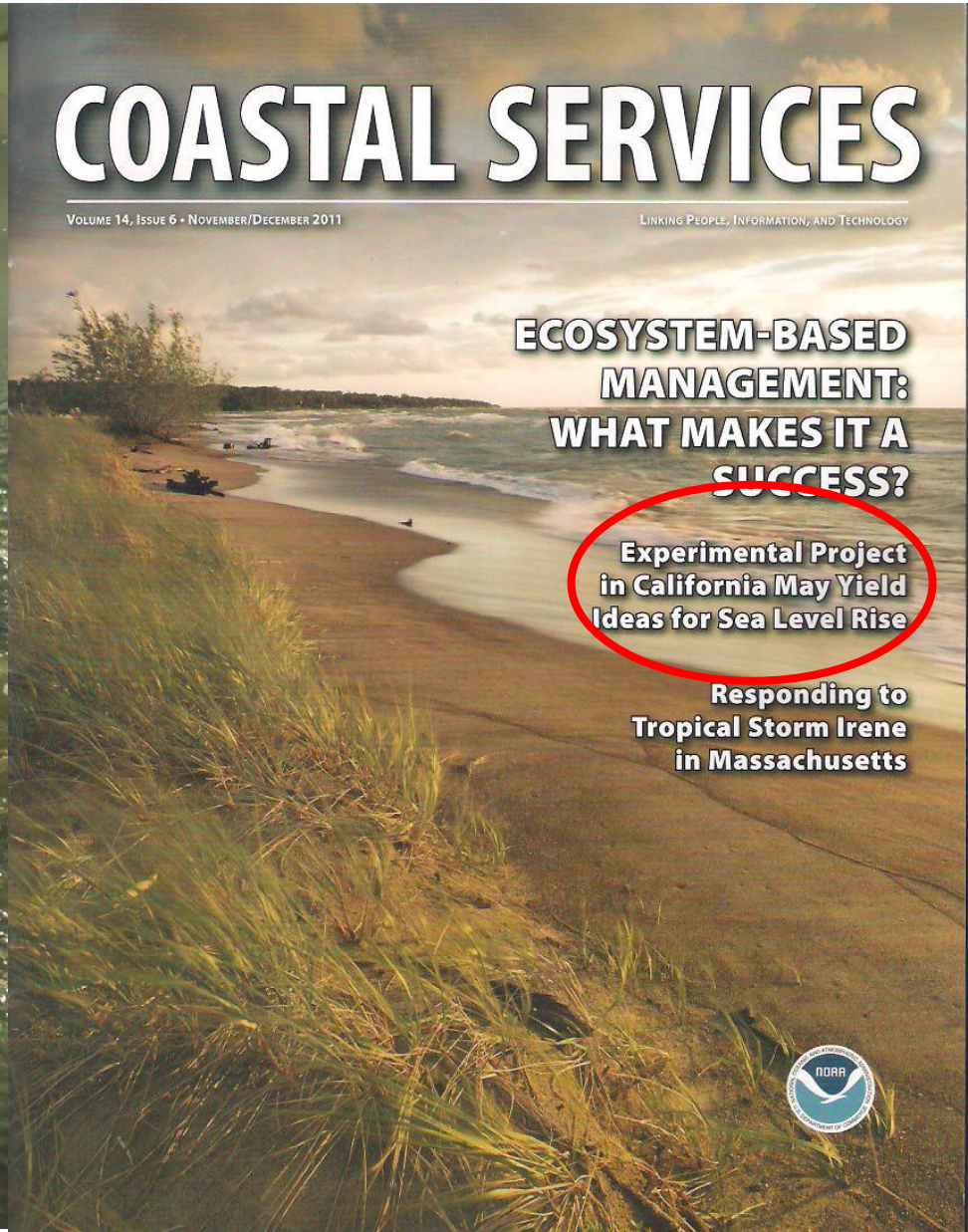






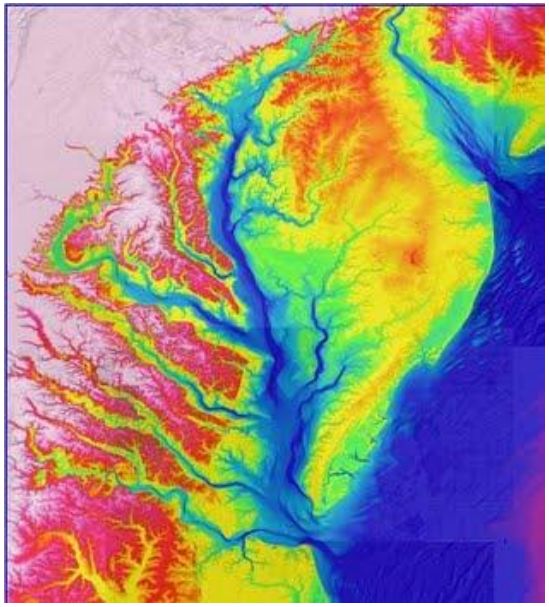


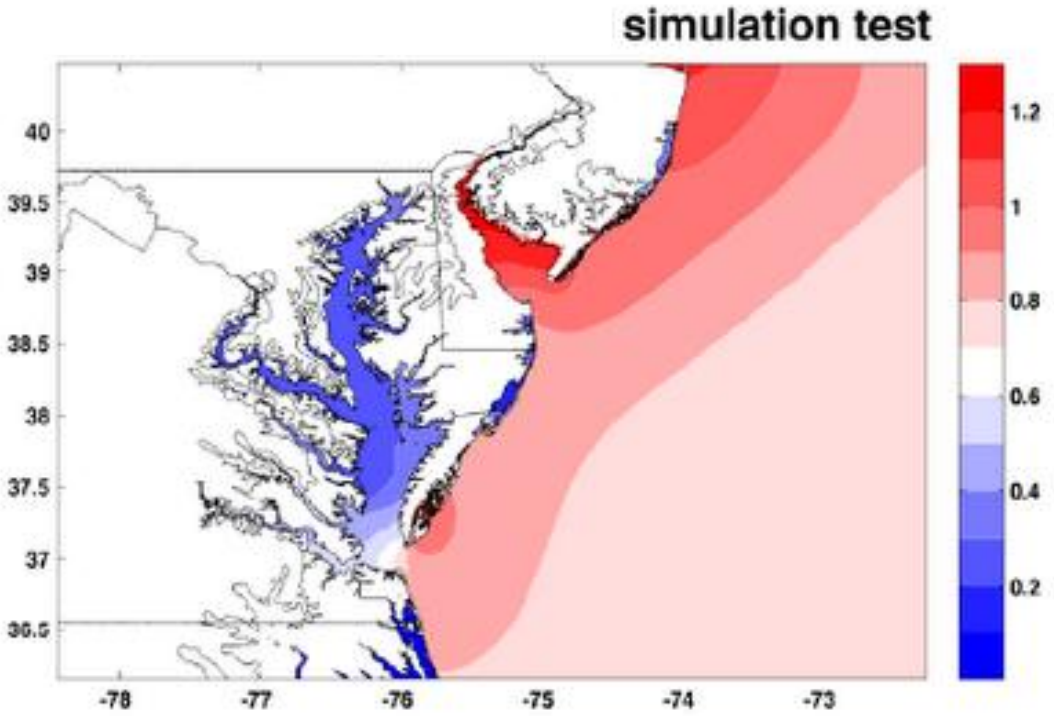

COASTAL SERVICES
Volume 14, Issue 5 • September/October 2011
Linking People, Information, and Technology
INTEGRATING CLIMATE CHANGE ADAPTATION AND HAZARD MITIGATION IN DELAWARE
Getting Climate Smart in American Samoa
Using a Smartphone Application to Explore Indiana's Coast
NOAA


COASTAL SERVICES
Volume 14, Issue 6 • November/December 2011
Linking People, Information, and Technology
ECOSYSTEM-BASED MANAGEMENT: WHAT MAKES IT A SUCCESS?
Experimental Project in California May Yield Ideas for Sea Level Rise
Responding to Tropical Storm Irene in Massachusetts
NOAA

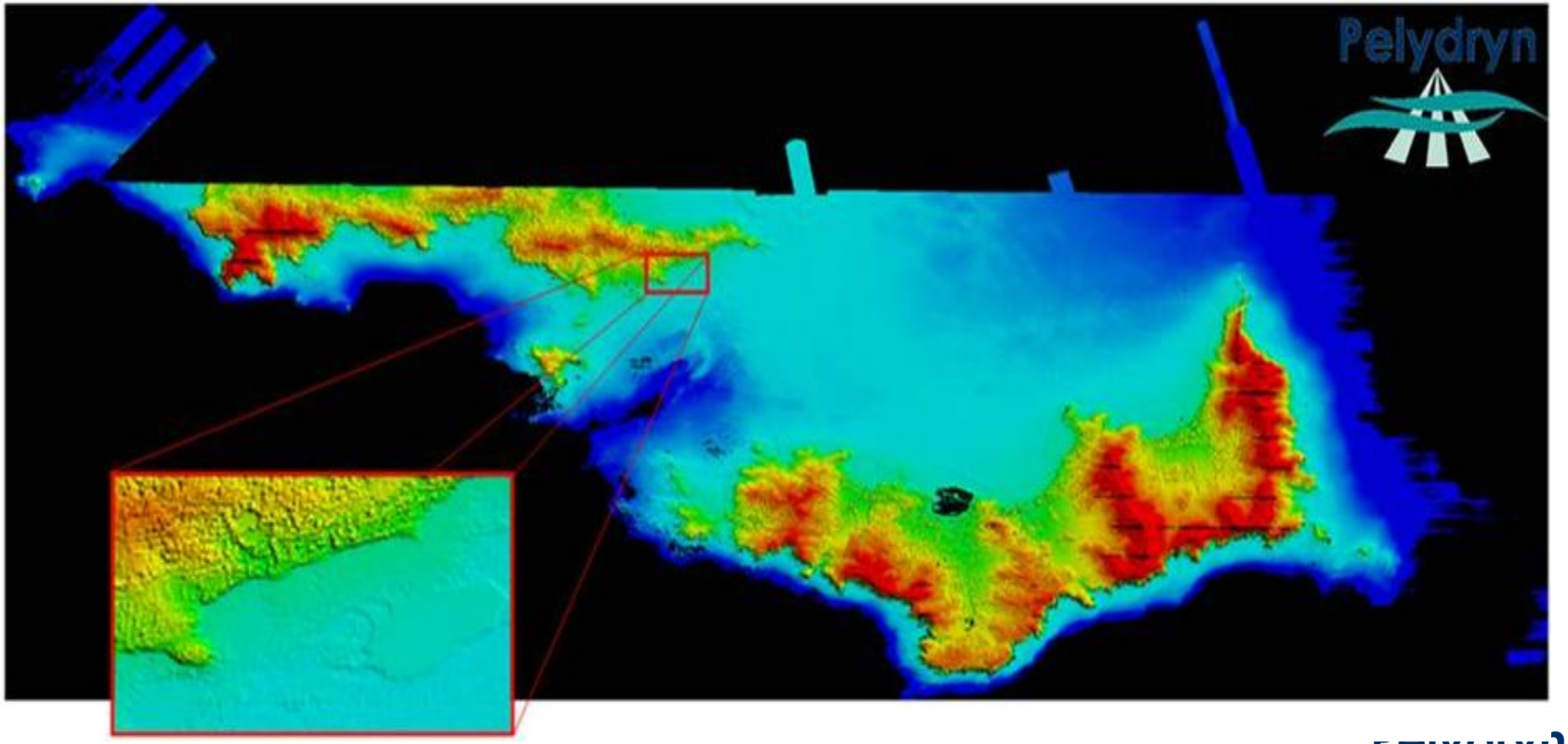
Current uses of combined Topo/bathy data
Storm Surge Modeling - NOAA

- **Ideal foundation dataset on which to base:**
  - **Storm Surge/Climate Change modeling**
  - **Infrastructure design**





Current uses of combined Topo/bathy data
French Hydrographic Office (charting)

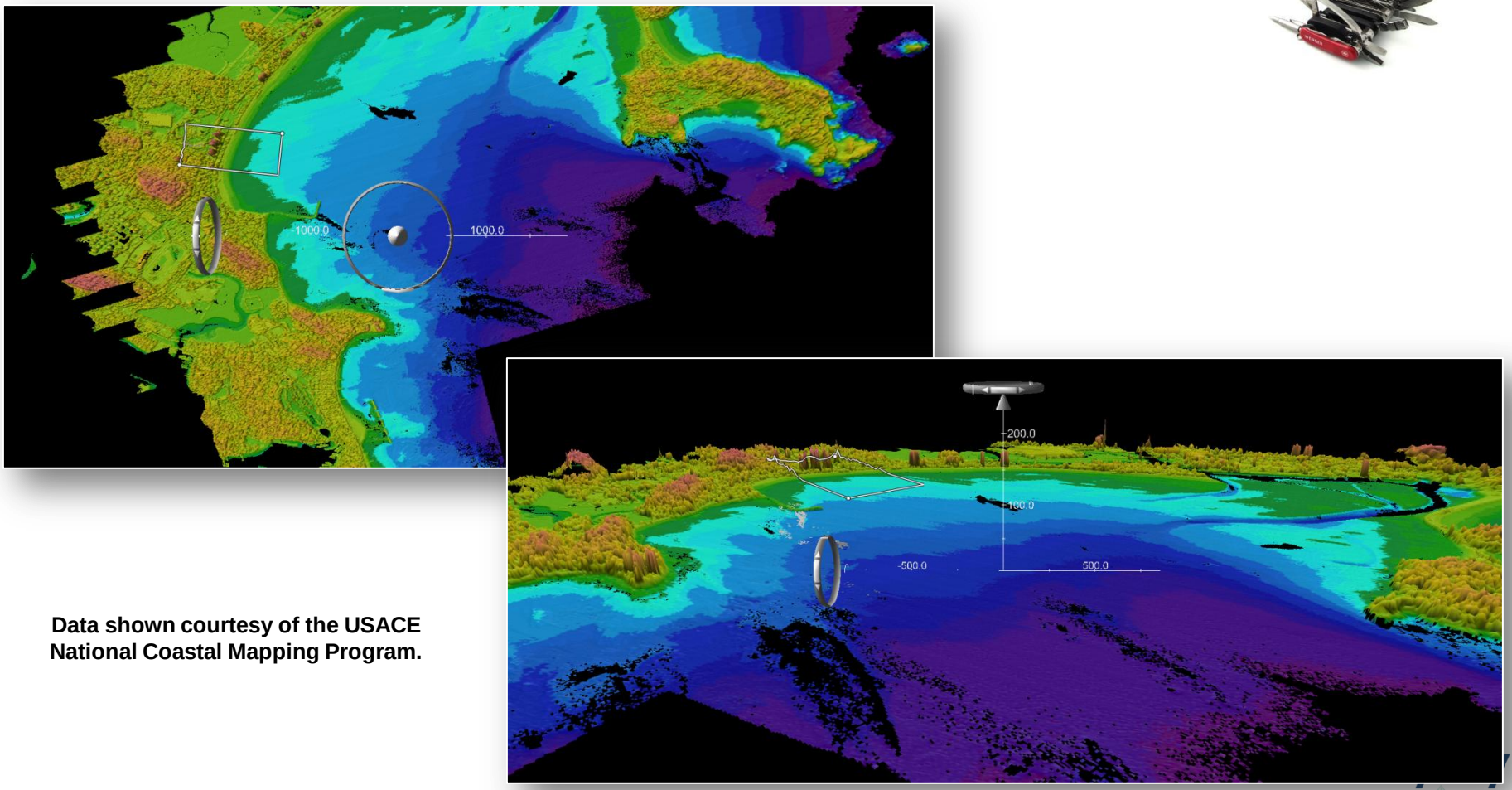


Current uses of combined Topo/bathy data

Maine to New England
Survey Area 1500 SqKm

US ACE National
Coastal Mapping Programme

Current uses of combined Topo/bathy data
New England, USA



Data shown courtesy of the USACE National Coastal Mapping Program.

Current uses of combined Topo/bathy data
Irish Government – EEZ Delineation

Ireland – Not a place for rapid boat work! Mannin Bay,

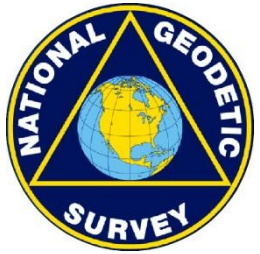
Pelydryn

Sharing between Agencies

US Army Corps of Engineers®

Inter-American Development Bank

THE UNITED KINGDOM HYDROGRAPHIC OFFICE



Wyn Williams

CEO

Pelydryn Ltd
Merlin House
1, Langstone Business Park
Newport
Wales
NP18 2HJ
Tel: +44 (0) 1633 415 370
Email: *wyn@pelydryn.co.uk*
Fax: +44 (0) 1633 415371

Rupert Forester-Bennett

Pelydryn LLC (USA)
4116 Whiting Street
Mount Pleasant
South Carolina
USA
29466
Tel: +1 (843) 793 9193
Email: *rupert@pelydryn.org*