# Integration of MBES and ALB for ENC Charting Surveys and Capacity Building Issues

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# North Jeddah: The Project

- Project for the **General Commission for Survey,** Kingdom of Saudi Arabia
- 2009 pilot hydrographic IHO/ENC charting project **”North Jeddah”** (*The Red Sea Coastal Zone, area between “Sha’ab Naza” and “Sha’ab Al Kaber*”) awarded to Fugro

# Project Overview

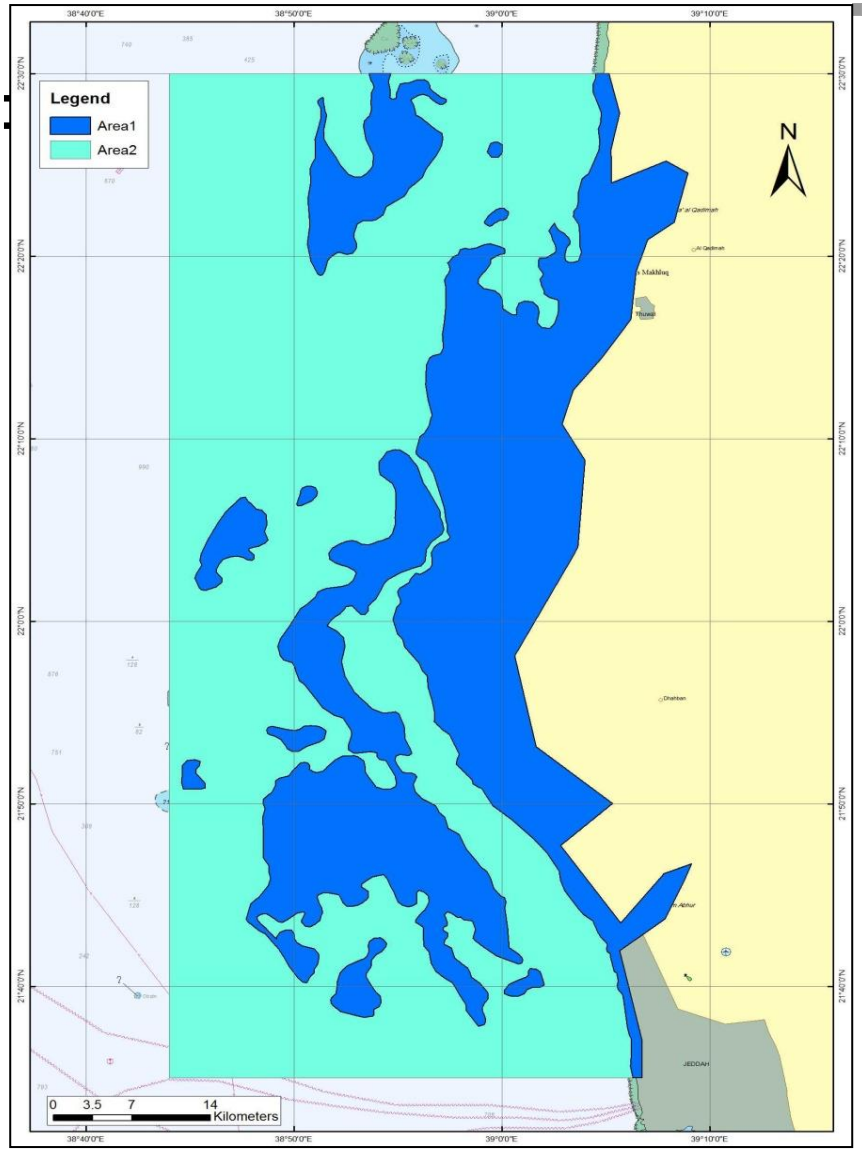
- Survey of complex coastal and deep water tropical bathymetry for IHO S44 standard navigational charting and port engineering near Jeddah, Red Sea, Kingdom of Saudi Arabia
- Total area: >3000 km$^2$
- IHO Order 1a
  - Full seabed coverage
  - Compliant target detection
    - For MBES
    - For ALB
- Deep water to land-sea interface
  - Up to 3km inland

# Project Overview

- Integration of :
  - Vessel-mounted Multibeam Echo Sounding (MBES) and Single-beam Echo sounding (SBES) bathymetric survey
  - Airborne Light Detection and Ranging (ALB) LiDAR bathymetric survey
- Additional (but not limited to) remote sensing:
  - Side scan sonar
  - Metocean – (Tide and current measurement)
  - Water quality
  - Geotechnical evaluation
  - Geodetic Control and Datum transfer survey

# North Jeddah: Acquisition Overview

- Total Project surveyed area: 3852 km$^2$
- MBES: 2635 km$^2$ (Area 2)
- LIDAR: 1517 km$^2$ (Area 1)
- Mar-June 2010 data acquisition period



# Project Challenges

- **Essential Elements**
  - **Communication** – effective meetings, internet application, briefings and handovers
  - **Procedure** - common task-focus and safe practices.
  - **Delegation** – diverse task-sharing and liaison within the Project Group
  - **Coordinated Client relationship building** – with ready Client access to both the survey team and Contractor Management in a mutually progressive consulting process.

# MBES/LiDAR Data

- **Merge and Final Products**
  - Higher data point resolution for MBES systems over bathymetric LiDAR.
  - High standard deviation values in any overlap avoided by trimming LiDAR data to an agreed overlap boundary before delivery for merge with MBES data.
  - CARIS HIPS was used to incorporate both MBES and LiDAR data within the project structure.
  - Application of final tidal modelling and any geodetic adjustment applied to one final, fully- incorporated data set.

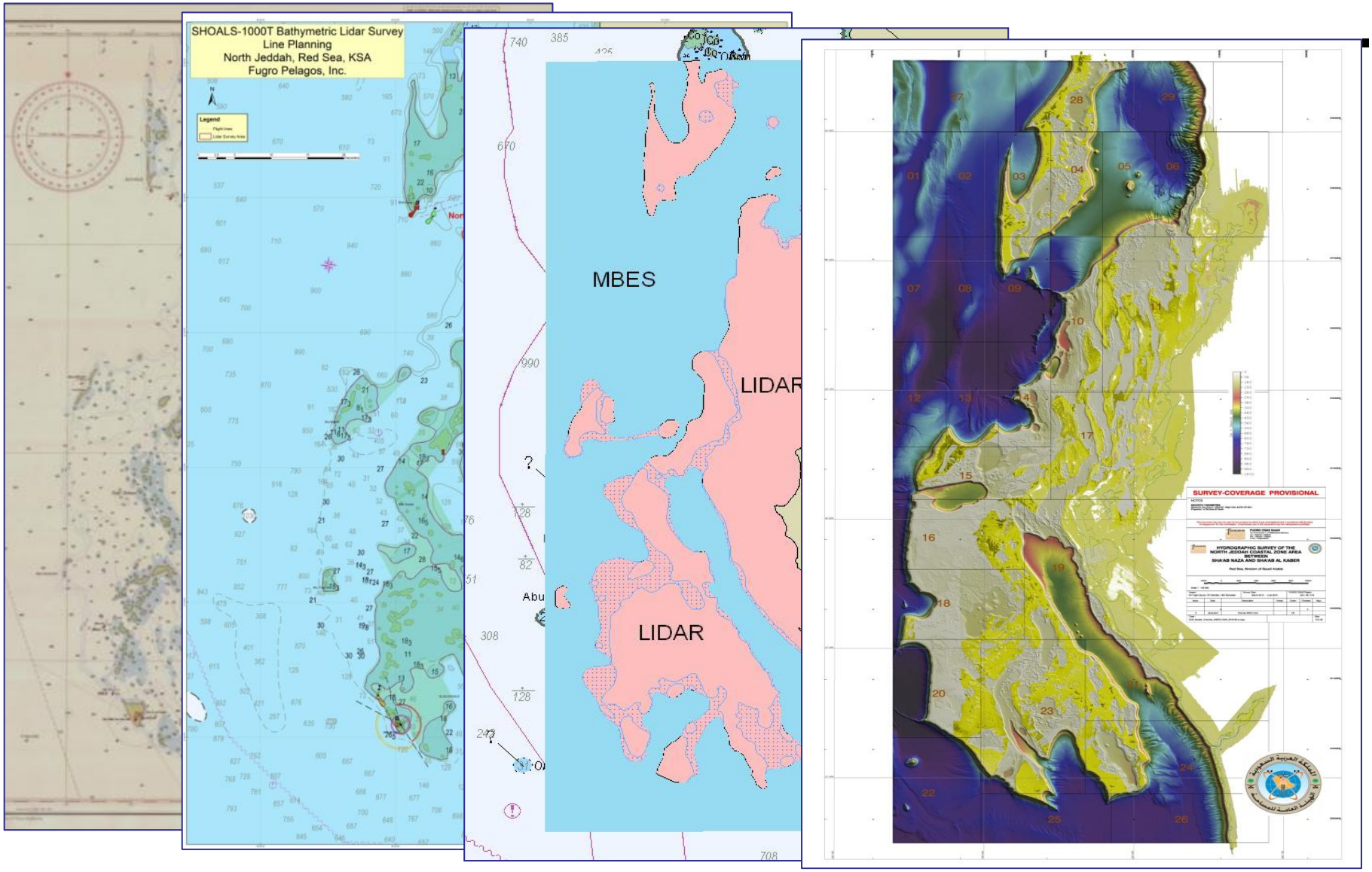
# North Jeddah: Vessel Acquisition

- MBES:
  - 3 vessels
  - 5 MBES systems
    - Full ocean depth range
- Side-scan sonar; Magnetometer
- 112% utilization (i.e. 12% above planned efficiency target)
- Fully compliant acquisition program
- 97% Acquisition in 5 weeks of operation

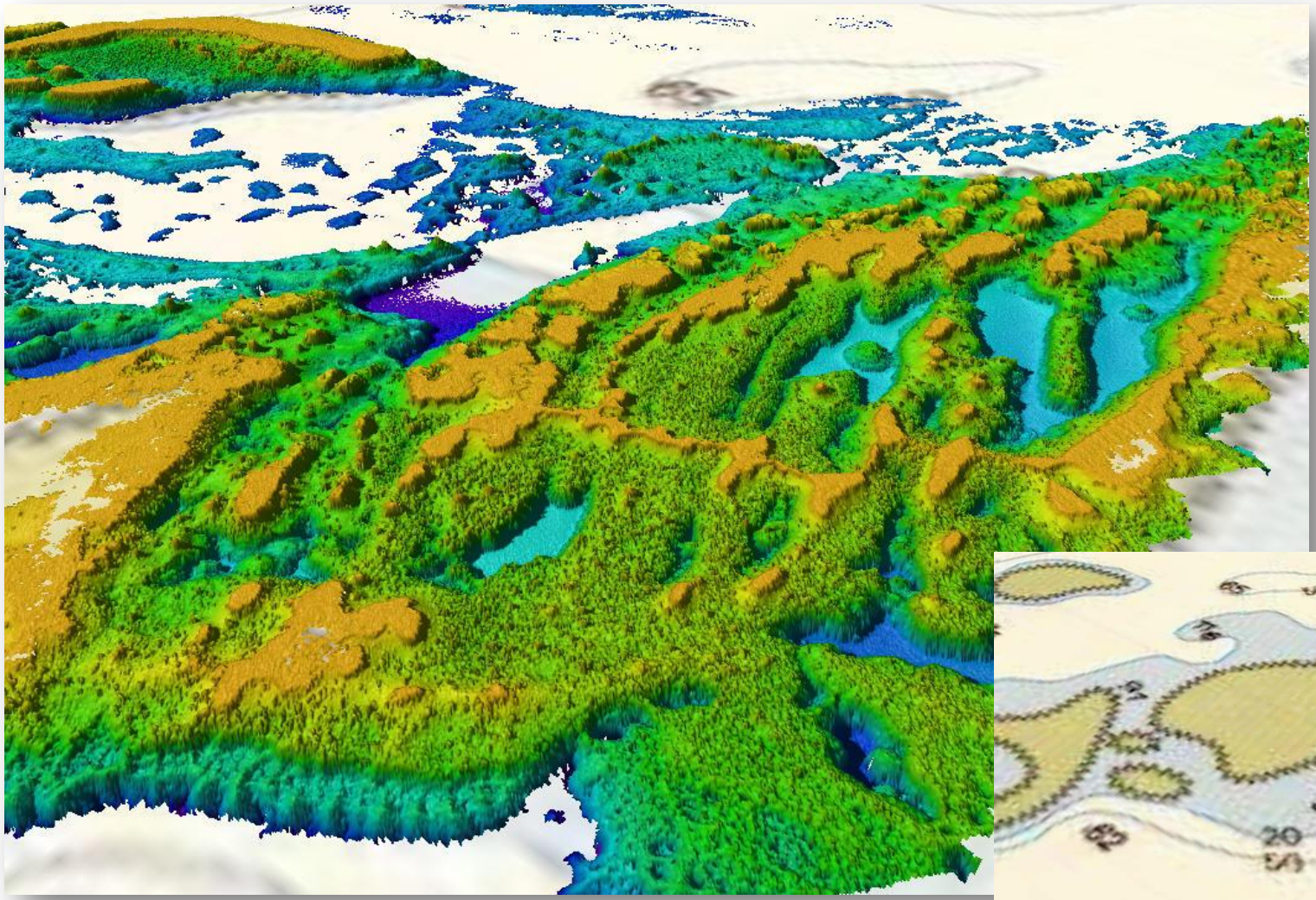
# North Jeddah: Airborne Acquisition

- LIDAR:
  - 4 flights per day
  - 5 days per week
  - total 445 hrs flying
  - 2049 flight lines
  - 395 hrs data collection
- 1KHz Lidar
- 4mpix digital camera
- Hydro and topo capability
- 89% utilisation (data collection vs. flying)

# North Jeddah Project: Chart Data Progression



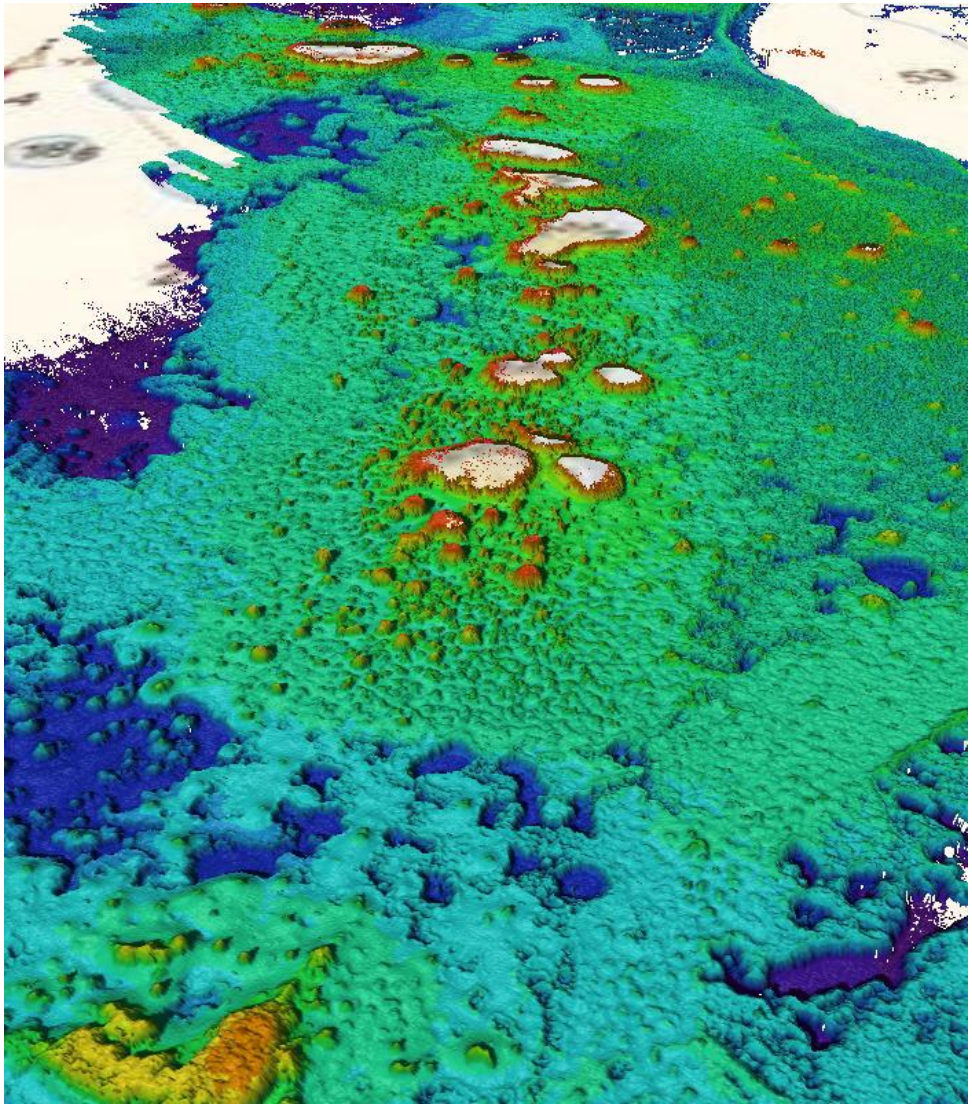
# North Jeddah: Chart Comparison



Complex reef morphology

# North Jeddah: Chart Comparison


Larger drying coral approx. 100x200m



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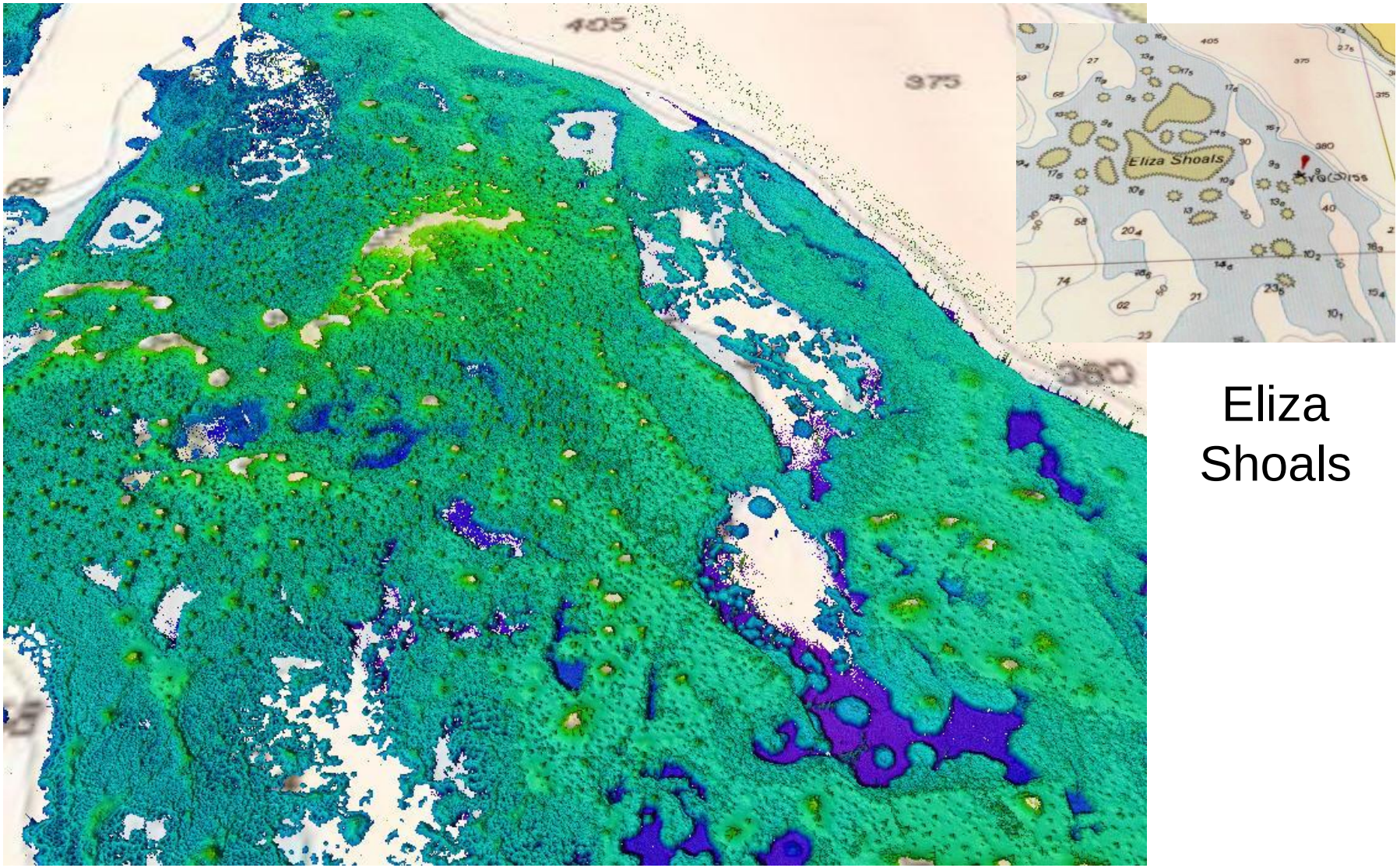
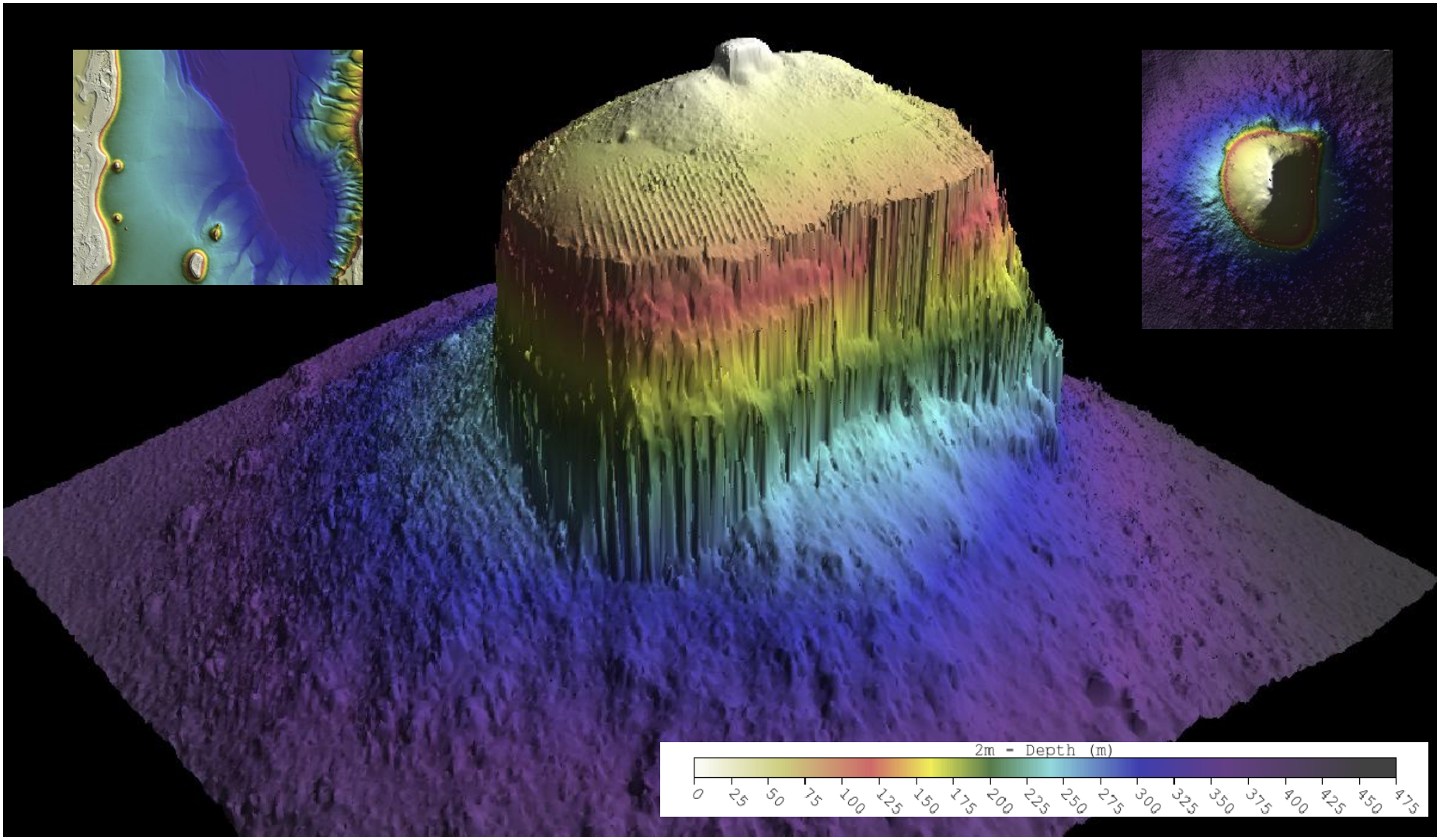



Eliza Shoals

# North Jeddah: Chart Comparison

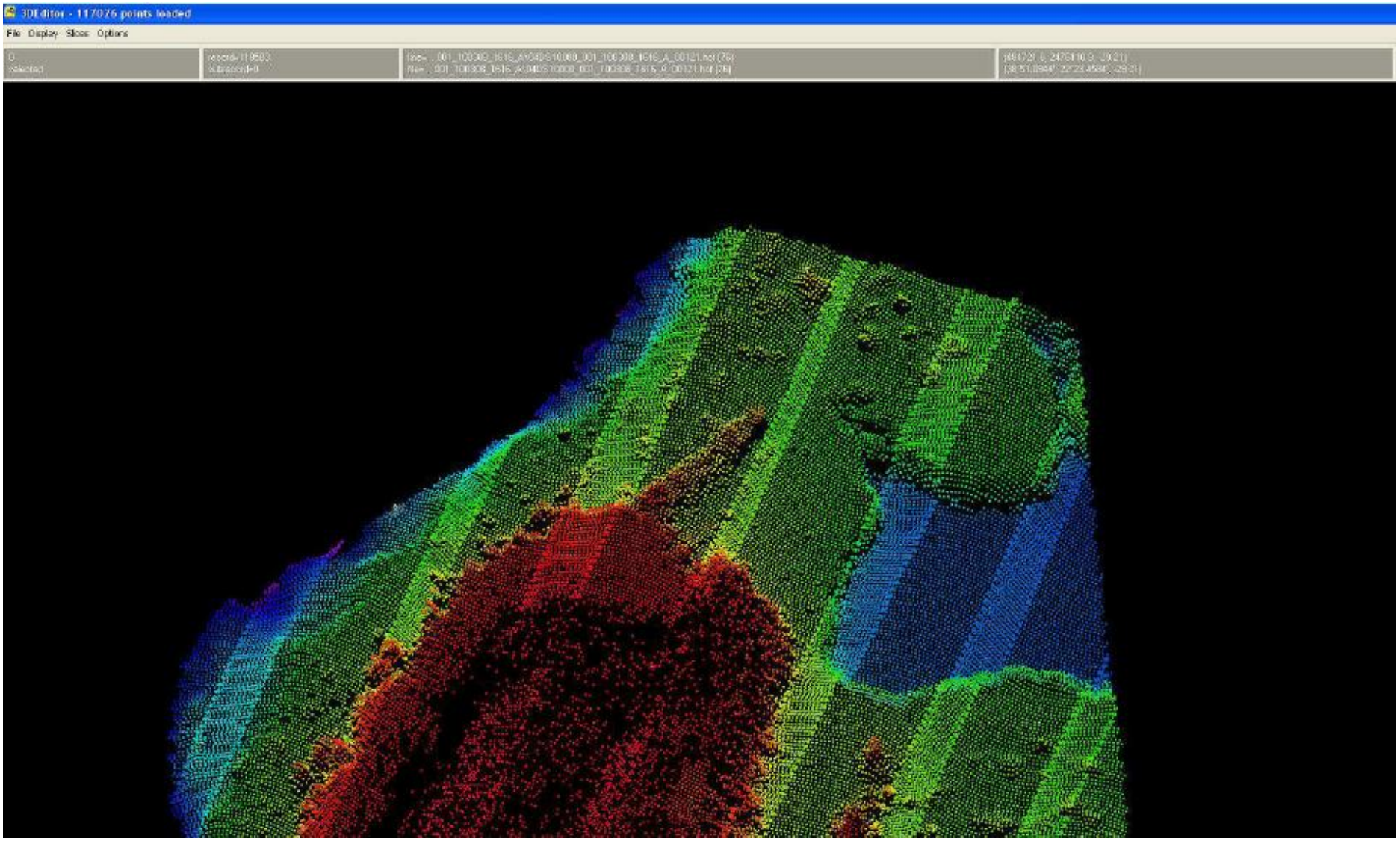
View south from Tuwwal showing both terrestrial and bathymetric LiDAR Coverage (from the SHOALS 1000 system)

# North Jeddah: High Resolution MBES
# Deep to Shallow Water on ‘sea-mount’

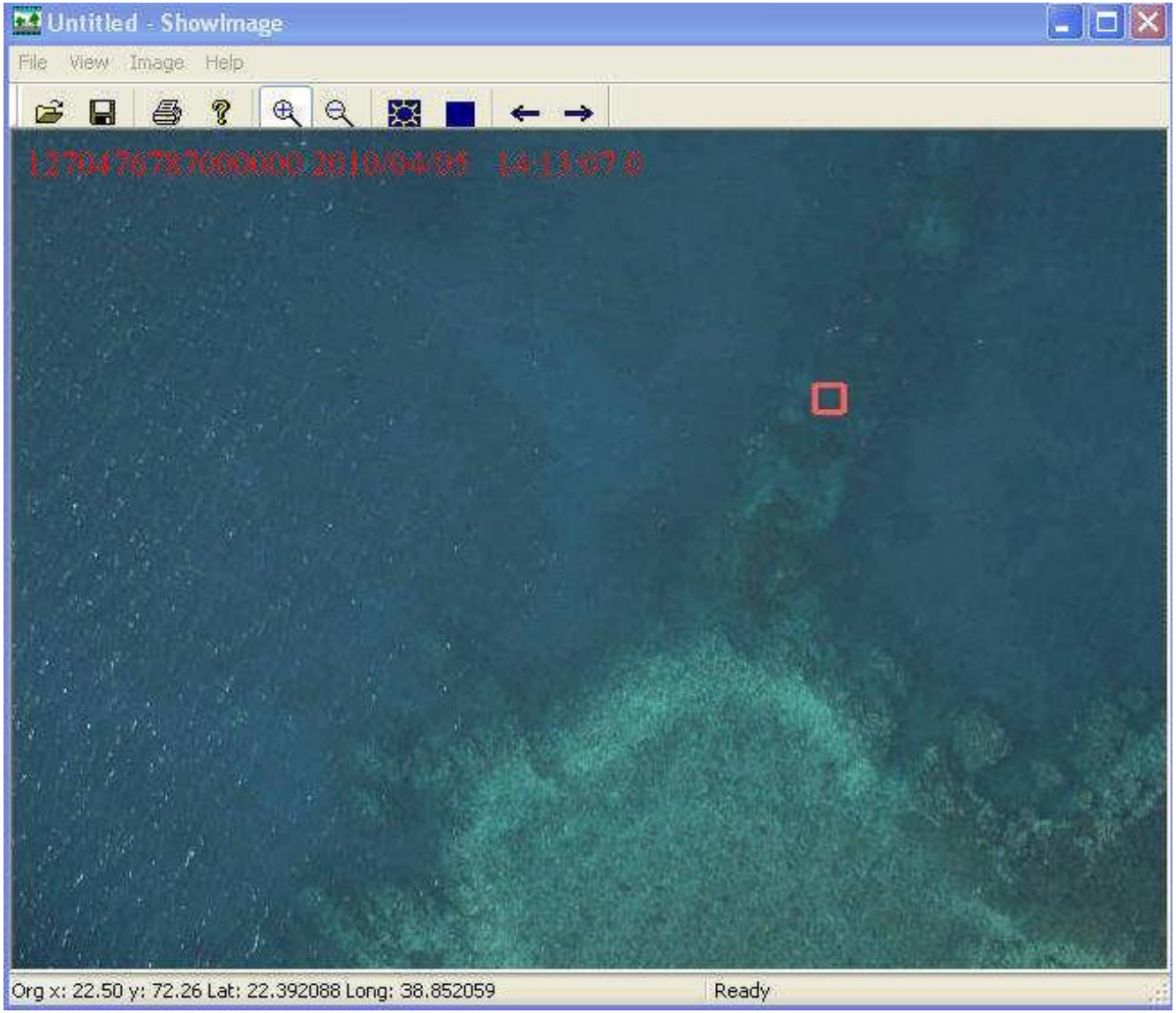



Seamount Feature shoaling from 355m to 2m

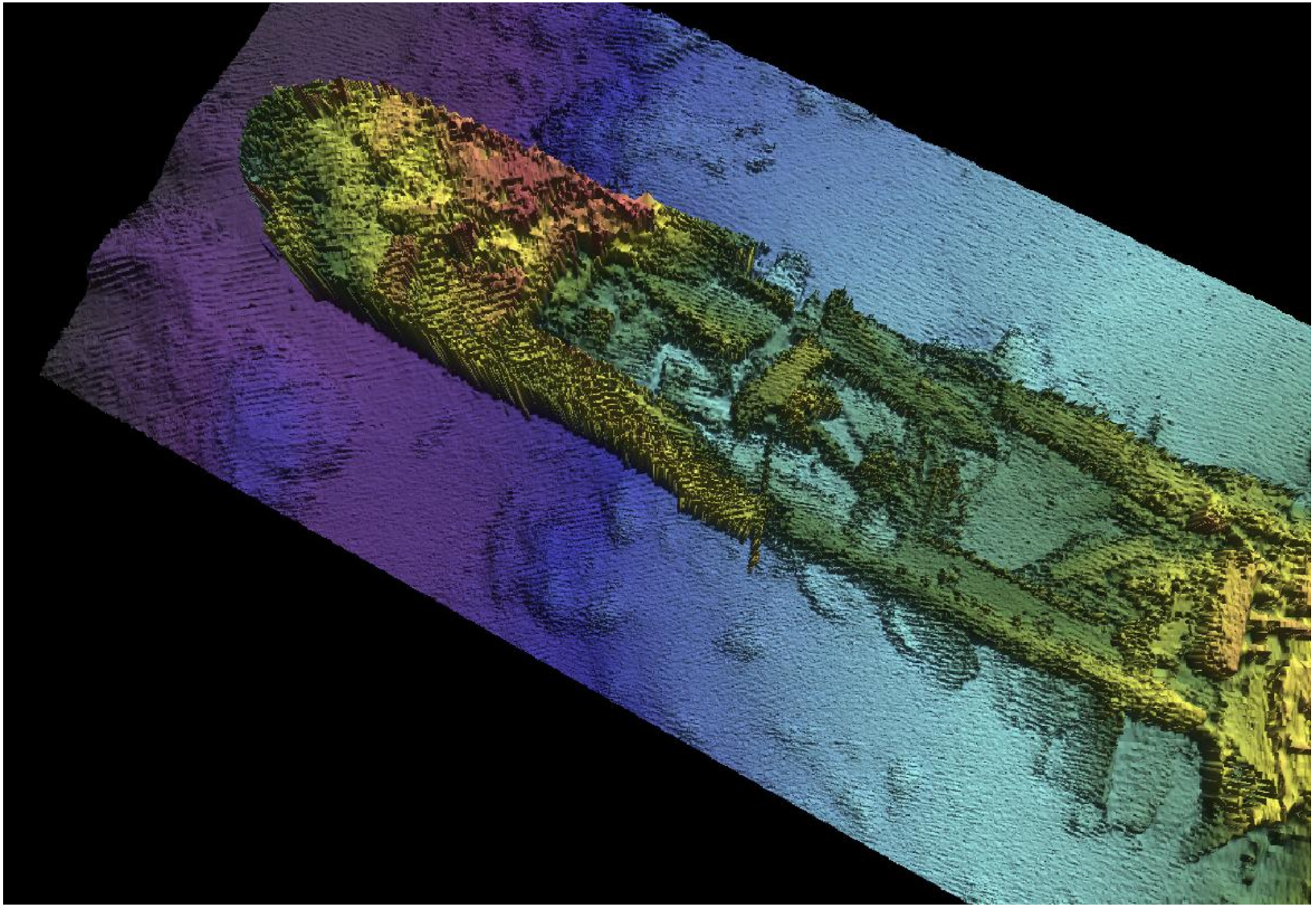
# North Jeddah: Wreck inspection - LIDAR



# North Jeddah: Wreck Investigation - Imagery

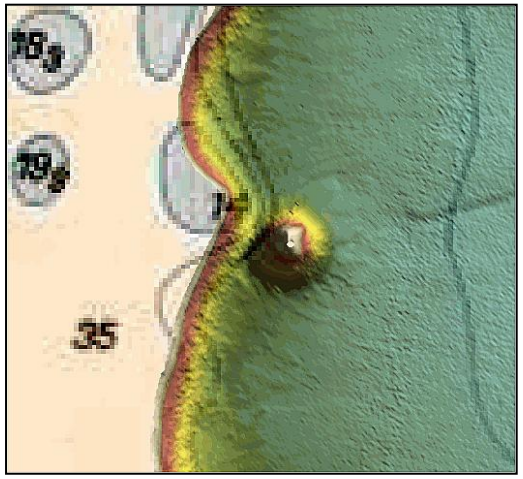


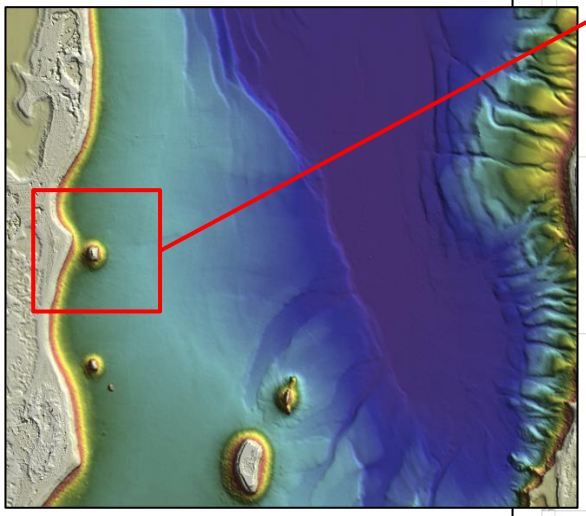
# North Jeddah: Wreck investigation – MBES

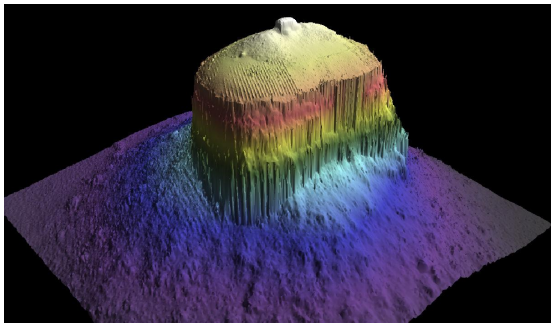


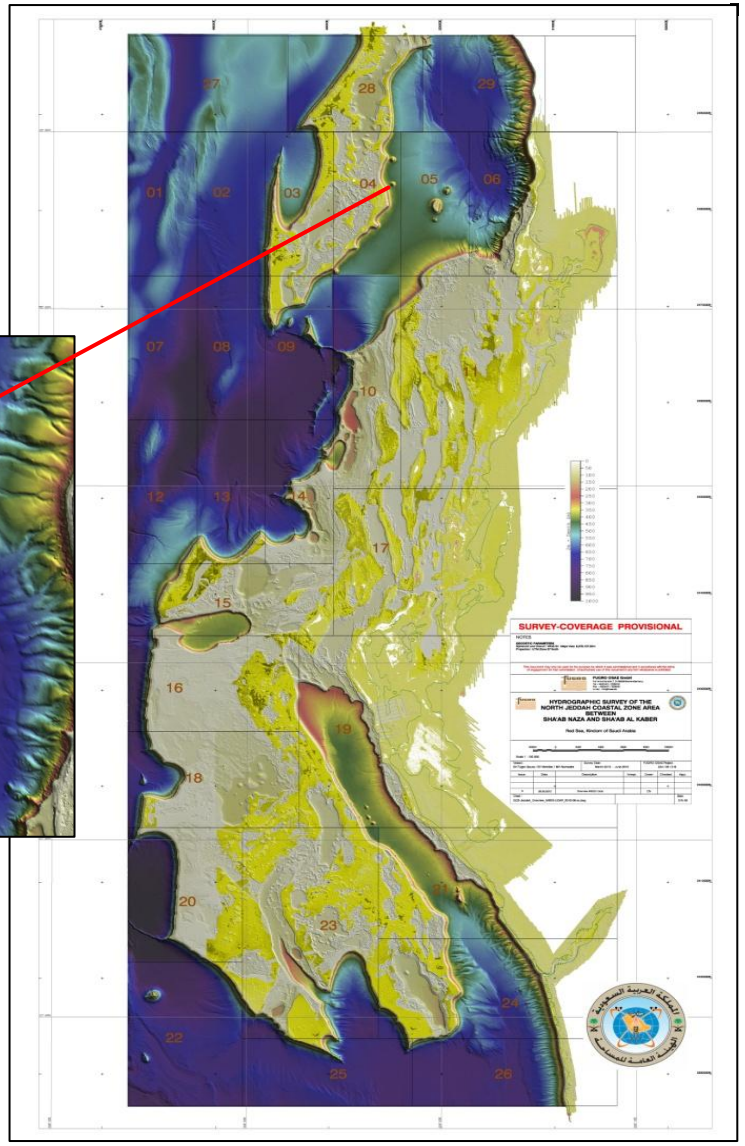
# Integration

…So a synergous approach to the survey with all sensors utilized in concert can provide seamless data from deep sea to several kilometres inland and detect all critical features in between









# In-Service Support for National H.O.s

- In-Service Support (ISS) is another collaborative model between Industry and hydrographic agencies possessing survey assets of their own
- Several business models already established globally for ISS
- Australian Hydrographic Service is perhaps the most copied
- Fugro is long-standing technical contractor to the AHS (since 1992)
- Assets wholly owned by client
- Expertise in planning, operation, maintenance and production of both system and associated data provided by incumbent contractor
- Collaborative approach for all elements of survey encourages building of long-term, sustainable capacity for host nation

# Education Element of Capacity Building

- This is an essential component of CB
- Fundamental to maintenance of a national core competency
- Beneficial for employer and employee alike
- Can be difficult and costly to deliver for certain regions with current education paradigm in survey industry
- Industry, Academia and Govt. have taken steps to address this global issue

# A Global Hydrographic Industry problem

- A remote, deployed workforce
- How do you get your people to a basic (safe) standard of education and training?
- How do you maintain or improve this level of understanding?

# Concept of the Hydrographic Academy

DISTANCE E-LEARNING WITH PLYMOUTH UNIVERSITY

The Hydrographic Academy

- Distance learning hydrographic surveying courses
- Flexible learning that fits around working patterns and location
- University level qualifications and professional body recognition
- Individual CPD modules, undergraduate and postgraduate qualifications

# Current Hydrographic Academy partners

MARINE SCIENCE & ENGINEERING WITH PLYMOUTH UNIVERSITY

FOST HM

FUGRO

National HE STEM Programme

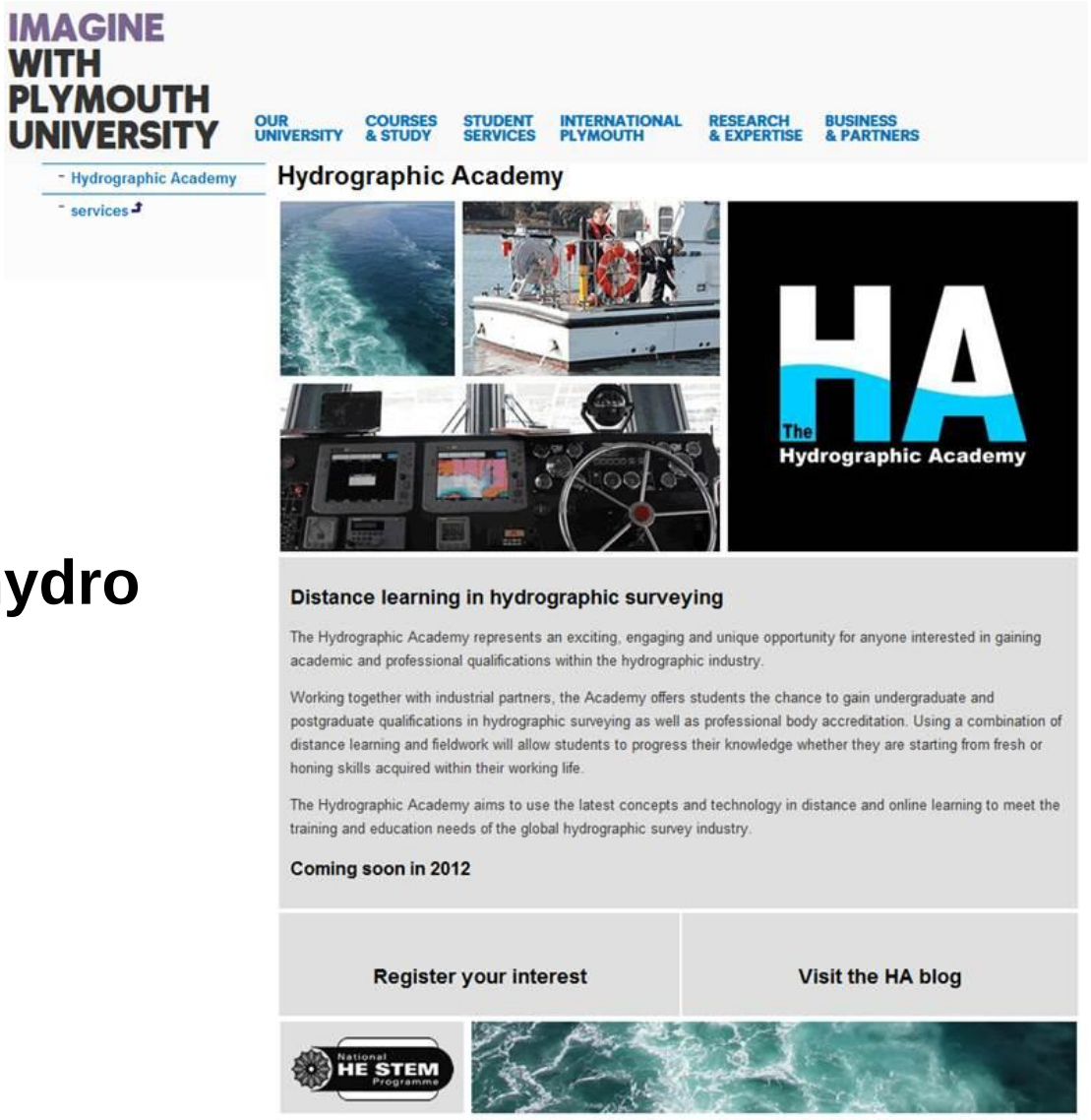
CENORE
Centre of Excellence in
Naval Oceanographic Research and Educatior

# The TLP is born

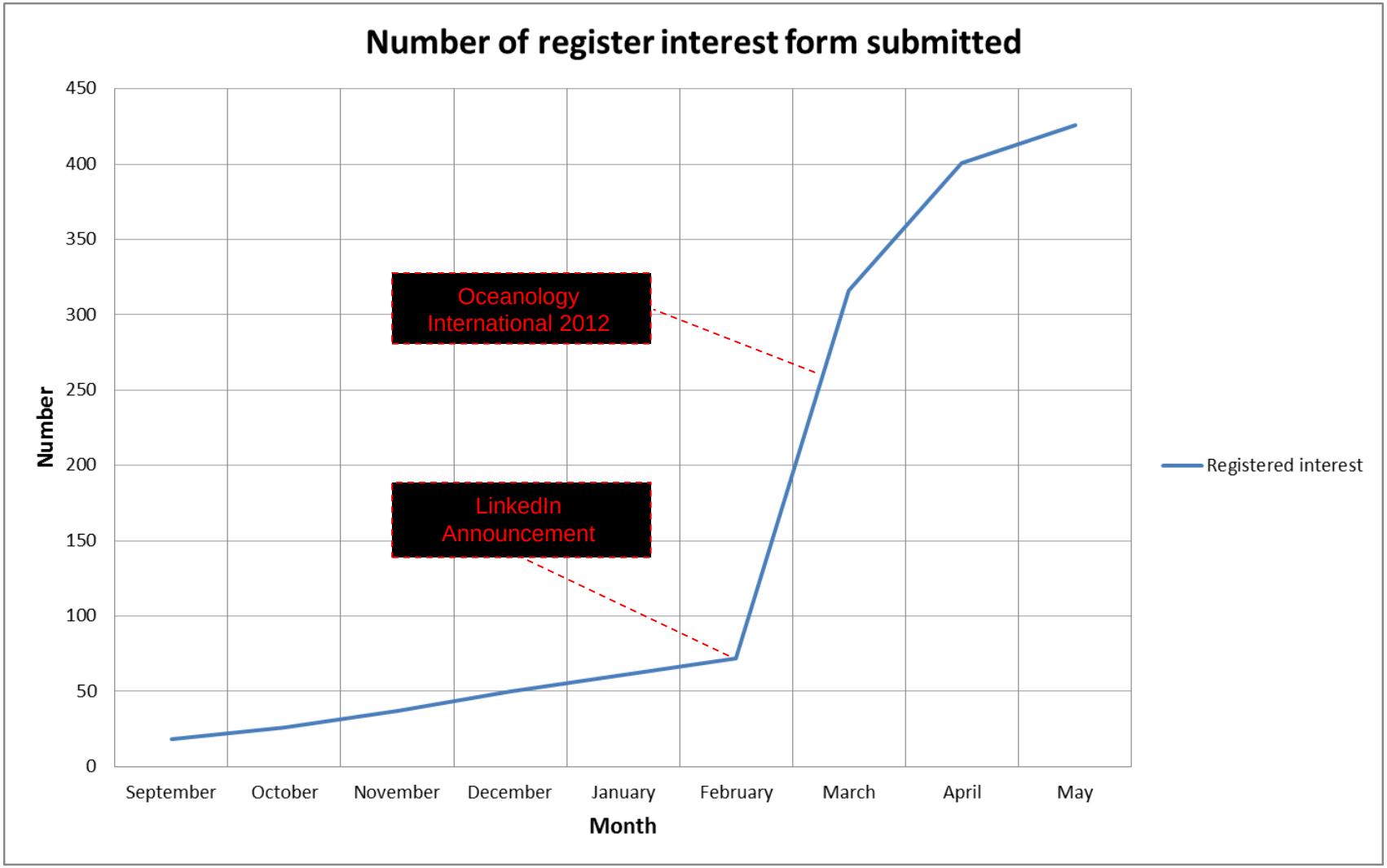
- Creation of the **T**otal **L**earning **P**ackage
- ALL Teaching materials on interactive USB Stick
- Online resources
  - Discussion groups
  - SCOLAR (Submitting Coursework OnLine and Remotely)
  - Skype and Email; Webinar etc.
- Tutor support provided via e-comms

# HA Webpage

**www.plymouth.ac.uk/hydro**



# Graph of registered interest*

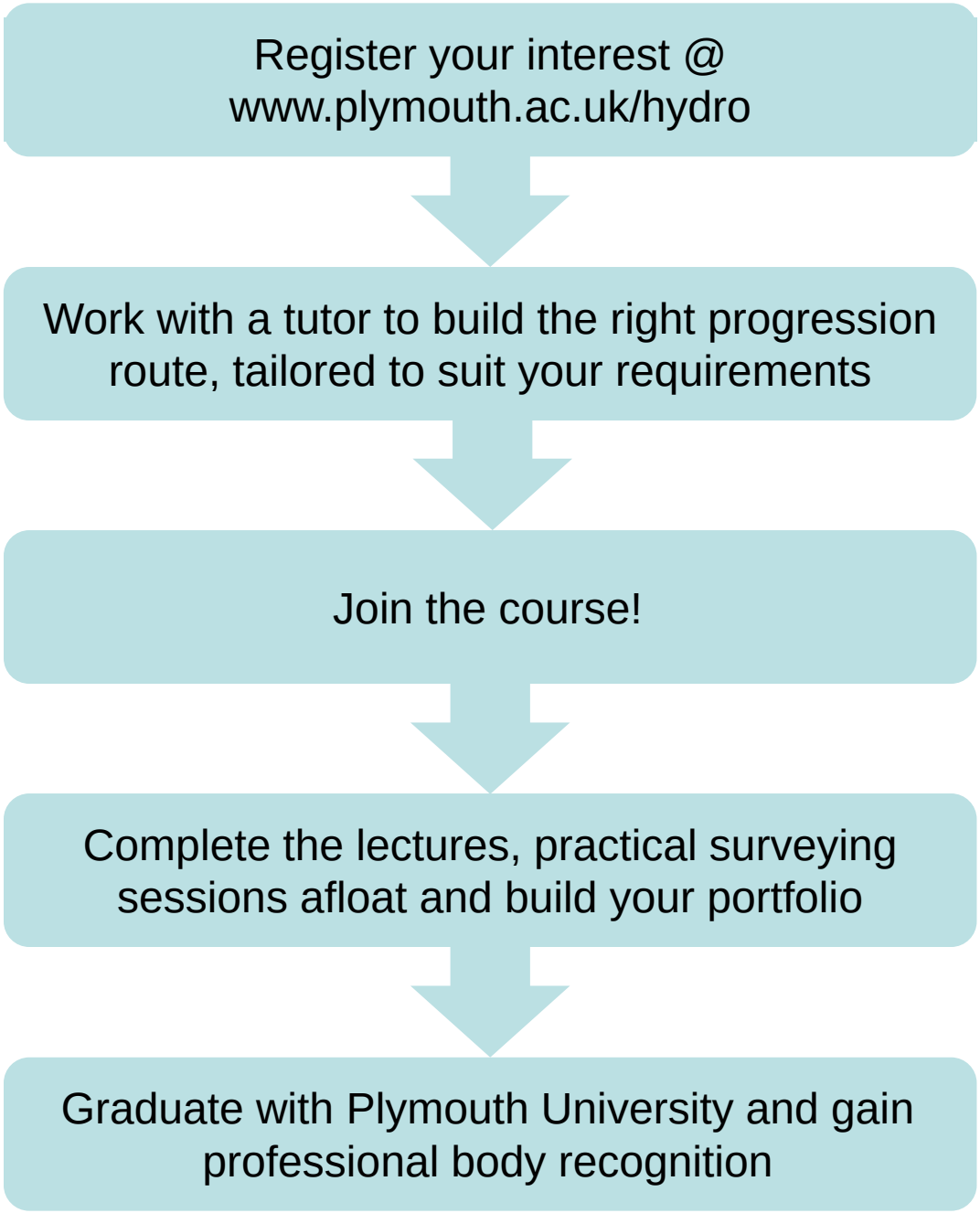



*All registrations as of 23/05/12

# Ease of access

- Whole module self-contained on a USB stick
- No need for an internet connection
- Tutor support by email/Skype
- Online discussion area

- Five steps to a degree and professional body recognition



# Thank You