The GEBCO-Nippon Foundation Alumni Team's Success Story:

Winners of the Shell Ocean Discovery XPRIZE challenge

Dr Rochelle Wigley
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Context: Map the ocean floor

The UN Decade of Ocean Science for Sustainable Development (2021-2030):
Research and Development Proposed Priority Areas:
Map the entire ocean floor and processes

Forum for Future Ocean Floor Mapping (June 2016)
~150 senior representatives from major ocean related organisations to understand needs of community and the way forward

The Nippon Foundation-GEBCO Seabed 2030 Project
100% of the ocean floor mapped by 2030

Shell OCEAN DISCOVERY XPRIZE

Recognizing that mapping our ocean floor: Current grand challenges (2016-2019)
Need to look for disruptive ways to achieve this

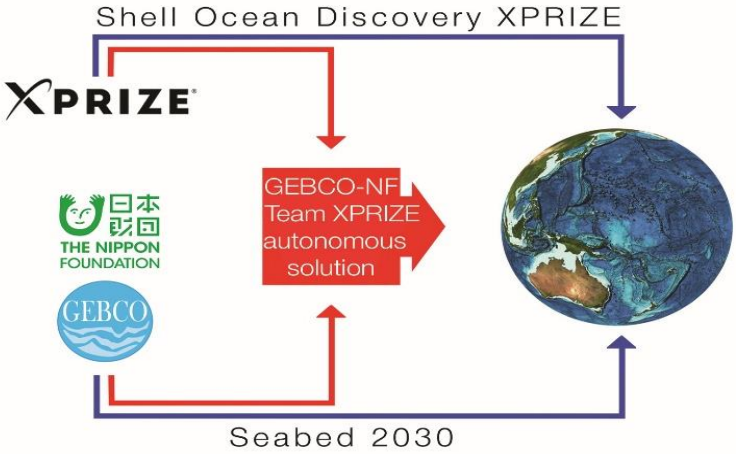
Shell OCEAN DISCOVERY XPRIZE

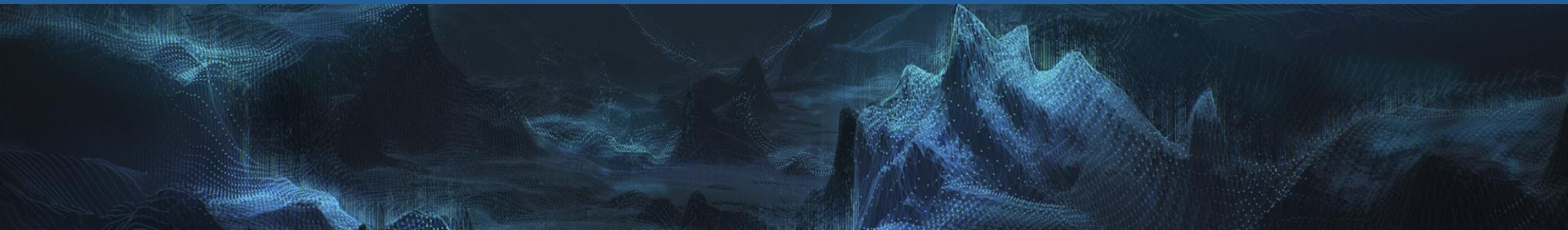
A $7 million global competition challenging teams to advance deep-sea technologies for autonomous, fast and high-resolution ocean exploration.

Create solutions that advance the autonomy, scale, speed, depths and resolution of ocean exploration
http://oceandiscovery.xprize.org

Forum for Future Ocean Floor Mapping

Meeting global challenges





14 December 2015: Prize launched at AGU

2016:

32 teams from 25 countries

Forum for Future Ocean Floor Mapping

15 July: Team registered

17 December: Submission of technical documents

2017:

21 (19) Semi-finalists : Round 1

16 February

22 March
$3.25M

THE NIPPON FOUNDATION

7 August to 19 November:
Sea trials in Horten, Norway

20-24 November
Technology Readiness Test

2018:

9 (5) finalists: Round 2

7 March

12 April
$3.09M

THE NIPPON FOUNDATION

13 June to 12 October
Sea trials in Horten, Norway

29 October to 4 November
Sea trials in Kalamata, Greece

5-12 November
Round 2 field test

31 May 2019: Grand Prize awarded

The GEBCO-Nippon Foundation Alumni Team

Capacity-building Initiative: Nippon Foundation / GEBCO Postgraduate Certificate in Ocean Bathymetry

Training a new generation of scientists and hydrographers in ocean bathymetry

Funded by:
The Nippon Foundation of Japan

Taught at:
Center for Coastal and Ocean Mapping / Joint Hydrographic Center
University of New Hampshire







Nippon Foundation / GEBCO Training Program

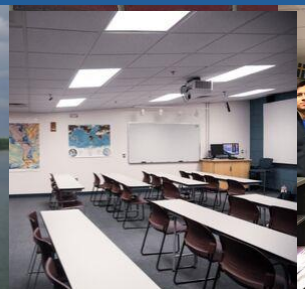
- Mix of academic and practical training
- Summer hydrographic field course
- Lab visits / Cruise participation

THE NIPPON FOUNDATION

United Nations Educational, Scientific and Cultural Organization

Intergovernmental Oceanographic Commission

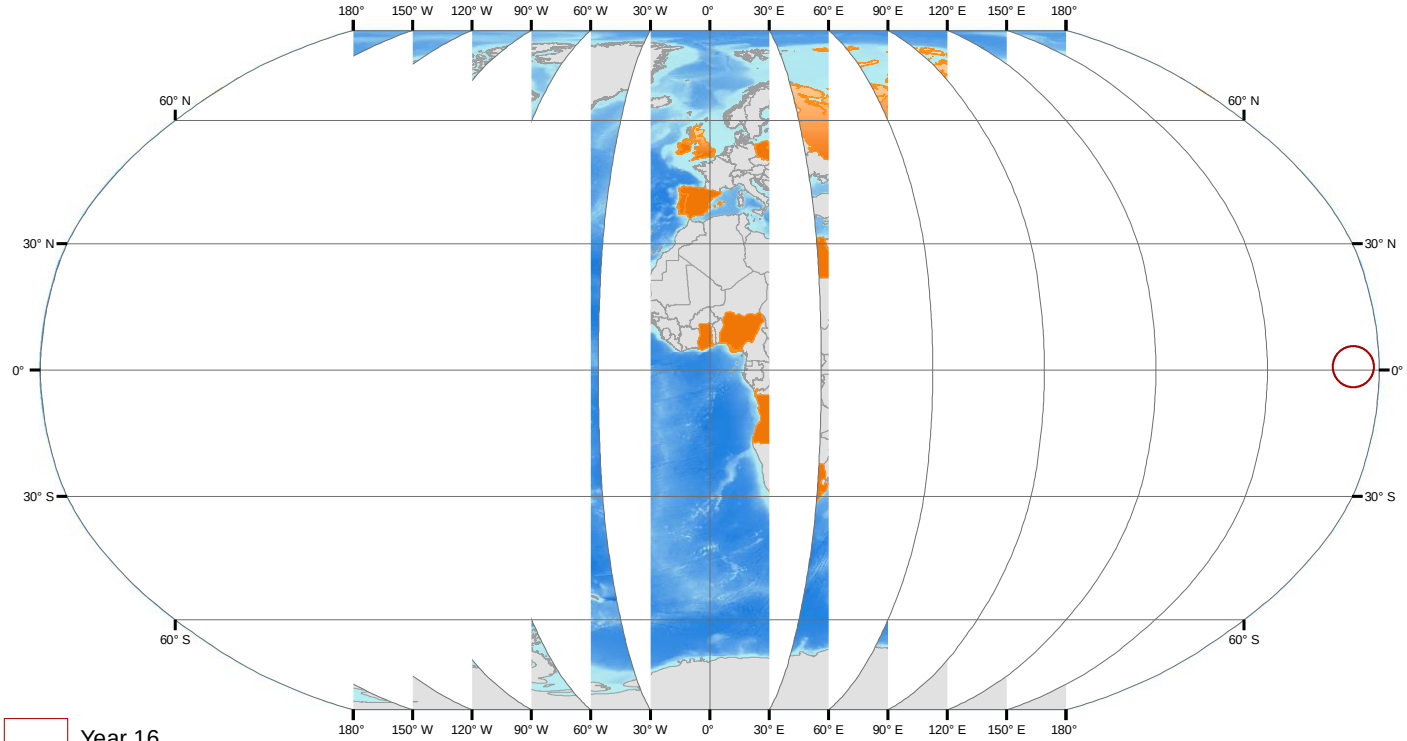
General Bathymetric Chart of the Oceans



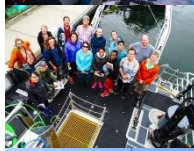










The Nippon Foundation / GEBCO Training Program
96 students from 43 countries over the last 16 years

The GEBCO-Nippon Foundation Alumni Team

GEBCO-NF Alumni

Dr Rochelle Anne Wigley
Project Coordinator and Management

Dr Yulia Zarayskaya
Geologist and Data Product Developer

Dr Karolina Zwolak
Hydrographer and Sonar Specialist

Jaya Roperez
Hydrographer and Data Processor

Hadar Sade
Hydrographer and GIS Specialist

Neil Tinmouth
Project Management and Business Development

Dr Evgenia Bazhenova
Geologist and Data Product Developer

Masanao Sumiyoshi
Hydrographer and Data Processor

Seeboruth Sattiabaruth
Surveyor

Christina Lacerda
Hydrographer and Cartographer

Tomer Ketter
Hydrographer

Ivan Ryzhov
Geologist

Dr Mohamed Elsaied
Geophysicist

Andres Fitzcarrald
Hydrographer

Aileen Bohan
Hydrographer and Data Processor

Bob Anderson
GEBCO

Robin Falconer
GEBCO

Expert Advisors

Azmi Rosedee
Hydrographer and Data Manager

Timothy Kearns
Numurus

Benjamin Simpson
Hushcraft Ltd.

Dr Alison Proctor
Technical Operations Manager Subsea Project Engineer, OFG

Dr Wetherbee Dorshow
GIS Specialist Earth Analytic

GEBCO-NF ALUMNI

THE SASAKAWA PEACE FOUNDATION

University of New Hampshire

CCOM JHC

HUSHCRAFT

KONGSBERG

OFG Ocean Floor Geophysics

EARTH ANALYTIC

esri

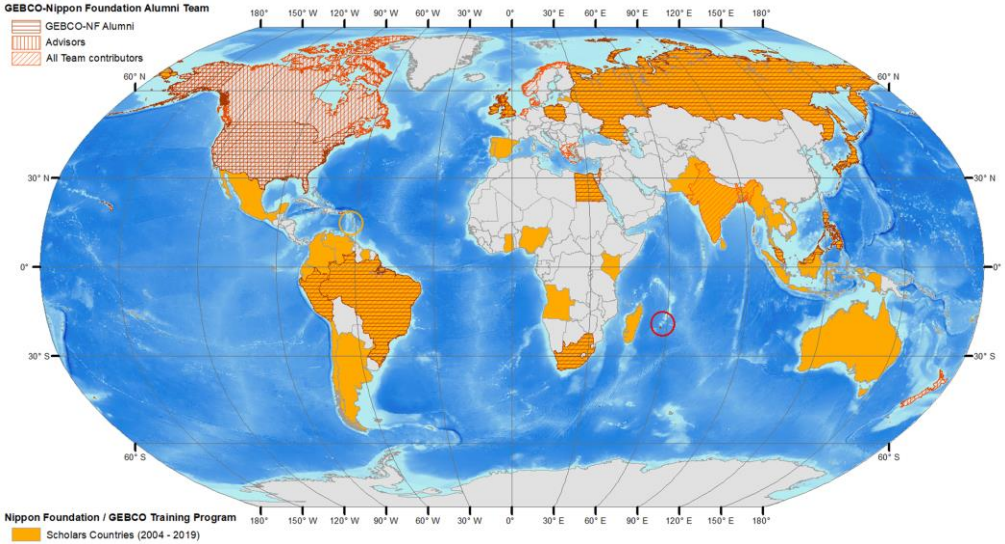
TELEDYNE CARIS

QPS.

SHIPOWNERS

OmniAccess

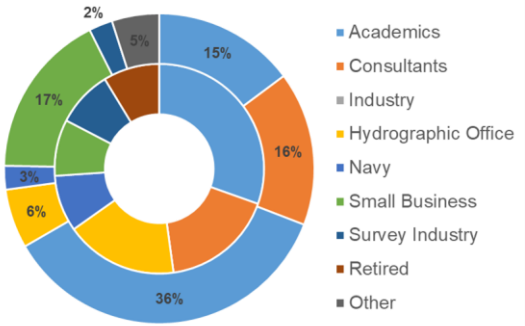
Strength Through Diversity



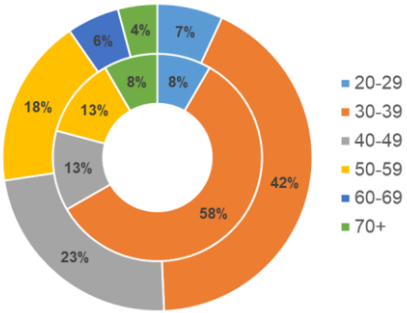
Global Distribution

The GEBCO-Nippon Foundation Alumni Team is unique in its diversity of nationalities, education, culture, age, gender and color. Our backgrounds and careers represent academia, industry, national governments, and non-profit corporations from around the world.

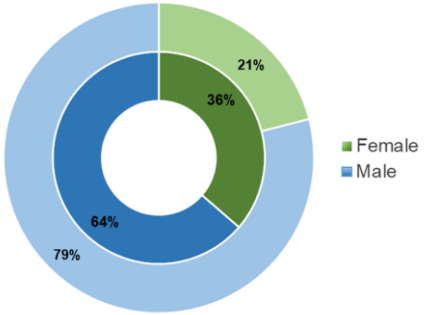
Sector



Age



Gender




FIELD TESTING
FIELD TESTING

Shell OCEAN DISCOVERY XPRIZE Requirements

14 December 2015: Prize launched at AGU

2016:

32 Teams from 25 countries

Pre-elimination phase

http://www.telemundo.com/noticias/2017/09/20/el-huracan-maria-deja-todo-puerto-rico-sin-electricidad

2017:

21 Teams from 13 countries

Round 1
Min. **100 km²** in **16 hours**
48 h of data processing
Max. Depth – **2,000 m**

Round 1
Technology Readiness Test

2018:

finally 5

9 Teams in the Final Round

Round 2
Min. **250 km²** in **24 hours**
48 h of data processing
Max. Depth – **4,000 m**

31 May 2019:
Grand Prize awarded

The Road to the Finals

14 December 2015: Prize launched at AGU

2016: **2017:** **2018:**

15-17 June: Forum for Future Ocean Floor Mapping

15 July: Team registered

17 December: Submission of technical documents

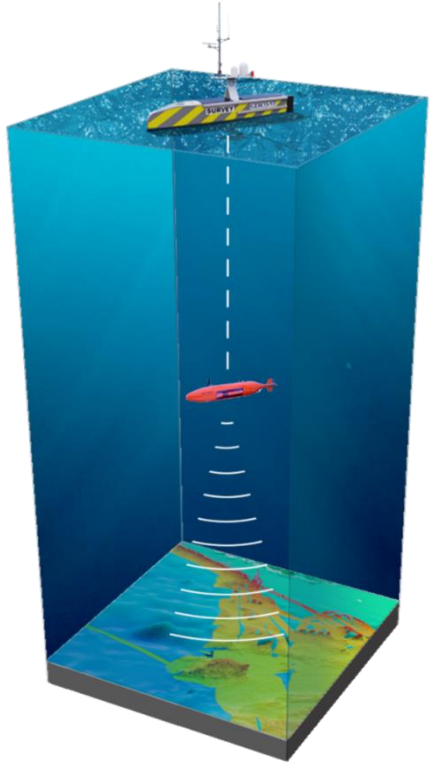
Pre-elimination phase

32 Teams from 25 countries

- **REQUIREMENT:** written description of the Team's proposed solution

Our Approach to the Challenge

Our team concept was to utilize existing technology wherever possible and to integrate these existing solutions into a **simple** concept – then address shortfall and find solution.



New autonomous surface vessel capable of deployment & retrieval of AUV

- Hushcraft Limited SEA-KIT USV *Maxlimer*
- Remote and autonomous operations facilitated by Kongsberg Maritime K-MATE.

Commercially available Kongsberg Maritime HUGIN AUV

- Round 1: Ocean Floor Geophysics AUV *Chercheur* 3,000 m
- Round 2: Kongsberg Maritime AUV *Rental 1*: 4,500 m

Fusion of seafloor bathymetry and imagery

- Fusion of EM2040 MBES, HISAS1032 real aperture bathymetry, HISAS synthetic aperture side-scan imagery, and spot-focused synthetic aperture HISAS imagery and bathymetry.

The Road to the Finals: Round 1

16 February
Round 1 semifinalist

22 March:
$3.25M

THE NIPPON FOUNDATION
For Social Innovation

SPF

21 April:
Metal cut for surface vessel

2017:

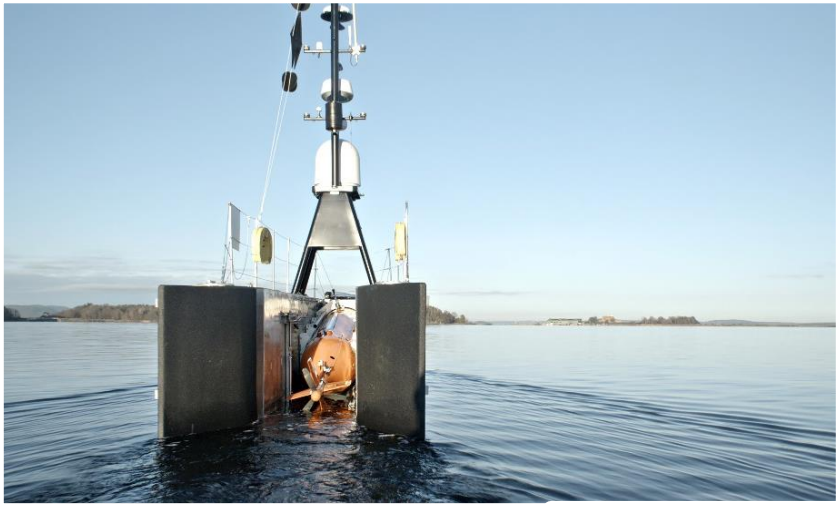
7 August to 19 November:
Sea trials in Horten, Norway

http://www.telemundo.com/noticias/2017/09/20/el-huracan-maria-deja-todo-puerto-rico-sin-electricidad

20-24 November
Technology Readiness Test

Horten, NORWAY

Sea-Kit *USV Maxlimer*



- Designed to meet XPRIZE requirements
- Allowed uncrewed deployment and retrieval of the AUV
- Acts in role of traditional “mothership” to manage operations - as the positioning and communication hub
- Energy efficient / low impact vessel

HUSHCRAFT

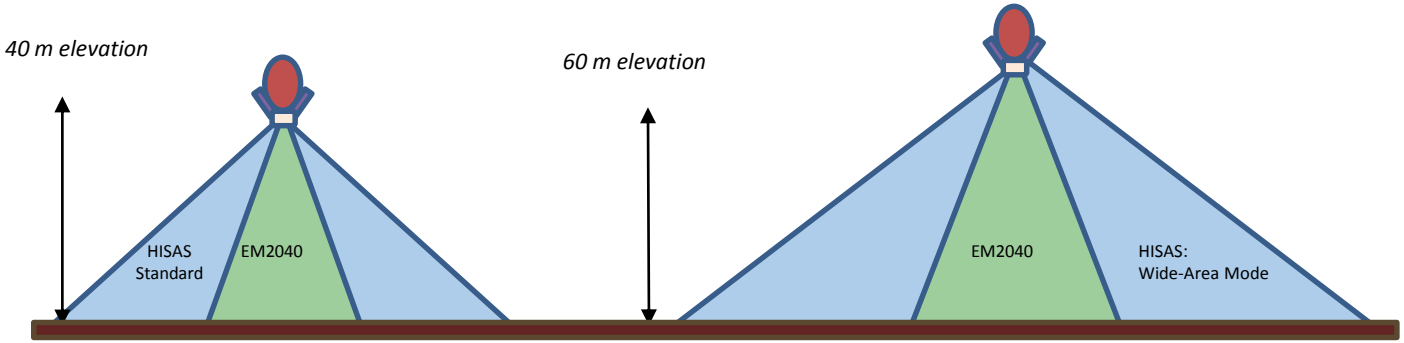
Data collection

SEAFLOOR FEATURE DETECTION:
Standard operating mode
Real aperture bathy
Synthetic aperture bathy & imagery

400 m swath
2-4 cm resolution

RAPID BATHYMETRY COLLECTION:
Wide-area operating mode
Real aperture bathy **only**

750 m swath
1-2 m resolution

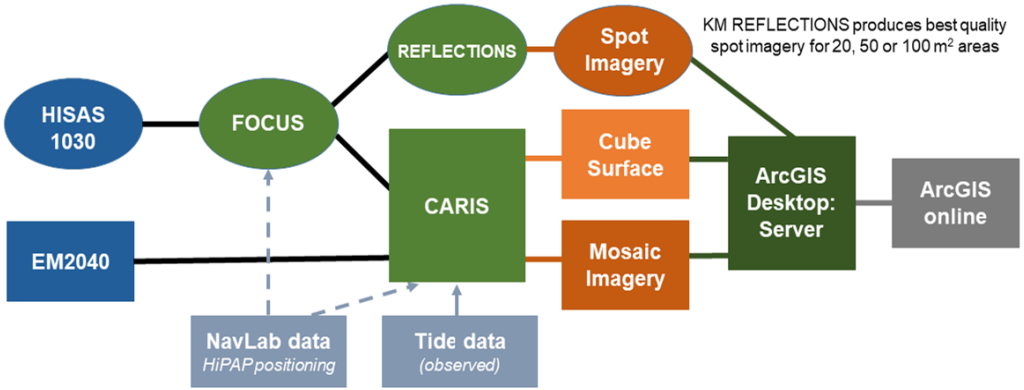


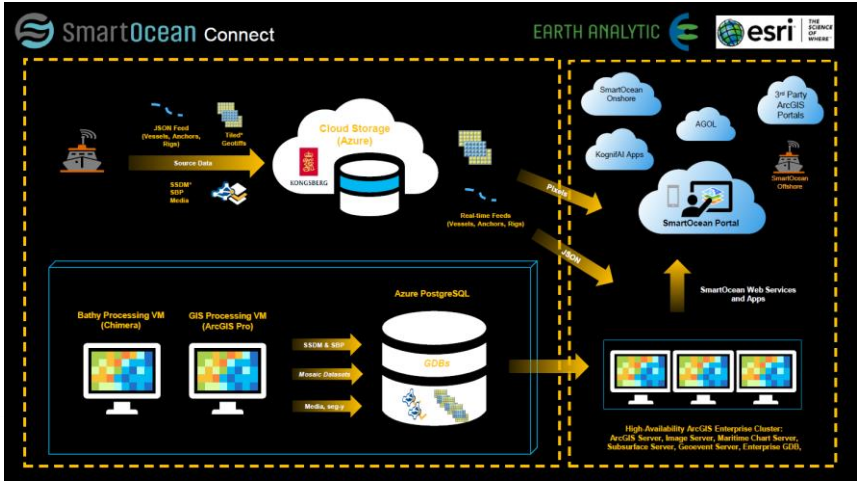
KONGSBERG

HISAS 1032

EM 2040

Data to Information





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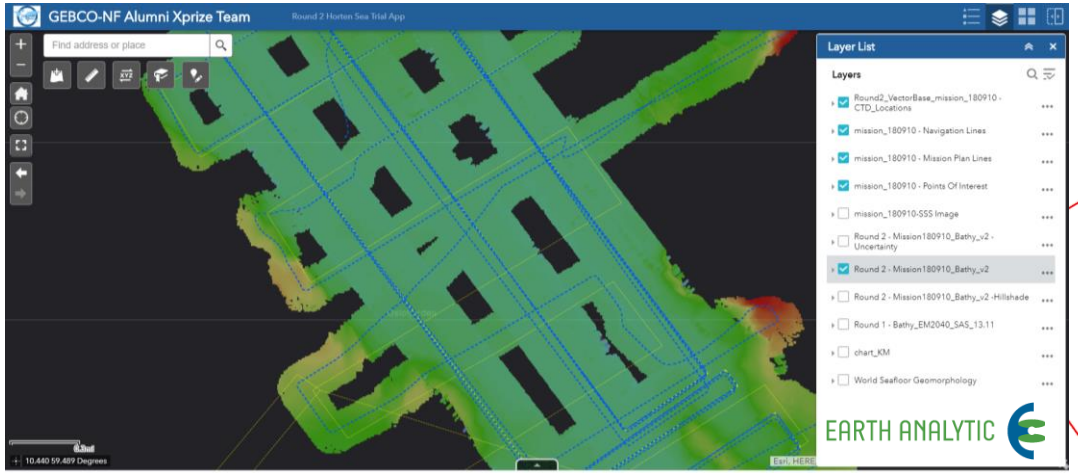
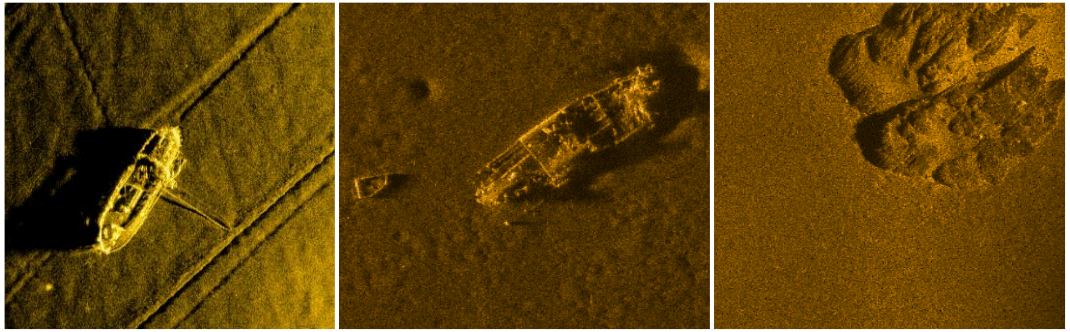
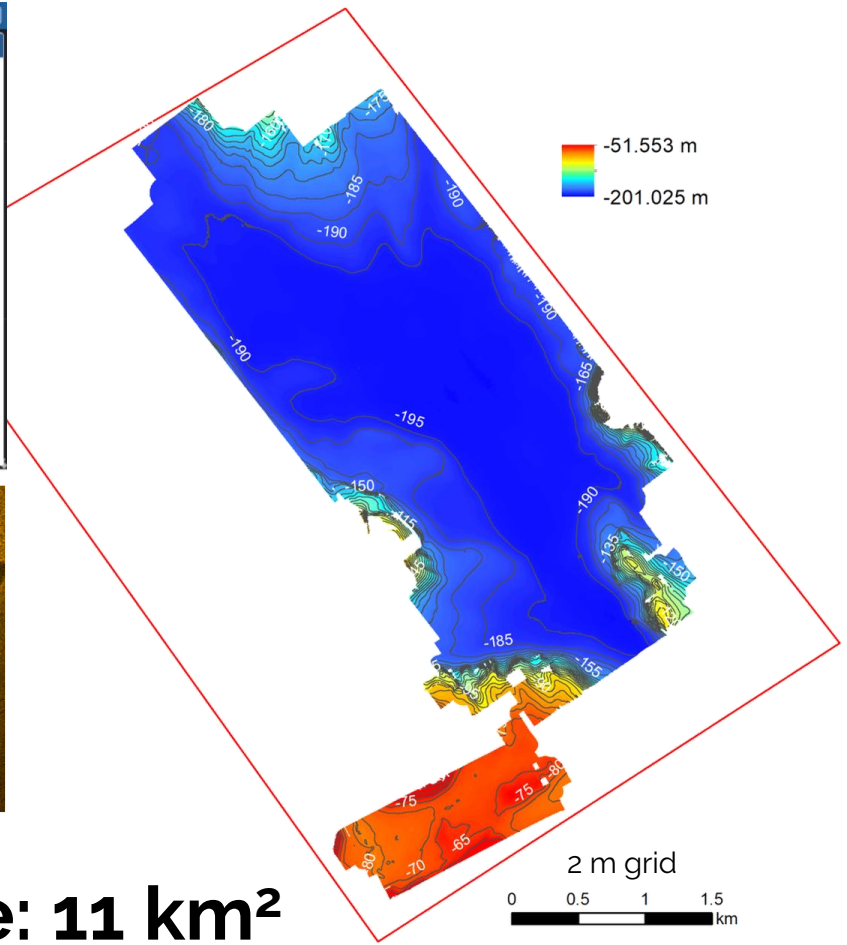
Semi-automated workflow from data processing through to publishing of information in ArcGIS online

Round 1 results: ArcGIS Online







Team Coverage: 11 km²

2018:

7 March: Finalist
9 finalists: Round 2

12 April
$3.09M

13 June to 12 October
Sea trials in Horten, Norway

29 October to 4 November
Sea trials in Kalamata, Greece

5-12 November
Round 2 field test

- Team concept evolved to include surface mount EM304 on USV Gondola
- Sea-trials focus on data work flow to include new EM304 multibeam

31 May 2019:
Grand Prize awarded

Shell OCEAN DISCOVERY XPRIZE

MARINE GEOLOGY

Seafloor mappers to compete for XPRIZE

Faster, cheaper autonomous systems could aid in resource extraction and science

By **Julia Rosen**

Race to the bottom

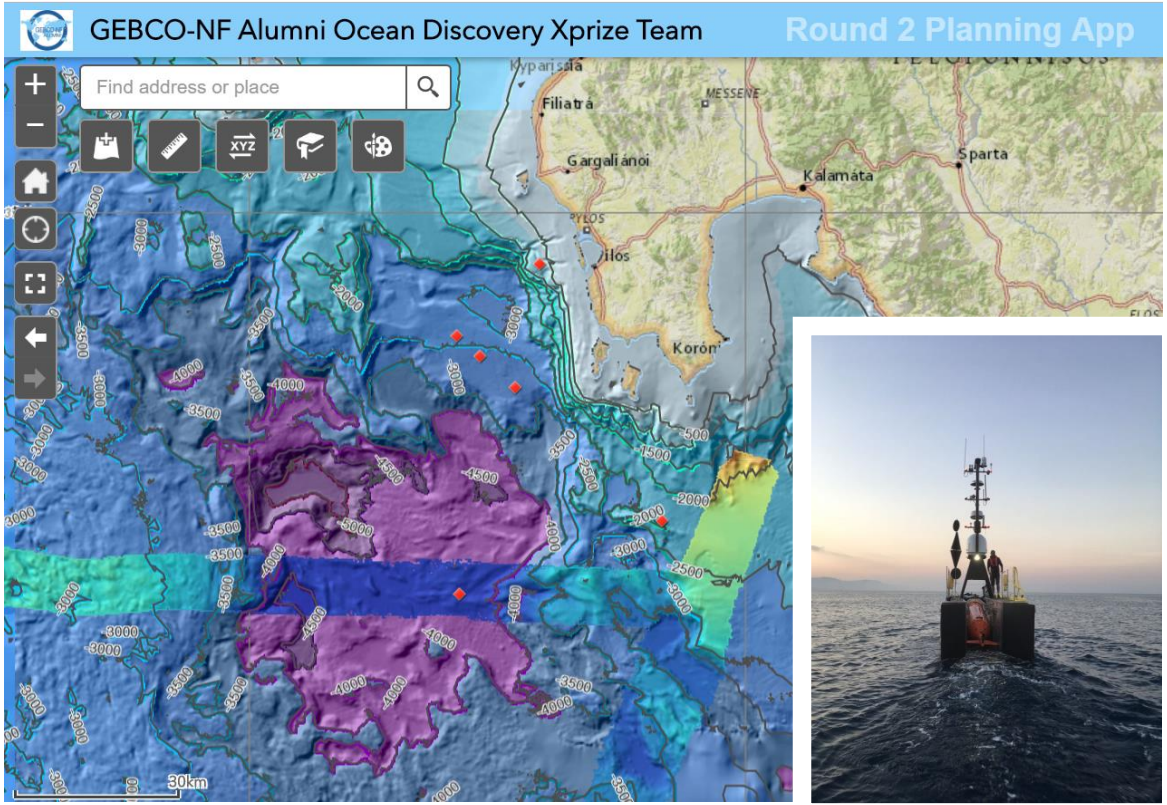
The eight teams competing for the ocean mapping XPRIZE use a mix of uncrewed surface vehicles and autonomous underwater vehicles (AUVs).

TEAM NAME	COUNTRY	SURFACE OPS	NUMBER OF AUVS
Arggonauts	Germany	Five ships	Five
Blue Devil Ocean Engineering	United States	Two aerial drones	Two
CFIS	Switzerland	None	20
GEBCO-Nippon Foundation alumni	International	One ship	One
Kuroshio	Japan	One ship	Two
PISCES	Portugal	One ship, two acoustic beacons	One
Team Tao	United Kingdom	One ship	Five
Texas A&M	United States	One ship	One

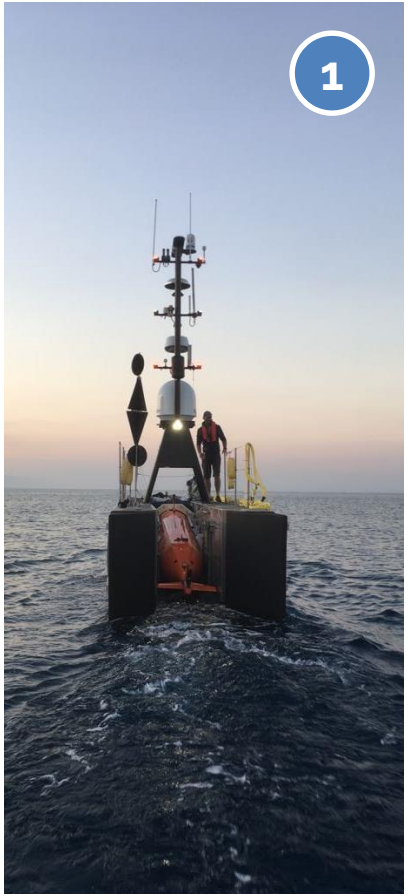
Virginia Deep-X *United States*

Round 2: Preparation

Situation and data analysis, mission planning, offshore tests



Round 2: Final Mission



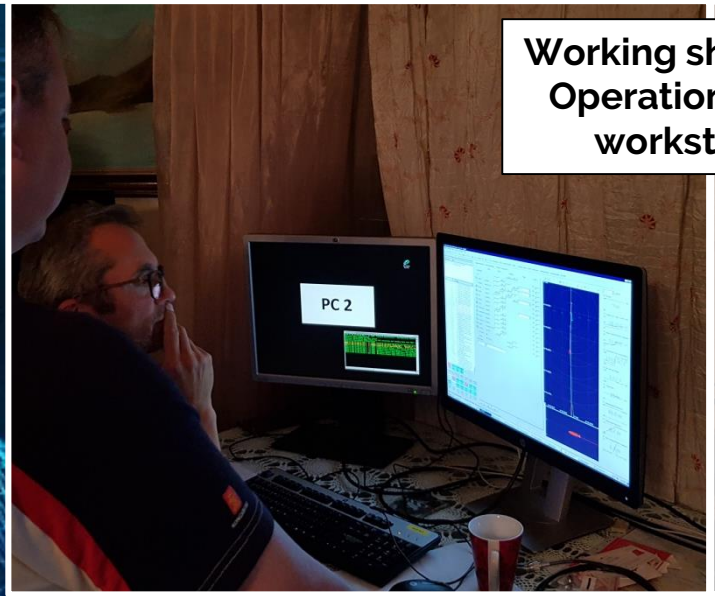
Main working locations:

1. Mapping Equipment
2. Operations Control
3. Data Processing (XPRIZE 'Mission Control')

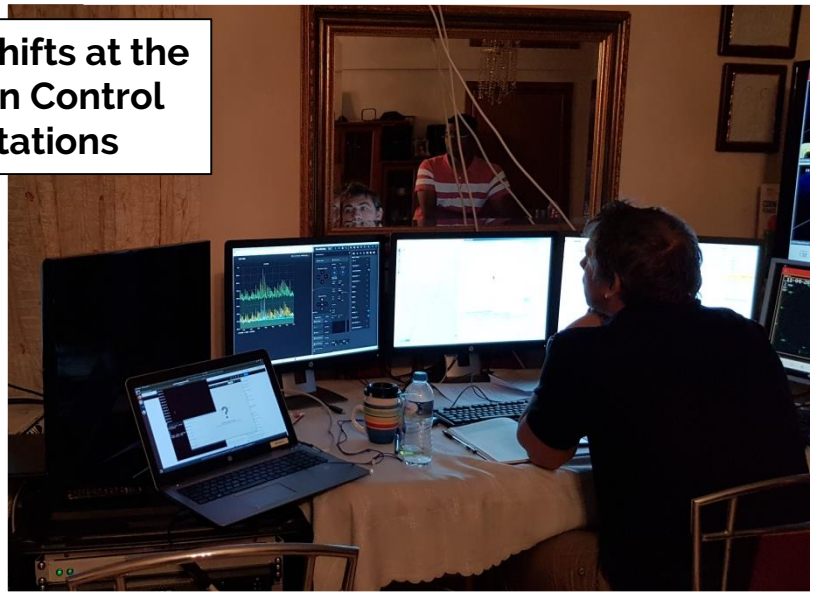
+ NETWORKING

Round 2: Final Mission

32 hours of continuous unmanned operation - including AUV launch and recovery in open seas



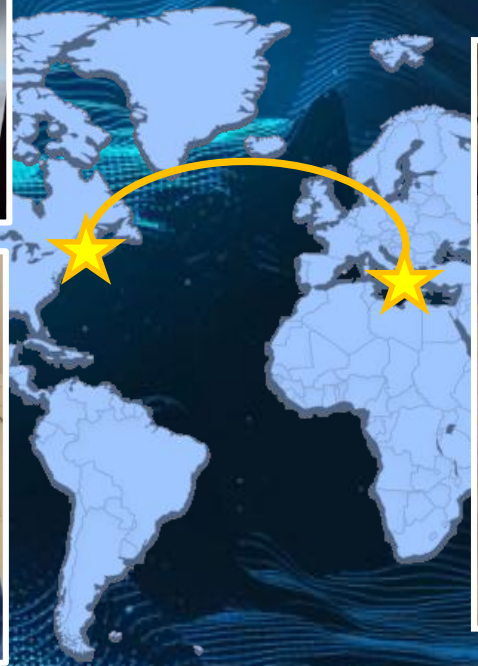
Working shifts at the Operation Control workstations



Round 2: Remote Data Processing

2 locations for data processing

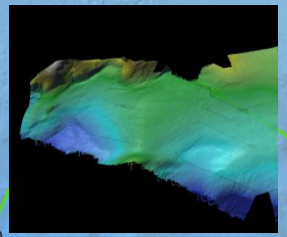
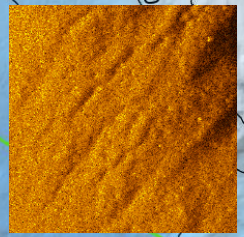
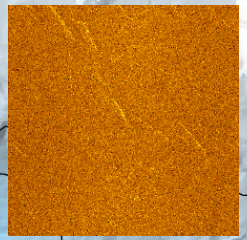
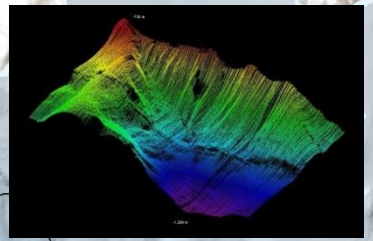
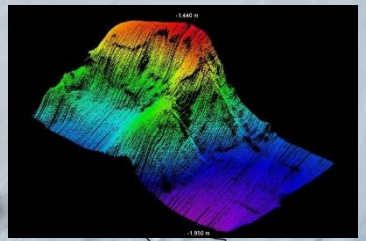
CCOM/JHC



'Mission Control'

Round 2: Submitted results

CRITERIA	Area mapped	Resolution	Bathymetric Map Accuracy	Depth	Additional Features
Shell Ocean Discovery XPRIZE Requirement	50% of Competition Area (250 km2)	5.0 meters horizontal 0.5 meter vertical	Pass/Fail vs Statistical Accuracy relative to Baseline Map	Find and image 1 specifically named item at 4,000 meters	Identify and image 10 features at any depth
GEBCO-NF Team	**278.9 km²** mapped	**1-5 m** horizontal **0.1 – 0.5 m** vertical	**(Pass)**	Map of obligatory area provided. **4134 m** deepest sounding recorded.	**35** images of various types submitted

The GEBCO-Nippon Foundation Alumni Team was announced winners on 31st May 2019

Shell OCEAN DISCOVERY XPRIZE

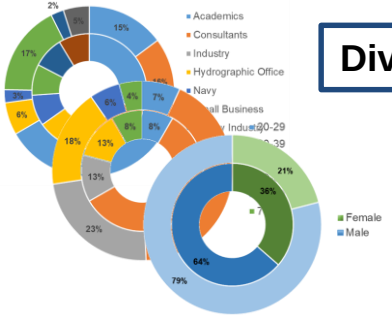
THE NIPPON FOUNDATION

Why Did We Win?

Strong education through the **Training Program at UNH.**

Passion and the commitment of the Team (and all industry partners) to map our oceans.

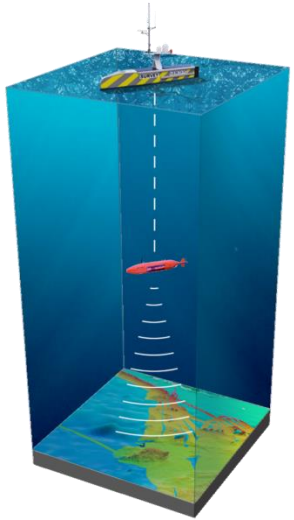
All team members **found a niche that built on their strengths.**



Diversity of our team.

Team worked together – as a unit that could effectively problem solve

Each team member **had a voice**.



Simplicity!

Innovative in how we **integrated exiting technology – developing new technology.**

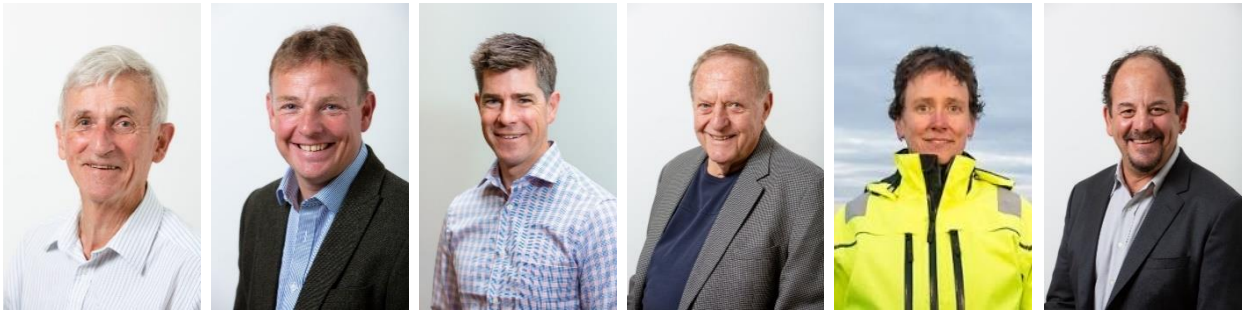
WHAT IS NEXT FOR THE TEAM

Seabed 2030 Centers

And more……

Media coverage:
Ambassadors for ocean mapping

Transit Surveyors



THANK YOU

THE NIPPON FOUNDATION

GEBCO-NF ALUMNI