Marine

MarineResearch Co,.Ltd

I. General Information

1. Company Introduction

- Marine Research Co., Ltd., specialized in marine exploration and survey business, is a company having top technology in Korea and marine exploration and survey equipment, supported by aggressive investment and technology development.

- Luxurious multi-beam eco-sounder (SeaBat 8125S) recognized by the International Hydrographic Organization was introduced first in Korea, and the dual head multi-beam system, a sole one in Korea, is owned by us.

- In the meantime, we possess a multi-beam survey vessel, where a transducer can be installed at the center of gravity of the vessel for the first time in Korea private companies, which allows us to obtain highest quality data. At present we hold 5 marine survey vessels, implementing projects like multi-beam acoustic sounding, sea-bed image exploration, sub-bottom profiling, and oceanographic observation in waters close to Korea.

- We promise that we will meet your diverse demands with ceaseless technology development and investment from channel investigation to ocean development

I. General Information

1. Company Introduction

Name	▪ Marine Research Co., Ltd.
CEO	▪ Dr. Kim Jong Sin
Fields	▪ Hydrographic Survey ▪ Oceanographic Research & Coastal sea road Survey ▪ Subsea Inspection for Offshore ▪ Biology & Environment ▪ Physics & Modeling ▪ Digital Nautical Chart ▪ GIS related Database build-up ▪ Digital mapping & Underground facility survey
Established	▪ January 20, 2003
Address	▪ 435-1, Haeyang-ro, Yeongdo-gu, Busan, Korea 49111
Employee	▪ 45

○ **Status of patents and certifications in possession (Domestic)**

▷ **Patent registration**

· Trnasducer attaching body support for a rubber boat and a rubber boat with the same

· Multi-beam echo sounder transducer securing

· Barge for underwater work

· Echo sounder bar-check plate device to update sound velocity correction

▷ **Patent registration**

· The ship driving device using low-water level

· Subsea audio and video map to overlap over the electronic navigation charter of Mercator's projection

· Automatic phase shift method for three dimensional sonar signal processing

· Signal processing and sampling technique for a multi-beam sonar

I. General Information

2. Company History

2003
- Founded Marine Research Co., Ltd. (Choryang-dong, Jung-gu, Busan City)
- Registration of Coast survey business in National Geographic Information Institute
- Registration of Engineer Surveying Geo-Spatial Information in Korea Engineering and Consulting Association
- Introduction of Multi-beam marine survey equipment
- Introduction of the Marine survey vessel (named as Marine EXPO)

2004
- Moved its head office (Korea Maritime and Ocean University, at Youngdo-gu, Busan City)

2005
- Registered as a subcontractor for SK Energy Co., Ltd. and KT Submarine Co., Ltd.

2006
- Introduction of the multi-beam dual head system first in Korea (Additional introduction of Seabat 8125S)
- Registration of Hydrographic Survey business in the Korea Hydrographic and Oceanographic Agency

2007
- Patent registration (Barge for underwater work)
- Awarded as a best entrepreneur (Busan City in Korea)

2008
- Certified as Venture business and Corporate R&D Center
- Awarded as a best entrepreneur (Ministry of Land, Transport and Maritime Affairs)

I. General Information

2. Company History

2009
- Registration of Public survey business in Pusan City
- Registered as a Public Survey Company (National Geographic information Institute)

2010
- Moved its head office
- Introduction of Multi-beam marine survey equipment (Seabat 7125V)
- Introduction of the Marine survey vessel (Marine No. 3, Marine No. 101)

2011
- Patent registration (Multi-beam echo sounder transducer securing)
- Registration of Nautical chart production business in the Korea Hydrographic and Oceanographic Agency
- Registration of Underground facility survey business in the National Geographic Information Institution

2012
- Patent registration (Transducer attaching body support for a rubber boat and a rubber boat with the same)
- Concluded an Industry-Academia Cooperation Agreement with the Korea Maritime and Ocean University

I. General Information

2. Company History

2013

· Registration of Overseas construction business in the International Contractors Association of Korea
· Joined in the overseas branch project (Oman) hosted by the Korea Trade-Investment Promotion Agency (KOTRA)
· Patent registration (Device for bar check plate of echo sounder)

2014

· Introduction of the Marine survey vessel (Marine No. 5)
· Participated in the marine survey area in connection with “Project for Development of Technology for Fisheries Resources Enhancement in Angola(PMC)”led by the Korea International Cooperation Agency (KOICA)

2015

· Registered in the Korea International Trade Association (KITA)
· Registration of Software business in Korea Software Industry Association
· Confirmation of Small & Medium Business In-house Production (Geographic information database and software development)
· Selected as the company for the Export capability enhancement project for High growth businesses (Small & Medium Business Corporation)
·Certified as Technology Innovative Small & Medium Business (Inno-Biz)

I. General Information

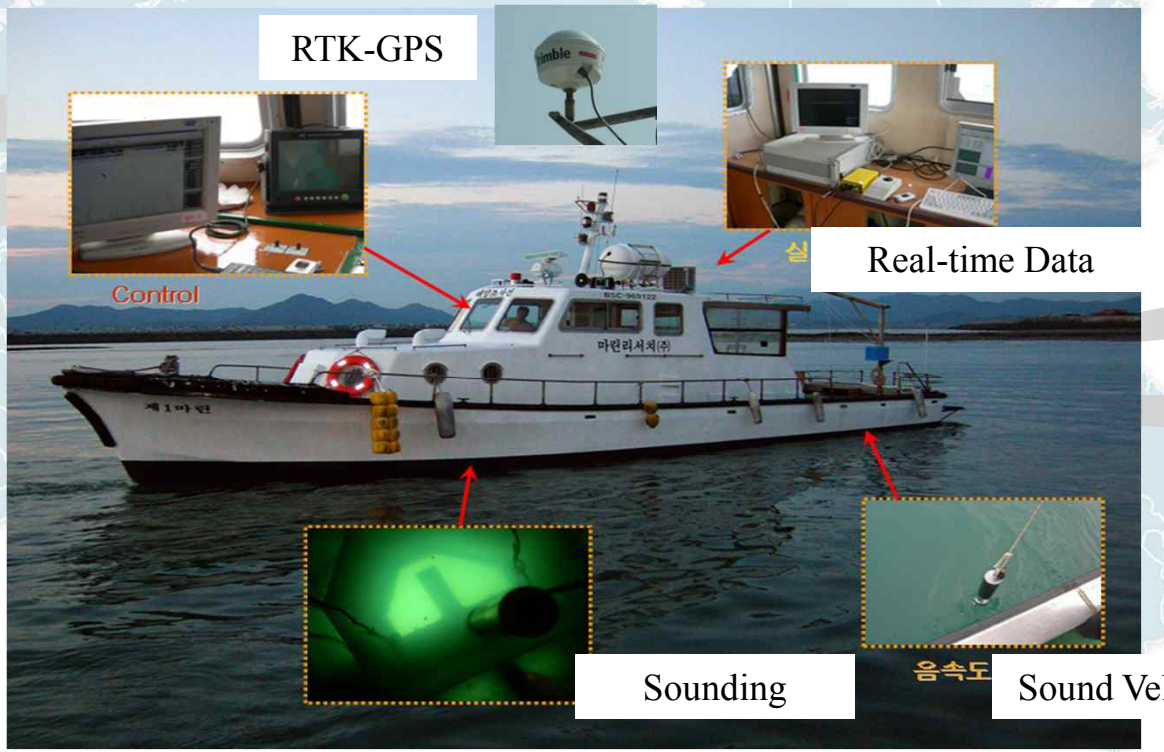
3. Equipment

Name of Equipment	Scope of the Research	Amount	Specification
Research Vessel	Littoral Sea	6	29-ton(2), 22-ton(1), 13-ton(2)
Multi beam Echo sounder	Multi beam bathymetriy	5	Seabat8125(2), Seabat7125SV2(1), SONIC2024(1), iWBMS(2)
Single beam Echo sounder	Single beam bathymetriy	5	Knudsen 320MP / jr
			aquaruller
Sub Bottom Profiler	Sub bottom Mapping	3	2～7kHz, 8～18kHz
Side Scan Sonar	Seafloor Imaging Survey	3	400kHz
Current meter	Tidal Current Observation, Suspended Solid	1	AWAC
Soil sampler	Soil sampling	2	Grab
Tide guage	Tidal Observation	10	
B/C GPS	Location Surveying	6	Trimble
DGPS	Detail Location Surveying for land	10	RTK, VRS (Novatel, South)
DGPS	Detail Location Surveying for maritime	4	VRS(CHC)
Total Station & Level	Topographic Surveying	8	Topcon603(6), DiniAT-G1(2)
UAV(Drone)	Photogrammetric mapping	1	TOPODRONE-100 (DroneMetrex Pty Ltd (Australia)
USV (Unmanned Surface Vessel)	Unmanned Surface Vessel	1	iWBMS

4. Equipment

Research Vessel

- Gross Tonnage: 13-ton
- Maximum Crew : 14
- Engine Horsepower : 450
- Maximum Speed : 20knot



4. Equipment

Research Vessel

- Gross Tonnage: 22-ton
- Maximum Crew : 11
- Engine Horsepower : 316 ×2EA
- Maximum Speed : 16knot

I. General Information

4. Equipment

Research Vessel

- Gross Tonnage: 29-ton
- Engine Horsepower : 500 ×2EA
- Maximum Crew : 12
- Maximum Speed : 15knot

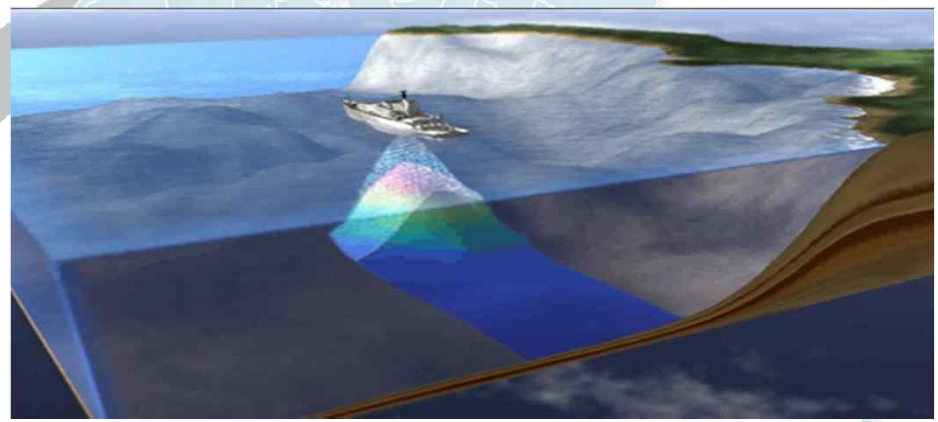
- Gross Tonnage: 29-ton
- Engine Horsepower : 600 ×2EA
- Maximum Crew : 12
- Maximum Speed : 25knot

- Gross Tonnage: 13-ton
- Engine Horsepower : 450×2EA
- Maximum Crew : 12
- Maximum Speed : 15knot

4. Equipment

Multi-beam Echo Sounder

Seabat 8125S, RESON (USA)



- Working Frequency : 455㎑
- Measuring Range : 120˚
- Vertical Resolution : 6mm
- Beam Interval : 0.5
- The number of Beam : 240
- Resolution : 6mm
- Obtaining maximum depth : 9600/sec
- **IHO** Special order requirements

(IHO, International Hydrographic Organization)

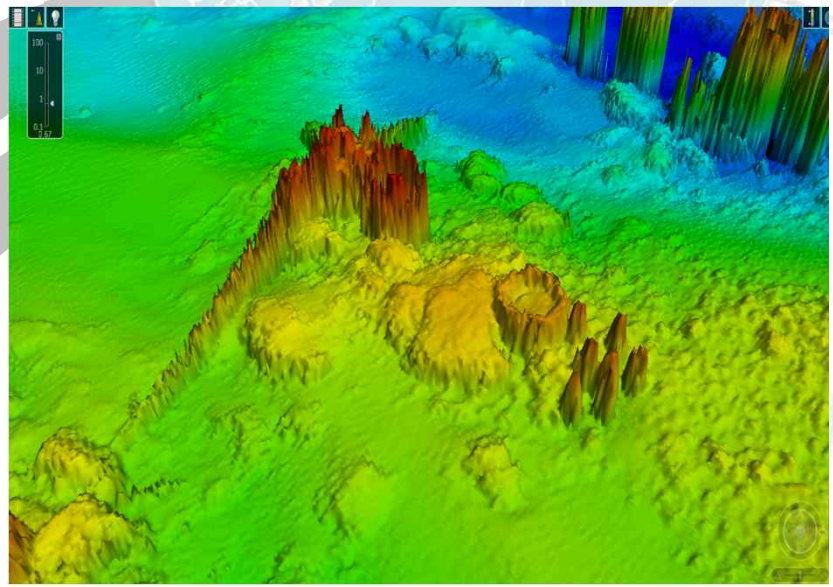
- Quantity : 2

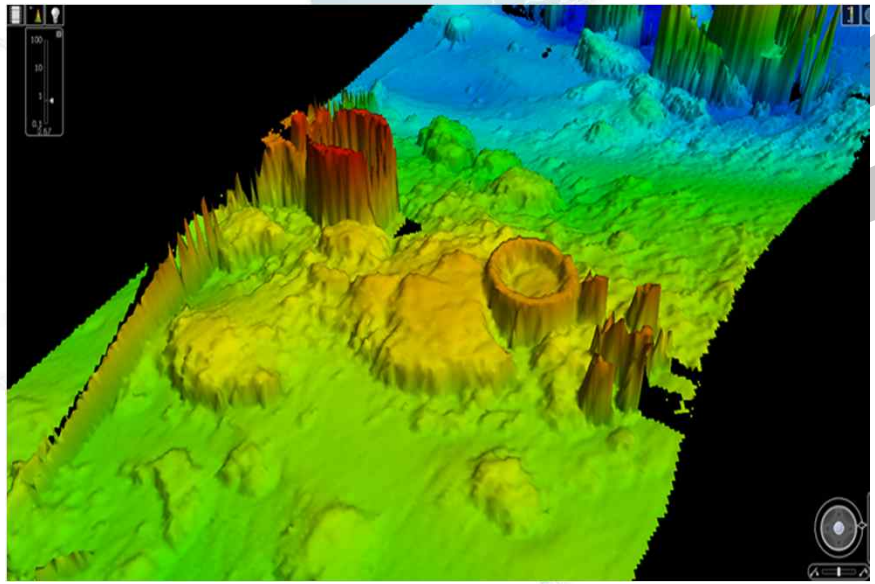
The Dual Multi-beam system was introduced to Korea for the first time since 2006

1. Hydrography

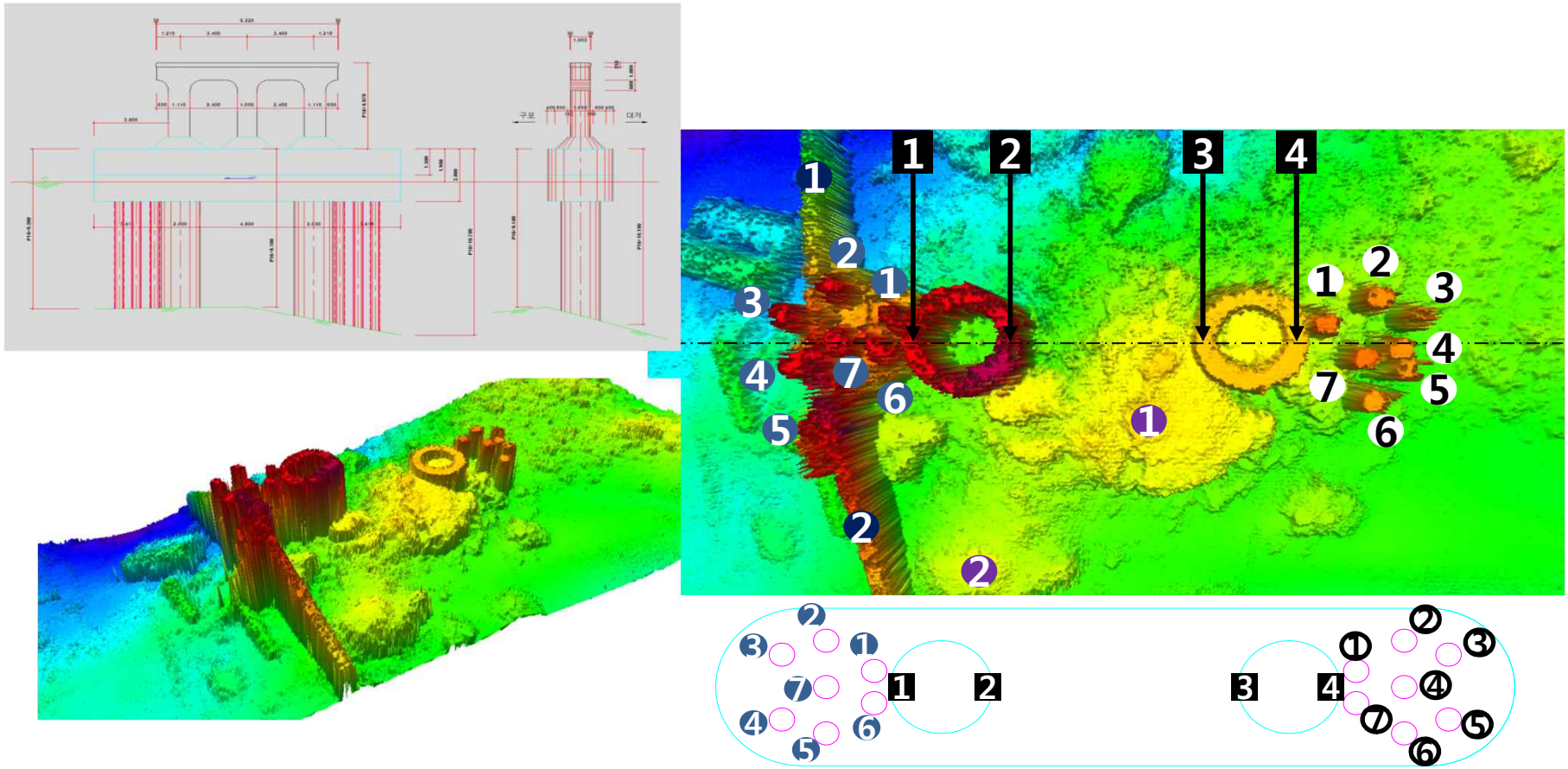
○ Multi-beam Bathymetry

Marine Research Co., Ltd. engages in performing precise hydrographic survey relating to port development for trade ports and fishery ports, performing Korea coastal waters survey including shore line survey, soundings, seabed obstruction survey, executing precise waterways survey for Jinhae port to support the navy, precise waterways survey for the eastern coast of Yeonpyungdo island, waterways survey of the West sea contact area, and producing nautical charts.





○ Hydrographic Survey for Piers at Gupo Bridge in Busan



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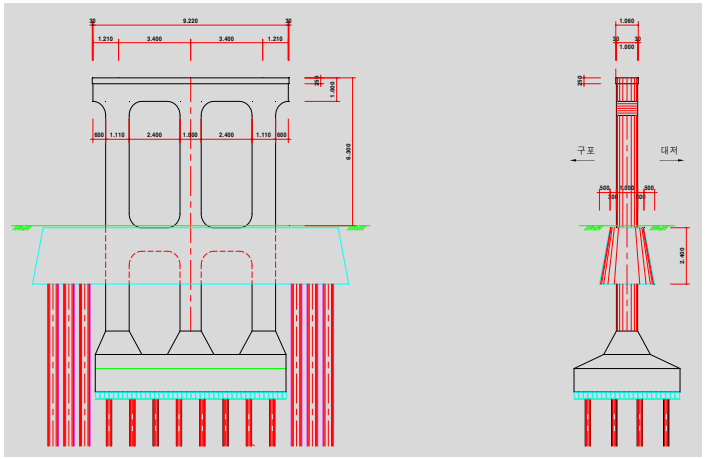

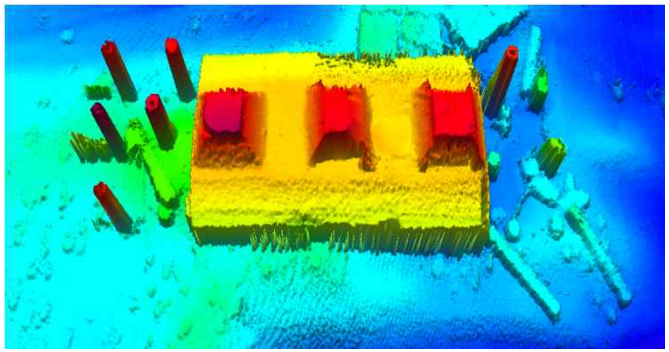

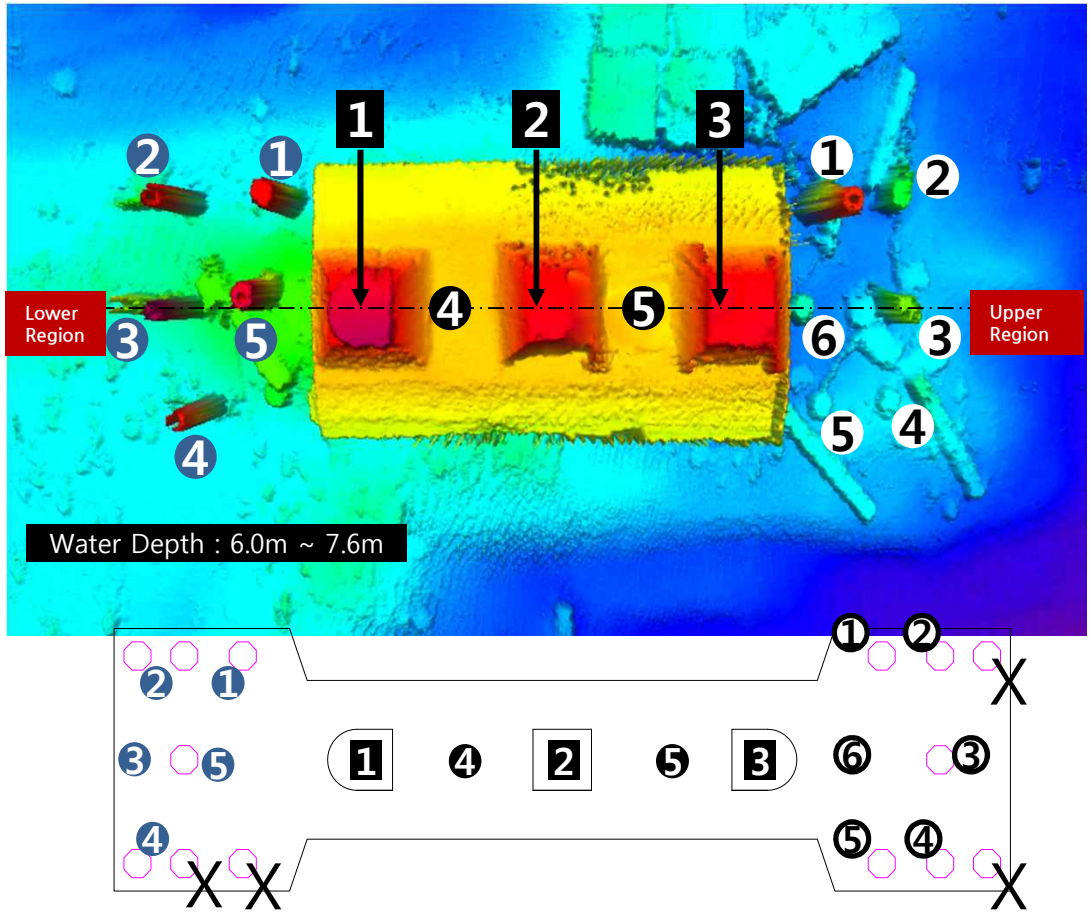

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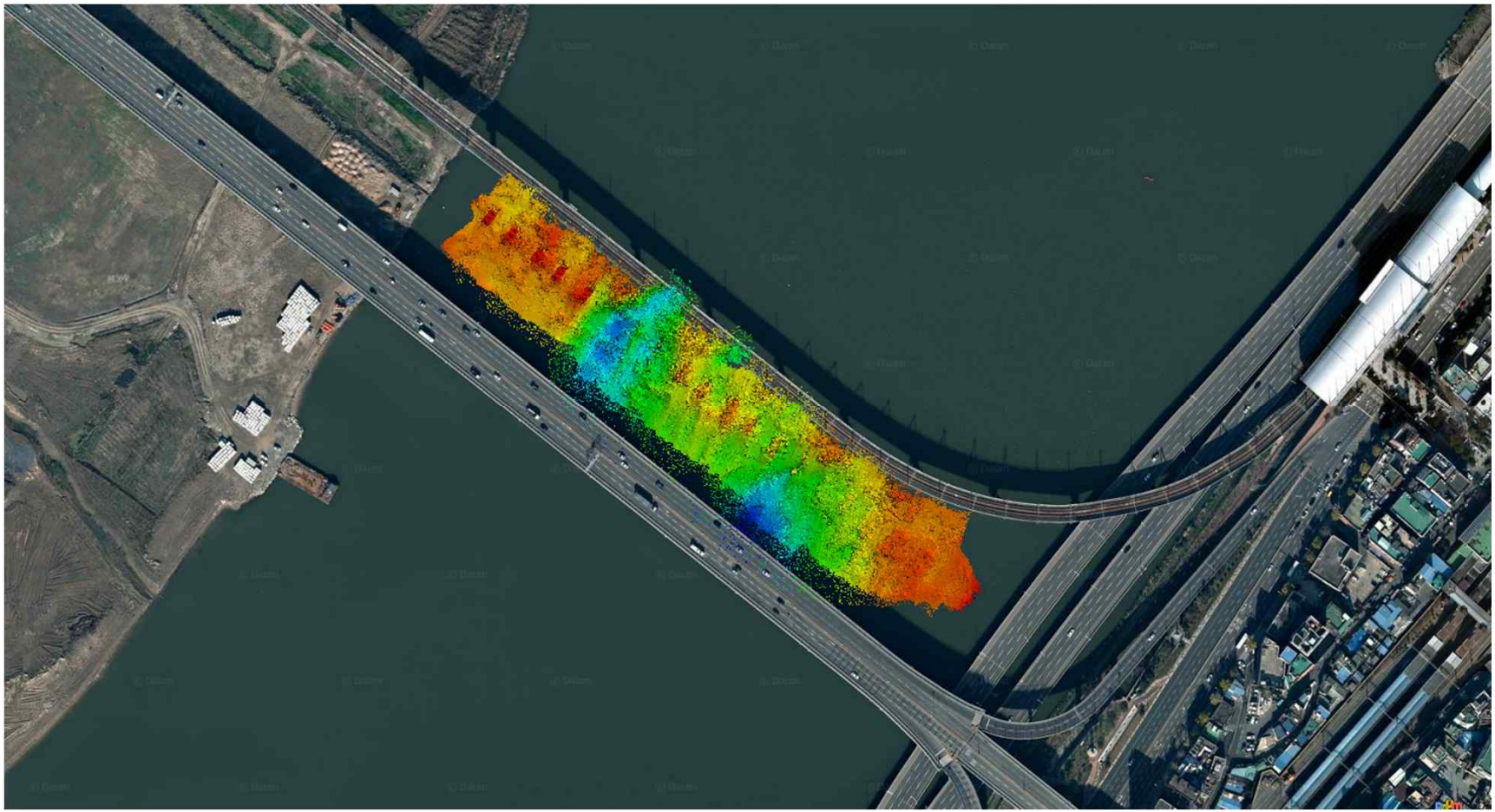
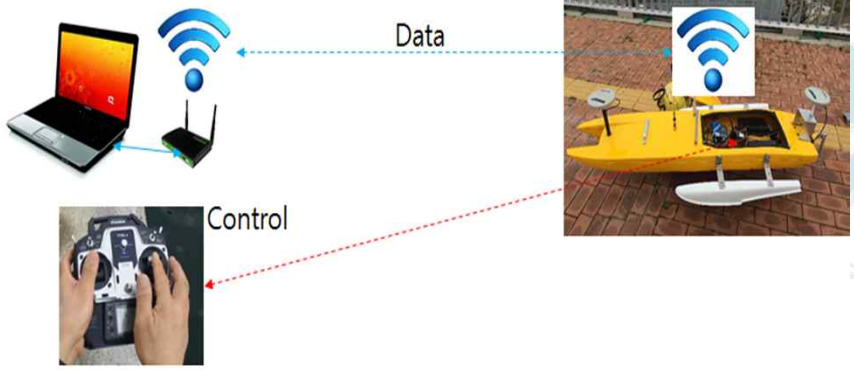
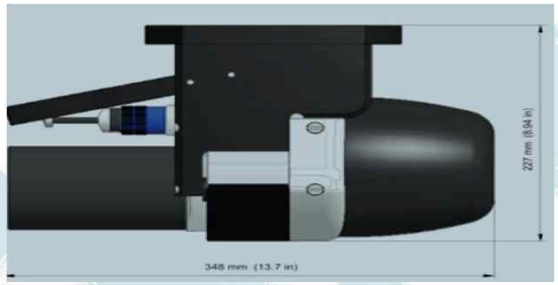


○ Subsurface Spatial Information Using USV (Unmanned Surface Vessel)

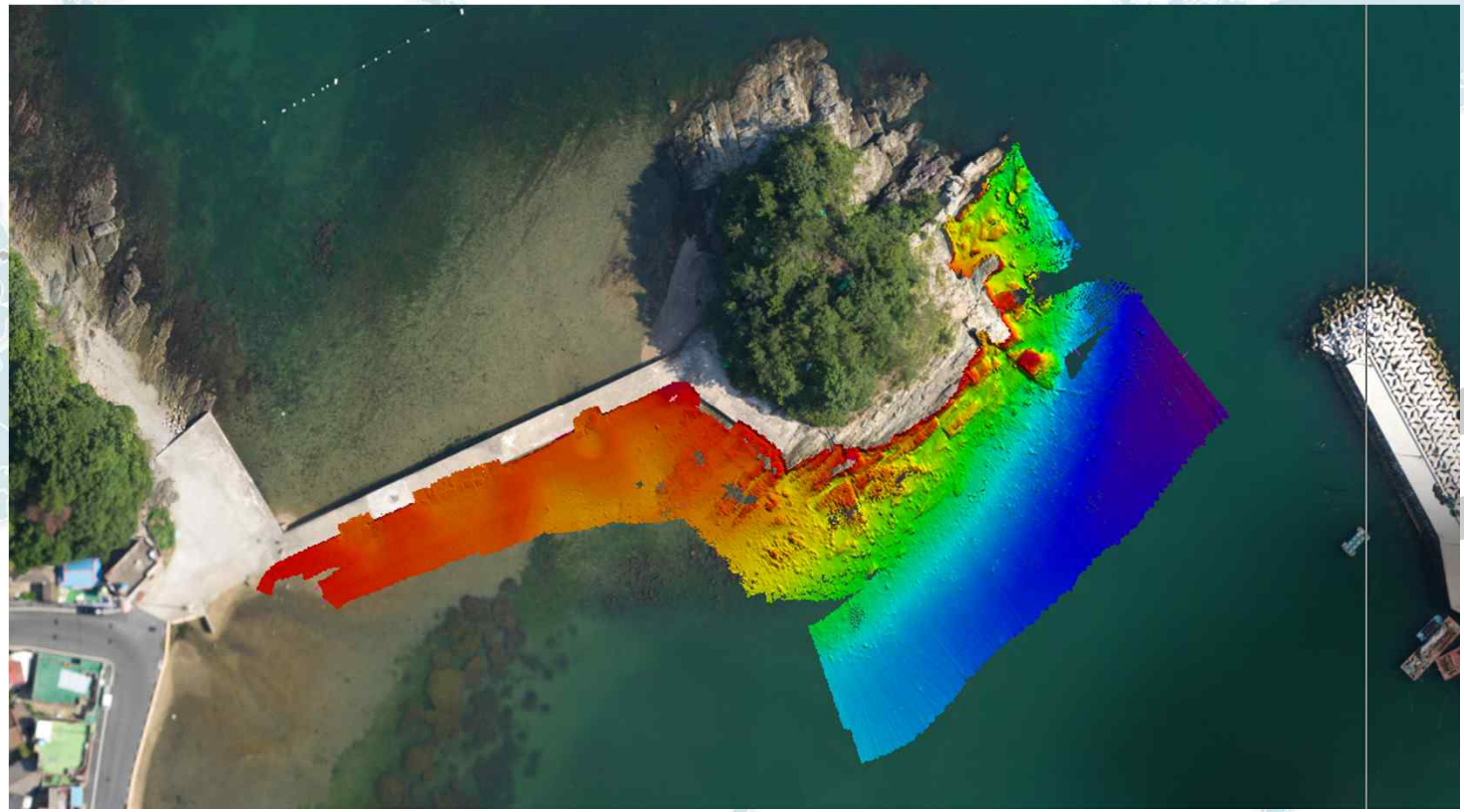




- iWBMS : Navigation, Motion, Gyro, Multibeam (Integral Type)
- Wireless Wi-Fi : 2.4GHz
- Vessel Control : Using Radio Frequency

Name of Equipment	iWBMS
Swath Coverage	7~179° (140° Normal)
Beams	256~512 EA
Frequency	400㎑
Depth Range	0.2~275m
Ping Rate	Up to 50Hz
Resolution	0.9° Across Track,
	1.9° Along Track
Position Accuracy	0.02~0.1m(RTK)
Heading Accuracy	0.03°(RTK)
Pitch/Roll Accuracy	0.02°
Heave Accuracy	5㎝ or 5%(2㎝ RTK)
Weight	9.5㎏

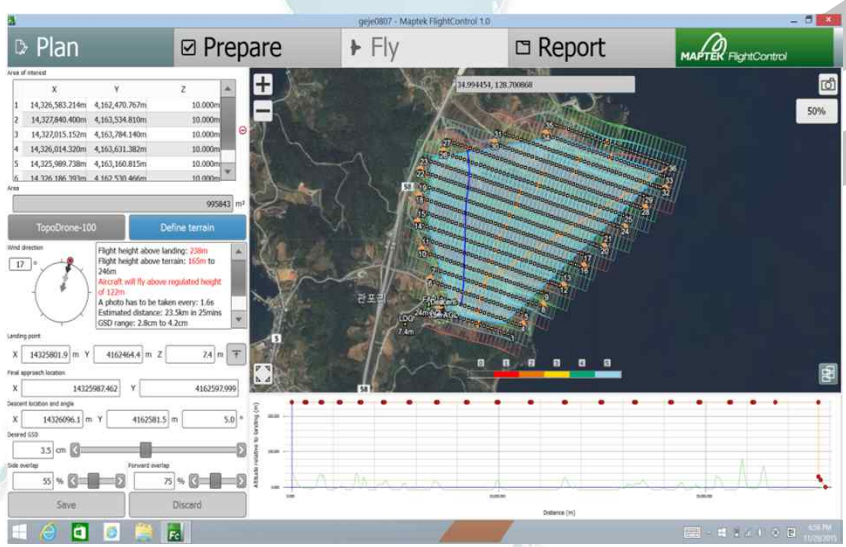
○ Subsurface Spatial Information Using USV (Unmanned Surface Vessel)



1. Hydrography

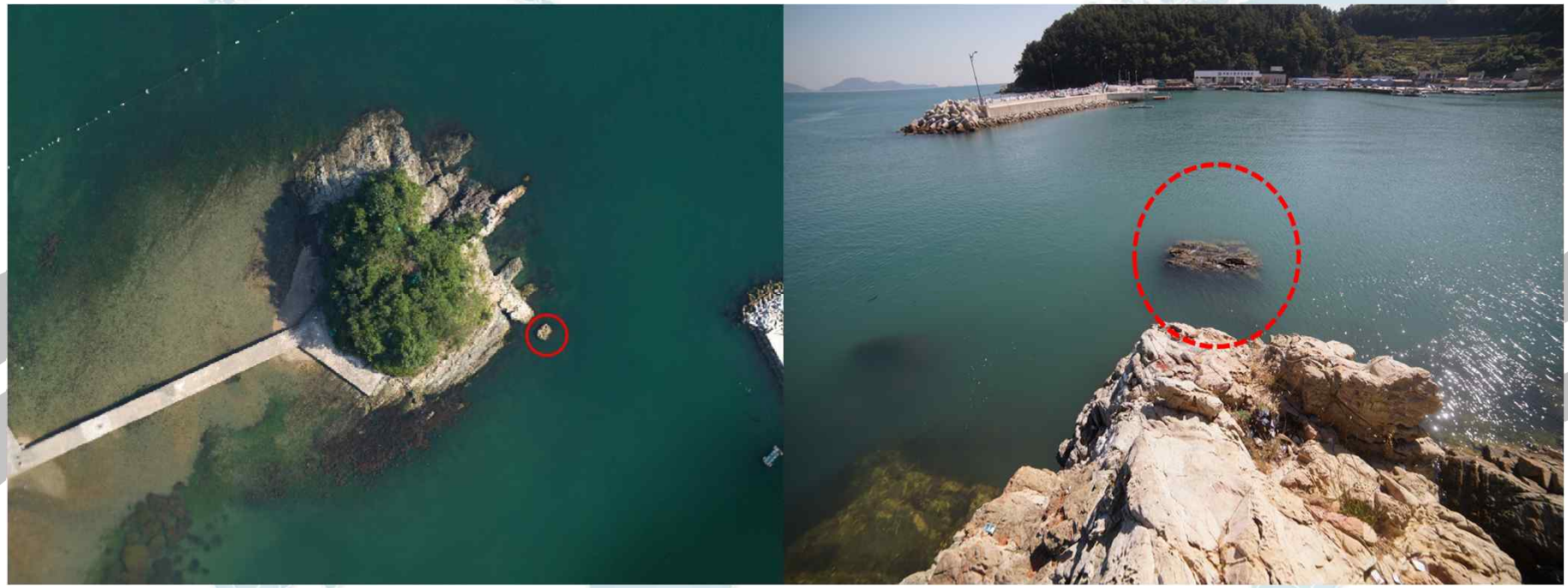
○ Subsurface Spatial Information Using UAV (Unmanned Aerial Vehicle)

Name of Equipment	TopoDrone-100
Camera	24Mp Full-frame
Shutter	Leaf Shutter
Lens	Zeiss fixed lens
Pixel Sensor	5.9 microns
SmartGymbal System	Installation
GAM	Yaw, crab, pitch
Weight	4.5kg
Flight Method	9kg Launcher
Flight Time	60 minutes
Height Accuracy	25mm
Engine	14.8V, Power : 7300RPM
Speed Limit	Cruising Speed(V_{NO}) : 0-90 km/h
3D Stereo-restitution	Available



○ Subsurface Spatial Information Using UAV (Unmanned Aerial Vehicle)

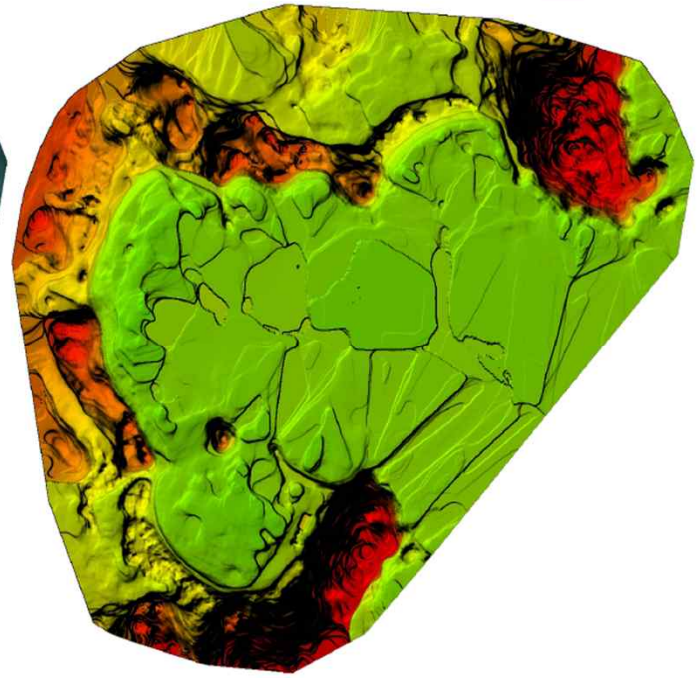
- Comparative Analysis of a Dry Rock Point



○ Subsurface Spatial Information Using UAV (Unmanned Aerial Vehicle)

- Comparison of the Satellite Image and Digital Elevation Model(DSM) Data

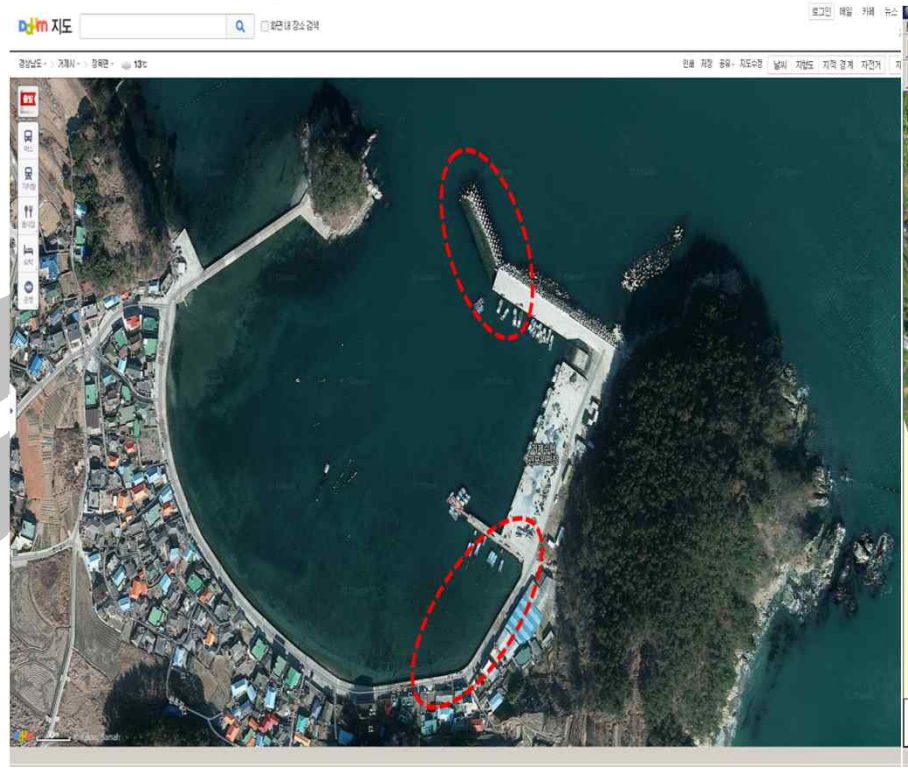
Satellite Image



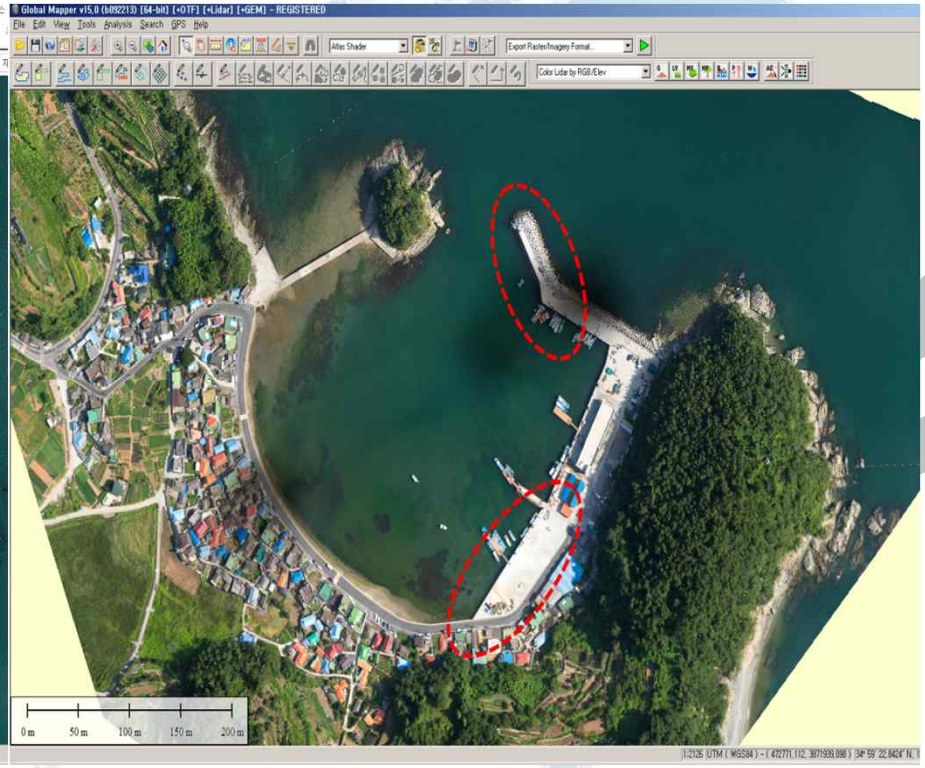
DSM Data (UAV)

○ Subsurface Spatial Information Using UAV (Unmanned Aerial Vehicle)

- Comparison of the Satellite Image and UAV for Ortho Image Generation



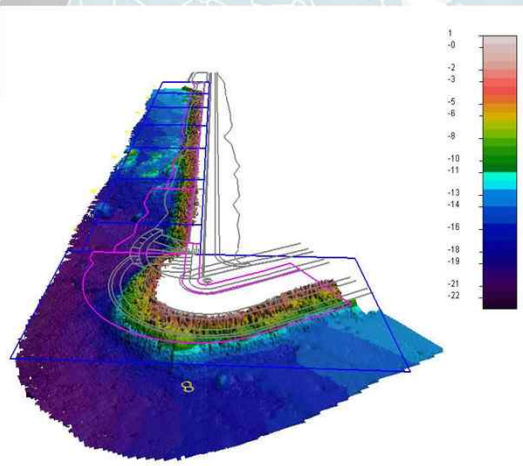
Satellite Image

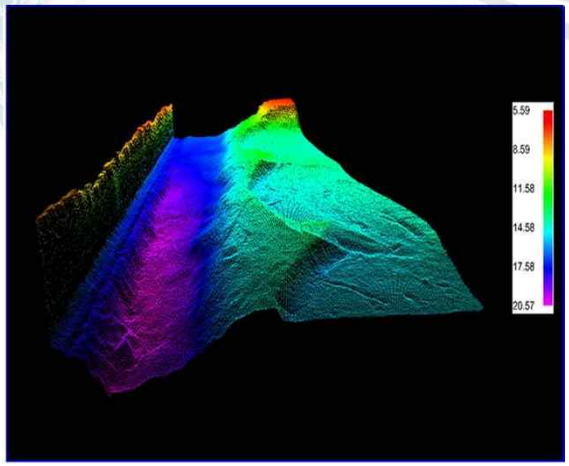


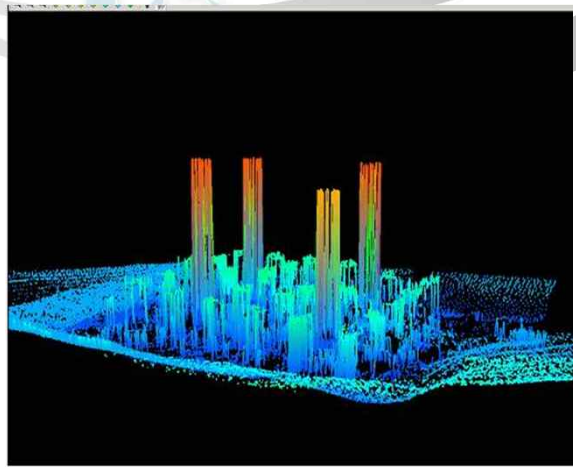
Ortho Imagery(UAV)

○ Subsea Inspection for Offshore Construction

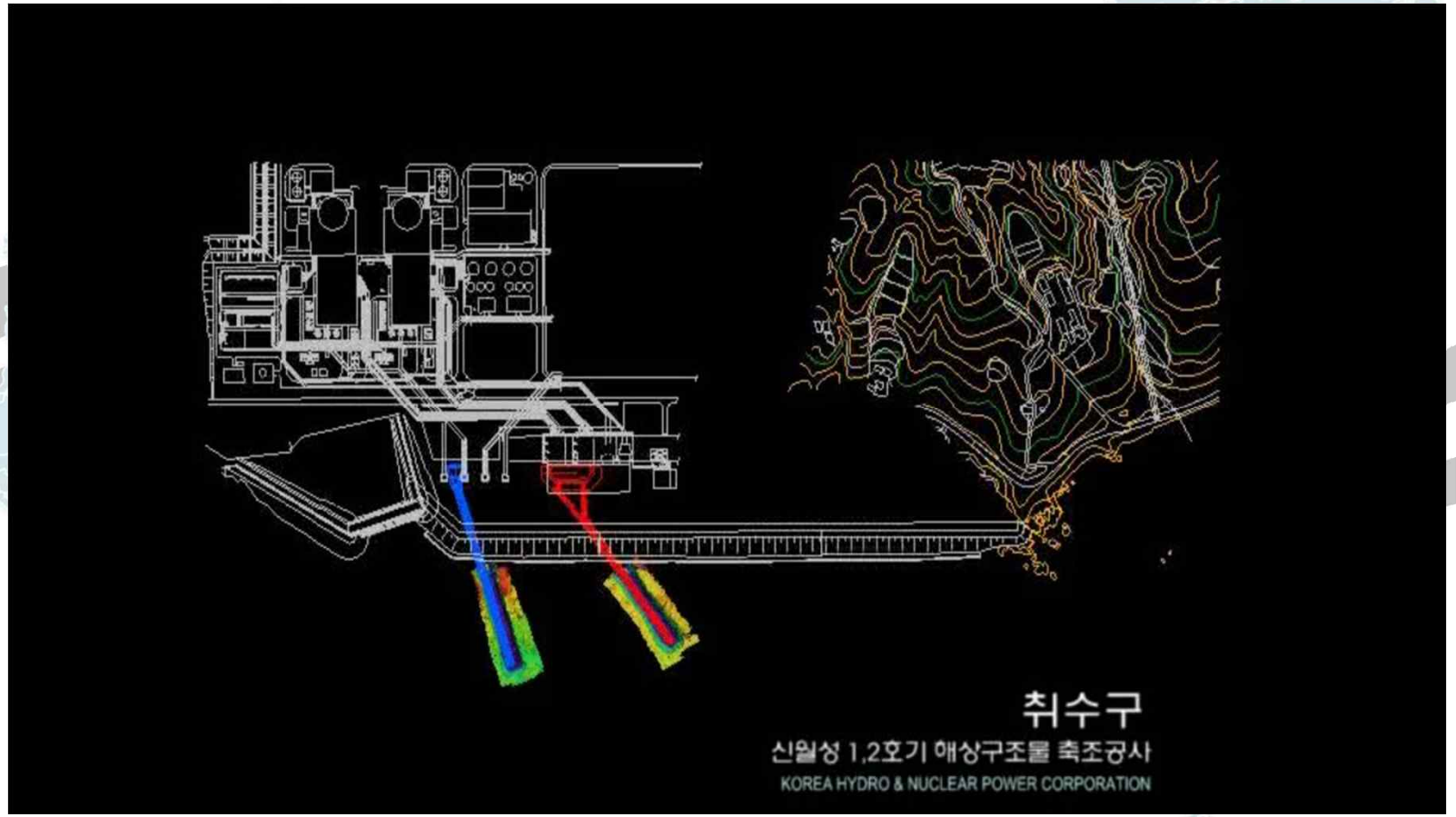
Marine Research Co., Ltd. performs construction progress check, construction ability inspection, integrity evaluation, construction volume calculation as well as offshore marine precision survey and topography exploration for port development and maintenance dredging construction, submarine cable installation construction, and oil pipeline installation construction.
Marine Research Co., Ltd. can implement precise survey with minimum errors, using a multi-beam vessel where its patent technology is applied.



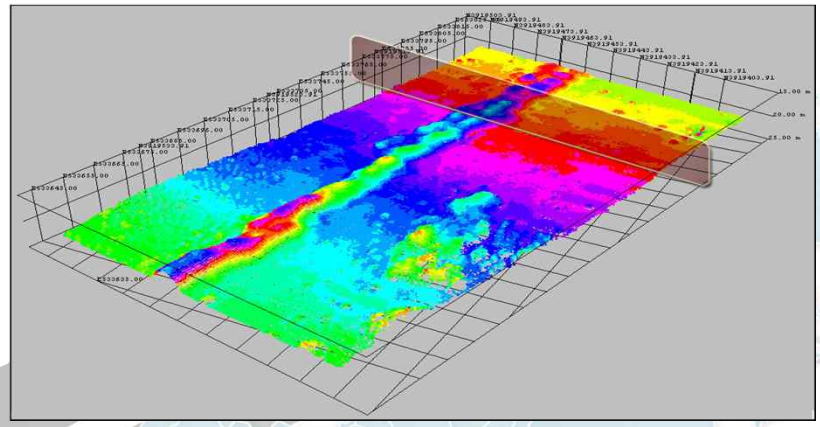


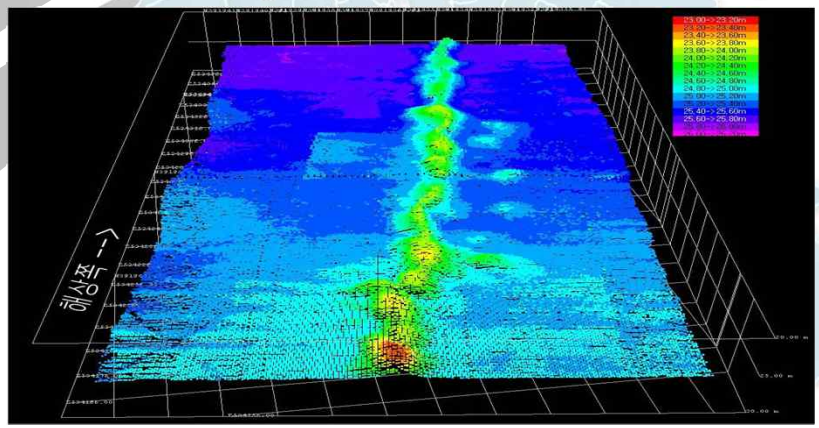


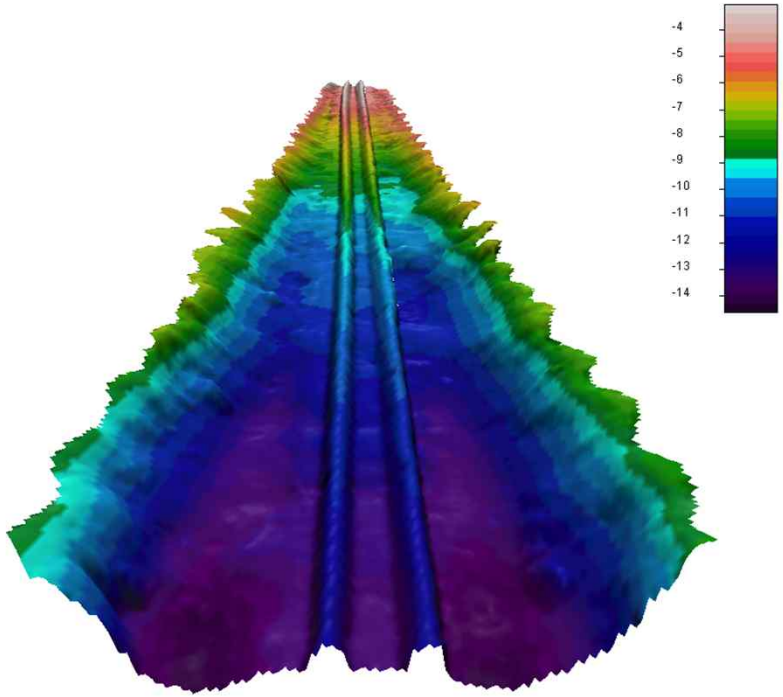
○ Subsea Inspection for Korea Hydro & Nuclear Power Corporation



○ Subsea Inspection for Offshore Pipeline Construction and Maintenance Dredging

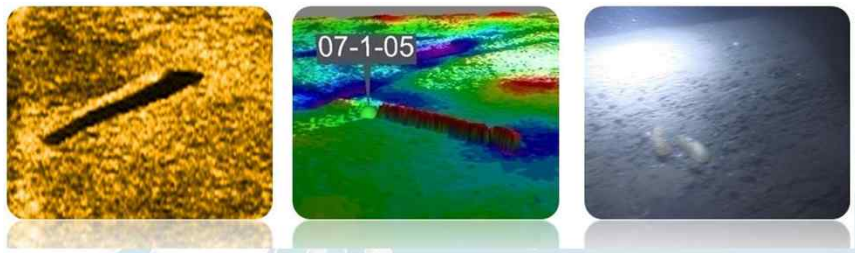


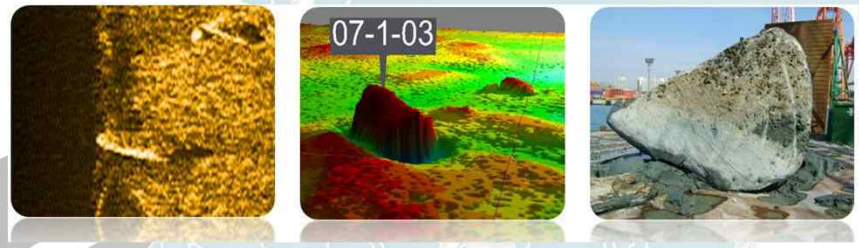


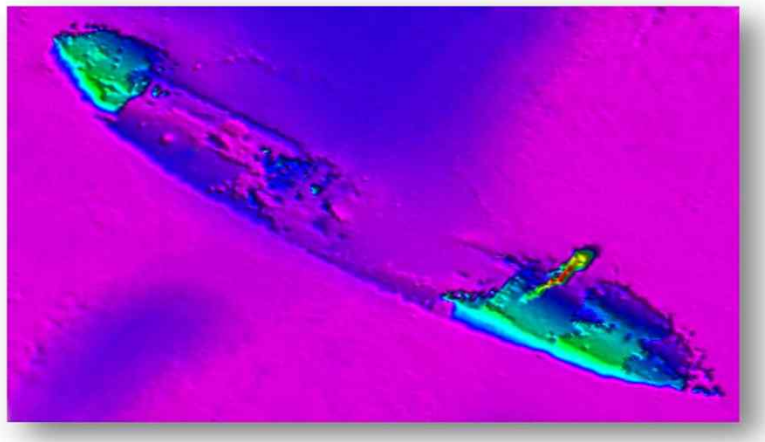


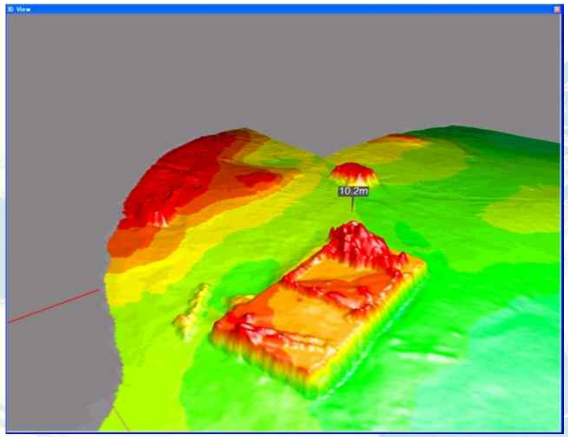
2. Offshore

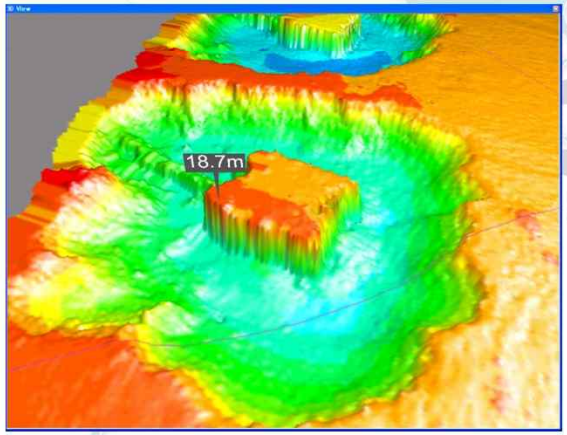
○ Survey for a marine facilities and dangerous obstacles

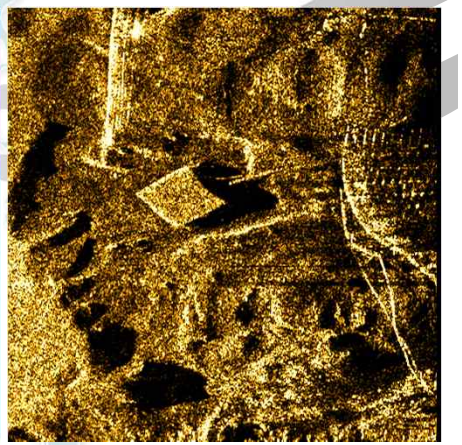






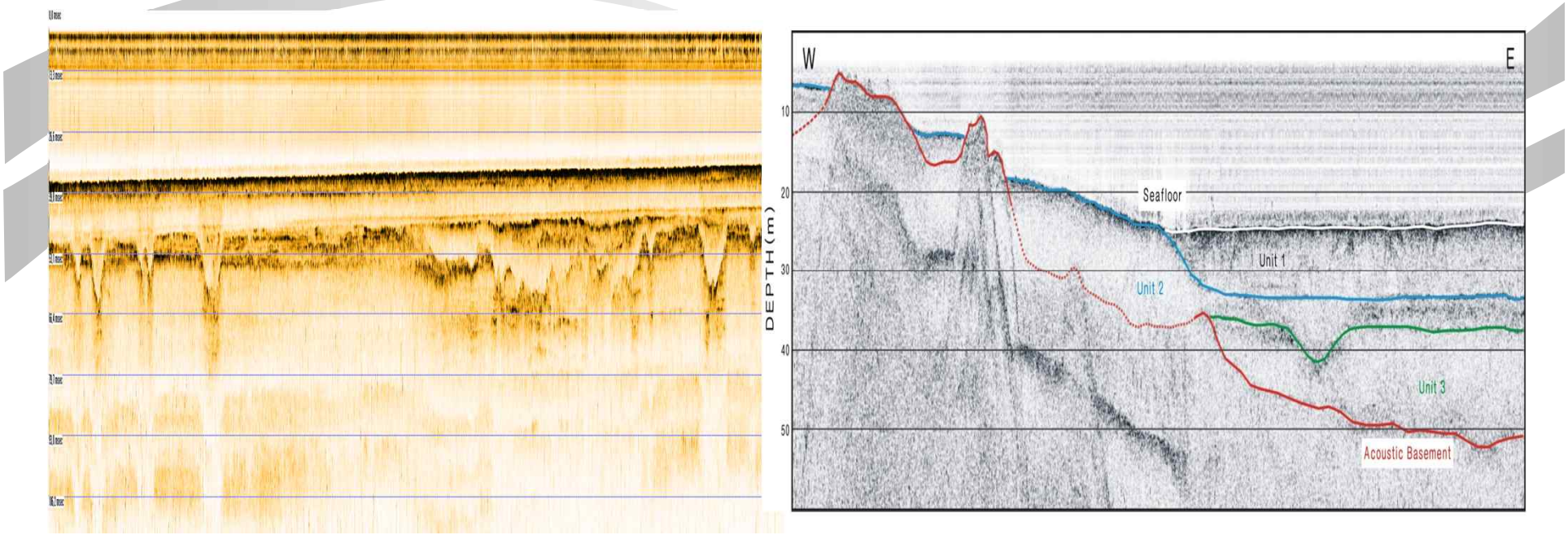






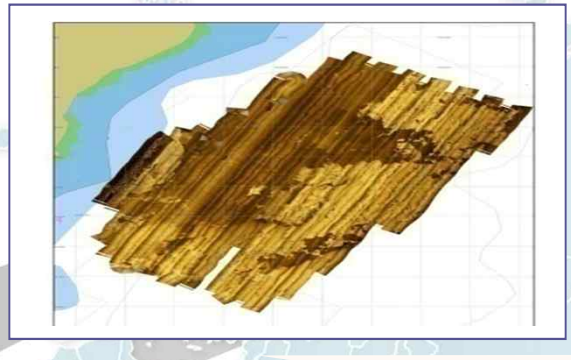
○ Sub-bottom Profiler Survey

Marine Research Co., Ltd. holds diverse sub-bottom profilers to analyze sub-bottom structures. Besides, by analyzing thickness of sedimentary layers and bedrock depth, marine sand reserves are identified, and earth surface investigation for underwater cultural properties is performed.

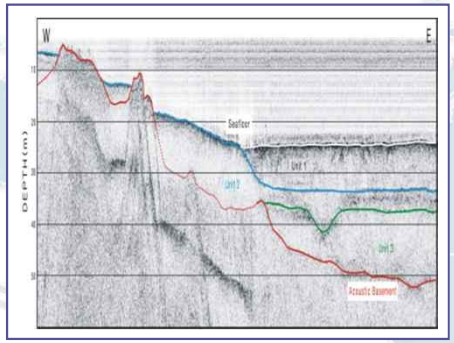


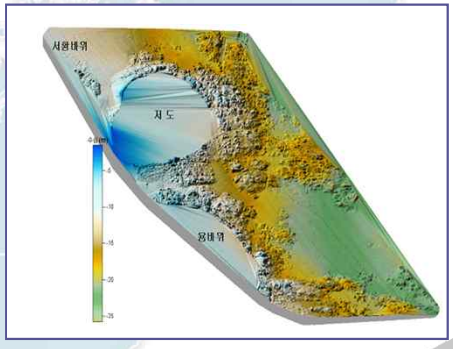
○ Sub-bottom Profiler Survey

Result of Sub-bottom image exploration

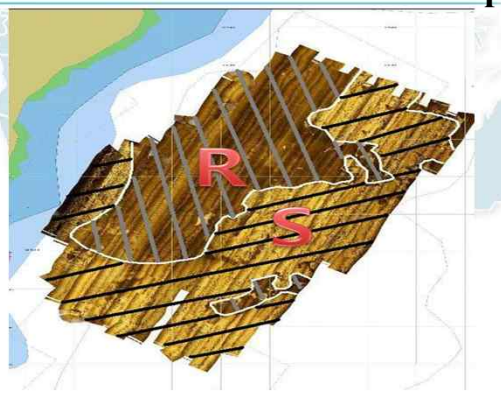


Result of Substratum detailed exploration

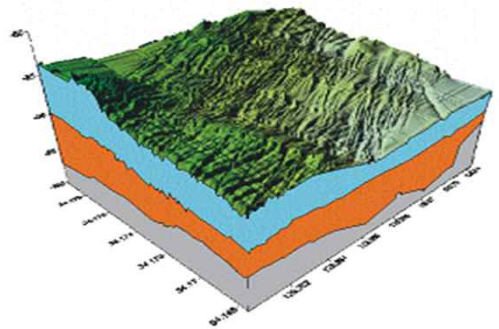




Substratum Distribution Map

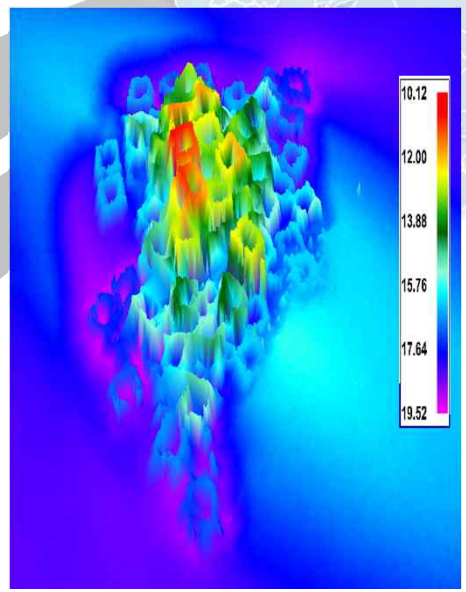


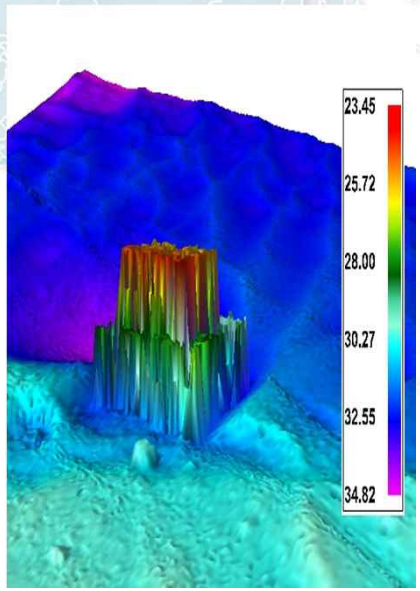
Stratum Structure Map

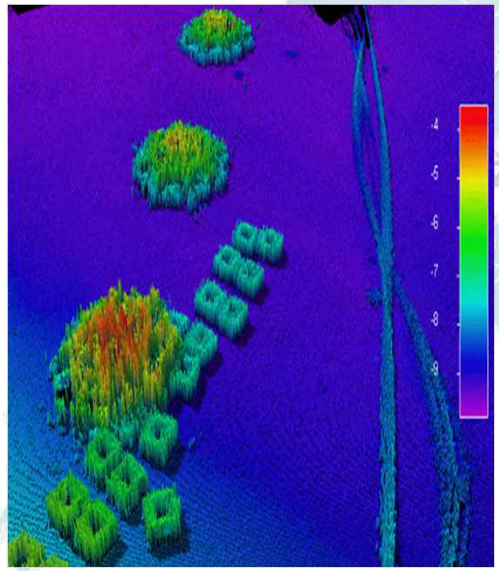


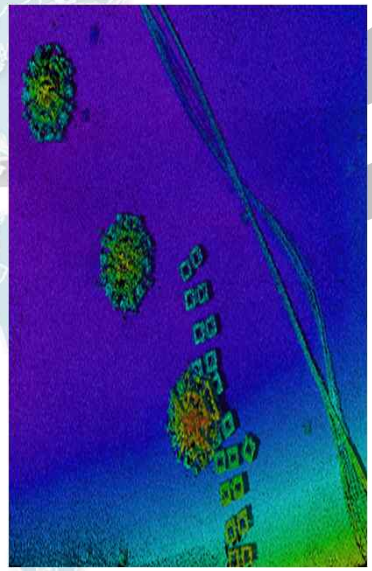
○ Survey for the Artificial Fishing Reefs

Marine Research Co., Ltd. investigates installation locations, facility states, and facility volumes of artificial reefs, performing post-management of artificial reefs, proper locations and effect of marine ranching projects, also performing environmental impact assessment resulting from marine development and structure installation.



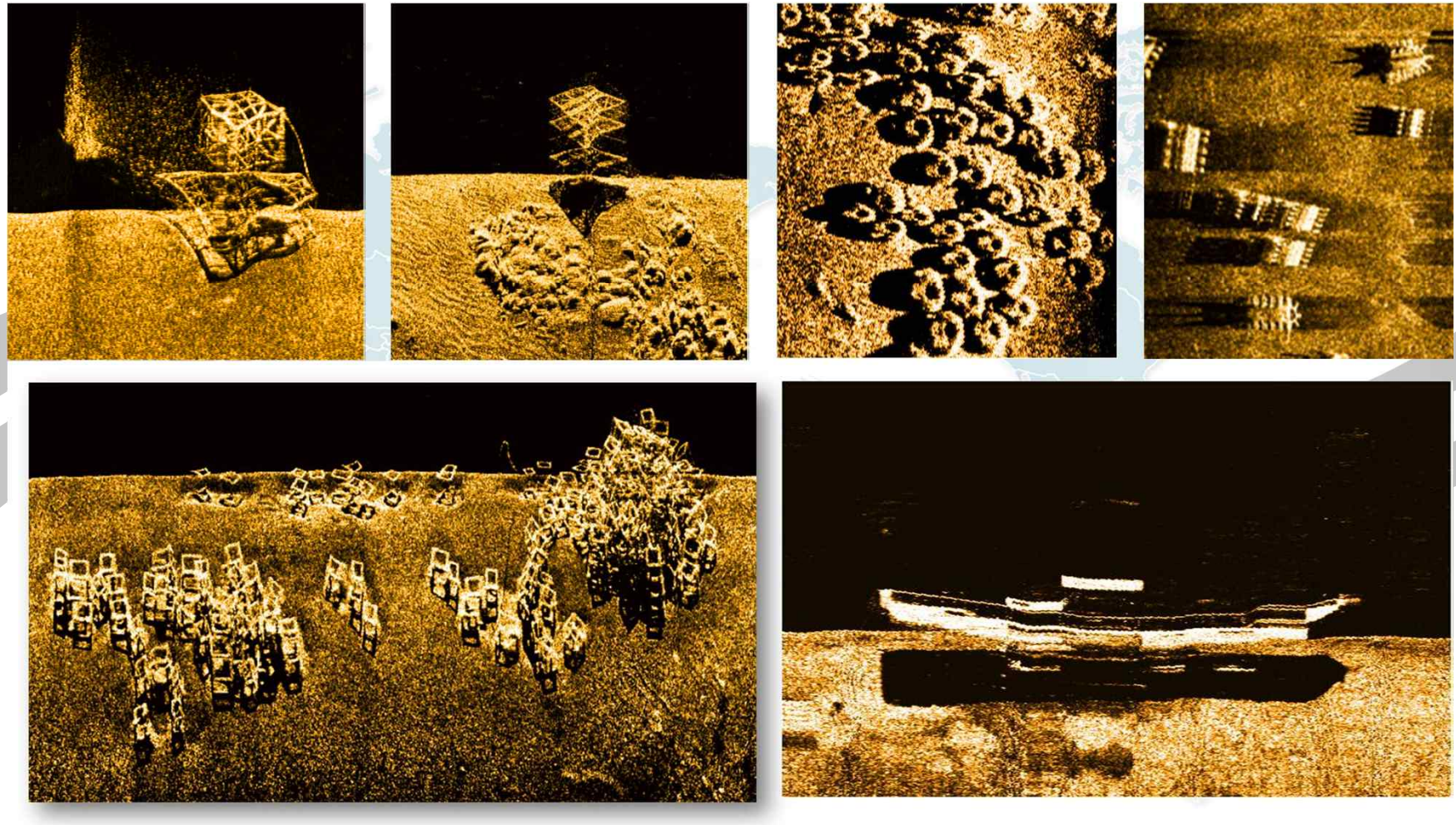




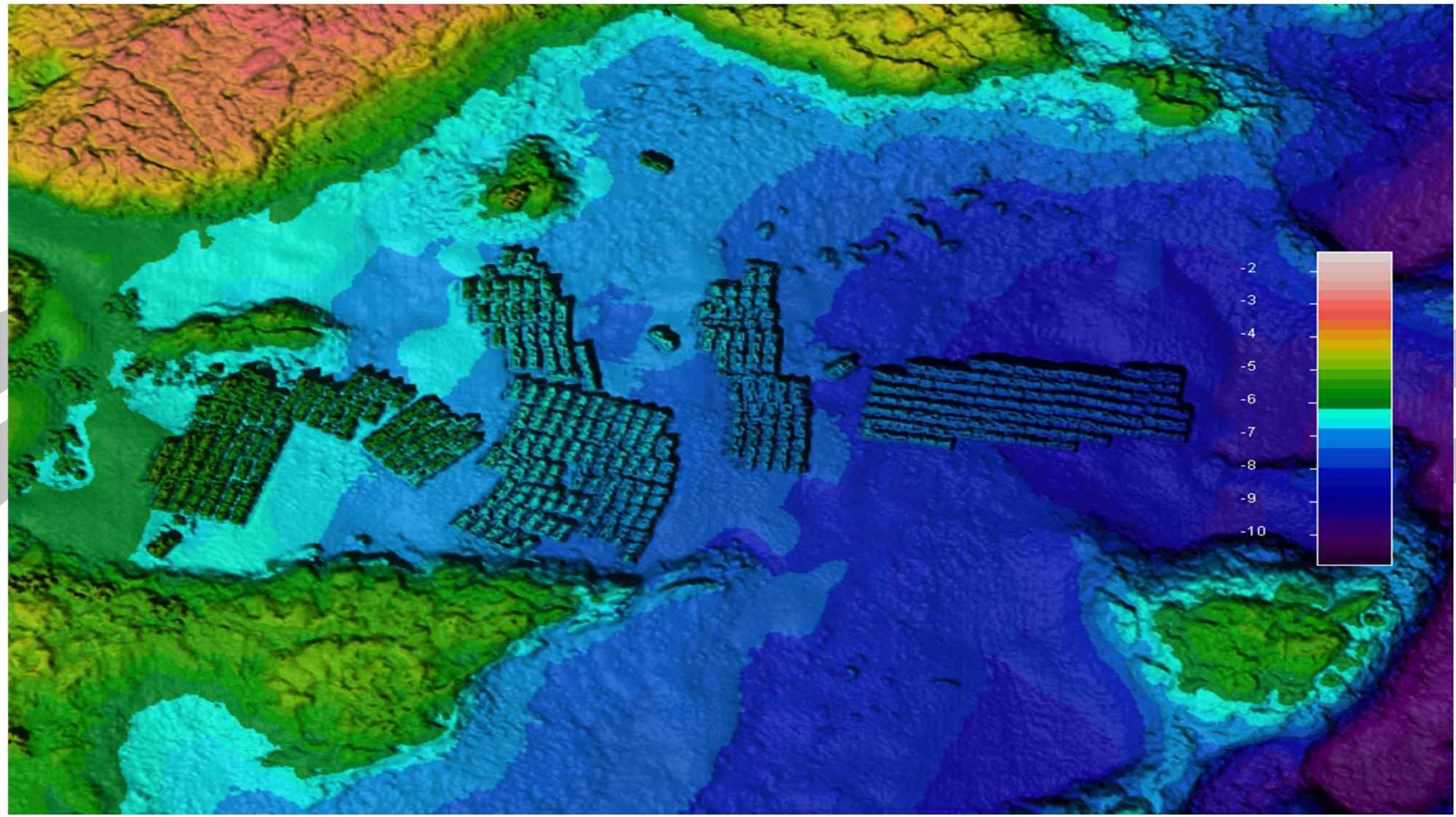


4. Biology & Environment

○ Survey for the Artificial Fishing Reefs



○ Survey for the Artificial Fishing Reefs



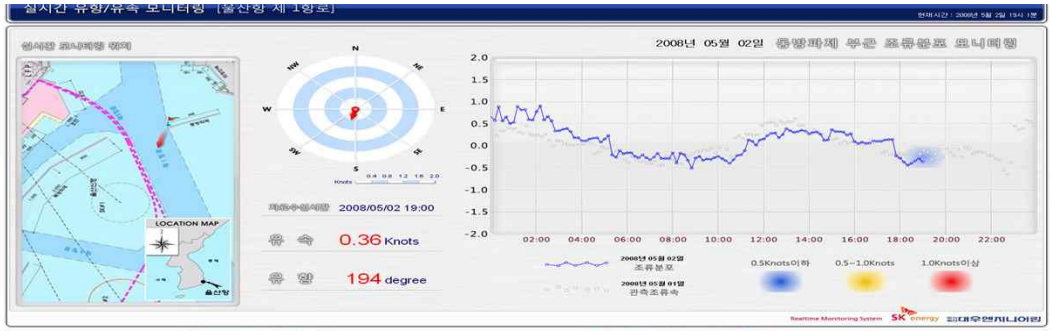
5. Physics & Modeling

○ Physical investigations of wave, tide and current

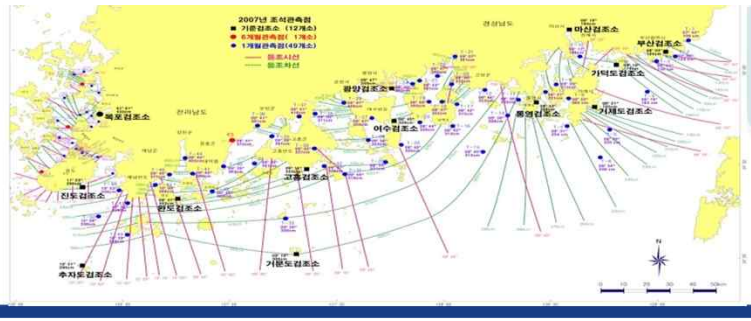
Marine Research Co., Ltd. performs physical oceanographic observation including oceanographic physical survey, hydraulic state survey, numerical analysis, and numerical model experiment.

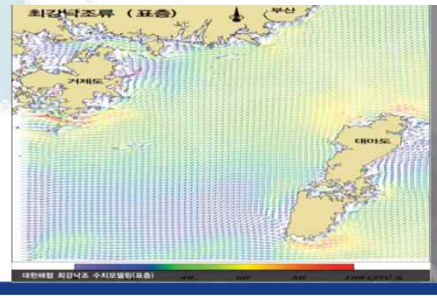
Besides, by constructing the flow direction and velocity system, it contributes to reliability maintenance of pilots and port authorities as well as marine accident prevention.

- **Real-time Current Monitoring**



- **Tidal Current Chart**





Ⅲ. Major Experiences

Domestic Projects

2011

- Coastal Survey of Eastern Naro Island Port
- Coastal Survey of Northern Imja Island
- Coastal Survey of around Keonygin
- Submarine Topographic Survey of Geoje City Sea Jungle Project
- Submarine Topographic Survey for Sea Jungle of Local Coastal in Incheon
- Submarine Topographic Survey of Sea Jungle Construction in Kyeongbuk
- **Total 58 Projects (32million US dollar)**

2012

- Coastal Precision Survey of Southern Jeju Island
- Submarine Topography and Data Processing of Southwest Sea in Korea
- Coastal Survey of Northern Oeyeon Island
- Hydrographic Survey of around Yeonpeong Island
- Hydrographic Survey of Han River
- Submarine Topographic Survey of Saemangeum
- **Total 92 Projects (36million US dollar)**

Ⅲ. Major Experiences

Domestic Projects

2013

· Seafloor Topography and Data Process in the Southwestern of Korea
· Detail Survey for Coastal Waters (National Designed Ports)
· Hydrographic Survey for S-oil New SPM Construction Project
· Multi Beam Survey of Hyundai Heavy Industries Co
· Multi Beam Survey of Submarine Pipeline and Buoy in SK Energy
· Multi Beam Survey of Daewoo Shipbuilding & Marine Engineering Co
· Submarine Topographic Survey of Sea Jungle Construction in Gijang Area
· **Total 66 Projects (36million US dollar)**

2014

· Coastal Precision Survey of Palgeum Island
· Seafloor Topography and Data Process in the Southwestern of Ieodo
· Hydrographic Survey of around S-oil FPSO
(Floating, Production, Storage and Off-loading Facility)
· Hydrographic Survey of Onsan National Industrial Complex
· Project for Oceanographic Survey in Development of Technology for Fisheries Resources Enhancement in Angola
· **Total 63 Projects (45million US dollar)**