Rock and Reef Survey and Service with Airborne Lidar

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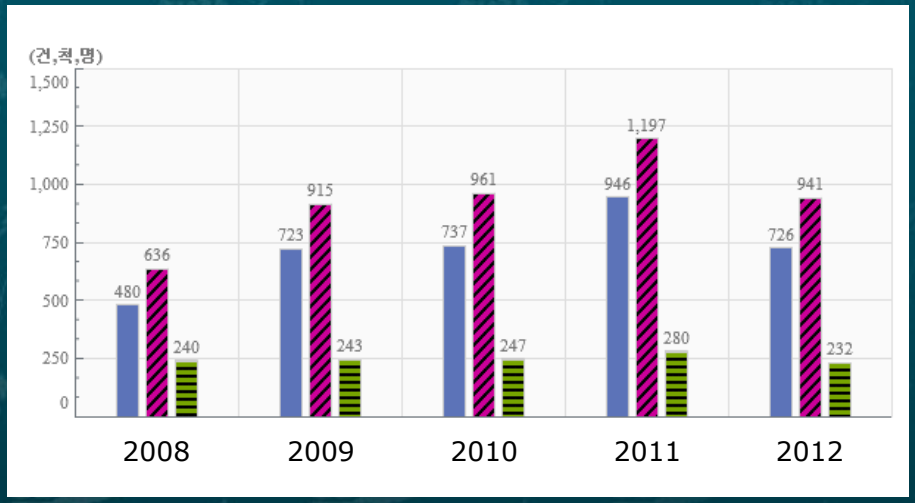
Geostrory INC.

1. Backgrounds

Based on (IMO Res. A 884(21))

Marine accidents has increased

- Rias form coast (headland-bay-lots of islands)
- Nautical Charts have been distributed to large ships but small leisure ships do not have such information



Number of accidents
Number of ships
Number of death

Recent 5 years showed the increase in number of all the marine accident including fishing boat and non fishing vessel. Main causes are engine malfunction, collision, being stuck on a rocks, fire, explosion, and sinking.

1. Background
-Accident at Tidal Flat

Police widen probe into boot camp deaths

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The deaths of five students at a private seaside boot camp Thursday have ignited debate over lax safety and flawed operations of military-style boot camps for young people. Police were widening their probe into the accident in Taean, South Chungcheong Province, in which the high-school students drowned after they followed trainers' orders to take off their life jackets and go into the sea. Two instructors, who were leading a group of 80 students on the second day, ordered them to enter the sea without life jackets.

Minutes after entering the water at around 5:10 p.m., 23 students were swept up by a strong current and five went missing.

"The camp instructors called the coast guard at around 5:34 p.m., 24 minutes after the accident, during which they were looking for the kid un, head of the West Regio .

n (monicasuk@heraldcorp.com)

1. Backgrounds

Systematic Survey Required

- Real Time Kinematic-GPS survey costs much. Less detailed information over larger areas.
- The shape of rocks are not known
- It is necessary to keep large scale survey for the rocks and reefs.

Undersea feature in shallow water

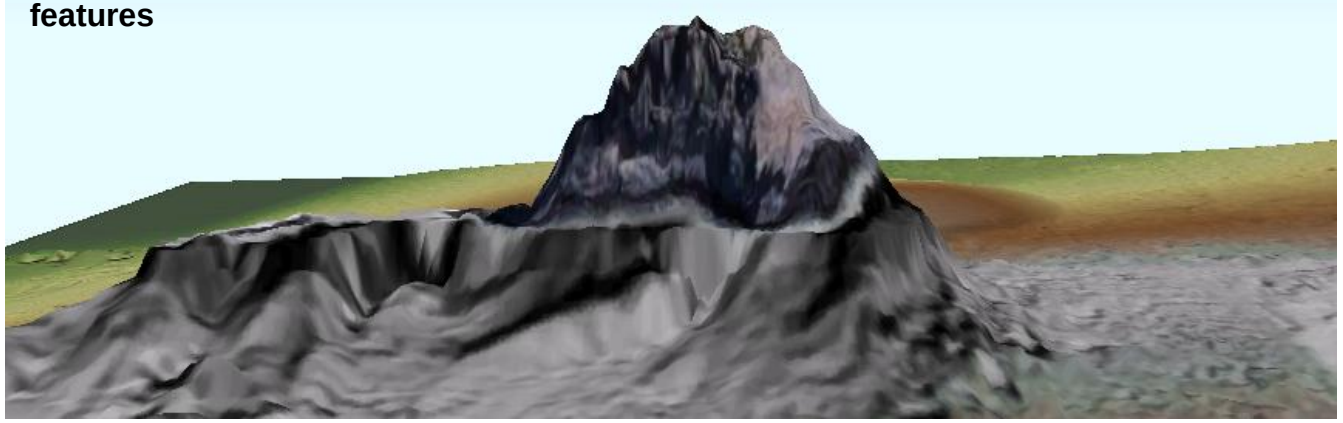
- Important for the navigation
- Individual experience cost or Societal cost?
- Increase in leisure activities

1. Backgrounds

Rocks shows always or
Rocks in case of lower sea level

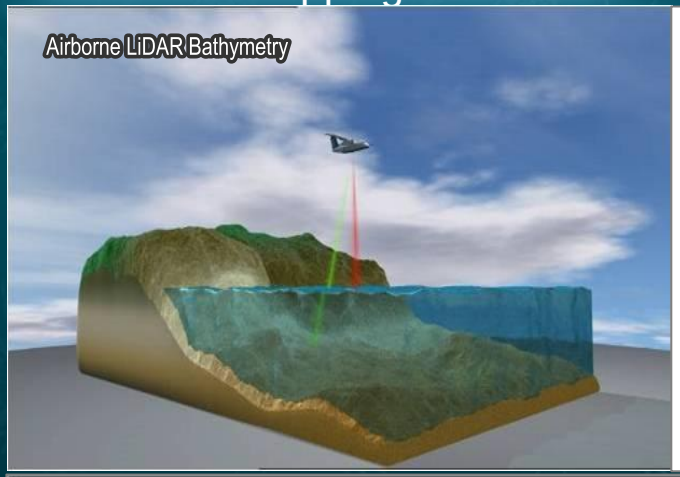
The shape of rocks from the sea surface

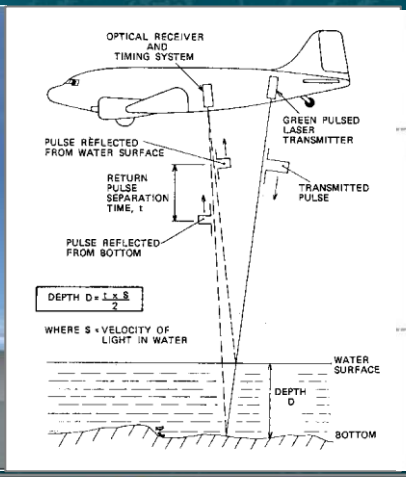
Rocks with the continuous depth data which show the undersea part of geomorphic features

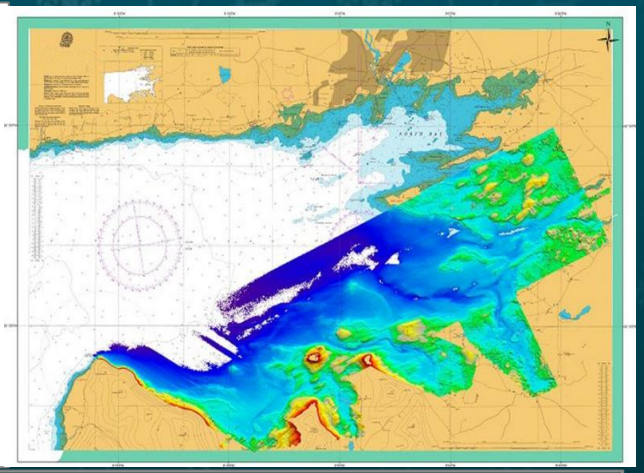


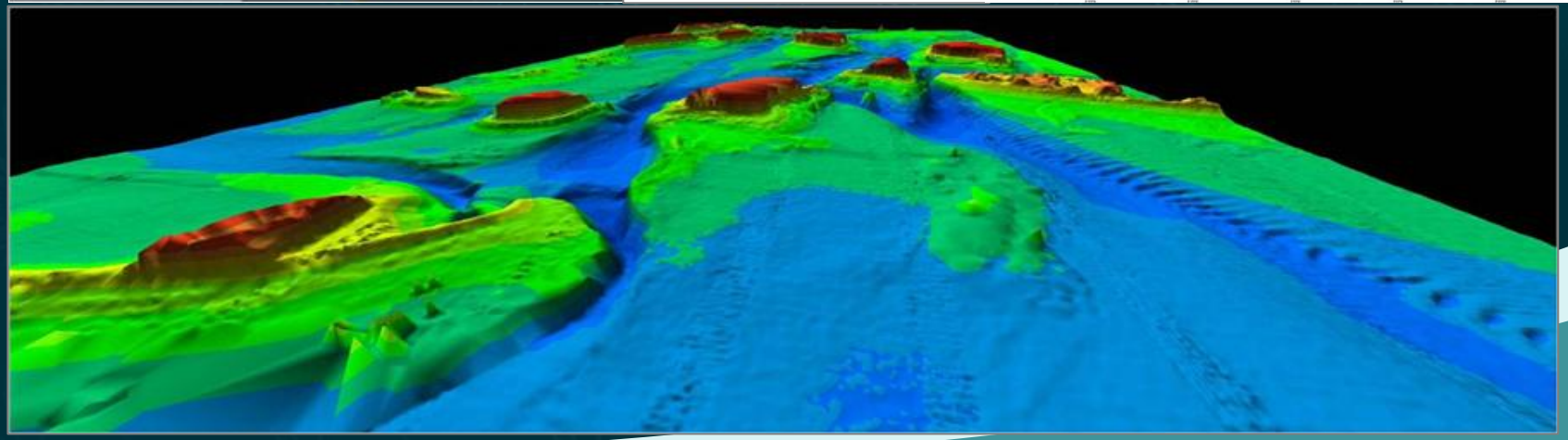
2. Review cases: CZMIL

Laser Mapping cases

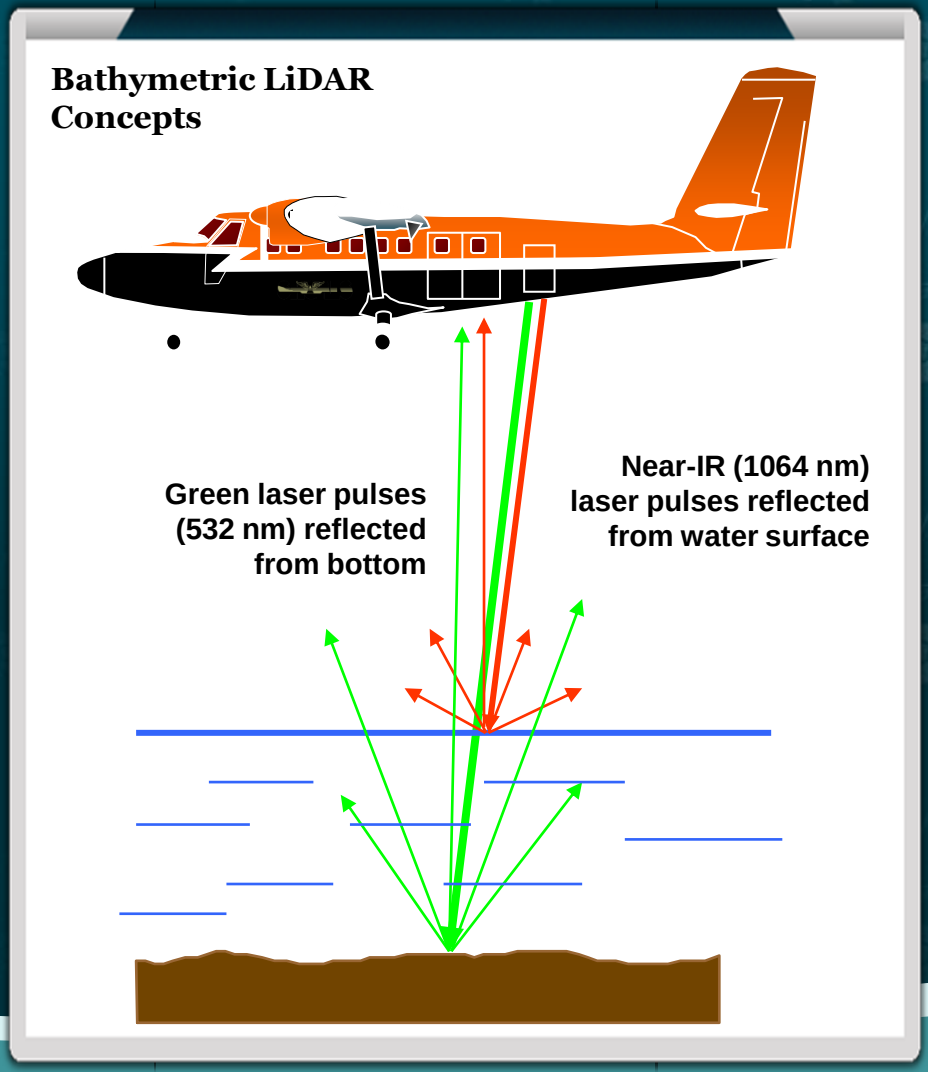


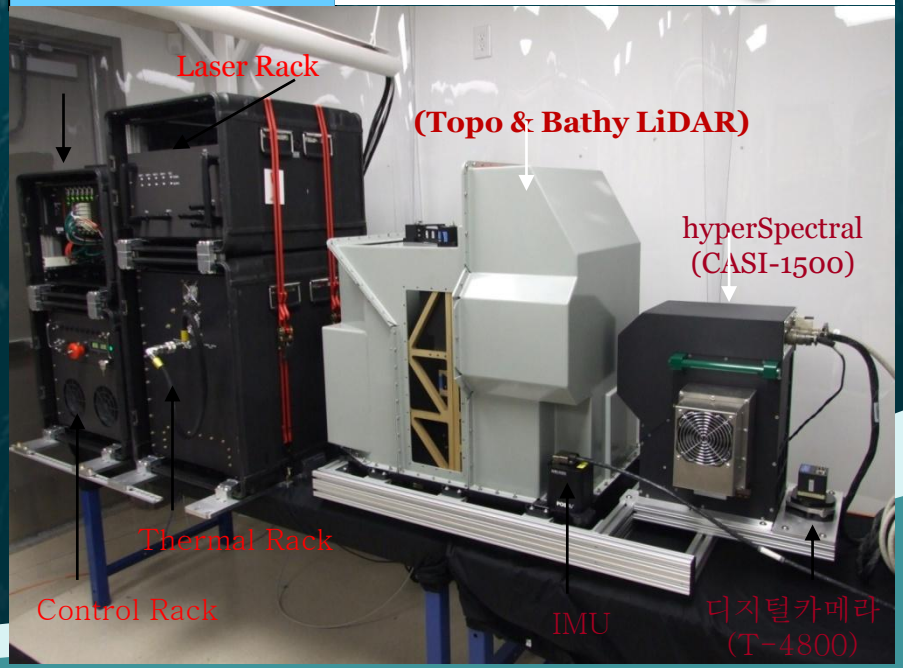






2. Review cases: CZMIL





2. Review cases: CZMIL

「history of development」

1984 LARSEN 500

1988 FALSH ALARMS

1994 SHOALS 200

1995 **HAWK EYE**

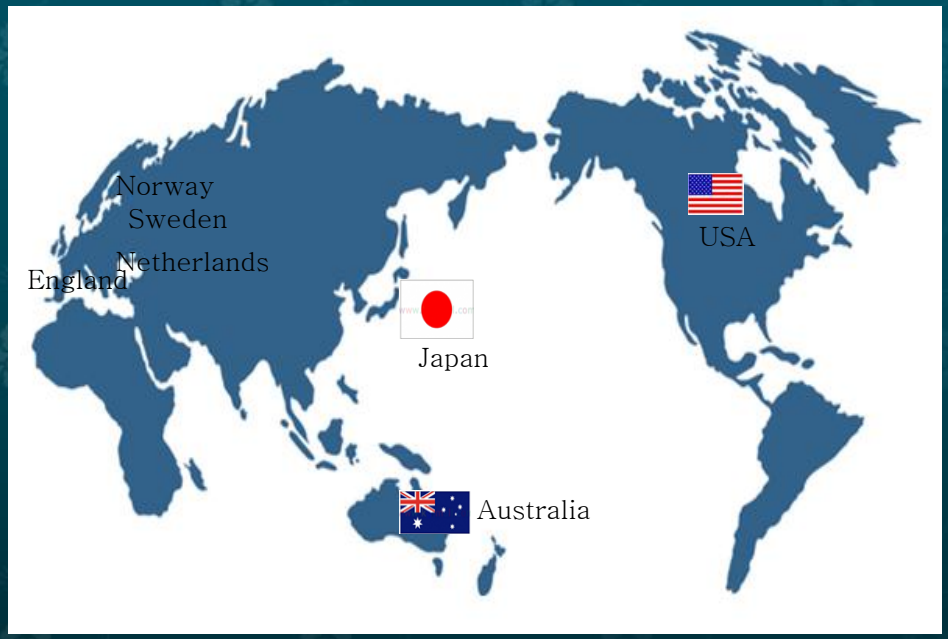
2003 SHOALS 1000
SHOALS 1000T

2005 **SHOALS 3000TH(CHARTS)**

2006 **CZMIL development starts (JALBTCX)**

2010 **SHOALS 3000**

2012 **CZMIL product (4)**

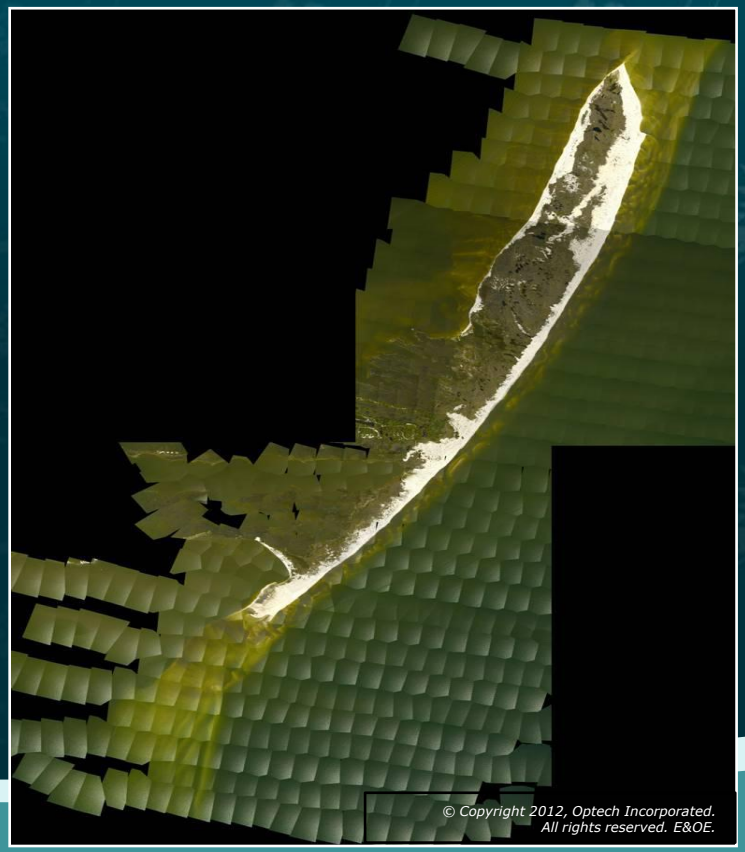


2. Review cases: CZMIR

CZMIL HydroFusion Product	Processing Level
Lidar points cloud	Level 2
Lidar depth grid Lidar topo/bathy DEM, 1 m Lidar topo/bathy bare earth DEM, 1 m LIDAR and Hyperspectral surface reflectance image mosaic LIDAR and Hyperspectral bottom reflectance image mosaic LIDAR and Hyperspectral water attenuation images Hyperspectral bottom fraction images Hyperspectral water quality image mosaics(Chl, SSC ,CDOM) RGB Ortho image mosaic, 0.2 m	Level 4
Benthic habitat classification map Land cover classification map	Level 5
NAVD88 shoreline vector USGS Dune height elevations Building foot print vector	Level 6

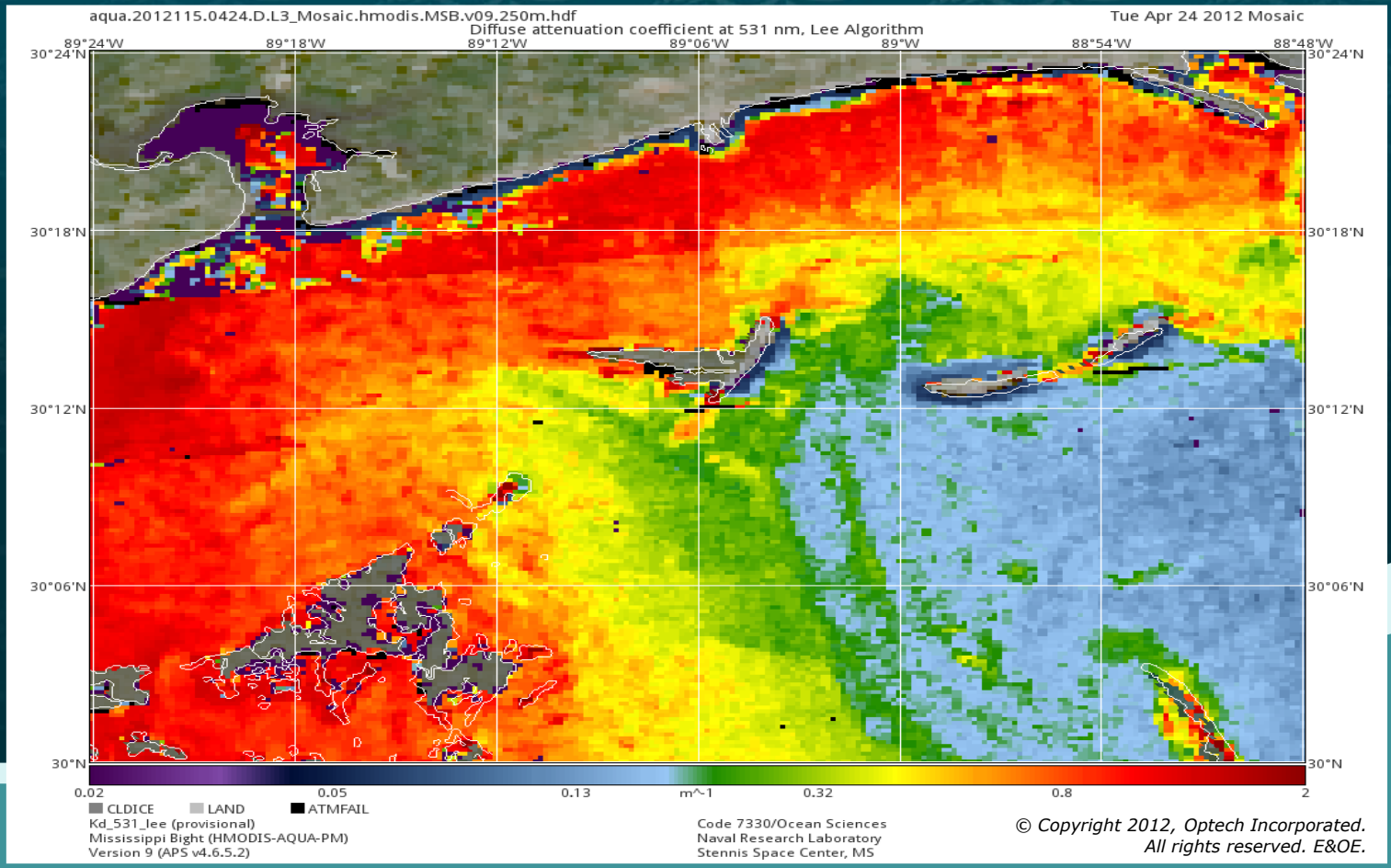
2.US. Army Corps Eng. Test

- Digital Camera Image
  - **20cm resolution Digital Camera Image Cat Island April 25. 2012**



2. US. Army Corps Eng. Test

- Cat Island April 24, 2012 MODIS Aqua
  - Kd_531 (250m Resolution)



2.Their Results

- Preliminary Results
  - Short system response time allow to detect power lines.
  - 10,000 Hz for deep water and 70,000Hz for Shallow/Topo provide high spatial resolution image products.
  - CZMIL detectable depth is about 2.5 time of secchi depth.
  - High performance in shallow or turbid water
  - Maximum Depth
    - Mississippi Data Collection
      - → 7.1m at approximately 0.4 Kd @532nm (MODIS data)
    - Florida Data Collection
      - → 40 m at approximately 0.12 Kd @532nm (MODIS data)

2.Lessons from the test:

- ALB Wish List
  - Cost reduction
    - Smaller team (Max. 4 people in the field)
    - Reduce processing time
    - Lighter system to fit smaller planes
  - Improved performance
    - Non fixed altitude system
    - Dedicated topo mode
    - Very shallow water and high density
    - Seafloor reflectance
    - Less sensitive to environmental condition
    - Universal software

CZMIL

2/3 cost cut

2. Purpose of Study

“ ”

Using Bathymetric Lidar technologies
Scientific Reef ad Rock Survey and Data Management

scope

Individual Rock Survey

- limitations of existing technologies
  - single beam, and multi beam data
  - Virtual Reference System-RTK output
- Design for the survey outputs and test

Reef and rocks DB setting

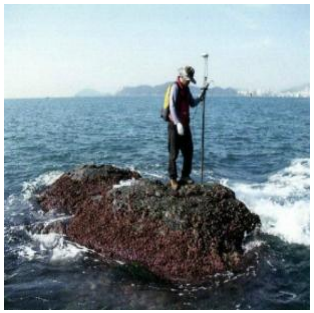
- Database design for current status of reefs
- Reef Shape classification and application suggestion
- Information communication and propagation

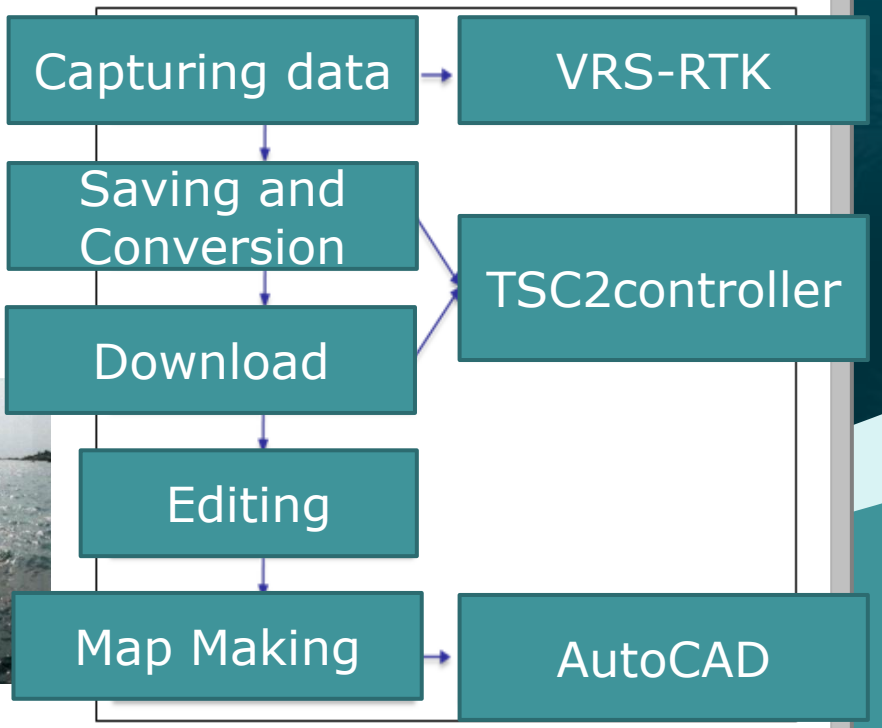
3. Methods: Reef Survey

(1) AS-IS analysis

Survey by ship

- field survey with RTK – not accessible
- expected position: estimated
- limited information with small ships
- undersea part of the feature not known
- danger of surveyors

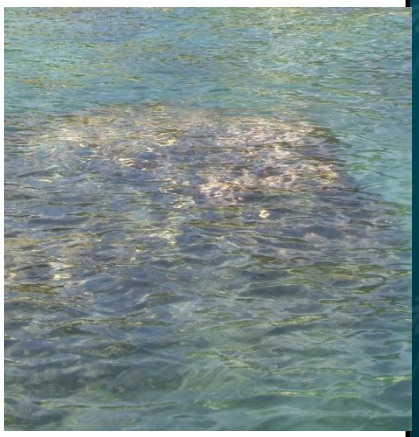



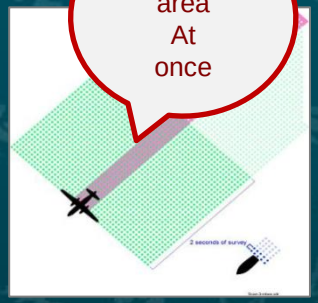



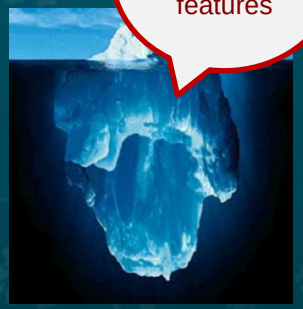
3. Methods :Reef Survey

(1) data sheet

number		CS-N-82
Old data	coordinate (WGS84)	-
		-
	Depth (DL)	-
New data	coordinate (WGS84)	36-24-18.74 N
		129-25-31.64 E
	Depth (DL)	-0.3m
class		Always-Occasional
Average surface height		0.131㎝
AHHL		0.262㎝





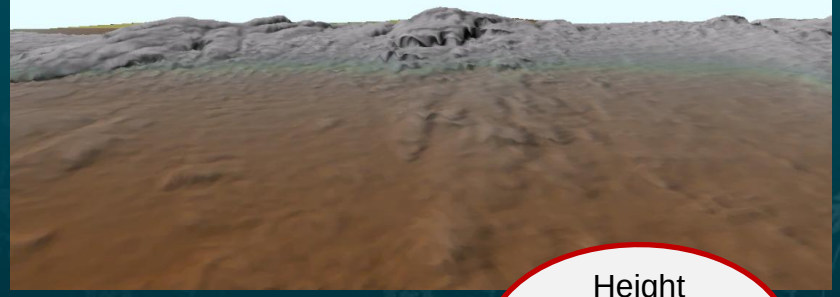


- site location and depth data
- subjective & experience-dependent
- time-consuming
- spot survey possible
- undersea part of rocks are not know

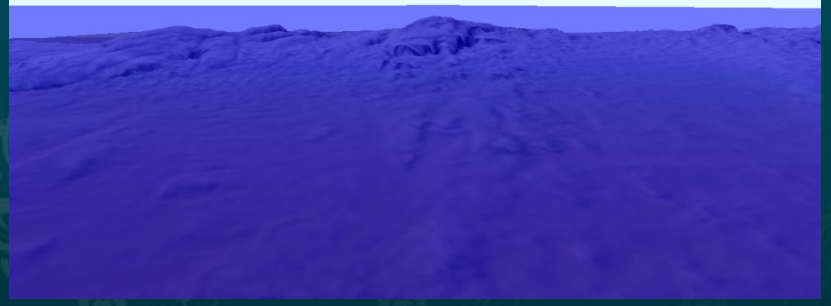
3. Methods: new approach

(2) Report from the survey results

3D visualization for the rock or reef



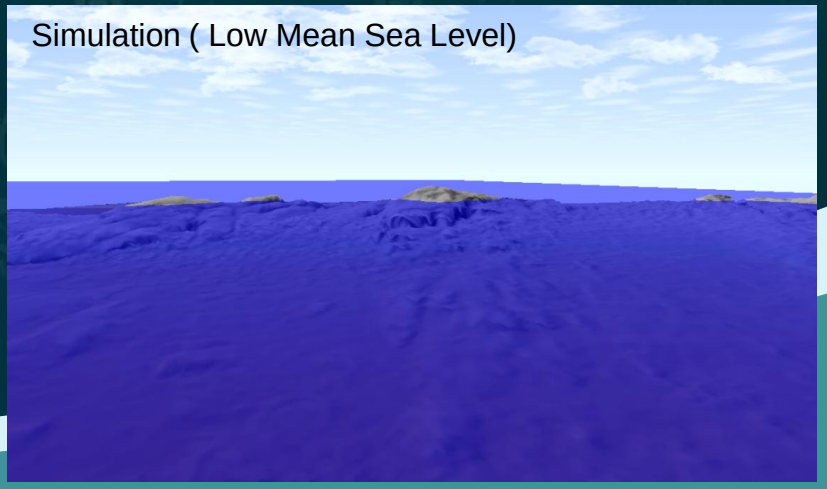
Simulation (approximate highest high water)



Simulation (datum level)

Height criteria based on DL

Simulation (Low Mean Sea Level)



3. Methods: mapping two ways

(3) Old Data collections

- collecting old data from data sheet
- reports, vector data, pictures
- classify the data to old and new
- high level height determination

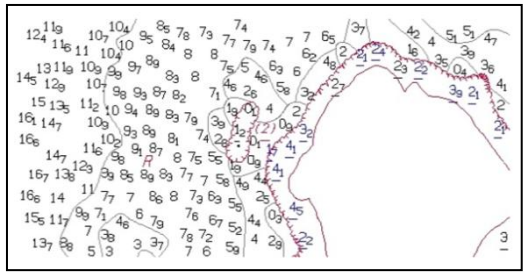
No.	2-1	관측고 : -1.92			결정고 : -2.0
WGS-84	구성과	-	UTM	구성과	-
		-			-
	신성과	35-49-09.86 N		신성과	3967070.13
		126-23-12.81 E			263925.04
천소수심 (m)	구성과	-	비 고	간출	
	신성과	-2.0			

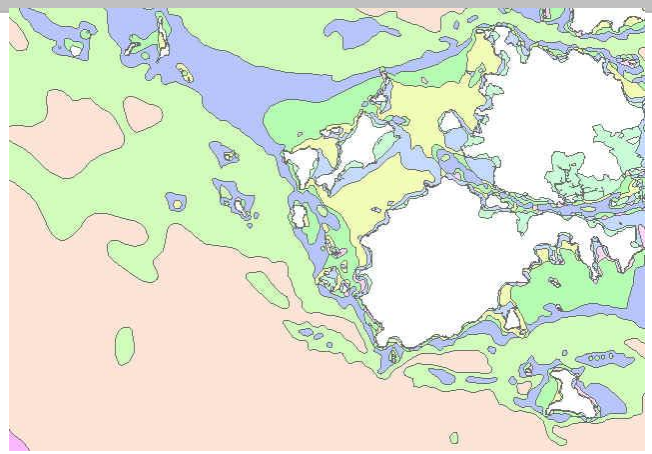
	조위관측소 : 신시 No. 1 T B M									
계산자: 지호근	검산자: 최승우		평균해면 3.395m					약최고고조면 6.790m		
순번	위 치		신 성 과					구성과		비고
	신성과	구성과	관측 일시	관측고 (m)	조위 (m)	결정고 (m)	노,간출 구분	높이 (m)	노간출 구분	
5-7	35-48-26.10N 126-25-21.85E	35-48-25.92N 126-25-22.03E	9/17	-8.1		4.7	노출	-	-	
5-8	35-48-35.05N 126-25-40.88E	35-48-35.02N 126-25-41.04E	9/17	-6.99		3.6	노출	3.3	노출	
5-9	35-48-43.09N 126-25-42.00E	35-48-43.11N 126-25-42.17E	9/17	-9.63		6.2	노출	6.1	노출	
5-10	35-48-44.94N 126-25-46.19E	35-48-44.55N 126-25-46.33E	9/17	-10.18		6.8	노출	7	노출	
5-11	35-48-48.01N 126-25-46.26E	-	9/17	-5.01		-5.1	간출	-	-	
5-12	35-48-48.59N 126-25-42.74E	35-48-47.75N 126-25-42.76E	9/17	-4.31		-4.4	간출	-	-	
5-13	35-48-54.92N 126-25-37.11E	35-48-54.72N 126-25-36.99E	9/17	-6.53		-6.6	간출	-	-	
6-1	35-48-17.22N 126-24-27.80E	35-48-17.08N 126-24-27.55E	10/5	-2.66		-2.7	간출	-	-	
6-2	35-47-34.86N 126-25-05.01E	35-47-35.76N 126-25-03.34E	9/17	-1.7		-1.7	간출	-2.2	간출	
6-3	35-47-43.16N 126-25-25.81E	35-47-43.09N 126-25-26.05E	9/17	-8.24		4.8	노출	-	-	
6-4	35-47-34.80N 126-25-29.40E	35-47-34.97N 126-25-29.68E	9/17	-6.91		3.5	노출	4.9	노출	
7-1	35-47-49.98N 126-25-47.74E	-	10/26	-7.23		3.8	노출	-	-	
7-2	35-48-03.38N 126-26-13.76E	35-48-03.01N 126-26-13.55E	9/17	-5.66		-5.7	간출	-	-	
7-3	35-48-00.10N 126-26-18.03E	35-48-00.47N 126-26-18.09E	9/17	-2.96		-3.0	간출	-	-	
7-4	35-47-59.78N 126-26-21.88E	35-47-59.66N 126-26-22.49E	9/17	-5.11		-5.2	간출	-5.6	간출	
7-5	35-47-55.04N 126-26-38.87E	35-47-55.06N 126-26-37.70E	9/17	-2.63		-2.7	간출	-1.7	간출	
7-6	35-47-55.22N 126-26-42.39E	35-47-55.42N 126-26-42.02E	9/17	-14.19		11	노출	13	노출	
7-7	35-47-57.45N 126-26-48.80E	35-47-57.63N 126-26-48.53E	9/17	-10.53		7.1	노출	8.5	노출	

3. Method: Database Design

(4) DB design for the management

- link land class for old and new data
- configuration DB management





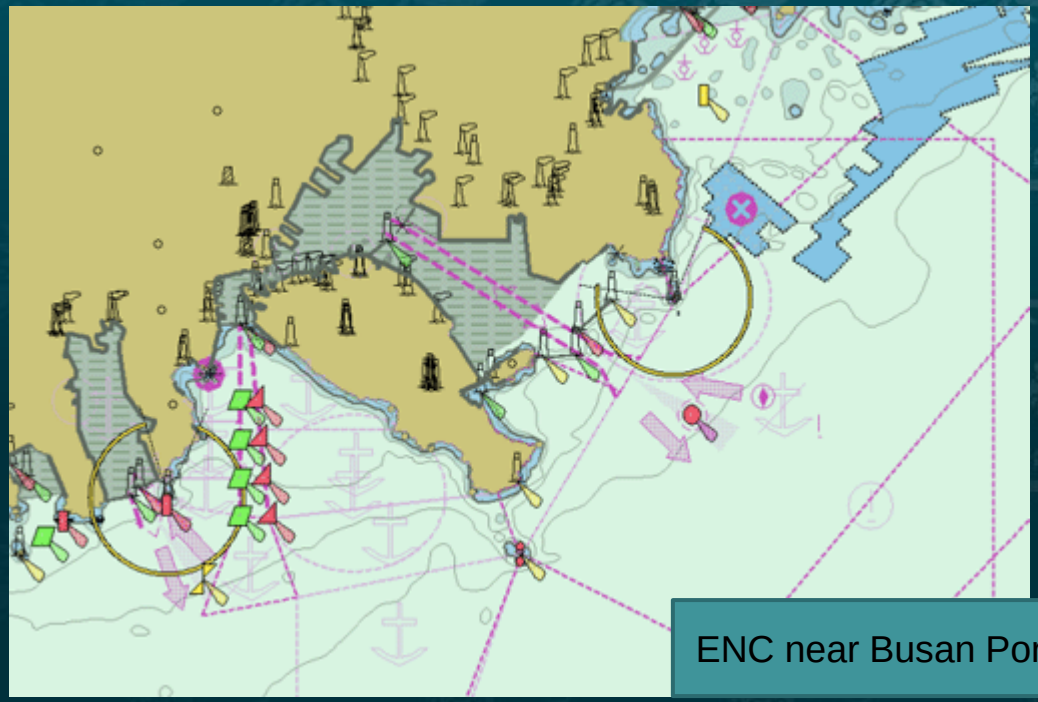
FID	Shape	OBJ_CD	SGG_CD	SURV_KD	ISLD_NM	SURV_	OBJ_LENGTH	LI_KIND
8254	Polyline	LA	46770	측량	외나호도	2008	37,2089	육지부
8255	Polyline	LA	46770	측량	외나호도	2008	156,547	육지부
8256	Polyline	LA	46770	측량	외나호도	2008	64,4198	육지부
8257	Polyline	LA	46770	측량	외나호도	2008	120,381	육지부
8258	Polyline	LA	46770	측량	외나호도	2008	303,263	육지부
8259	Polyline	LA	46770	측량	외나호도	2008	42,210201	육지부
8260	Polyline	LA	46770	측량	외나호도	2008	174,619	육지부
8261	Polyline	LA	46770	측량	외나호도	2008	62,429001	육지부
8262	Polyline	LA	46770	측량	외나호도	2008	337,004	육지부
8263	Polyline	LA	46770	측량	외나호도	2008	66,308601	육지부
8264	Polyline	LA	46770	측량	외나호도	2008	267,30701	육지부
8265	Polyline	LA	46770	측량	외나호도	2008	462,646	육지부
8266	Polyline	LA	46770	측량	외나호도	2008	255,506	육지부
8267	Polyline	LA	46770	측량	외나호도	2008	126,138	육지부
8268	Polyline	LA	46770	측량	외나호도	2008	35,665501	육지부
8269	Polyline	LA	46770	측량	외나호도	2008	719,94	육지부
8270	Polyline	LA	46770	측량	외나호도	2008	70,020302	육지부

4. Expected Results

- set of point clouds (screened raw data)
- comparison sheet between old data and new data
- limitations of each method for the survey of rocks and reefs
- database design and data propagation strategies: accepting Gov 3.0 policy

4. Expected Effects

- 1. updating nautical chart



ENC near Busan Port

Nautical chart

e-Navigation

Application System Development
-ECDIS
-ENC distribution

4. Expected Effects

1. updating nautical chart

- Application System Development
  - ECDIS
  - ENC distribution

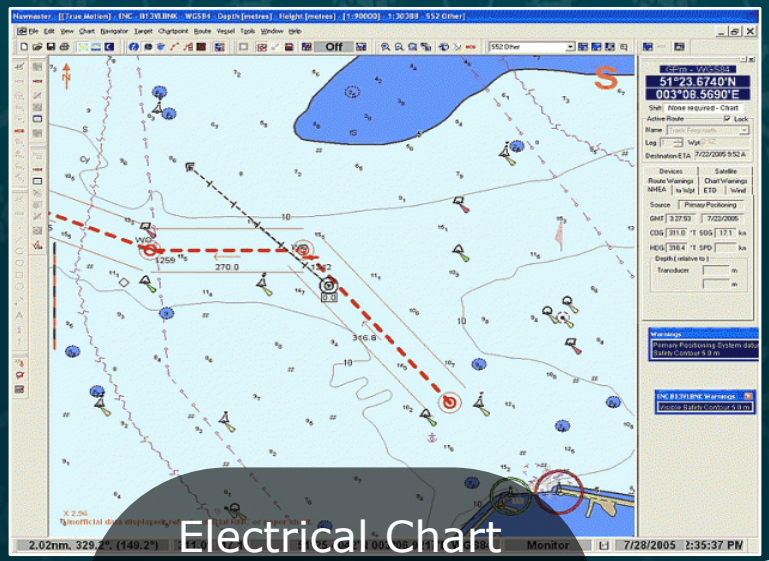
Nautical chart

GPS/DGPS

Radar

Compass

Speedometer



Electrical Chart Display Information System(ECDIS)

Warning Alert

Cruise Planning

Cruise Recoding

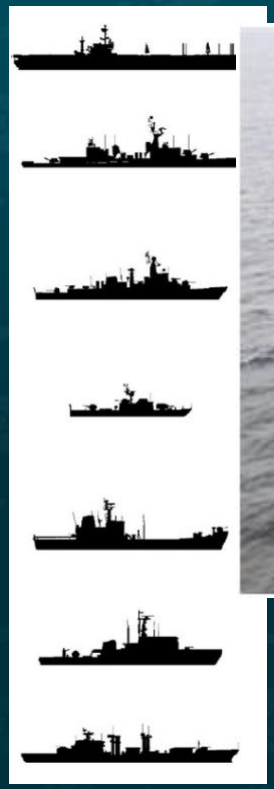
Cruise Surveillance

Navigation information

4. Expected Effects

2. providing basic data for coastal area management

NAVY

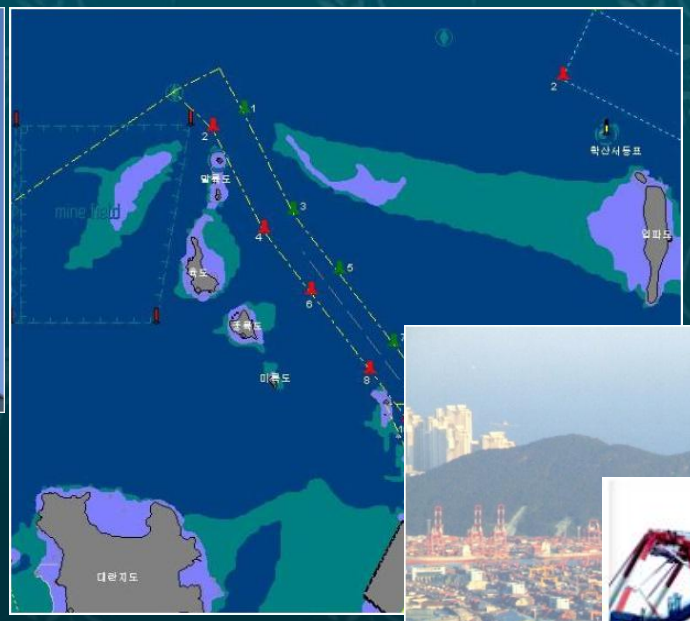


KNTDS

4. Expected Effects

2.providing basic data for coastal area management

Radar

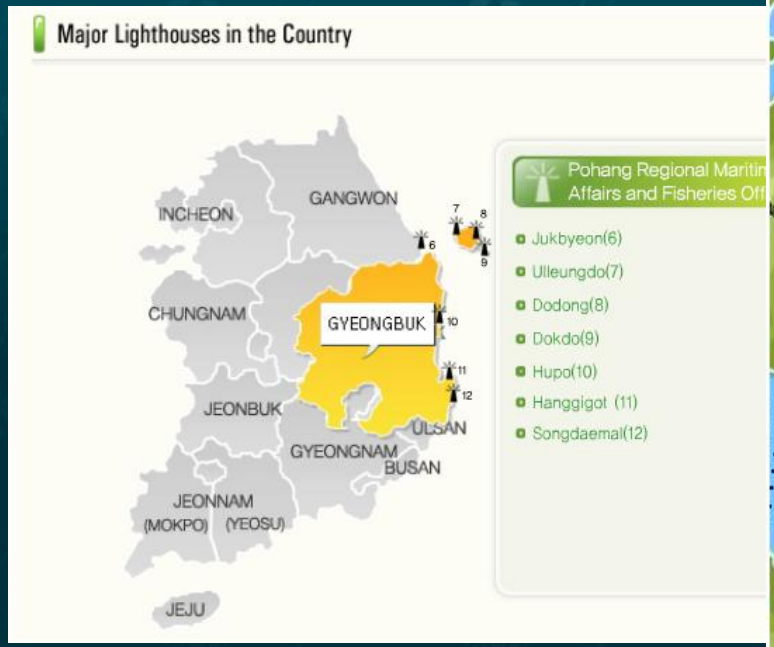


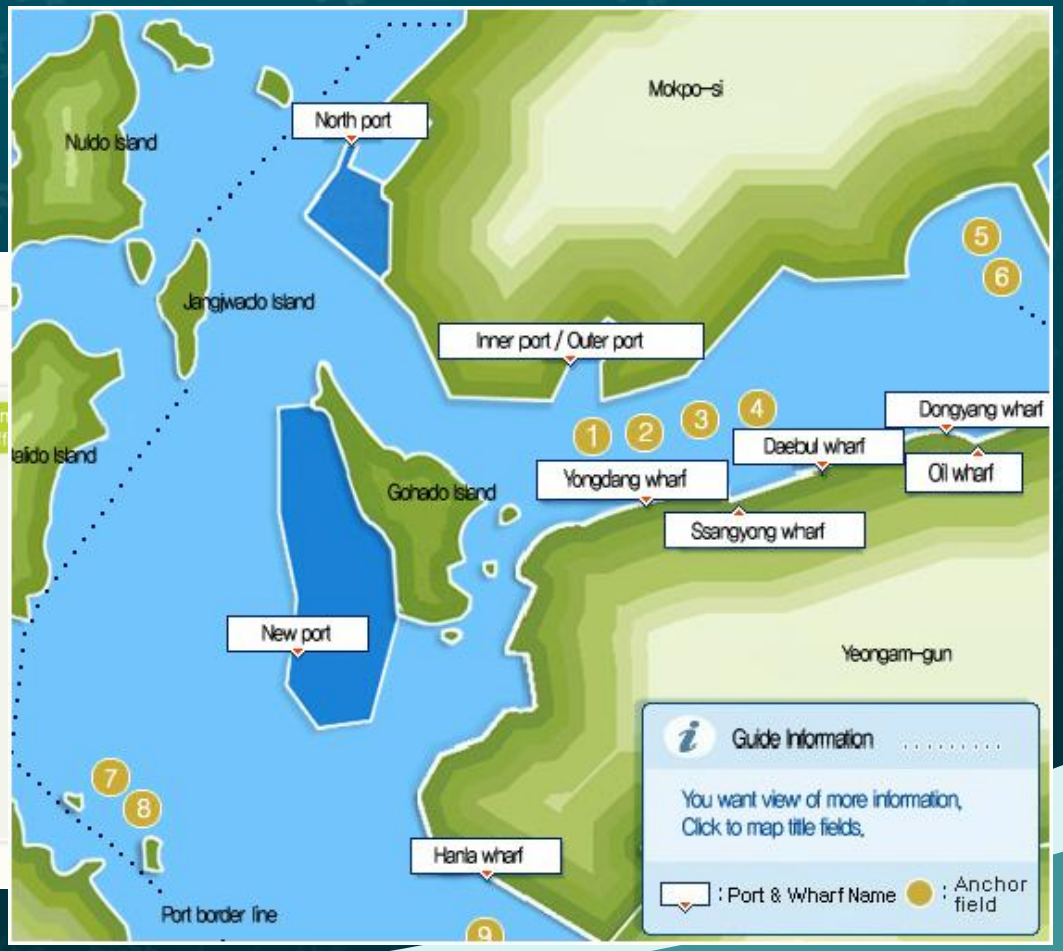
Leading vessel
Piloting vessel

Korea Maritime and Port Administration

4. Expected Effects

Surface navigation and Lighthouse information system





Conclusions

We explained why Korean Government has tried to adopting emerging technologies: ultimate goal for the safety in the area :Tidal flat and rock and reef near shore

Old survey results are also archived with matching table with new results

Database design and Application development plan will enhance the usage of the scientific results of Coastal Zone Mapping and Imaging Laser.

- Thank you for listening
- Further information: emchang21@gmail.com
- www.ziinconsulting.com