REPORT OF IN-HOUSE WORKSHOP ON BENTHIC HABITAT MAPPING ON BOARD M.V. SEAFDEC 2

17 - 19 September 2012

TD/RP/163

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Referring to the recommendations made at the "*Expert Meeting on Deep-Sea Fishing and Its Impact on Ecosystem*[1]" that SEAFDEC is requested to find best practice of the sampling gears for deep-sea fisheries resources. Over the years, SEAFDEC/TD has explored ways to utilize the deep-sea fisheries resources in Southeast Asian Region through improvement of so-called "environmental friendly sampling gears", including mid-water trawl, gillnet, and bottom vertical longline. It was also suggested through the series of activities related to deep-sea fisheries resources exploration in the Southeast Asian Region that technical information/knowledge and experience on bathygraphic mapping (fisheries resources mapping) should be transferred to the Member Countries in order to provide an alternative source of fisheries resources from the deep-sea waters of the Member Countries with science-based information, particularly on the vulnerable marine ecosystem of their respective waters. In respond to this, SEAFDEC TD has developed a set of equipment ready to be put into the trial before transferring such knowledge and technology to the Member Countries. Subsequently, SEAFDEC/TD plans to organize "Regional training workshop on benthic habitat mapping" scheduled in the third quarter of 2012, of which the tools[2] for resources mapping are needed to be trailed.

With this regard, SEAFDEC/TD proposes to carry out the in-house workshop on the benthic habitat mapping on board M.V. SEAFDEC 2.

Objectives:

System testing preparing benthic habitat mapping including:

- Underwater VDO camera
- ROV
- Side Scanning Sonar
- Echo Sounder and
- Bottom trawl

Participant s

1.	Ms Penchan Laongmanee	Coordinator
2.	Asst.Prof. Pachoenchoke Jintasaeranee(Ph.D.)	Resource person (Lecturer from Burapa University)
3.	Dr. Natinee Sukramongkol	Participant
4.	Mr. Sukchai Arnupapboon	„
5.	Mr. Narong Ruangsivakul	„
6.	Mr. Sayan Promjinda	„
7.	Mr. Nakaret Yasook	„
8.	Mr. Suchart Kitsamut	„
9.	Mr. Komson Pofa	„
10.	Dr. Taweekiet Amornpiyakrit	„
11.	Dr. Nopporn Manajit	„
12.	Mr. Weerasak Yingyuad	„

[1] organized under project deep-sea fisheries resources exploration in the Southeast Asia during 31 August - 2 September 2010

Activities summary

Lecture

Two topics related to basic knowledge echo-sounder including bottom topography survey and mapping the sea floor basic knowledge were lectured by Asst.Prof. Pachoenchoke Jintasaeranee (Ph.D.) from Department of Aquatic Science, Faculty of Science, Burapha University. He also shared his experience on sea floor mapping project in collaboration with German University in Andaman Sea. His lecture notes were attached in Annex I and II.

Performance testing result

1. Underwater VDO camera (SEA Viewer underwater VDO camera) , fig. 2
   The sledge attached with Underwater VDO camera were operated five cast to depth about 20 meter near Ko Phai island (fig.1) to test the most suitable angle of VDO camera and light to capture bottom seafloor. It was found that the survey area is high turbidity; the light source from the SEA Viewer is too low to focus sea floor. Following is recommendation for the future SEA Viewer cast in the turbid water.
   - SEA Viewer light should be turn off (the camera lens focus to colloid / suspended solid when turn on the SEA Viewer light)
   - Use outside light source which should be alternately switches on and off every 5 minutes to save battery.
   - Trawling speech 0.7-1 knot
   - Attached angle of SEA viewer to frame is 67°
   - Operating time should be in day time
   - Should overlay position from GPS to VDO
   - Should mark length of sea cable to correct position

2. Remotely Operated underwater Vehicle (ROV), fig. 3
   The ROV system is working well when testing on desk. With unknown reason it malfunctions when lowering to depth about 20 meters after 5 minutes testing period. Both underwater and on desk unit were check by Port engineer. There were no part of the ROV is leak. He suggested to send main board of underwater unit to repair.

3. Side Scanning Sonar (Furuno HF 600)
   The system was not able to retrieve before the workshop period. The performance testing of HF600 was abolished from the schedule. We are contracting to Furuno co. Ltd. to repair the system.

4. Echo Sounder (Furuno GP-1650 WF) fig. 4
   The Furuno GP-1650 WF is working well when testing. However some improvement is need for better operation in term of quality of data and convenience for practical operation including:
   - Portable rack for installing transducer (fig. 5)
   - Purchase electric power inverter (220 V to 12 V)
   - Operate at ship speech 2 knot
   - Data should be plot to overlay with underwater VDO seafloor

5. High opening trawl , fig. 6
   Refer to MV.SEAFDEC 2 survey in Vietnam cruise no. 39-1-2012 that more than 50% of survey area are in the water deeper than 100 meter depth. The bottom trawl of M.V.SEAFDEC 2 opening mouth is too small for sampling mid water fishery resource. In order to solve the problem, SEAFDEC/TD construct new High opening trawl which more appropriate for the mid water fishery resource survey.

This new high opening trawl were operated four haul to adjust trawling technique. Trawling area are near to Phai island where depth about 30-40 meter. This trial suggested that it able to catch pelagic fish. Highest catch rate was 94 kg/hour. Majority of catch are pelagic fish. Following is note for future operation and improvement of high opening trawl.

- The trawl body of high opening trawl is lighter than bottom trawl, therefore M.V. SEAFDEC 2 able to trawl at faster speed to maximum at 5 knots.
- Trawl trial by M.V.SEAFDEC 2 found that maximum trawl height is 22 meter with ship speed at 3.5 knots while the faster speed (4.5 knots) reduced trawl height to 8-12 meter.
- Head rope should be improved to avoided entangle with trawl wing. Number of float should be added as well in order to increase the trawl height.

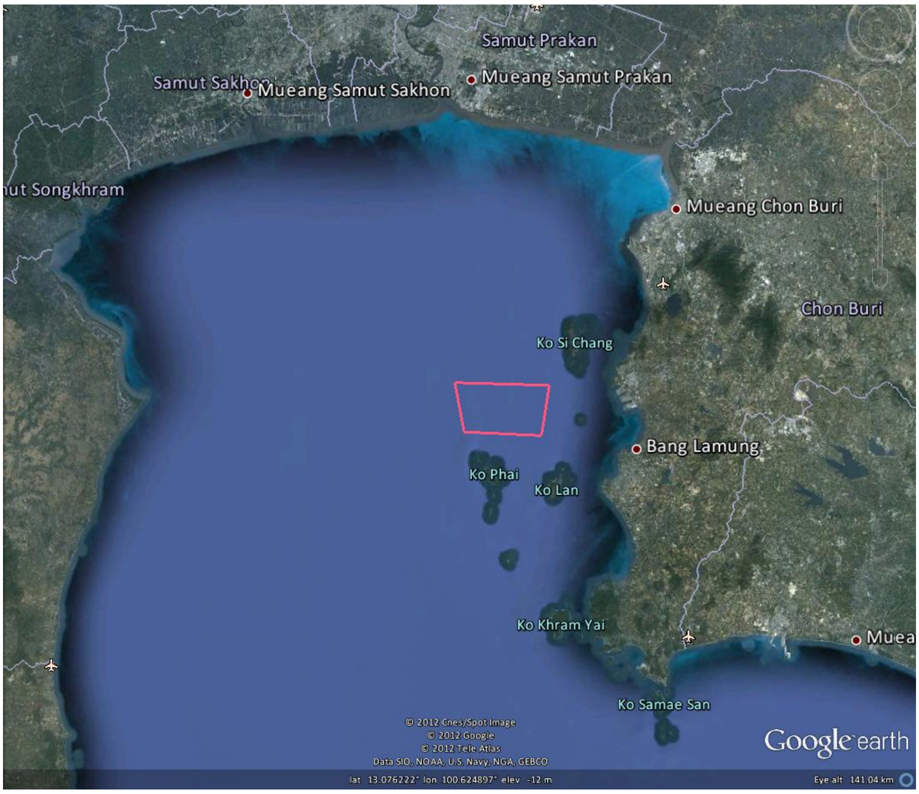

Figure 1 Map of working area (pink square)

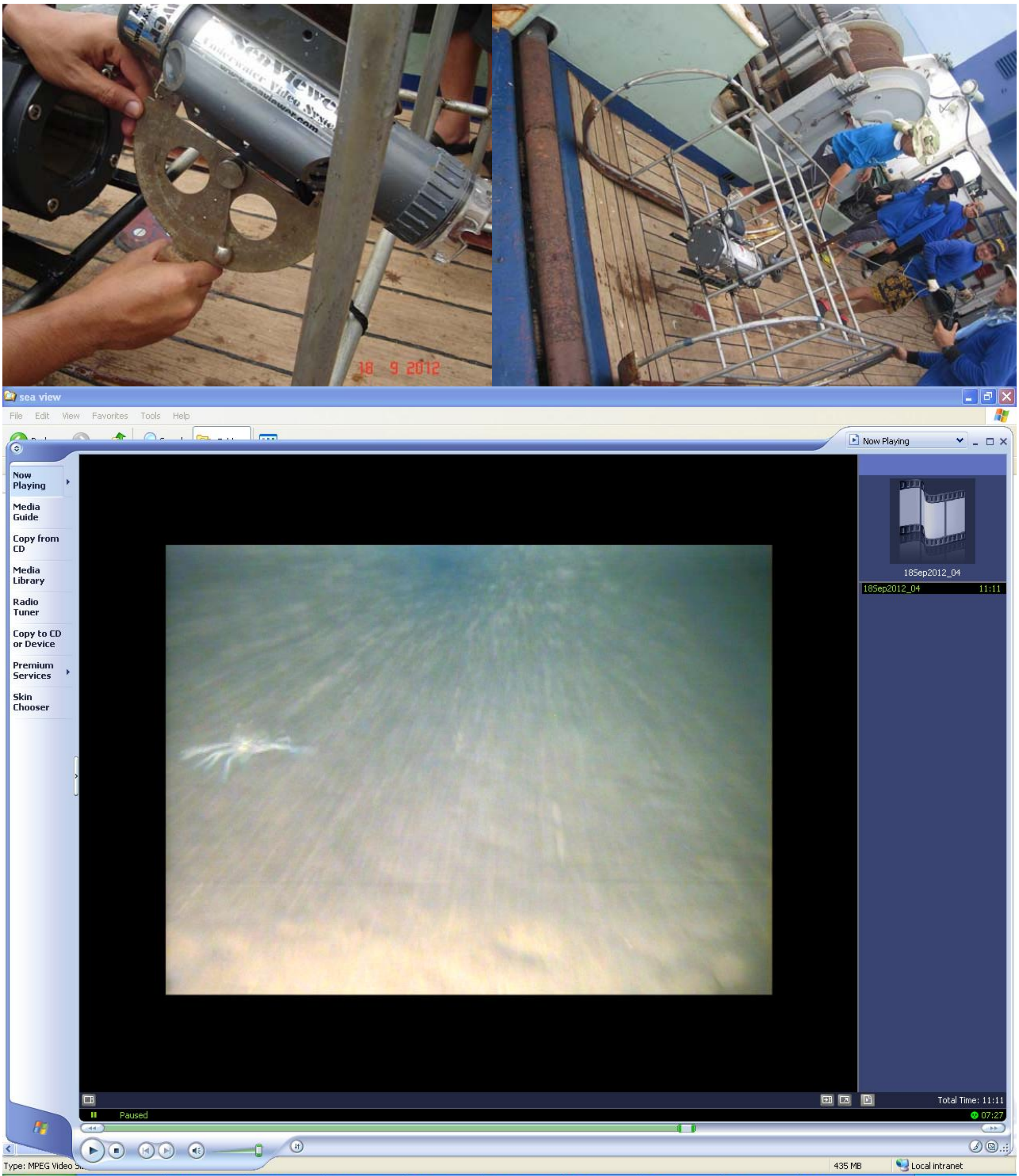

Figure 2 Underwater VDO camera performance testing

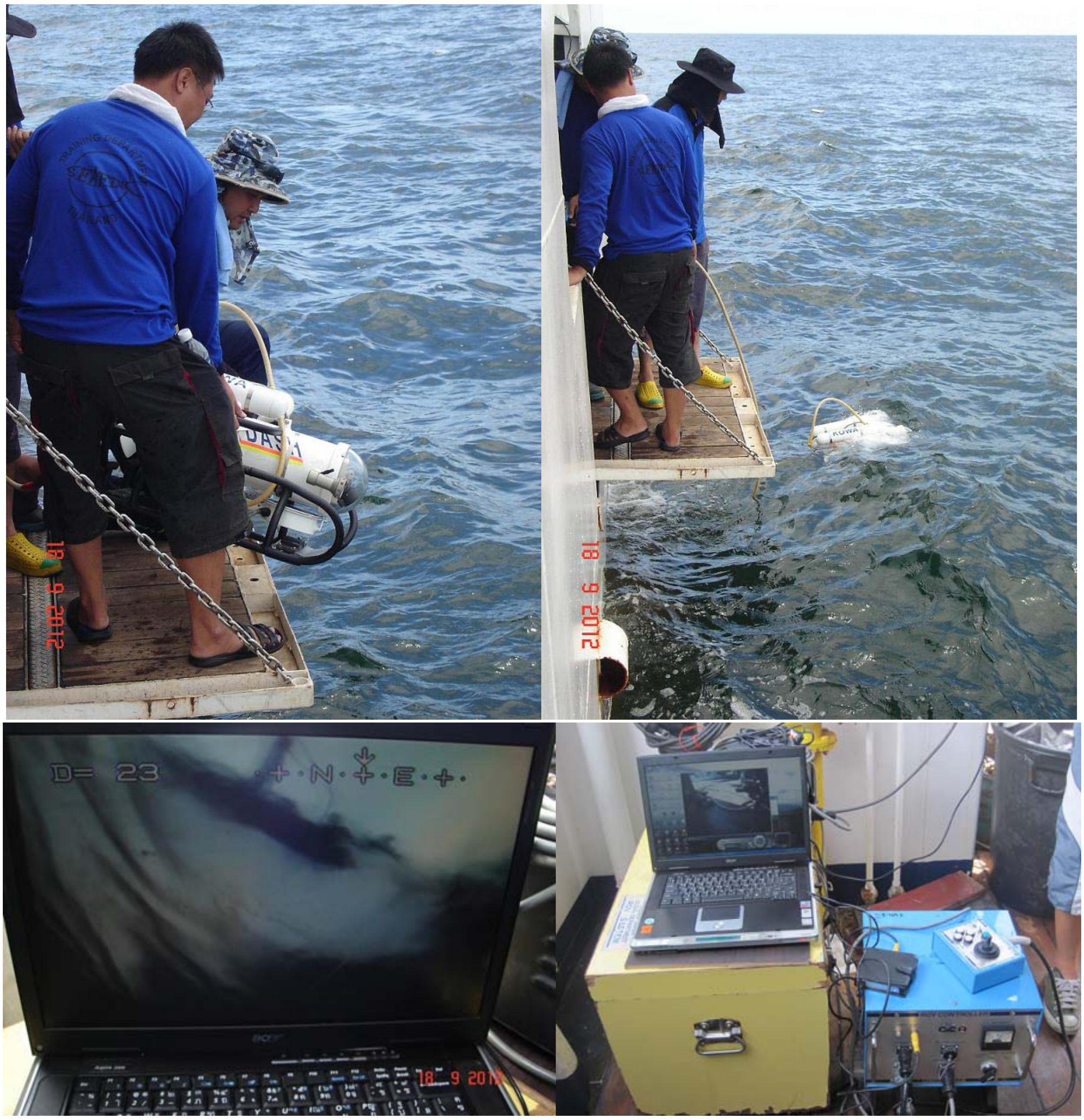

Figure 3 ROV performance testing

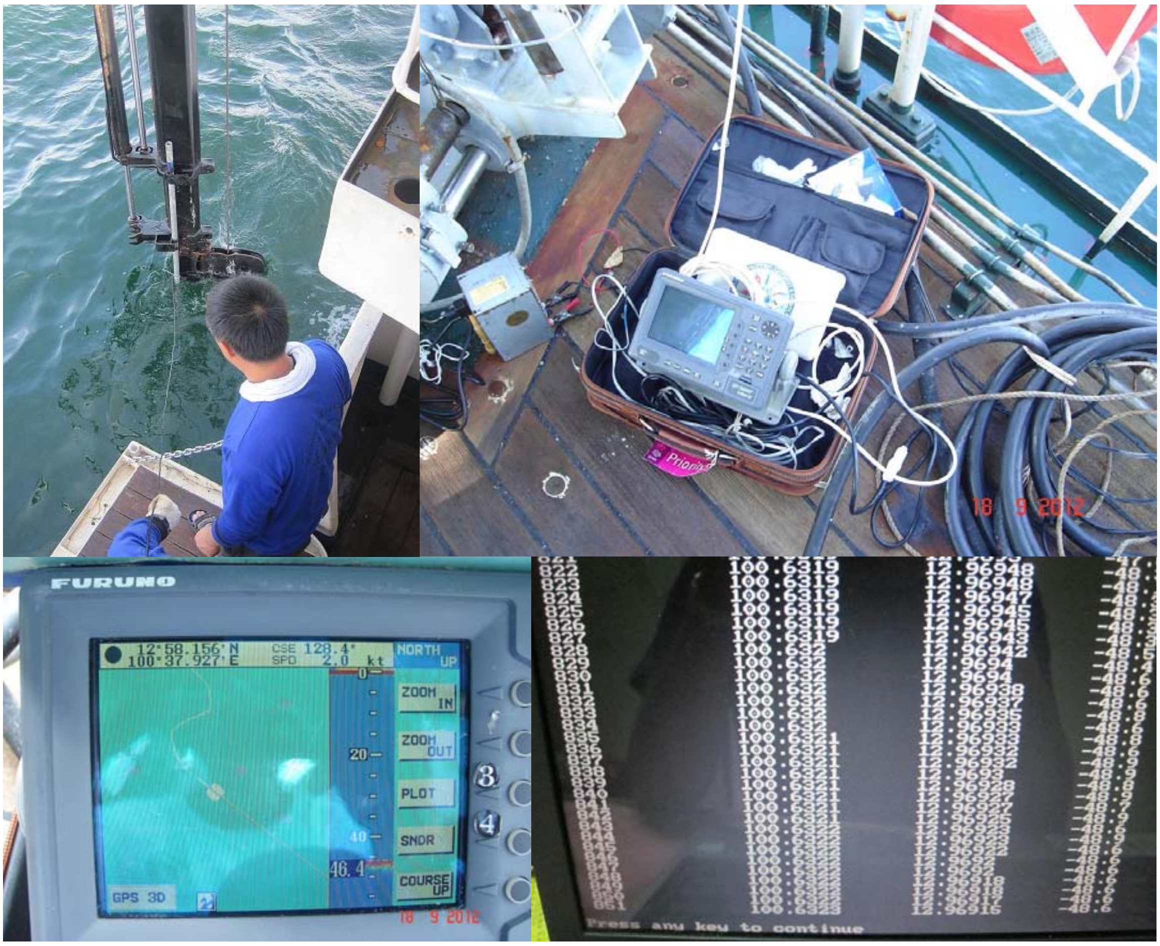

Figure 4 Portable Echo Sounder performance testing

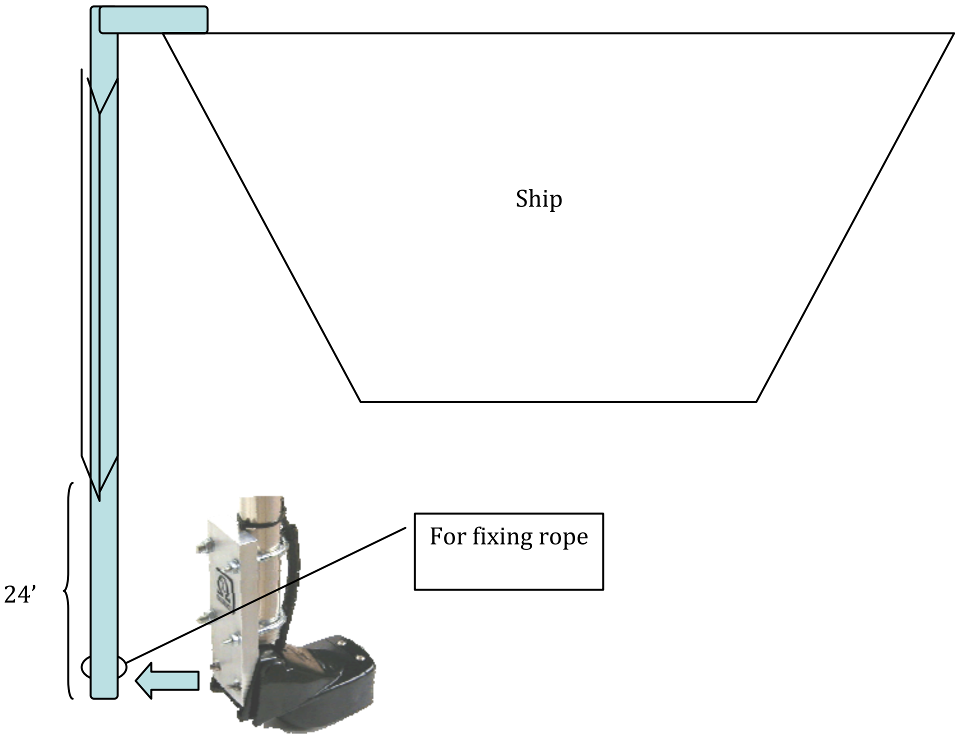

Figure 5 Suggested Echo sounder transducer mouthing unit

Figure 6 High Opening Trawl performance testing

Activities time table

Date/time	Activities
17 September 2012	
09:00-10:00 10:00-11:00	Lecture on Bottom topography survey by. Dr. Pachoenchoke Lecture on Mapping the sea floor by Dr. Pachoenchoke
11:00-14:00	Equipment preparation
14:00-16:00	M.V.SEAFDEC 2 leave for Phai island
17:00-19:00	Underwater VDO camera performance testing
18 September 2012	
05:00-08:30	High opening trawl performance testing
08:30-10:00	Portable echo sounder no.1 performance testing
10:00-11:00	High opening trawl #1
11:00-13:00	ROV performance testing
13:00-15:00	Underwater VDO camera performance testing
15:00-17:00	High opening trawl #2
19:00-19:30	Discussion for testing result
19 September 2012	
06:00-07:30	High opening trawl #3
07:30-10:00	High opening trawl #4
10:00-11:00	Packing all equipments
11:00-15:00	Leave for SEAFDEC/TD
16:00	Arrived SEAFDEC/TD

Bottom topography survey

Asst.Prof. Pachoenchoke Jintasaeranee

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Faculty of Science
Burapha University

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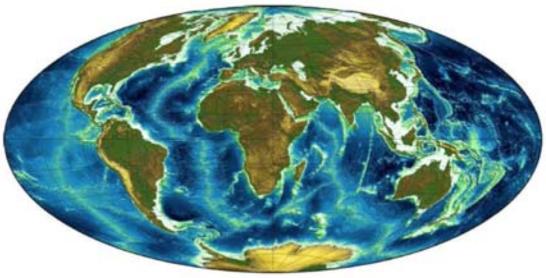
1982 GEBCO (GEneral Bathymetric Chart of the Oceans) published the first bathymetric data (resolution ~1.85 km)

2010 published GEBCO 30 arc-second (resolution ~926 m)

1997 Smith and Sandwell: Global sea floor topography from satellite altimetry and ship depth soundings. The data on shallow water need to be corrected before using (Smith & Sandwell, 2006)

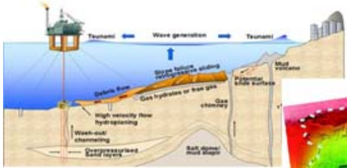


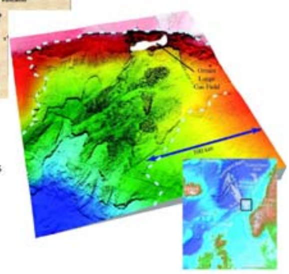
Why do we need bottom topography surveys?

1. Risk
- submarine landslide generated tsunami
- tsunami propagation/run up model
- applications as diverse as tsunami hazard assessment

2. Resources
- communications cable and pipeline route planning
- resource exploration
- habitat management
- territorial claims under the Law of the Sea

3. Climate changes
– methane hydrate

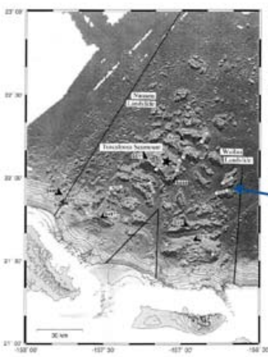




1. Risks
- Submarine landslide generated tsunamis
- No warning
- No prediction

Characteristics of known submarine landslides (Hampton et al., 1996).

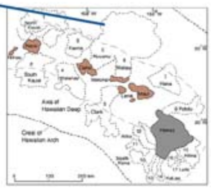
Location	Slope Steepness α, deg	Runout Length L, km	Height H, m	H/L Ratio	Volume, m³	Reference
Grand Banks	3.5	110	365	0.0033	7.6×10^{10}	Prior and Coleman [1979]
Hawaii	6.0	160	2000	0.0125		Prior and Coleman [1979]
Kidnappers	2.5	11	50	0.0045	8×10^{8}	Prior and Coleman [1979]
Bay of Biscay		21	250	0.0012		Prior and Coleman [1979]
Rockall	2.0	160	330	0.0021	3×10^{11}	Prior and Coleman [1979]
Bassein	6.0	37	360	0.00973		Prior and Coleman [1979]
Agulhas		106	375	0.00354		Prior and Coleman [1979]
Copper River delta	1.0	18	115	0.00639		Prior and Coleman [1979]
Albatross Bank	7.0	5.3	300	0.0566		Prior and Coleman [1979]
Portlock Bank	4.0	6.5	200	0.03077		Prior and Coleman [1979]
Kayak Trough	1.0	15	115	0.00767		Prior and Coleman [1979]
Atlantic Coast	3.8	3.4	30	0.00882		Prior and Coleman [1979]
	5.7	4.8	80	0.01667		Prior and Coleman [1979]
	6.8	2.3	18	0.00783		Prior and Coleman [1979]
Magdalena	2.0	24	1400	0.05833	3×10^{8}	Edgers and Karlsrud [1982]
Valdez	6.0	1.28	168	0.13125	7.5×10^{7}	Edgers and Karlsrud [1982]
Mississippi River delta	0.5		20		4×10^{5}	Edgers and Karlsrud [1982]
Sava	3.0		100		1.5×10^{8}	Edgers and Karlsrud [1982]
Sagami Wan	11.0				7×10^{10}	Edgers and Karlsrud [1982]
Scripps Canyon	7.0		6		5×10^{4}	Edgers and Karlsrud [1982]
Orkdalsfjord		22.5	500	0.022	2.5×10^{7}	Edgers and Karlsrud [1982]
Sandnesjoen		1.2	180	0.15	5×10^{6}	Edgers and Karlsrud [1982]
Sokkelvik		2.5	120	0.048	5×10^{5}	Edgers and Karlsrud [1982]
Helsinki		0.4	11	0.0275	9×10^{5}	Edgers and Karlsrud [1982]
Storegga		160	1700	0.01063	8×10^{11}	Edgers and Karlsrud [1982]
Typical Atlantic Ocean	4.0	4	1200	0.3		Booth et al. [1993]
Cape Fear	4.2	30	700	0.0233		Popenoe et al. [1993]
Blake Escarpment	8.6	42	3600	0.00857	6×10^{11}	Dillon et al. [1993]
East Break East	1.5	70	1150	0.01643	1.3×10^{10}	McGregor et al. [1993]
East Break West	1.5	110	1100	0.01	1.6×10^{11}	McGregor et al. [1993]
Navarin Canyon	3.0	6	175	0.02917	5×10^{9}	Carlson et al. [1993]
Seward	25.0	3	200	0.0667	2.7×10^{6}	Hampton et al. [1993]
Alsek	1.3	2	20	0.01		Schwab and Lee [1993]
Sur	0.5	70	750	0.0107	1×10^{10}	Gutmacher and Normark [1993]
Santa Barbara	4.8	2.3	120	0.05217	2×10^{7}	Edwards et al. [1993]
Alika-2		95	4800	0.05053	3×10^{11}	Normark et al. [1993]
Nuuanu		230	5000	0.02174	5×10^{12}	Normark et al. [1993]
Tristan de Cunha		50	3750	0.075	1.5×10^{11}	Holcomb and Searle [1991]



Herrero-Bervera et al. (2002)

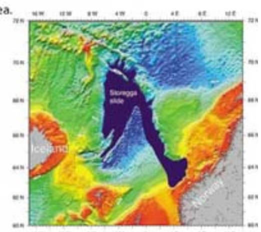
Recorded giant submarine landslide

The Nuuanu landslides (Normark et al., 1993).
- caused by the collapse of Koolau Volcano on Oahu in Hawaii ~1.5 myr. ago
- the slide volume was 1,500 km³
- extends more than 230 km from the island.
- no tsunami records



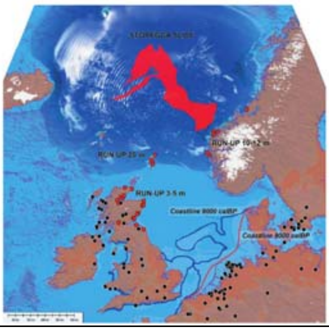
Recorded submarine landslides generated mega-tsunami (the storegga slide)

- caused by the rush of sand and mud off Norway coast ~6,000-8,000 yr. ago
- slide length ~1,500 km down a slightly sloped seafloor, with an initial burst of speed ~70 km/h.
- the estimated minimum volume of slide displacement was 2,400 km³ and the maximum was 3,200 km³ (Haflidason et al., 2004)
- the mass slid around 800 km into the deep sea.



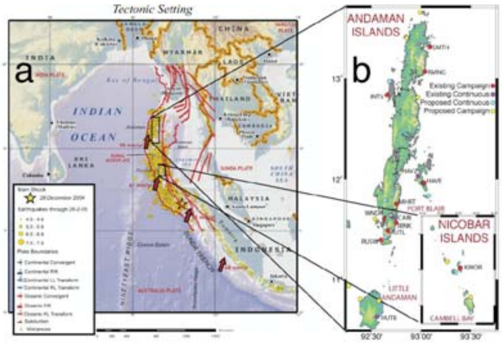
The storegga landslides generated mega-tsunami

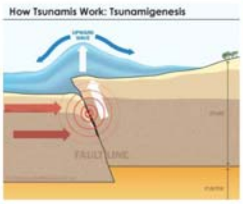
- tsunami reached a height of 25 m in Scotland and along the coasts of Iceland, Norway, the Faroe Islands and Shetland (Bondevik et al., 2003).



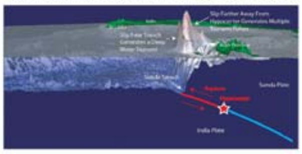
Sumatra-Andaman earthquake & aftershocks and major fault structures (USGS, 2005)

- Almost no bathymetric data available in the Andaman Sea

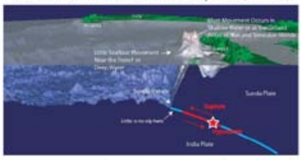




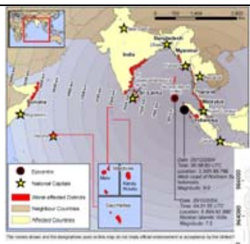
2004 Sumatra-Andaman Earthquake (M=9.2)



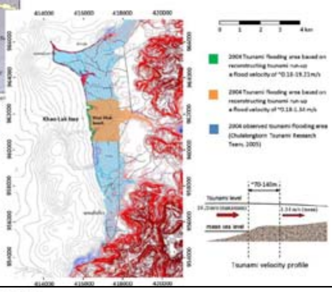
2005 Northern Sumatra Earthquake (M=8.6)



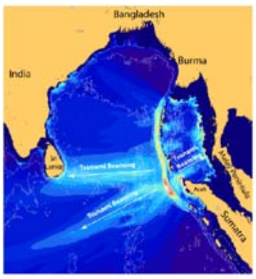
the initial tsunamis generated from 2004 & 2005 (USGS, 2005)



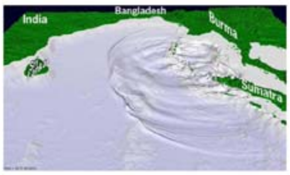
Areas affected by the 2004 Indian Ocean tsunami (USGS, 2005)



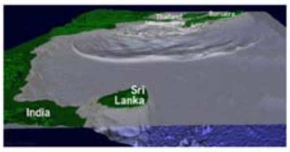
The 2004 Indian Ocean tsunami hazard map for Khao Lak bay assessed from field surveys and reconstructed tsunami run-up from tsunami deposit characteristics (Srisutam & Wagner, 2010)



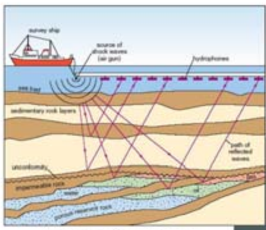
Tsunami beaming pattern associated with the 2004 Sumatra-Andaman earthquake. Lighter colors represent higher open-ocean tsunami amplitudes



Tsunami wavefield for the 2004 Sumatra-Andaman earthquake 1 hour after generation



2. Resources –Natural gas & petroleum



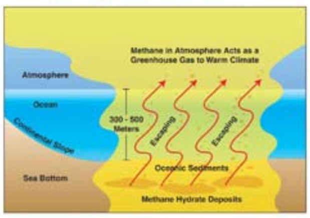
Air gun seismics & streamer

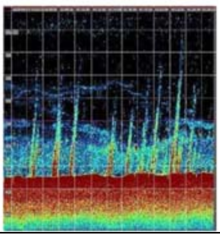
- Natural oil & gas complex
- Communications cable and pipeline route planning
- Resource exploration

3. Climate changes

- Methane hydrate
- Global warming

Methane Explosion Warmed Prehistoric Earth





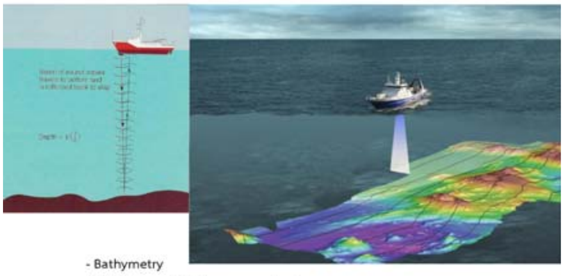
What mapping techniques are available?

- Bathymetry mapping (Single beam/Multibeam echosounding)
- Sediment echosounder
- Sidescan sonar

- 2D/3D reflection-seismics with different resolutions
- Refraction-seismics (Ocean Bottom Seismometer/Hydrophone; OBS/OBH)

- Deep-towed acoustics (AUVs, ROVs)

Single beam & multibeam sounding

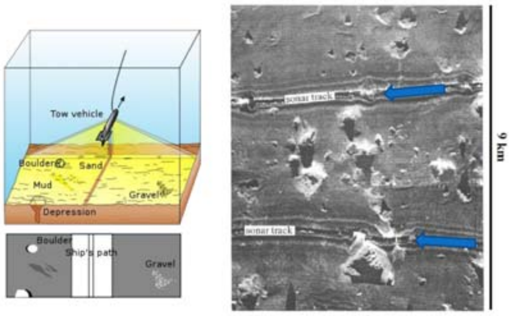


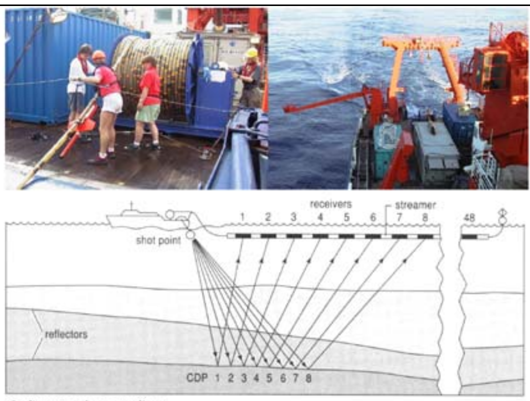
- Bathymetry

(Single beam/Multibeam sounding)

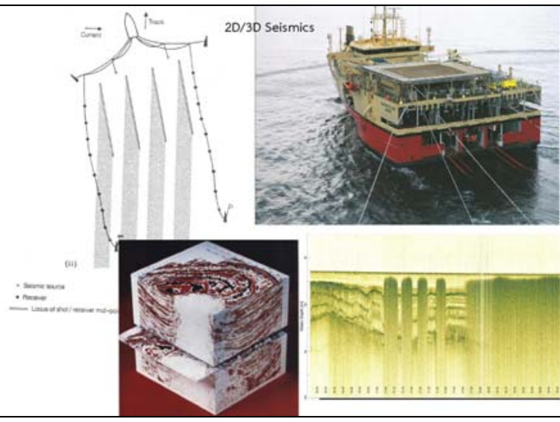
- Sediment echosounding

Side scan sonar

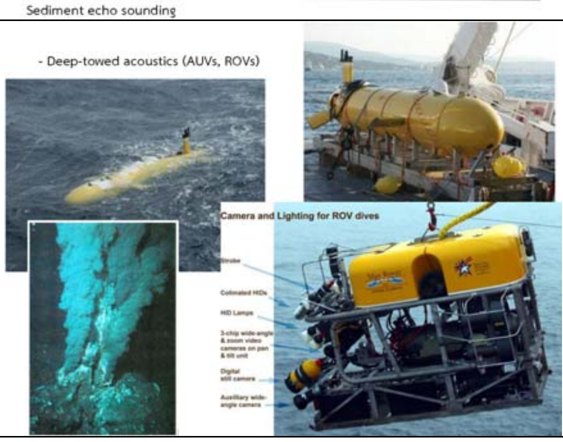




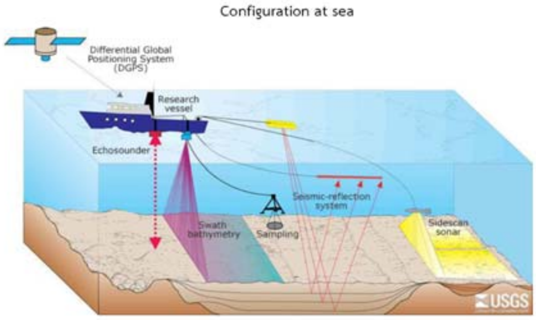
Sediment echo sounding



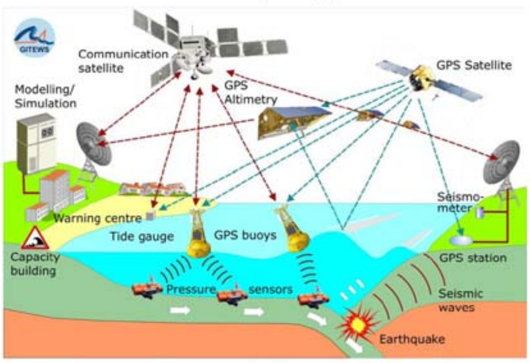
- Deep-towed acoustics (AUVs, ROVs)

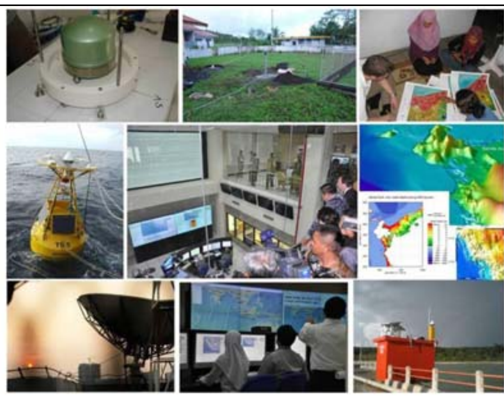


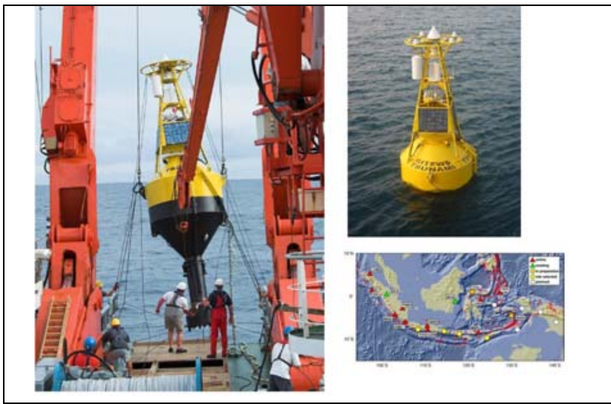
Configuration at sea

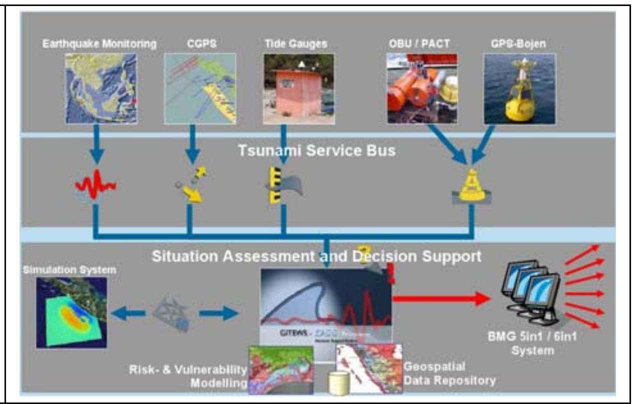


Tsunami early warning system

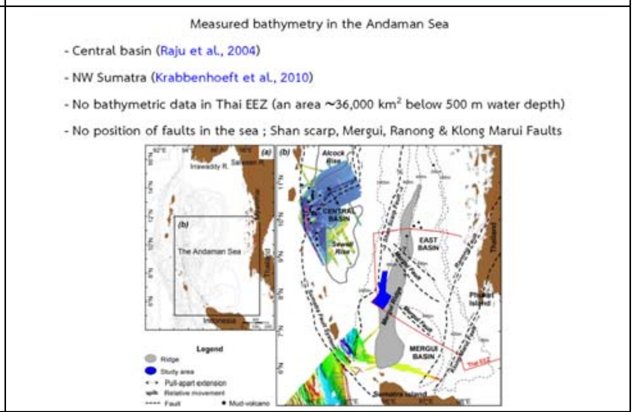


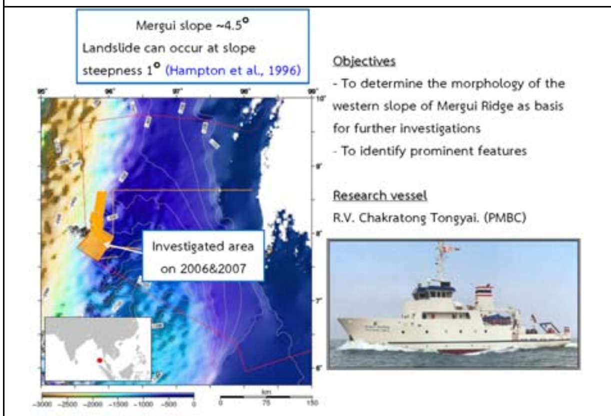




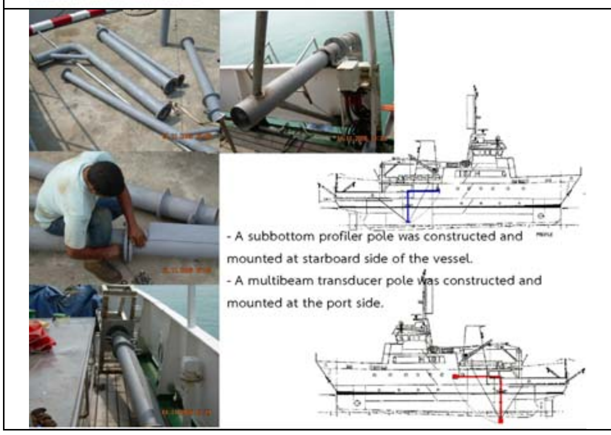

Earthquake Monitoring
CGPS
Tide Gauges
OBU / PACT
GPS-Bojen
Tsunami Service Bus
Situation Assessment and Decision Support
Simulation System
BMG 5in1 / 6in1 System
Risk- & Vulnerability Modelling
Geospatial Data Repository

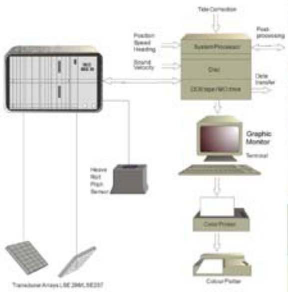

Deutsche Forschungsgemeinschaft DFG
IFM-GEOMAR
Southeast Asia START Regional Center
UNITED NATIONS UNIVERSITY UNU-EHS
GITEWS
Journal of Asian Earth Sciences 46 (2012) 78–85
Contents lists available at SciVerse ScienceDirect
Journal of Asian Earth Sciences
journal homepage: www.elsevier.com/locate/jseaes
ELSEVIER
Morphology of the Andaman outer shelf and upper slope of the Thai exclusive economic zone
Pachoenchoke Jintasaeranee, Wilhelm Weinrebe, Ingo Klaucke, Anond Snidvongs, Ernst R. Flueh


Measured bathymetry in the Andaman Sea
- Central basin (Raju et al., 2004)
- NW Sumatra (Krabbenhoeft et al., 2010)
- No bathymetric data in Thai EEZ (an area ~36,000 km² below 500 m water depth)
- No position of faults in the sea ; Shan scarp, Mergui, Ranong & Klong Marui Faults
The Andaman Sea
CENTRAL BASIN
EAST BASIN
MERGUI BASIN
Legend
Ridge
Study area
Pull-apart extension
Relative movement
Fault
Mud-volcano

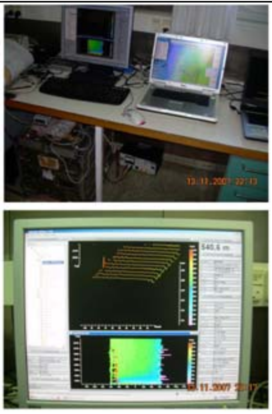

Mergui slope ~4.5°
Landslide can occur at slope steepness 1° (Hampton et al., 1996)
Objectives
- To determine the morphology of the western slope of Mergui Ridge as basis for further investigations
- To identify prominent features
Research vessel
R.V. Chakratong Tongyai. (PMBC)
Investigated area on 2006&2007

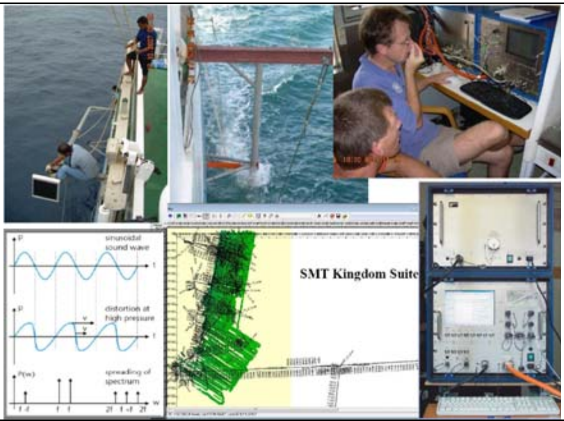

Field surveys
- 1st-cruise : 20 November-6 December 2006
- 2nd-cruise : 6-15 November 2007
- 3rd-cruise : 7-27 January 2011


- A subbottom profiler pole was constructed and mounted at starboard side of the vessel.
- A multibeam transducer pole was constructed and mounted at the port side.



The SEABEAM 1050 System, a multibeam echosounder collects bathymetric data in medium depth water up to 3,000 m maximum depth using a frequency of 50 kHz and 126 individual beams.

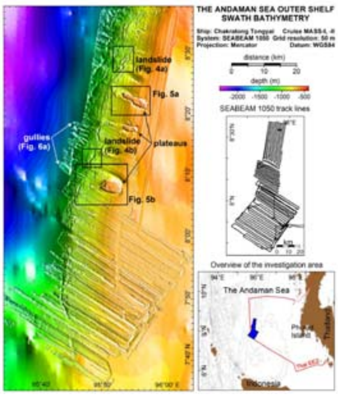


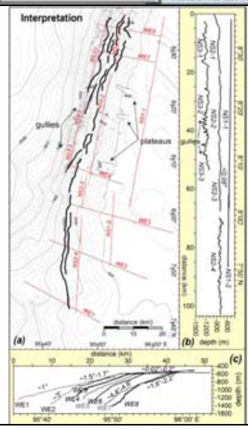


A new detailed bathymetry

- The depth accuracy tests revealed that 95% of the processed grids obtained values equal or better than 1% of water depth.

- The map is acceptable for the generation of a final grid (Beyer et al., 2003; de Alteriis et al., 2003; Beyer et al., 2005) when grid resolution has been set to 50 m.



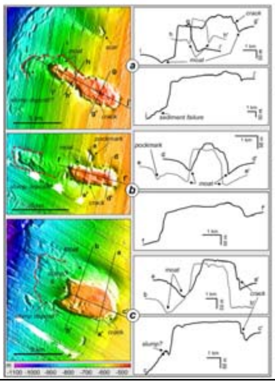


General morphology

- Gradient on the southern part of the upper slope is approximately 1°

- The northern part of the shelf gradients range between 1.5° and 2.2° at 600-900 m.

- The middle slope gradients vary from 3° along the southern part at 900-1300 m water depth to 4.8° further north



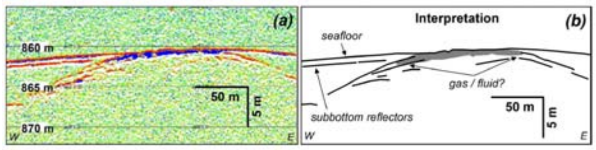
Previously unknown plateaus

- The plateau (a) has an elliptical shape and covers an area ~2X8 km. The plateau (b) is ~2X4 km, and the plateau (c) covers ~4X6 km.

- The plateaus have an almost flat top, but are slightly inclined westward.

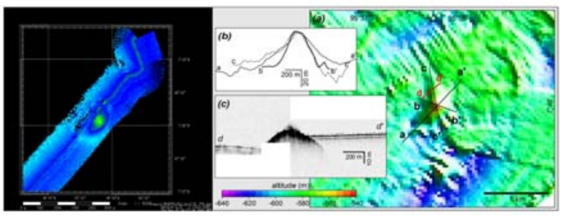
- The edges of the plateaus are bounded by rather steep vertical slopes with relief heights of about 50 m towards the shelf and exceed more than 200 m towards the slope.

- All plateaus show the presence of cracks around their edges and deep moats surrounding them.



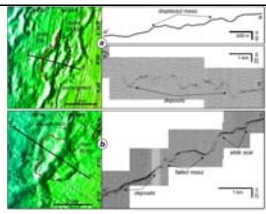
Fluid flow features

At least 24 locations show evidence of possible gas or fluid accumulation below the seafloor in the southwestern part of the study area in water depths of about 950 m



Previously unknown mud dome

- The size of this dome is ~20 m height and 400 m length.
- Strong subbottom echoes and echoes in the water column suggest that sediments are gas-charged in the vicinity of the mound and that gas may even escape into the water column



- One landslide (a) is studied at a water depth ~870 m.

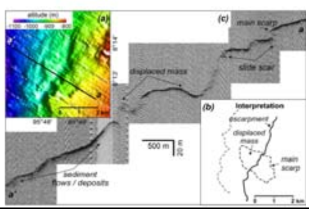
- The displaced mass is ~700X2000X18 m resulting in a volume of 4×10^7 m^3.

- Subbottom profiler records shows deposit of the failed mass.

- Another slide is studied at a water depth ~945 m.

- The failure is ~1100X800X25 m resulting in a volume ~2.2×10^7 m^3.

- A subbottom profile indicates different phases of failure processes.



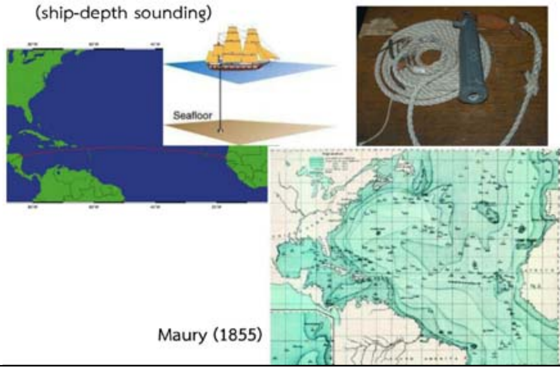
Mapping the seafloor

Asst.Prof. Pachoenchoke Jintasaeranee

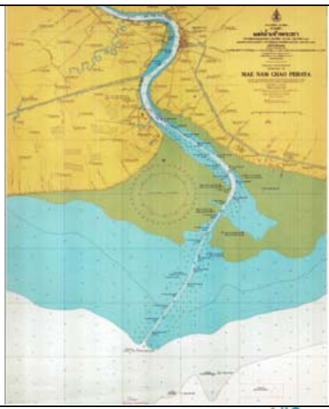
Department of Aquatic Science
Faculty of Science
Burapha University

contact : pachoenc@buu.ac.th

18th century First bathymetric measurements with plumbs (ship-depth sounding)



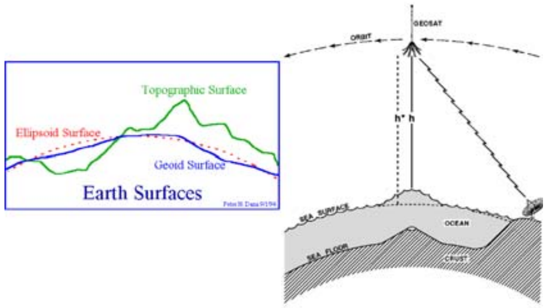
Maury (1855)



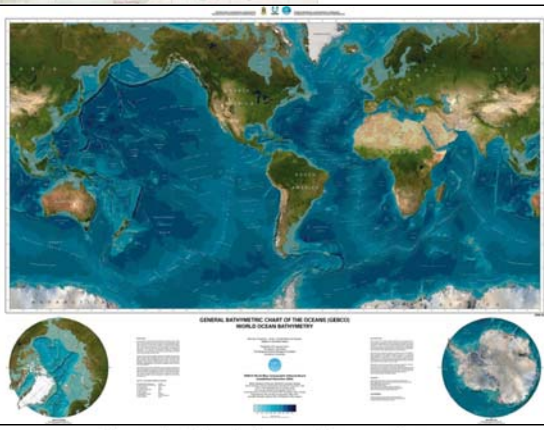
Ship-depth sounding map (Navigation charts; NC)

- Measure a wire angular to calculate actual depth
- Tide compensates to MSL
- Map projection
- Datum Indian1975/WGS84

Bathymetry from space



Specific netCDF data format

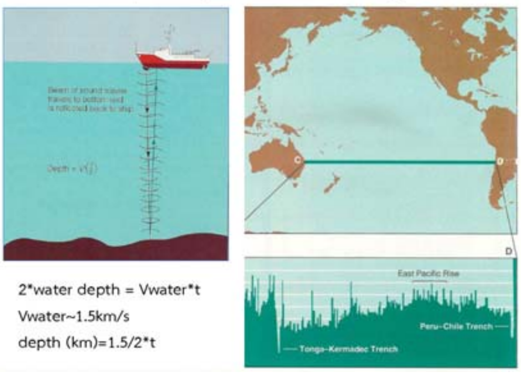


How can we read the GDA data ?

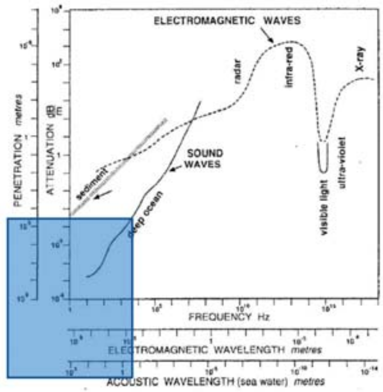
netCDF (network Common Data Form) is a set of software libraries and self-describing, machine-independent data formats that support the creation, access, and sharing of array-oriented scientific data.

C++, Fortran, Perl, MATLAB, Octave, Python, GMT

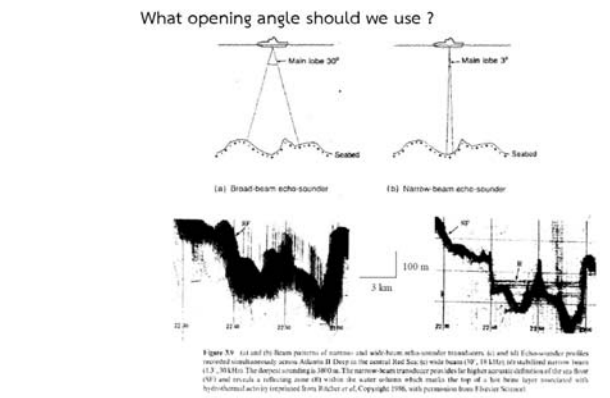
Concept of single beam echo-sounding

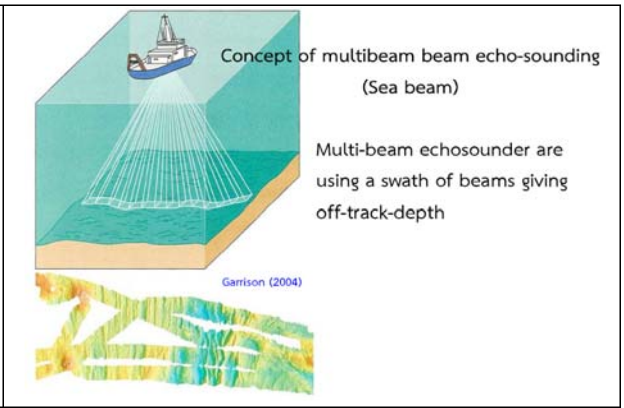


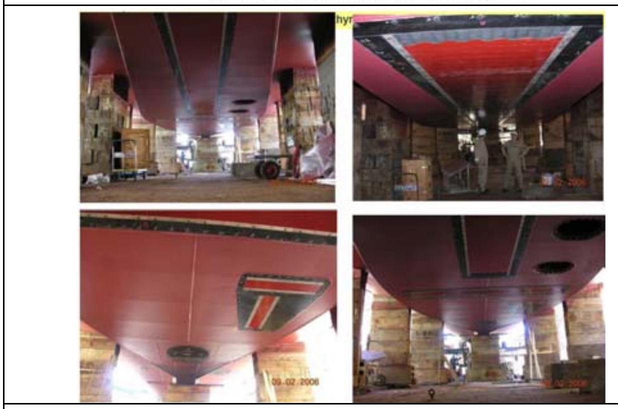
2*water depth = Vwater*t
Vwater~1.5km/s
depth (km)=1.5/2*t

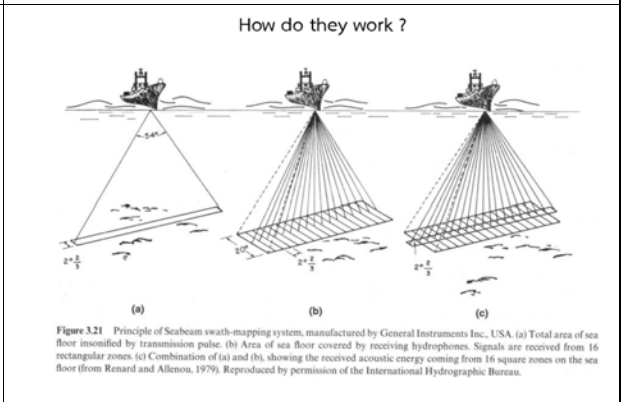


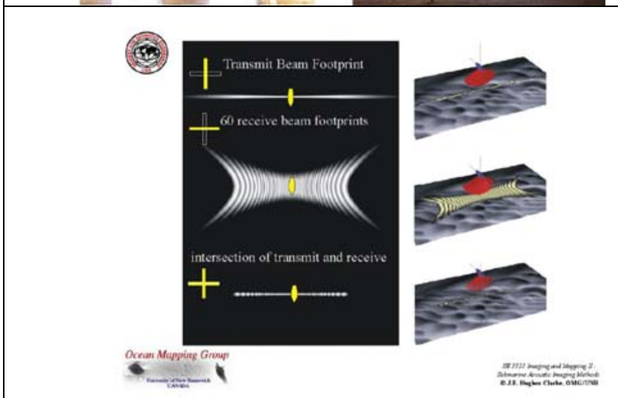
Attenuation of electromagnetic and sound waves in seawater (after Wille, 1986).

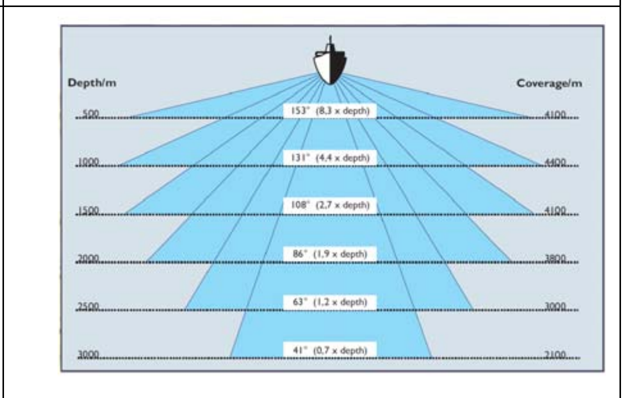

What opening angle should we use ?
Main lobe 30°
Main lobe 3°
Seabed
Seabed
(a) Broad-beam echo-sounder
(b) Narrow-beam echo-sounder
100 m
3 km

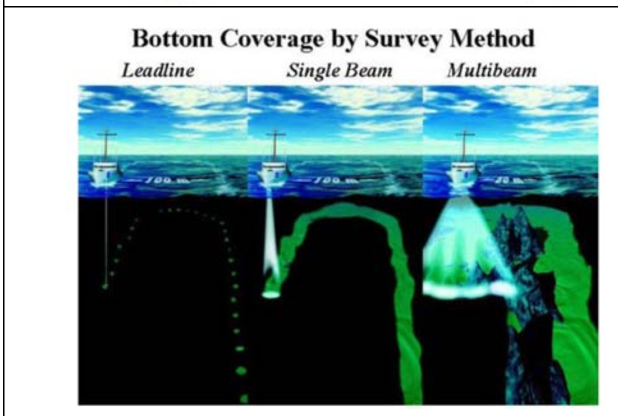

Concept of multibeam beam echo-sounding
(Sea beam)
Multi-beam echosounder are
using a swath of beams giving
off-track-depth
Garrison (2004)

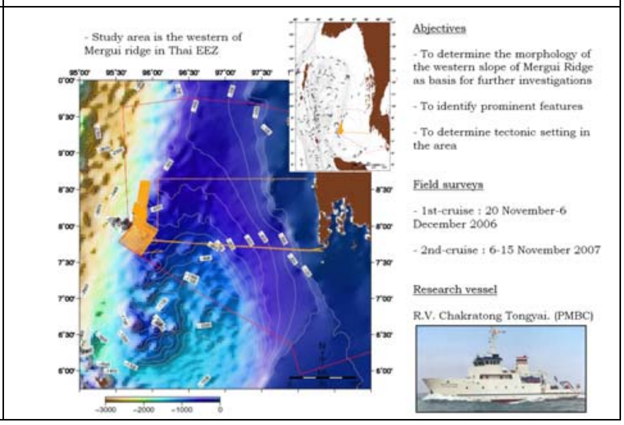


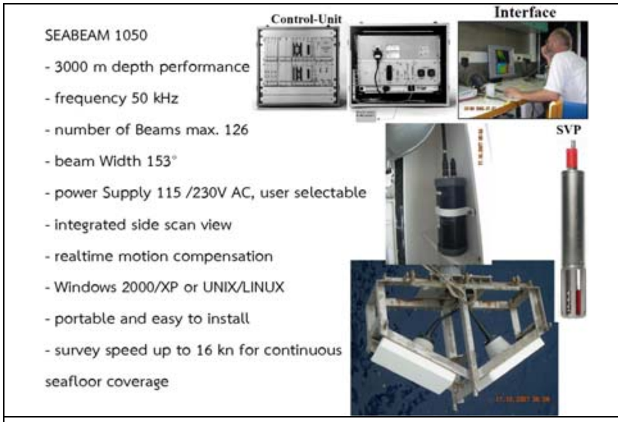

How do they work ?
54°
20°
(a)
(b)
(c)
Figure 3.21 Principle of Seabeam swath-mapping system, manufactured by General Instruments Inc., USA. (a) Total area of sea floor insonified by transmission pulse. (b) Area of sea floor covered by receiving hydrophones. Signals are received from 16 rectangular zones. (c) Combination of (a) and (b), showing the received acoustic energy coming from 16 square zones on the sea floor (from Renard and Allenou, 1979). Reproduced by permission of the International Hydrographic Bureau.

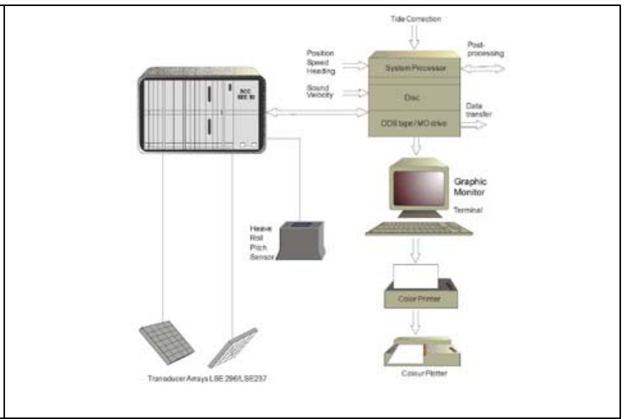

Transmit Beam Footprint
60 receive beam footprints
intersection of transmit and receive
Ocean Mapping Group

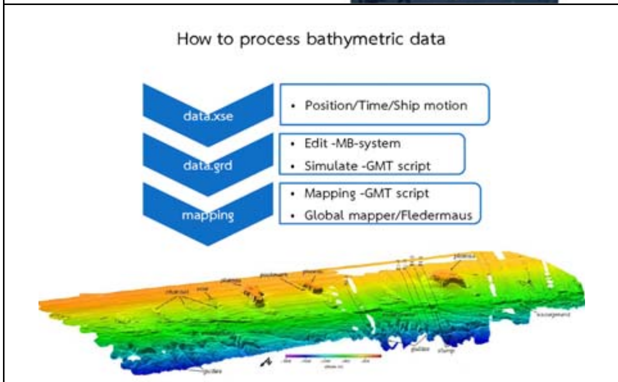

Depth/m
Coverage/m
500
153° (8,3 x depth)
4100
1000
131° (4,4 x depth)
4400
1500
108° (2,7 x depth)
4100
2000
86° (1,9 x depth)
3800
2500
63° (1,2 x depth)
3000
3000
41° (0,7 x depth)
2100

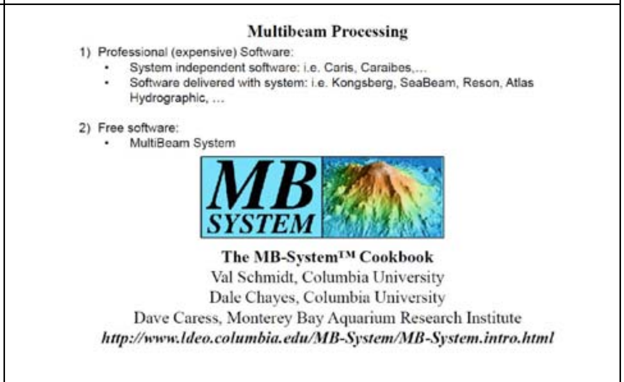

Bottom Coverage by Survey Method
Leadline
Single Beam
Multibeam


- Study area is the western of
Mergui ridge in Thai EEZ
Objectives
- To determine the morphology of the western slope of Mergui Ridge as basis for further investigations
- To identify prominent features
- To determine tectonic setting in the area
Field surveys
- 1st-cruise : 20 November-6 December 2006
- 2nd-cruise : 6-15 November 2007
Research vessel
R.V. Chakratong Tongyai. (PMBC)



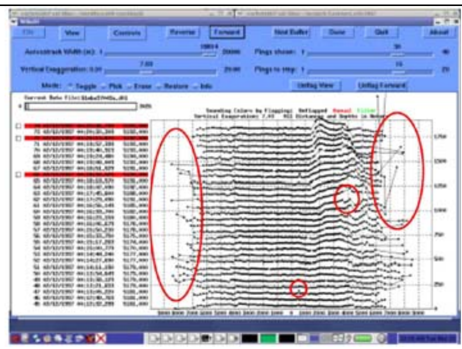


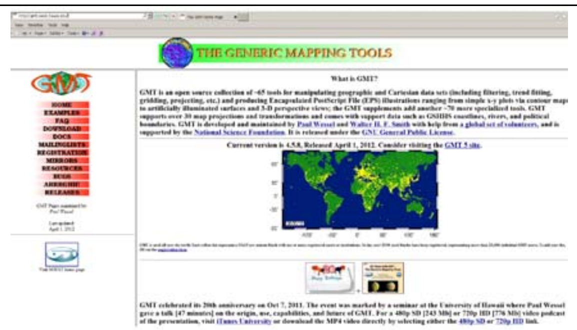


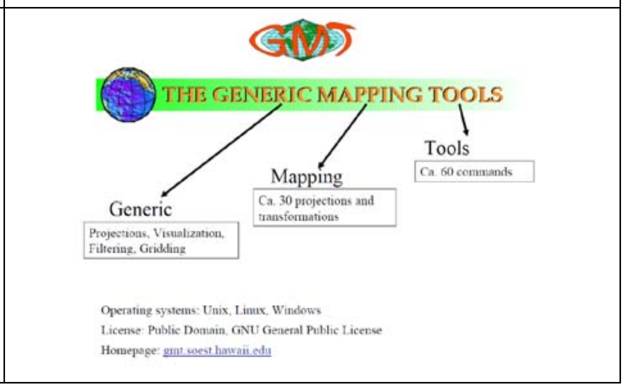


Processing strategy

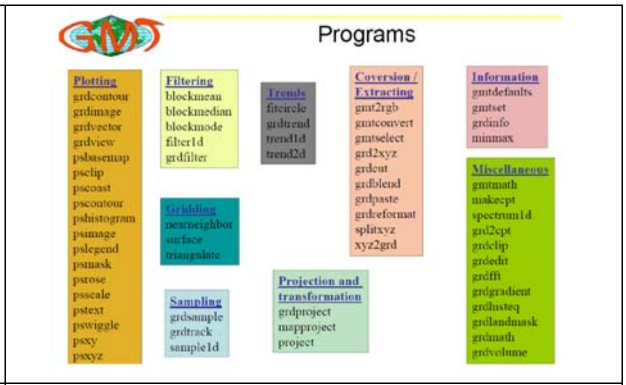
- Organize your data in useful surveys (covered area, data size)
- Check the raw data to get an overview about area coverage and quality of depth data, navigation data, metadata (roll, pitch, heave)
  - ⇒ plot data, look statistics
- Process Navigation data (smoothing)
- If neccessary (and possible), recalculate depth data with better VSP
- Automatic data processing (filter)
- Interactive depth data processing
- Grid and display data

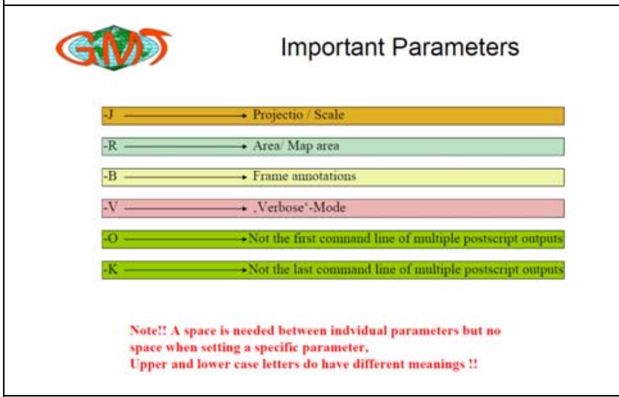


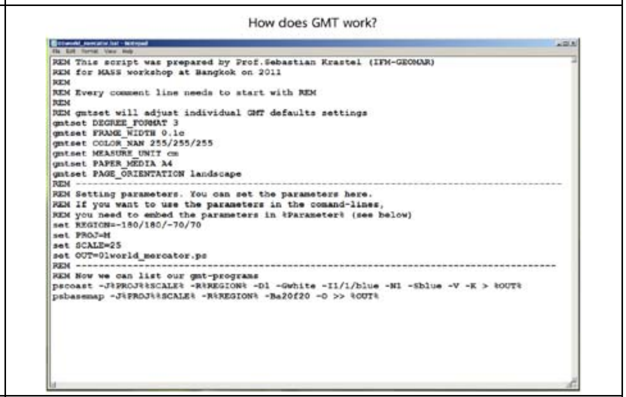


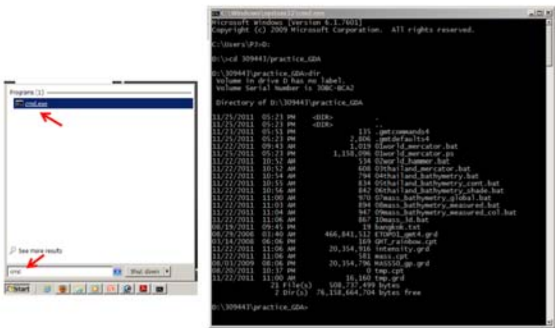


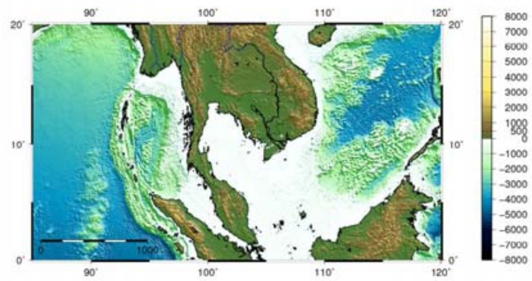

Installations for Windows
-Download von: ftp://ftp.geologi.uio.no/pub/gmt/windows or
https://ftp.ifm-geomar.de/users/skrastel/submarine_mapping/
• GMT_basic_install.exe (GMT-commands)
• GSHHS_highfull_install.exe (high-res coastlines)
• GMT_pdf_install.exe (PDF-documentation)
• Ghostview (Visualization of postscript
Install all files
- Configure /gmtfolder/share/conf/gmt.conf


Programs
Plotting
grdcontour
grdimage
grdvector
grdview
psbasemap
psclip
pscoast
pscontour
pshistogram
psimage
pslegend
psmask
psrose
psscale
pstext
pswiggle
psxy
psxyz
Filtering
blockmean
blockmedian
blockmode
filter1d
grdfilter
Trends
fitcircle
grdtrend
trend1d
trend2d
Gridding
nearneighbor
surface
triangulate
Sampling
grdsample
grdtrack
sample1d
Coversion / Extracting
gmt2rgb
gmtconvert
gmtselect
grd2xyz
grdcut
grdblend
grdpaste
grdreformat
splitxyz
xyz2grd
Projection and transformation
grdproject
mapproject
project
Information
gmtdefaults
gmtset
grdinfo
minmax
Miscellaneous
gmtmath
makecpt
spectrum1d
grd2cpt
grdclip
grdedit
grdfft
grdgradient
grdhisteq
grdlandmask
grdmath
grdvolume


Important Parameters
-J Projectio / Scale
-R Area/ Map area
-B Frame annotations
-V ‚Verbose'-Mode
-O Not the first command line of multiple postscript outputs
-K Not the last command line of multiple postscript outputs
Note!! A space is needed between indvidual parameters but no
space when setting a specific parameter,
Upper and lower case letters do have different meanings !!


How does GMT work?
REM This script was prepared by Prof.Sebastian Krastel (IFM-GEOMAR)
REM for MASS workshop at Bangkok on 2011
REM
REM Every comment line needs to start with REM
REM
REM gmtset will adjust individual GMT defaults settings
gmtset DEGREE_FORMAT 3
gmtset FRAME_WIDTH 0.1c
gmtset COLOR_NAN 255/255/255
gmtset MEASURE_UNIT cm
gmtset PAPER_MEDIA A4
gmtset PAGE_ORIENTATION landscape
REM --
REM Setting parameters. You can set the parameters here.
REM If you want to use the parameters in the comand-lines,
REM you need to embed the parameters in %Parameter% (see below)
set REGION=-180/180/-70/70
set PROJ=M
set SCALE=25
set OUT=01world_mercator.ps
REM --
REM Now we can list our gmt-programs
pscoast -J%PROJ%%SCALE% -R%REGION% -Dl -Gwhite -I1/1/blue -N1 -Sblue -V -K > %OUT%
psbasemap -J%PROJ%%SCALE% -R%REGION% -Ba20f20 -O >> %OUT%




90˚
100˚
110˚
120˚
20˚
10˚
0˚
8000
7000
6000
5000
4000
3000
2000
1000
500
0
-1000
-2000
-3000
-4000
-5000
-6000
-7000
-8000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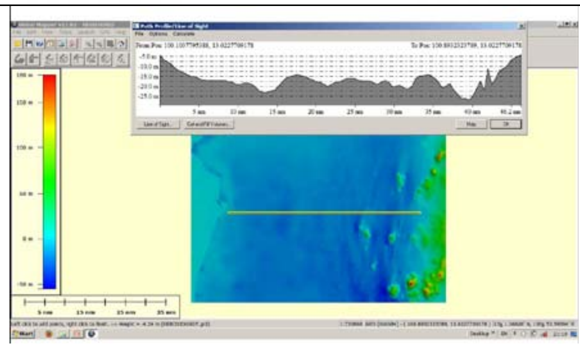

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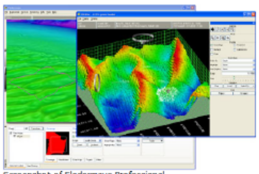
Products > Fledermaus Professional

"3D Visualization - more than just a pretty picture"

Fledermaus Professional is a powerful 3D data visualization system that uses the same core technologies as Fledermaus Standard, plus adds a sophisticated Area Based Editing module, cable and route planning, and real-time tracking of objects. Fledermaus Professional is used in a variety of applications such as swath bathymetry editing and quality control, marine construction, military applications, and coastal zone mapping.



Screenshot of Fledermaus Professional

Featuring the same intuitive data display as Fledermaus Standard, Fledermaus Professional is capable of visualizing large volumes of data of numerous types in a single 3D scene with the powerful ShiftScape^{TM} rendering engine. Data display can be controlled with the Bat, an intuitive 6 degree of freedom input device.

A wide variety of industry standard formats are supported for direct import of data to the 3D scene, and Fledermaus also allows data from remotely operated vehicles, ships or other entities, to be visualized in real-time. Due to its flexible object oriented software design, Fledermaus can be easily tailored to support many additional visualization modules.

If you would like more information on Fledermaus, the full documentation is available online. A free viewer for Fledermaus files named iView3D is also available.

Features

- Contains all of the functionality of the Fledermaus Standard visualization package.
- Adds a powerful Area Based Editing module for processing data from a wide variety of multibeam, single beam, Lidar, or other data formats.
- Support for CUBE based statistical based processing with support for uncertainty surfaces, error modeling, and multiple hypothesis editing, QC, and analysis.
- Track the position of remotely operated vehicles, AUVs, or other vehicles and visualize the object in real-time in a 3D scene.
- Plan routes for pipelines or cables with the Routeplanner application.
- Perform sophisticated statistically analysis of multibeam surveys to ensure data quality control.

Product Links:

- Fledermaus Standard
- Fledermaus Professional
- iView4D
- Fledermaus 7

Application Links:

- Geological Surveys
- Hydrographic Survey QC
- Offshore Industry
- Academic Research
- Environmental Applications
- Military Applications
- Large Immersive Visualization Centers
- Marine Construction
- Coastal Zone Mapping
- Google Earth

Related Links:

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- Technologies
- Purchase Information
- Academic Discounts
- Platforms Overview