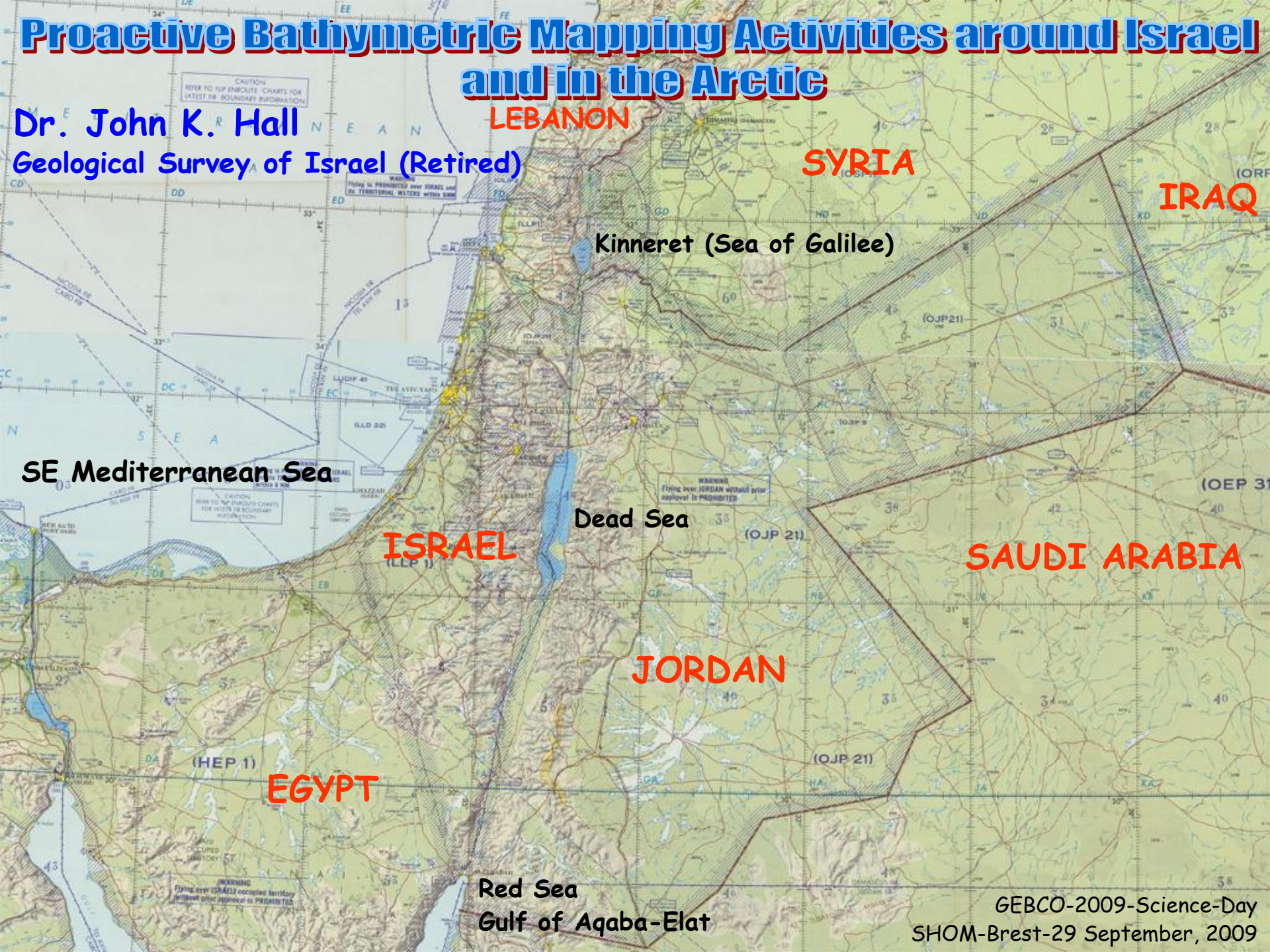
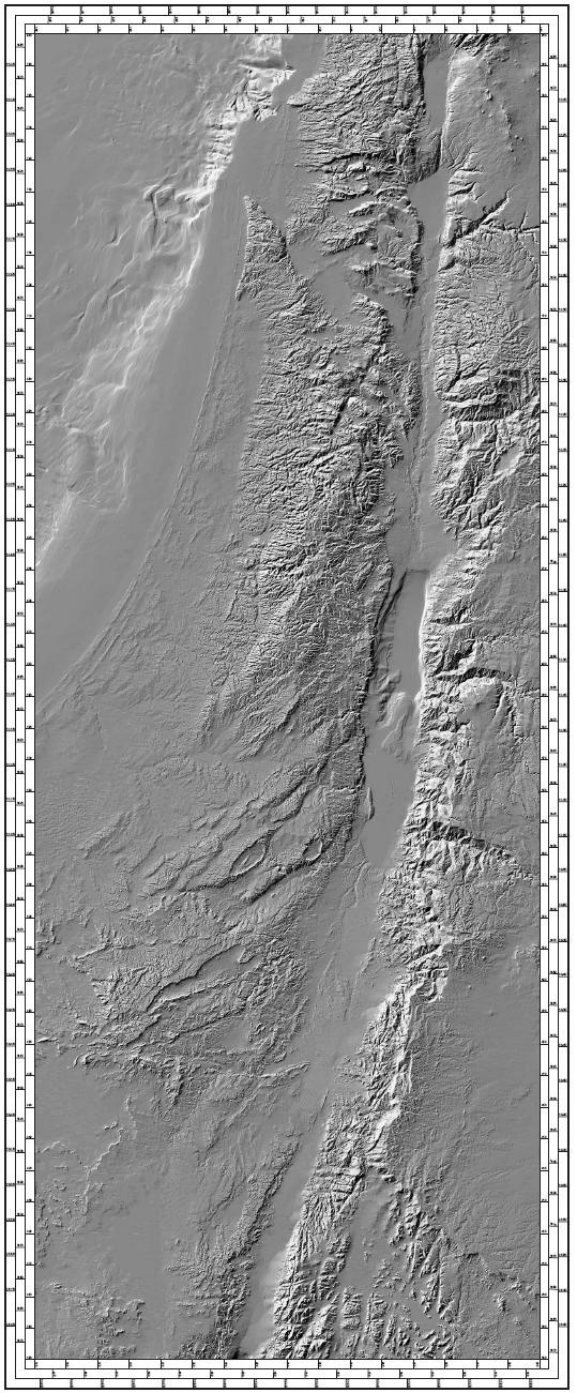
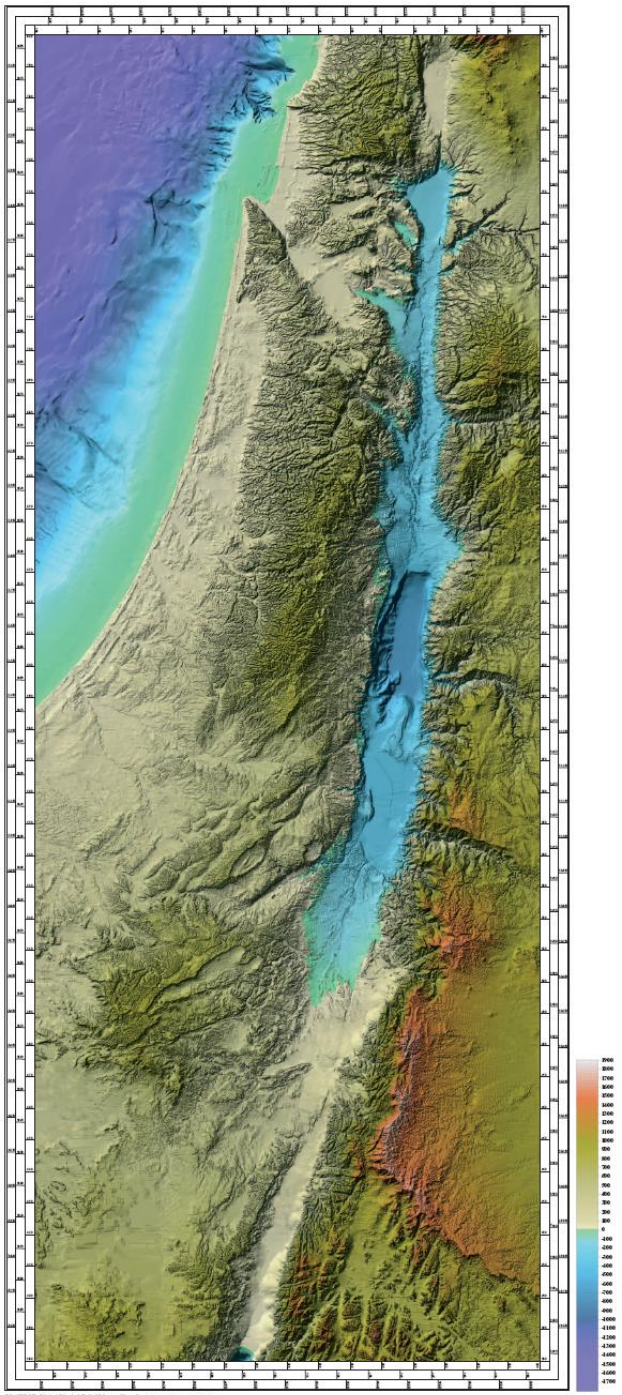
Proactive Bathymetric Mapping Activities around Israel and in the Arctic

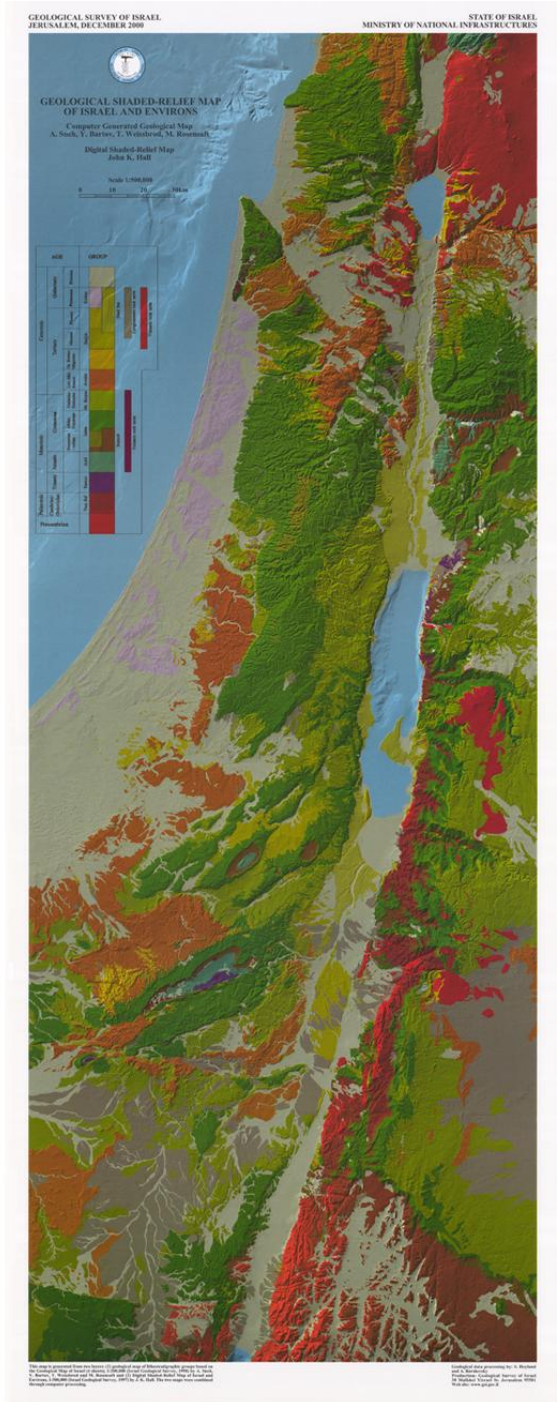
Dr. John K. Hall
Geological Survey of Israel (Retired)



GEBCO-2009-Science-Day
SHOM-Brest-29 September, 2009



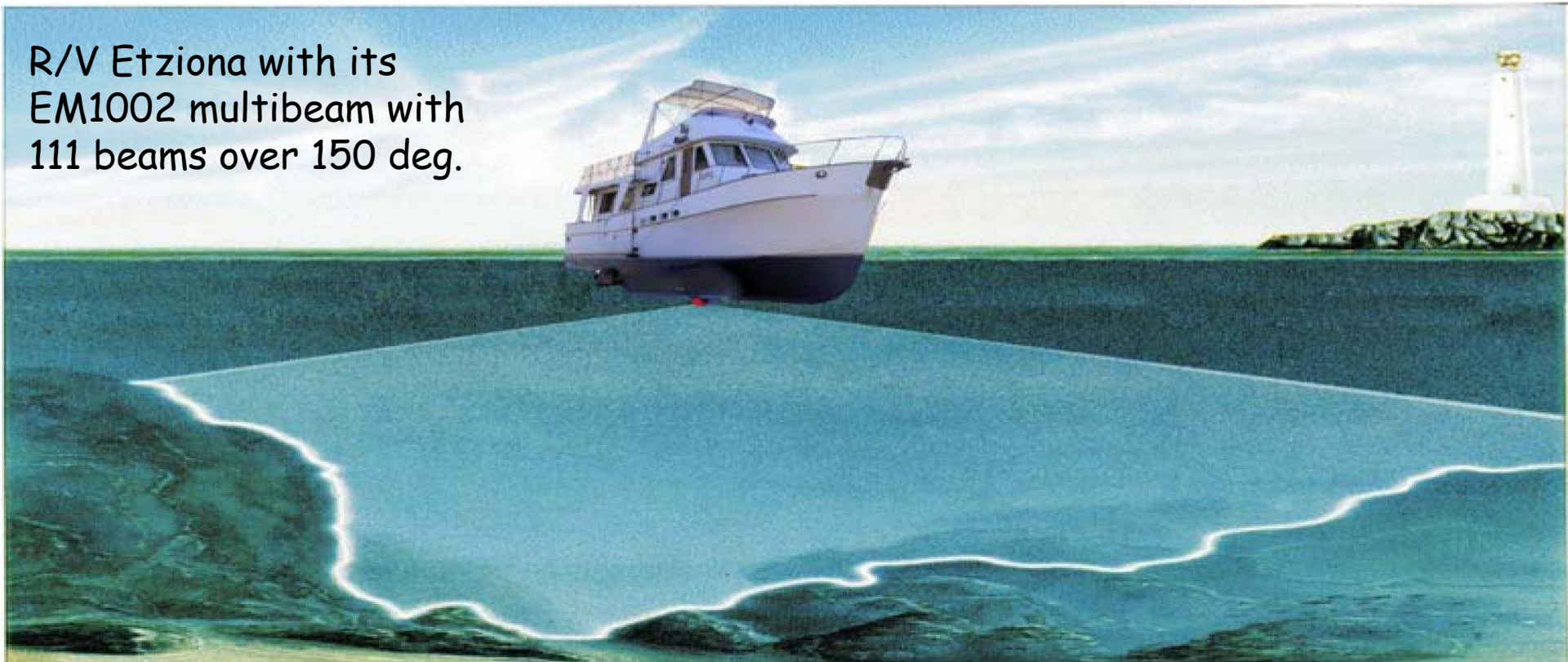


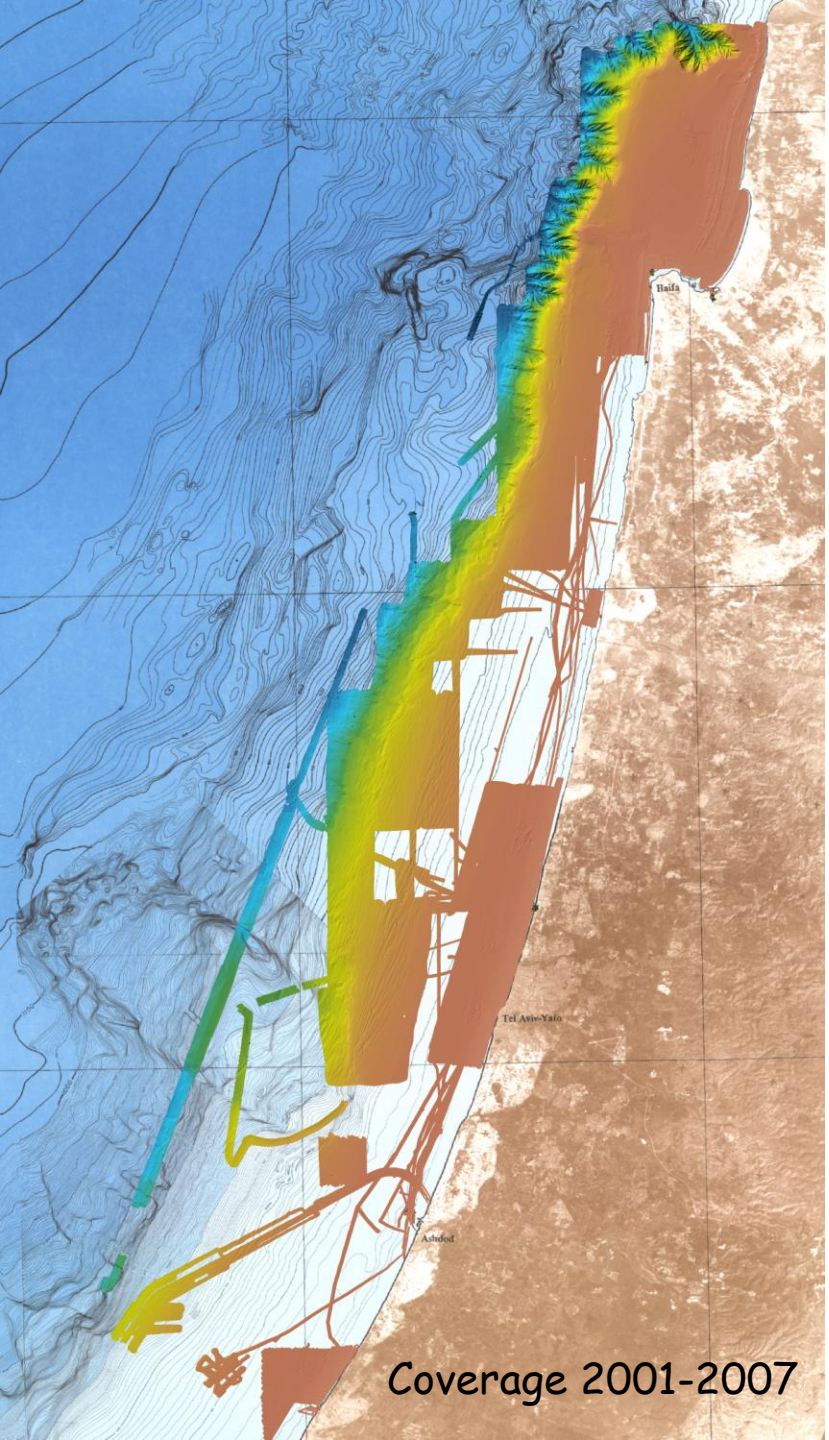


Israel 25m DTM 1987-1993

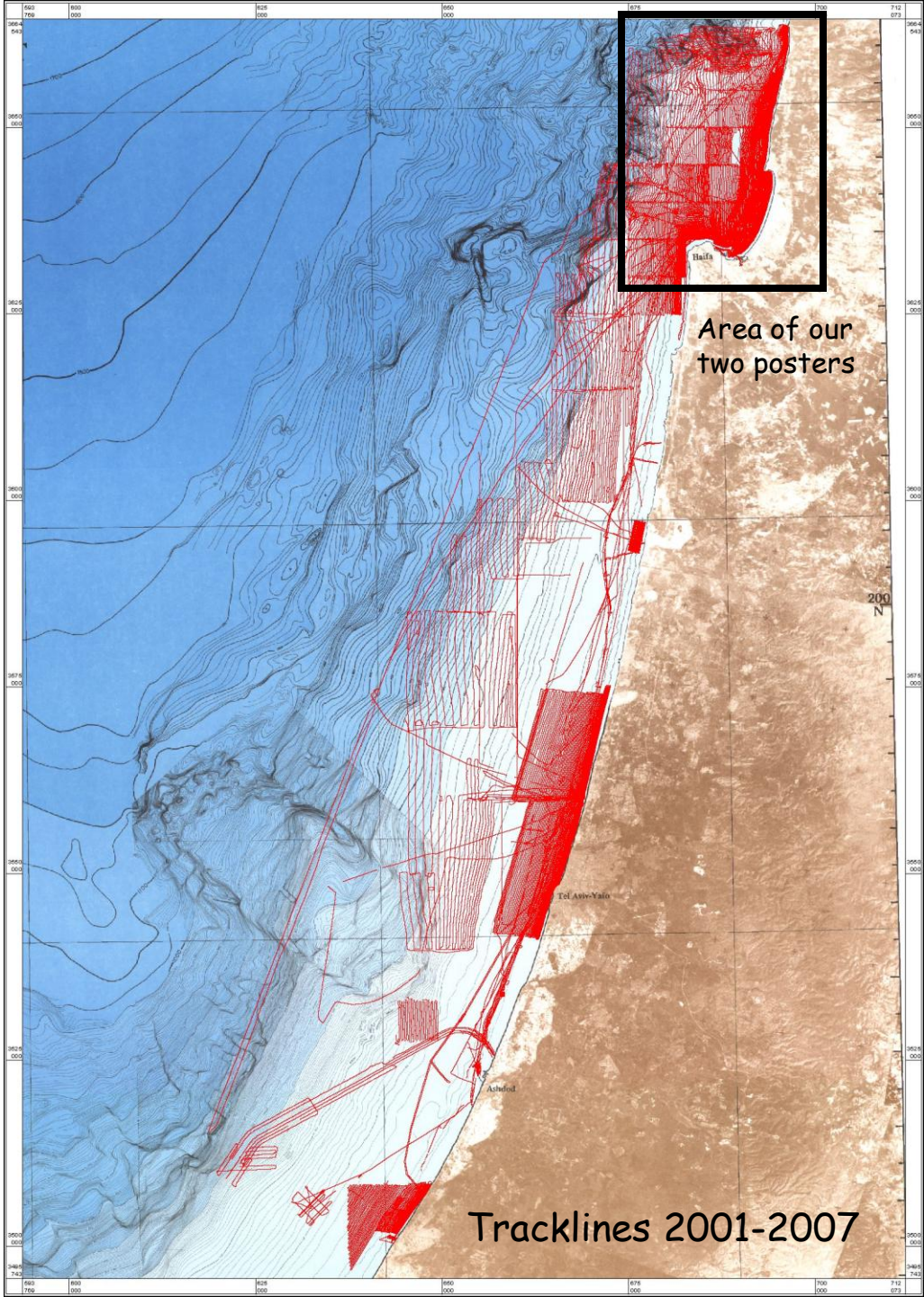
Multibeam Results from the latest Israeli surveys in the Med, Red, and Dead Seas, and the Sea of Galilee

Based upon the work of
Ronnie Sade, Gideon Amit, Gideon Tibor,
Arik Golan, Limor Gur-Arie, and Hadar Sade.





Coverage 2001-2007



Tracklines 2001-2007

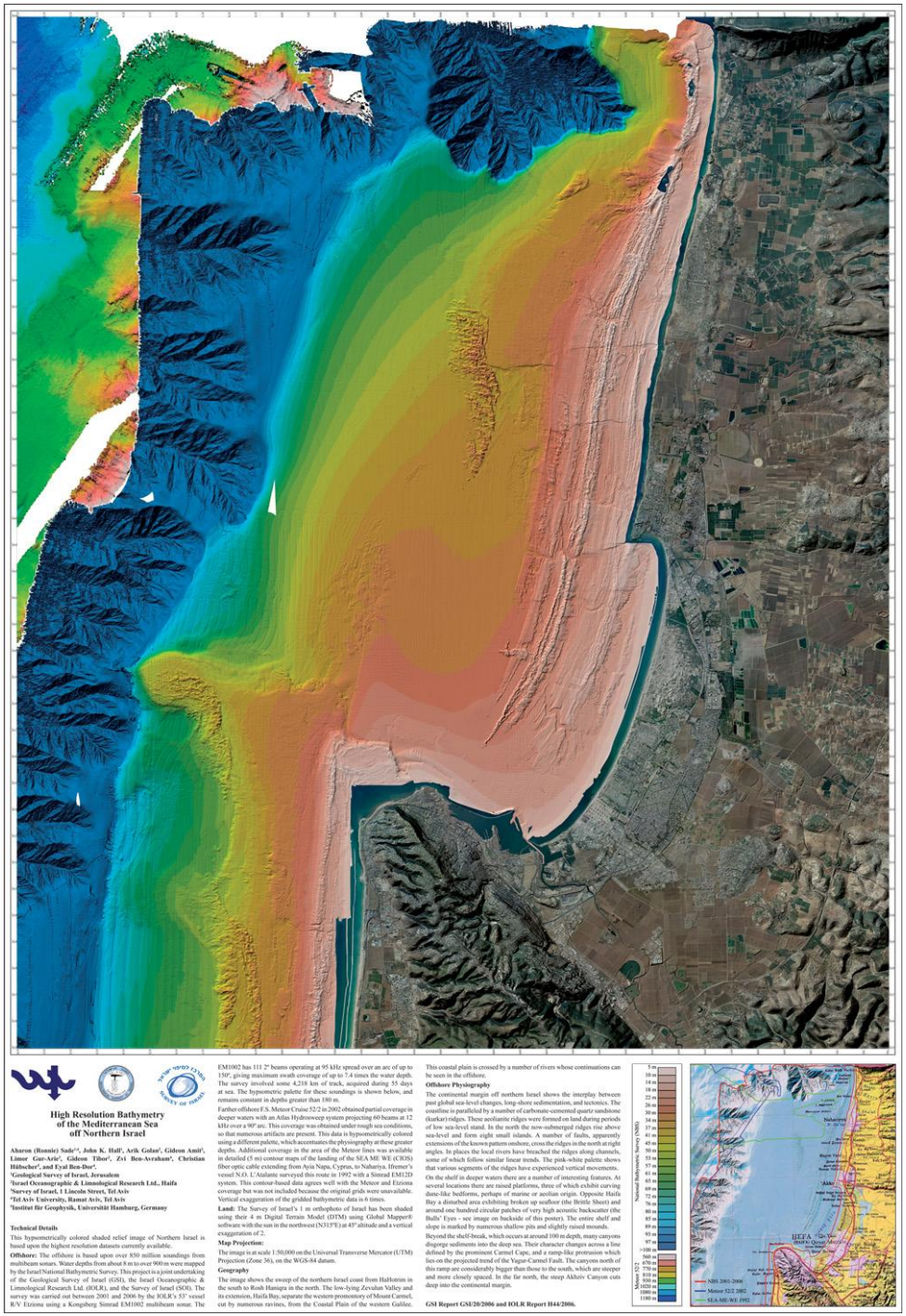
High Resolution Bathymetry of the Mediterranean off Northern Israel

Sade A. R. (1,4), Hall J. K. (1), Golan A. (2), Amit G. (2), Gur-Arie L. (3), Tibor G. (2), Ben-Avraham Z. (4), Hübscher C. (5), and Ben-Dor E. (4).

1. Geological Survey of Israel, Jerusalem , Israel
2. Israel Oceanographic & Limnological Research Ltd., Israel
3. Survey of Israel, Tel Aviv , Israel
4. Tel Aviv University, Tel Aviv , Israel
5. Institut für Geophysik, Universität Hamburg, Germany

4218 km of track,

840.4 million soundings

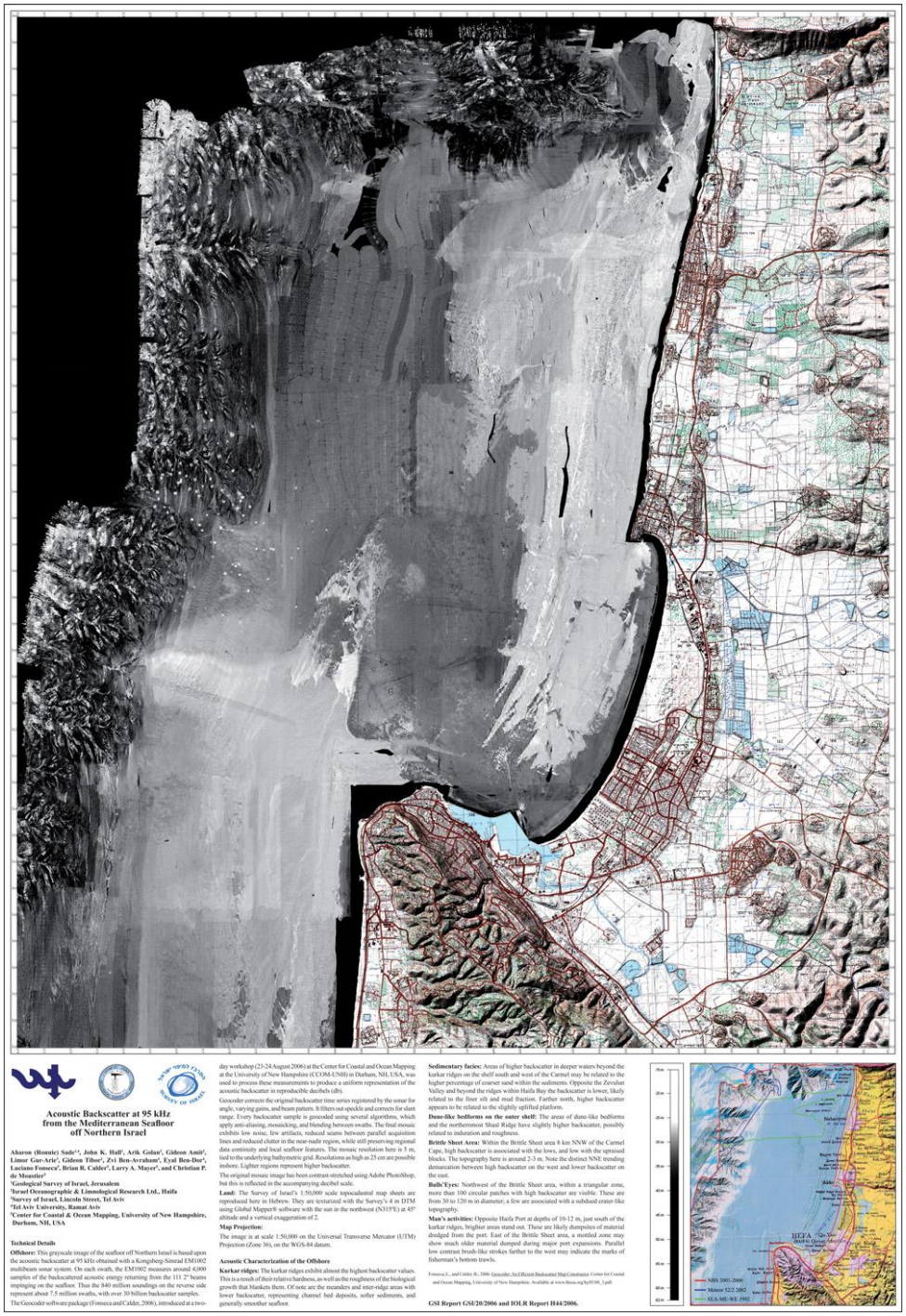


Acoustic Backscatter at 95 kHz from the Seafloor off Northern Israel

Sade A. (1,4), Hall J. K. (1), Golan A.(2), Amit, G. (2), Gur-Arieh L. (3), Tibor G. (2), Ben-Avraham Z. (4), Ben-Dor E. (4), Fonseca L. (5), Calder B. R. (5), Mayer L. A. (5), and de Moustier C. P. (5)

1. Geological Survey of Israel, Jerusalem, Israel
2. Israel Oceanographic & Limnological Research Ltd., Israel
3. Survey of Israel, Tel Aviv , Israel
4. Tel Aviv University, Tel Aviv 69978, Israel
5. Center for Coastal & Ocean Mapping, University of New Hampshire, Durham, NH, USA

Geocoder backscatter – ~30 billion measurements



Acoustic Backscatter at 95 kHz from the Mediterranean Seafloor off Northern Israel

Aharon (Ronnie) Sade[1,4], John K. Hall[1], Arik. Golan[2], Gideon Amit[3], Limor Gur-Arie[3], Gideon Tibor[2], Zvi Ben-Avraham[4], Eyal Ben-Dor[4], Luciano Fonseca[5], Brian R. Calder[5], Larry A. Mayer[5], and Christian P. de Moustier[5]
[1]Geological Survey of Israel, Jerusalem
[2]Israel Oceanographic & Limnological Research Ltd., Haifa
[3]Survey of Israel, Lincoln Street, Tel Aviv
[4]Tel Aviv University, Ramat Aviv
[5]Center for Coastal & Ocean Mapping, University of New Hampshire, Durham, NH, USA

Technical Details

Offshore: This grayscale image of the seafloor off Northern Israel is based upon the acoustic backscatter at 95 kHz obtained with a Kongsberg-Simrad EM1002 multibeam sonar system. On each swath, the EM1002 measures around 4,000 samples of the backscattered acoustic energy returning from the 111 2° beams impinging on the seafloor. Thus the 840 million soundings on the reverse side represent about 7.5 million swaths, with over 30 billion backscatter samples.
The Geocoder software package (Fonseca and Calder, 2006), introduced at a two-day workshop (23-24 August 2006) at the Center for Coastal and Ocean Mapping at the University of New Hampshire (CCOM-UNH) in Durham, NH, USA, was used to process these measurements to produce a uniform representation of the acoustic backscatter in reproducible decibels (db).
Geocoder corrects the original backscatter time series registered by the sonar for angle, varying gains, and beam pattern. It filters out speckle and corrects for slant range. Every backscatter sample is geocoded using several algorithms, which apply anti-aliasing, mosaicking, and blending between swaths. The final mosaic exhibits low noise, few artifacts, reduced seams between parallel acquisition lines and reduced clutter in the near-nadir region, while still preserving regional data continuity and local seafloor features. The mosaic resolution here is 5 m, tied to the underlying bathymetric grid. Resolutions as high as 25 cm are possible inshore. Lighter regions represent higher backscatter.
The original mosaic image has been contrast-stretched using Adobe PhotoShop, but this is reflected in the accompanying decibel scale.
Land: The Survey of Israel's 1:50,000 scale topocadastral map sheets are reproduced here in Hebrew. They are textured with the Survey's 4 m DTM using Global Mapper® software with the sun in the northwest (N315°E) at 45° altitude and a vertical exaggeration of 2.
Map Projection:
The image is at scale 1:50,000 on the Universal Transverse Mercator (UTM) Projection (Zone 36), on the WGS-84 datum.

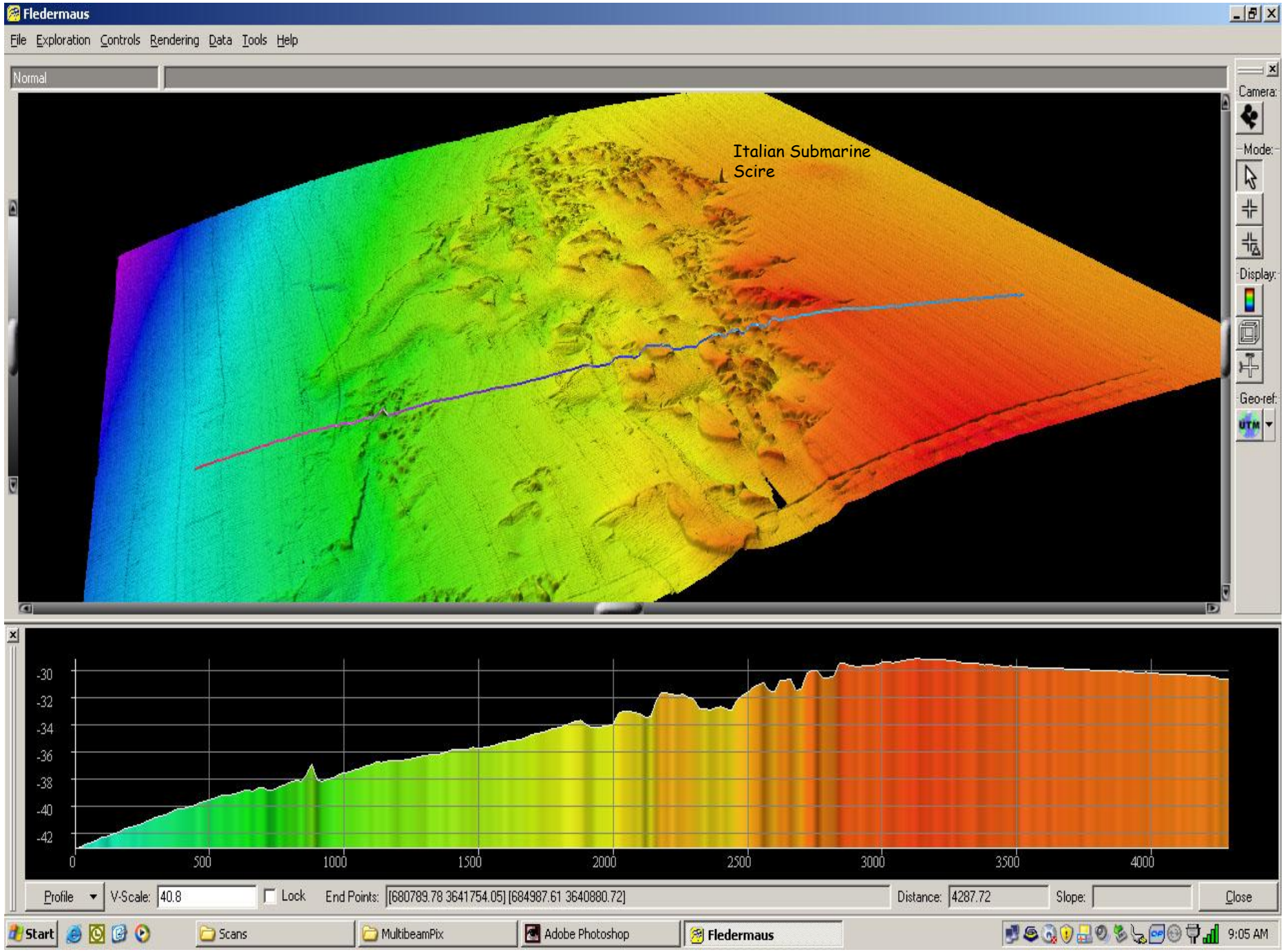
Acoustic Characterization of the Offshore

Kurkar ridges: The kurkar ridges exhibit almost the highest backscatter values. This is a result of their relative hardness, as well as the roughness of the biological growth that blankets them. Of note are the meanders and inter-ridge areas with lower backscatter, representing channel bed deposits, softer sediments, and generally smoother seafloor.
Sedimentary facies: Areas of higher backscatter in deeper waters beyond the kurkar ridges on the shelf south and west of the Carmel may be related to the higher percentage of coarser sand within the sediments. Opposite the Zevulun Valley and beyond the ridges within Haifa Bay the backscatter is lower, likely related to the finer silt and mud fraction. Farther north, higher backscatter appears to be related to the slightly -uplifted platform.
Dune-like bedforms on the outer shelf: The areas of dune-like bedforms and the northernmost Shaal Ridge have slightly higher backscatter, possibly related to induration and roughness.
Brittle Sheet Area: Within the Brittle Sheet area 8 km NNW of the Carmel Cape, high backscatter is associated with the lows, and low with the upraised blocks. The topography here is around 2-3 m. Note the distinct NNE trending demarcation between high backscatter on the west and lower backscatter on the east.
Bulls'Eyes: Northwest of the Brittle Sheet area, within a triangular zone, more than 100 circular patches with high backscatter are visible. These are from 30 to 120 m in diameter; a few are associated with a subdued crater-like topography.
Man's activities: Opposite Haifa Port at depths of 10-12 m, just south of the kurkar ridges, brighter areas stand out. These are likely dumpsites of material dredged from the port. East of the Brittle Sheet area, a mottled zone may show much older material dumped during major port expansions. Parallel low contrast brush-like strokes farther to the west may indicate the marks of fisherman's bottom trawls.

Fonseca, L., and Calder, B., 2006. Geocoder: An Efficient Backscatter Map Constructor. Center for Coastal and Ocean Mapping, University of New Hampshire. Available at www.ccom.unh.edu/theses/571.pdf.

GSI Report GSI/20/2006 and IOLR Report H44/2006.

NBS 2001-2006
Monzur 322 2002
SEA-MD WS 1992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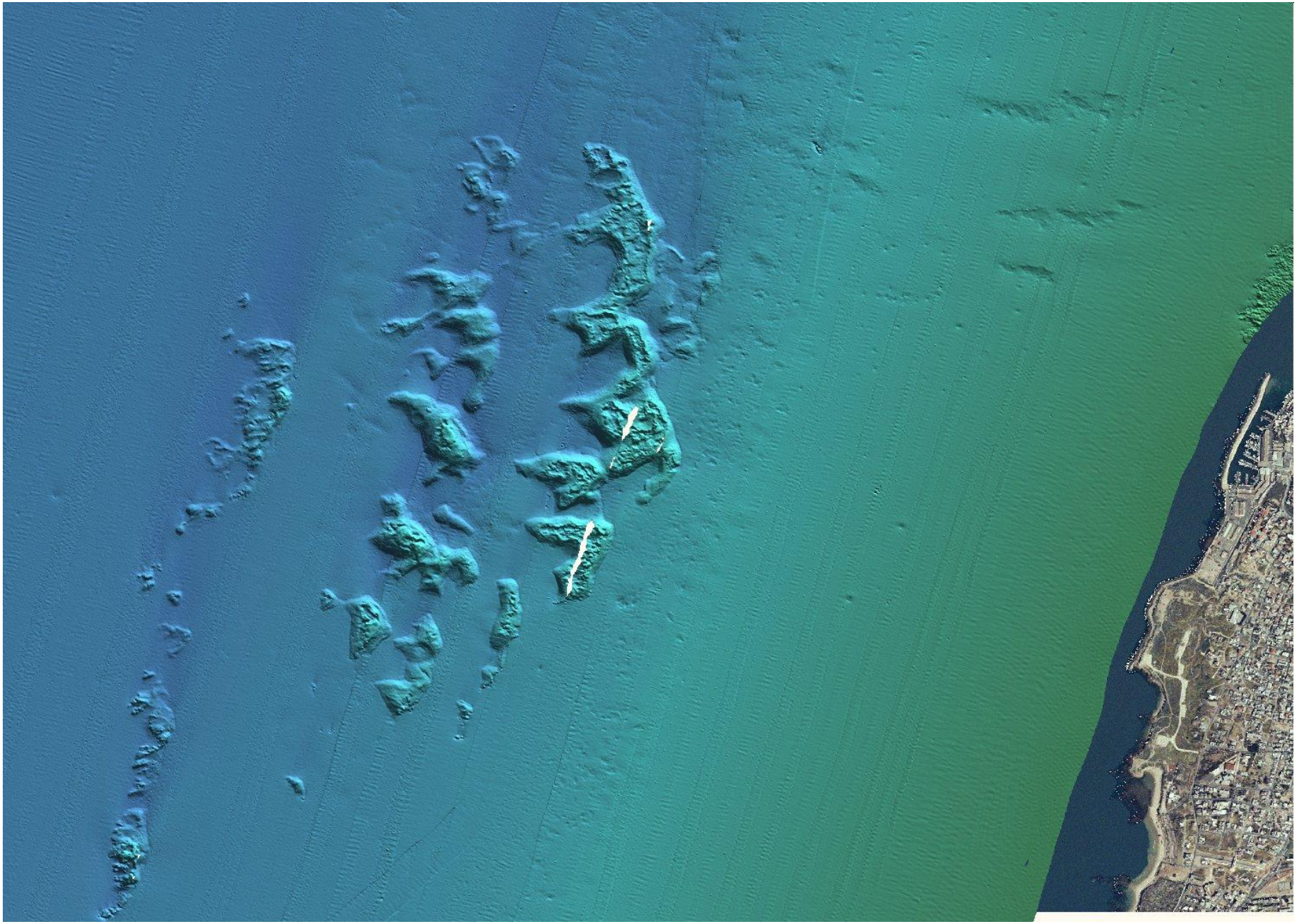
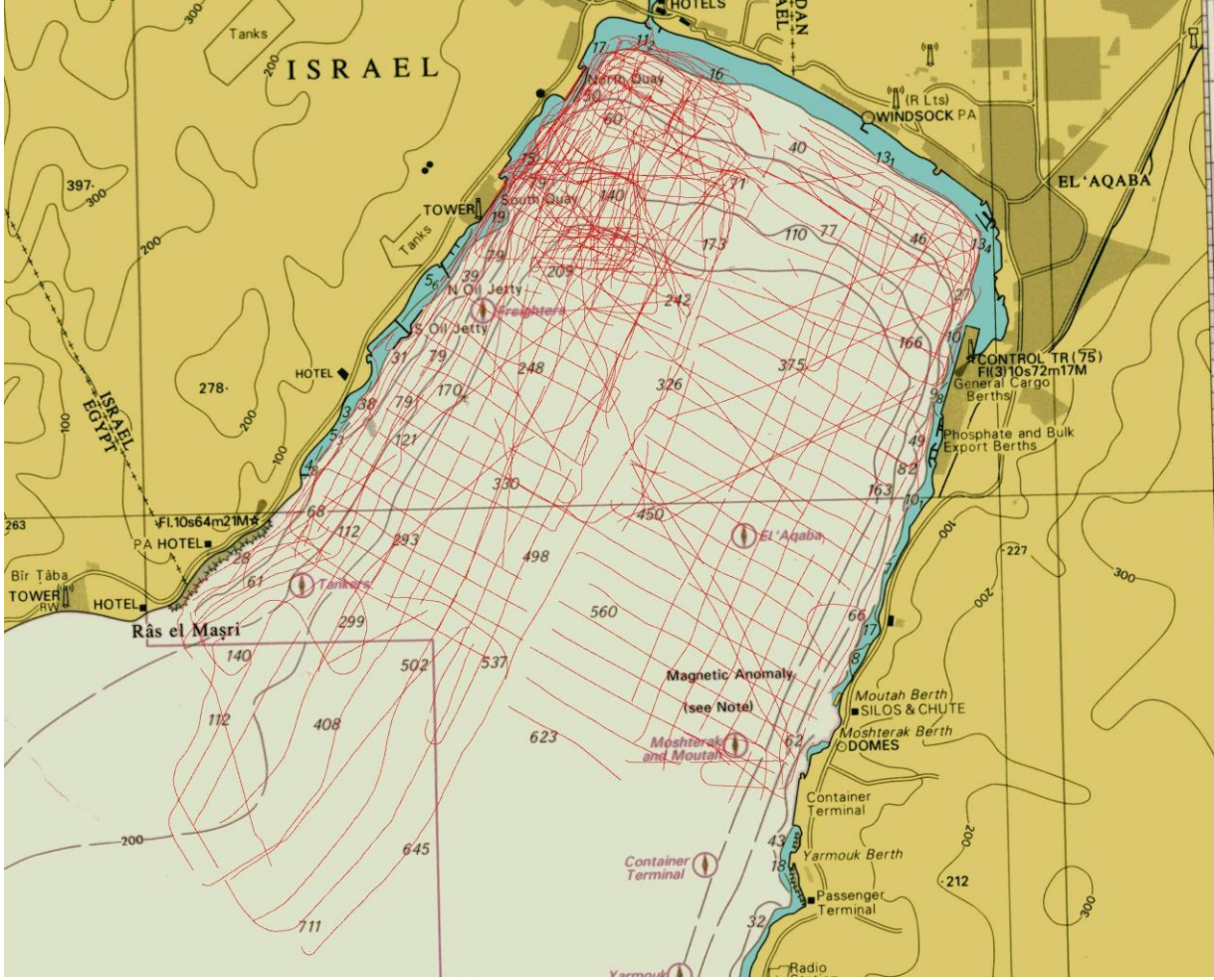


Kurkar 'ridges' off Jaffa Port – note pockmarks, and depressions found only north of the headland

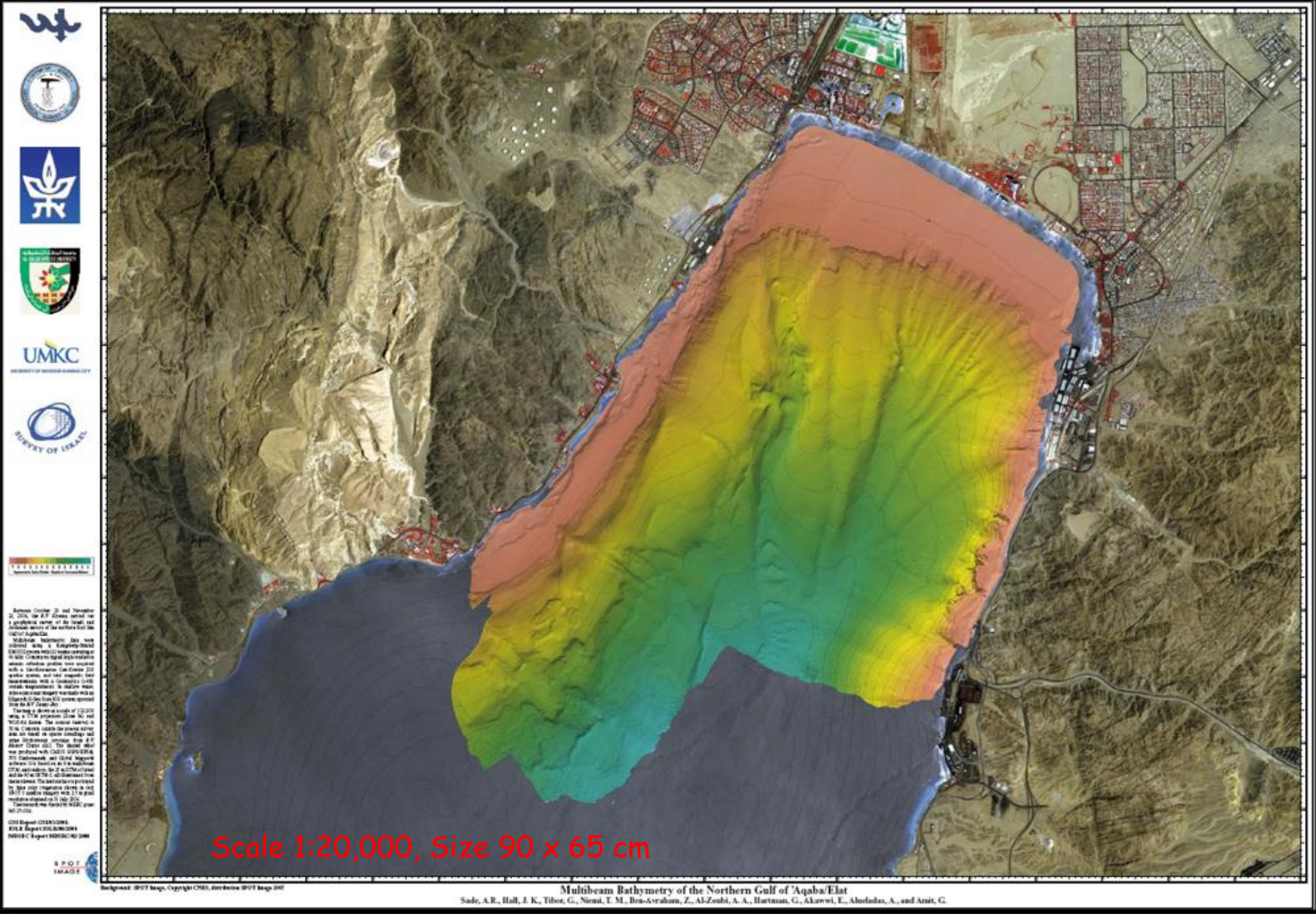
Turning south to the northernmost Red Sea

Track Lines of the R/V Etziona, which transited through the Suez Canal especially for this survey.

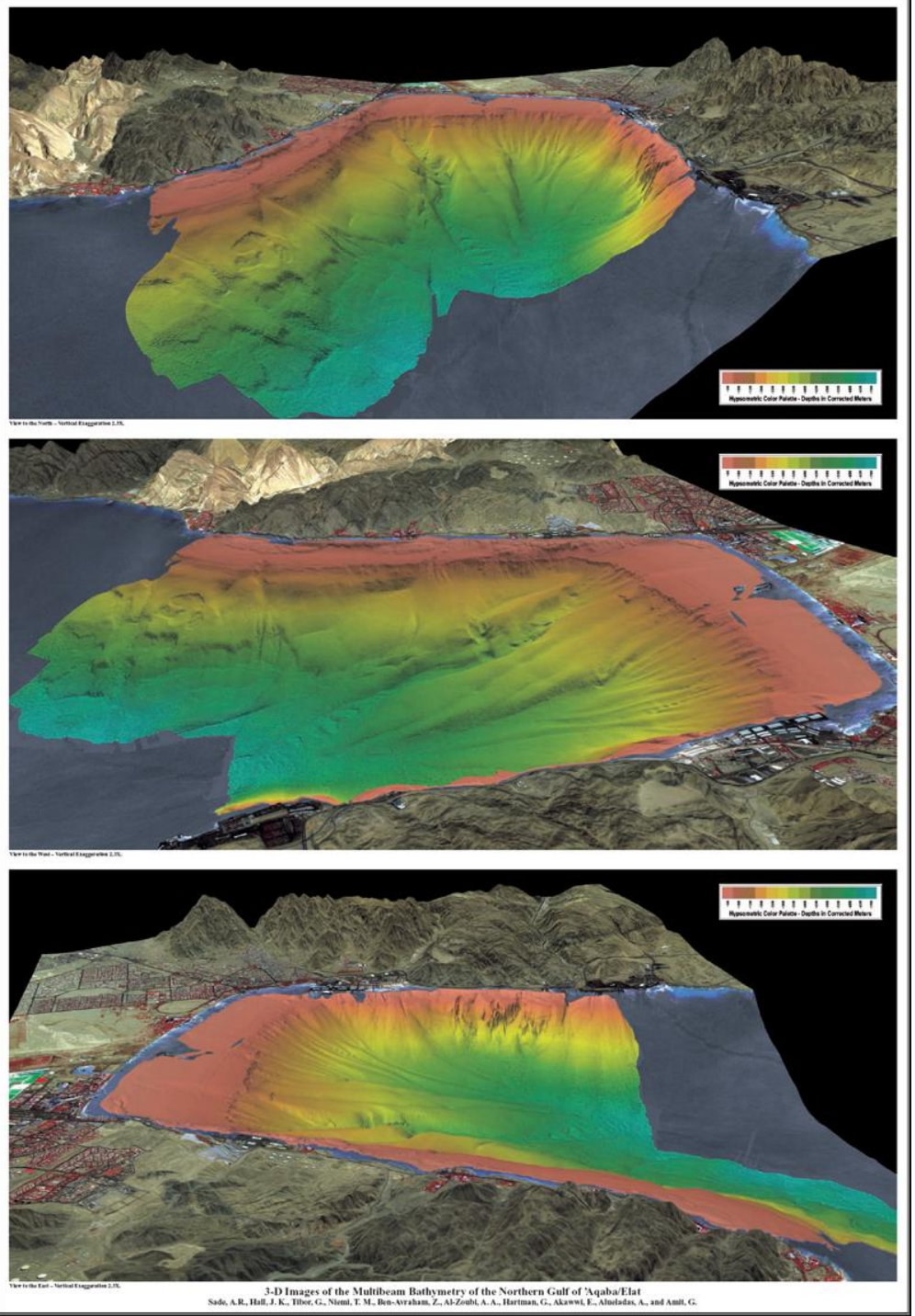


MERC Eilat - Aqaba
Sparker/Multibeam/Magnetic Survey
Joint Jordanian-Israeli project

26 Oct - 21 Nov 2006 (12 Days)



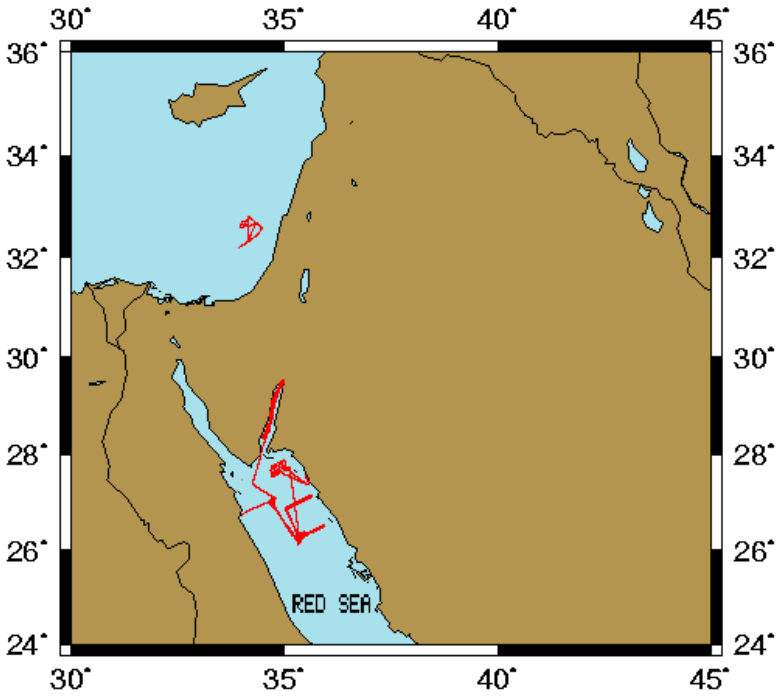
Multibeam coverage is 400%. Land cover SPOT 5 2.5m pixels (Copr. Spot/CNES)

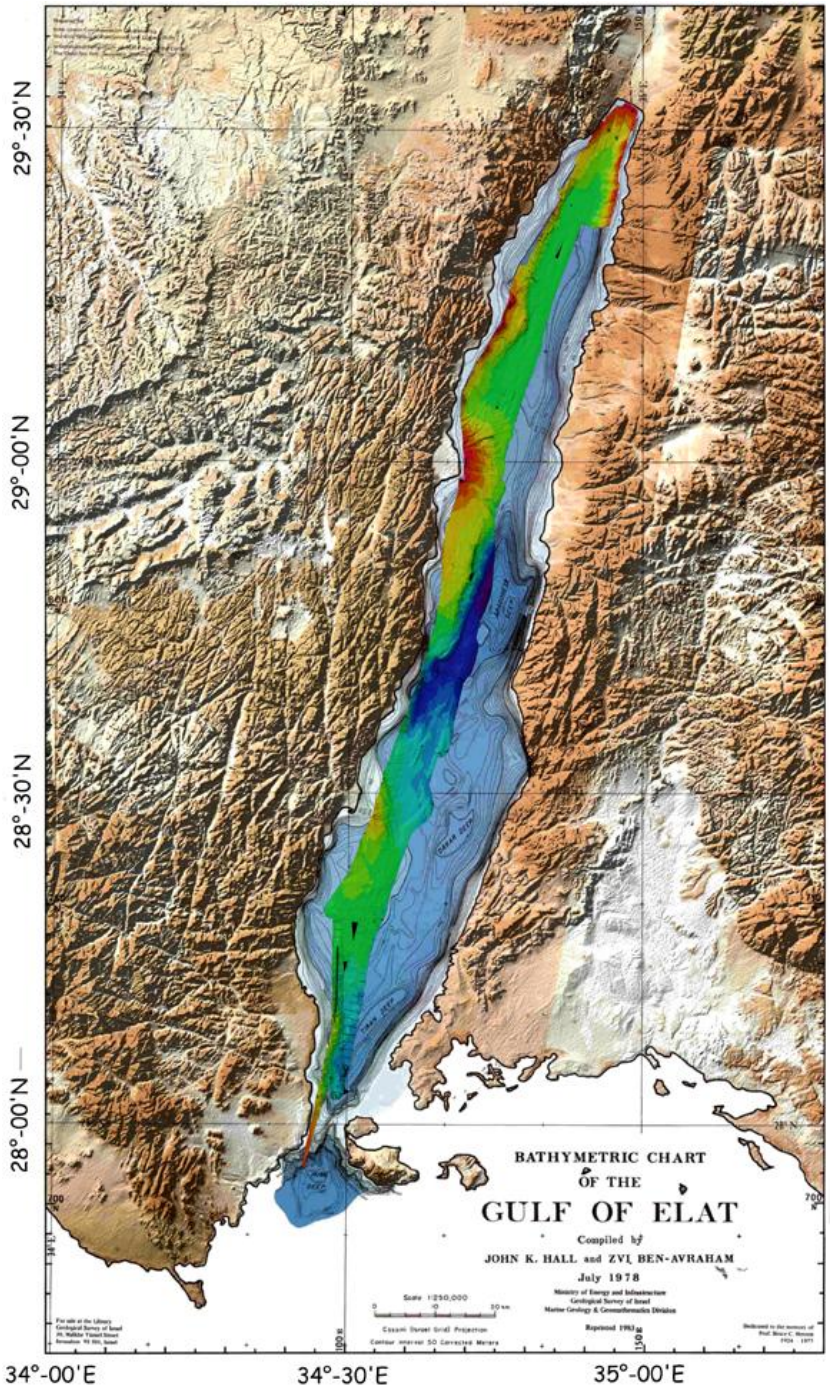


The backside of this laminated poster showed perspective views from the south (top), east (Jordan – middle), and west (Israel – bottom).

Multibeam coverage (Atlas DS-2 Hydrosweep) of the western Gulf of Elat, taken by the F/S METEOR during Cruise 44/3 (12 March – 7 April 1999).

Gridded at 30 m, and merged with 30 m ASTER topography.



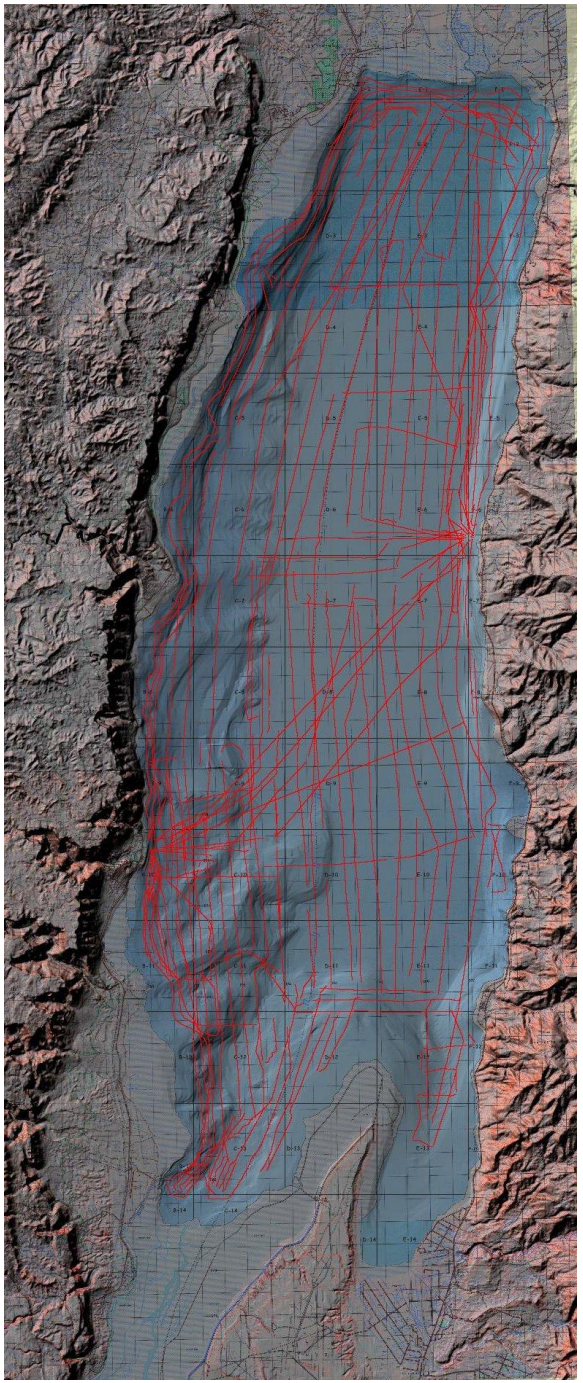


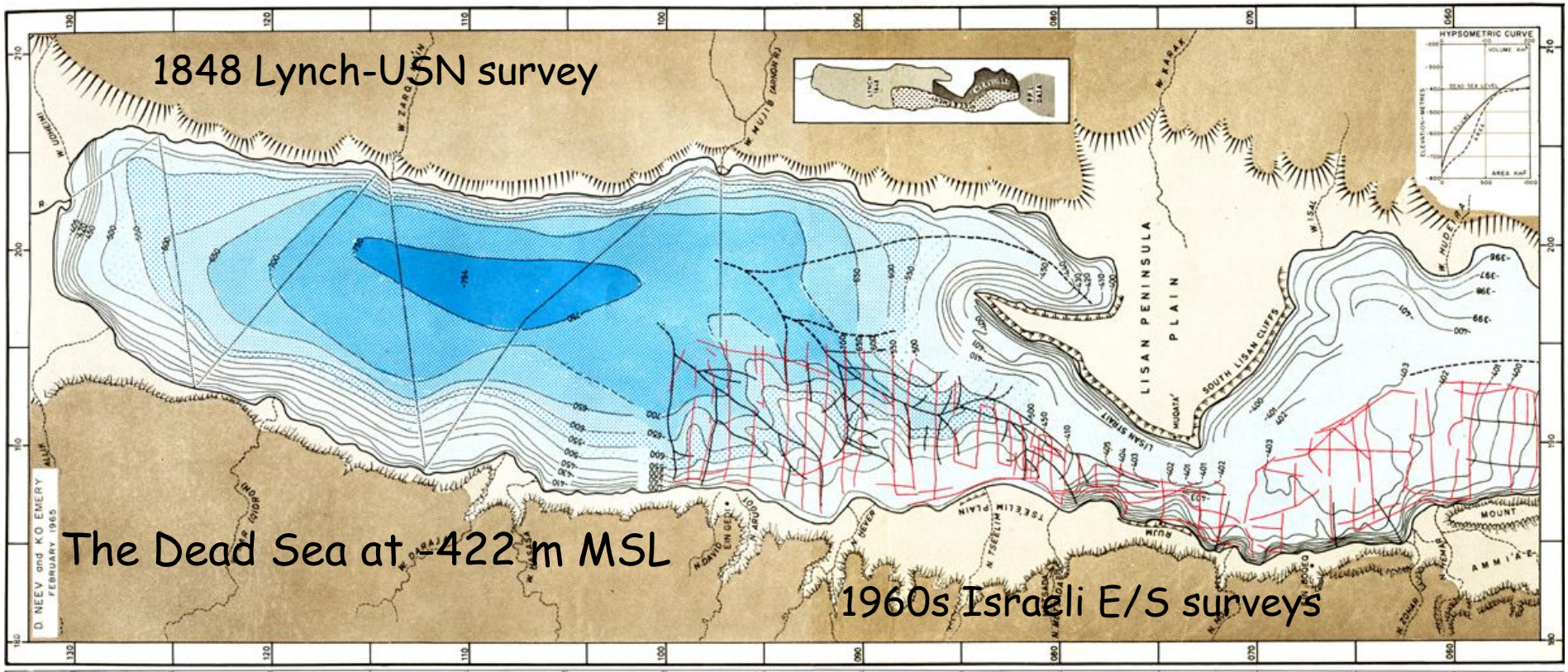
The Dead Sea Multibeam/Magnetic Survey

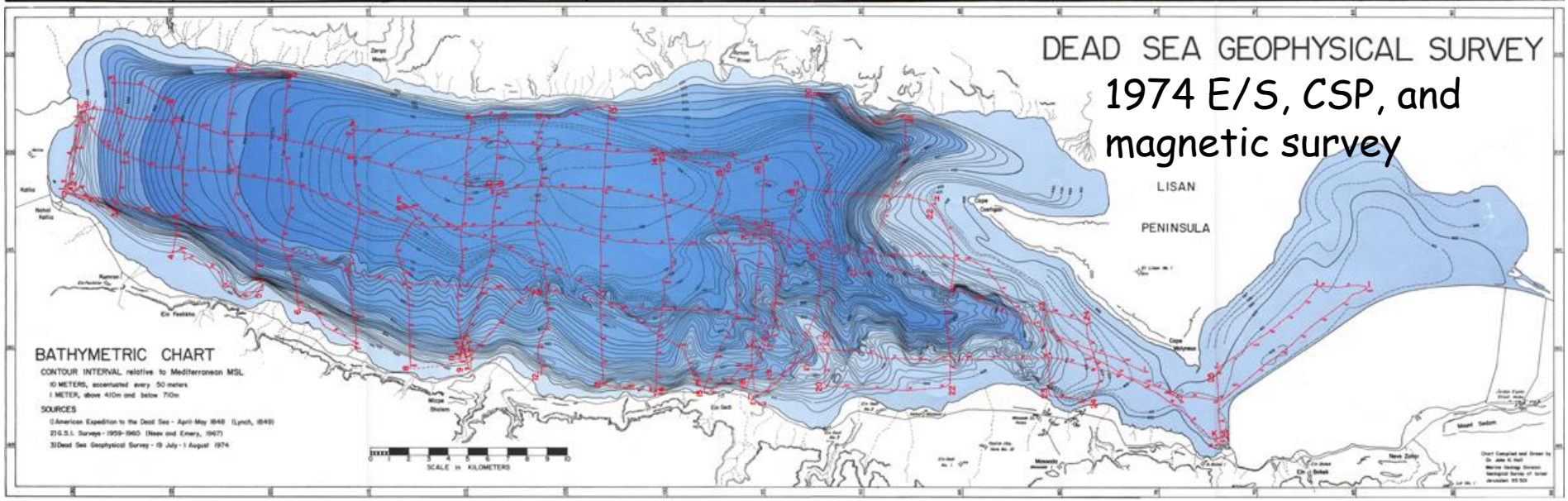
Joint Jordanian-Israeli project

9 Jan - 2 Feb 2007 (21 Days)

R/V Tuglit at Ein Gedi – Built at the Dead Sea in 2004 - 60 tons, 23 m overall

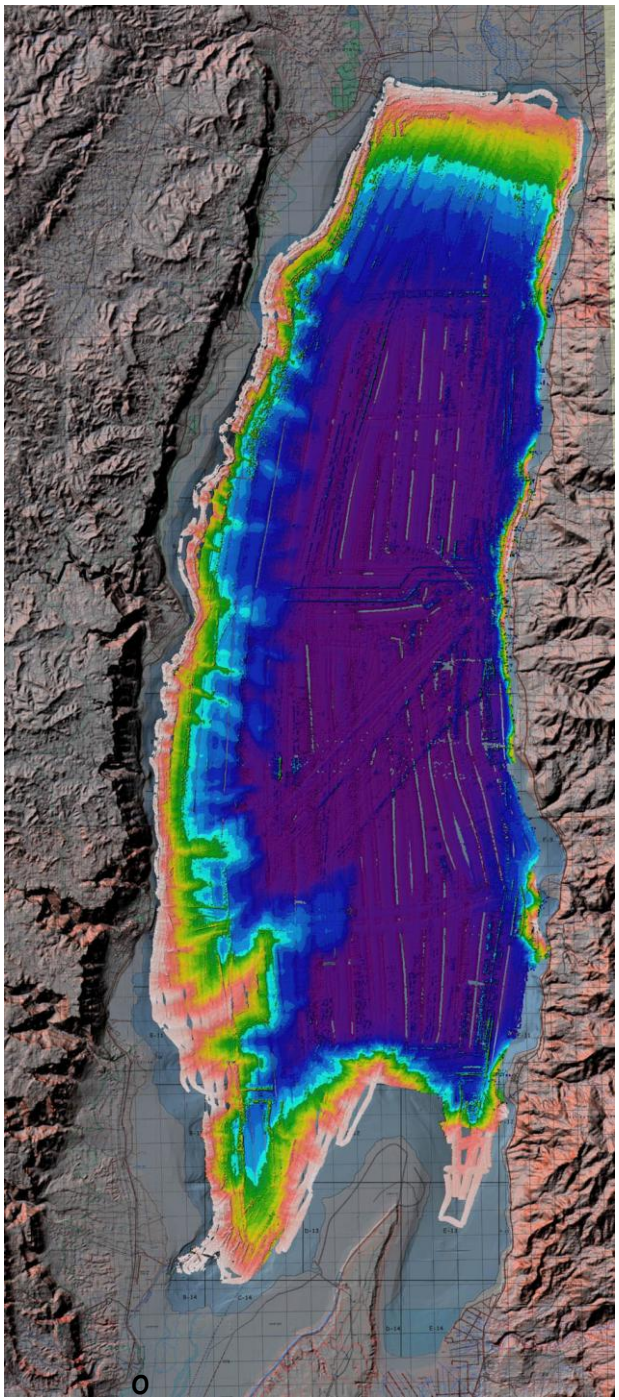



1848 Lynch-USN survey
The Dead Sea at -422 m MSL
1960s Israeli E/S surveys
HYPSOMETRIC CURVE
LISAN PENINSULA
PLAIN
SOUTH LISAN CLIFFS
LISAN STAGE
TSELELIM PLAIN
MOUNT
D. NEEV and K.O. EMERY
FEBRUARY 1965

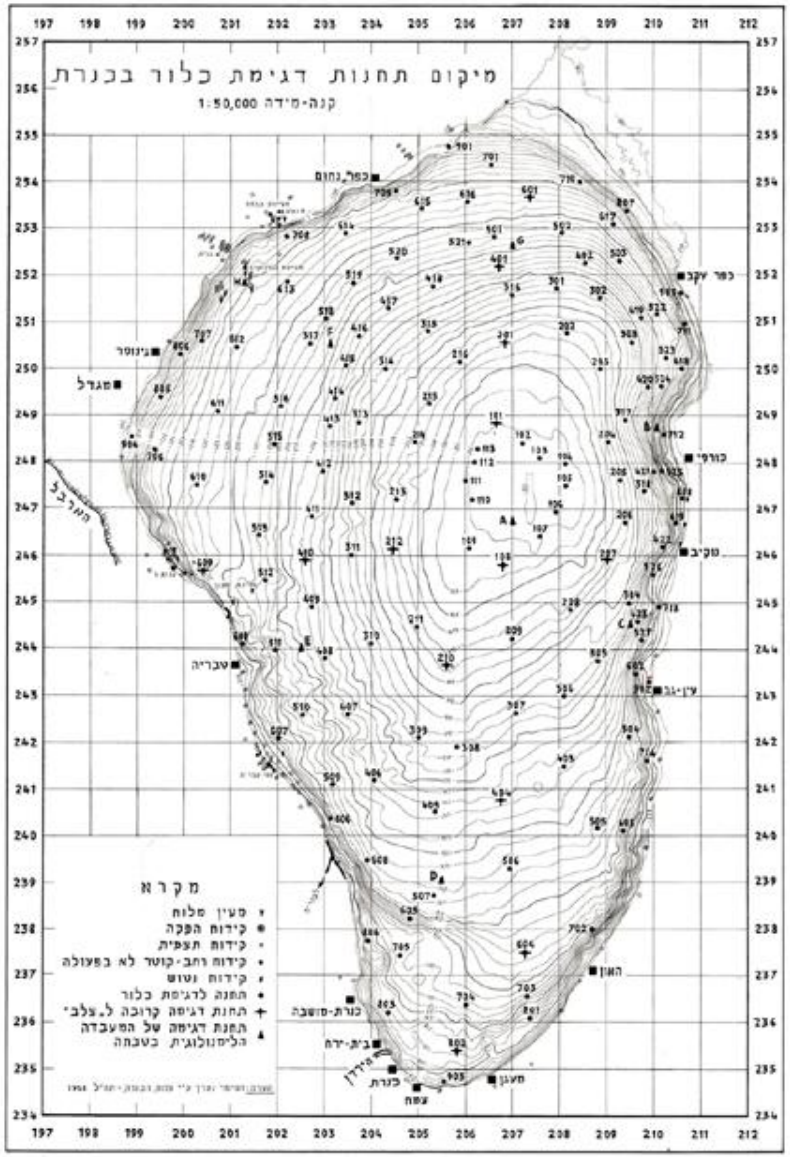

DEAD SEA GEOPHYSICAL SURVEY
1974 E/S, CSP, and magnetic survey
LISAN
PENINSULA
BATHYMETRIC CHART
CONTOUR INTERVAL relative to Mediterranean MSL
10 METERS, accentuated every 50 meters
1 METER, above 410m and below 710m
SOURCES
SCALE in KILOMETERS

The speed of sound in the Dead Sea is over 1,810 m/sec. The profile was measured with an industrial AML Ltd. SV2000 with measurement range of 500-2000 m/sec.

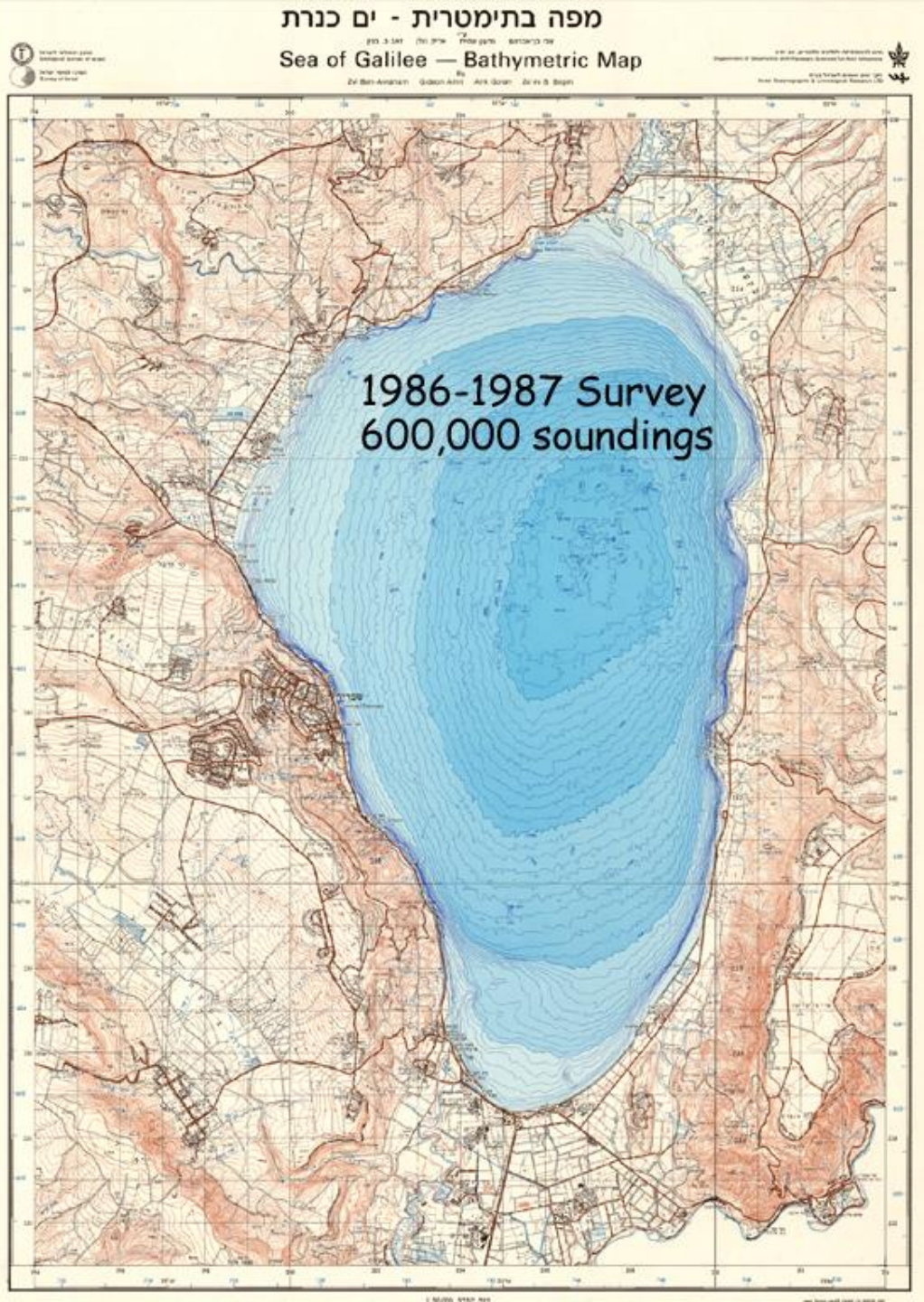
The ELAC 1055 firmware was tricked by indicating 30 instead of 38 degrees between the two transducer blocks. The result worked but no nadir beams were recorded….

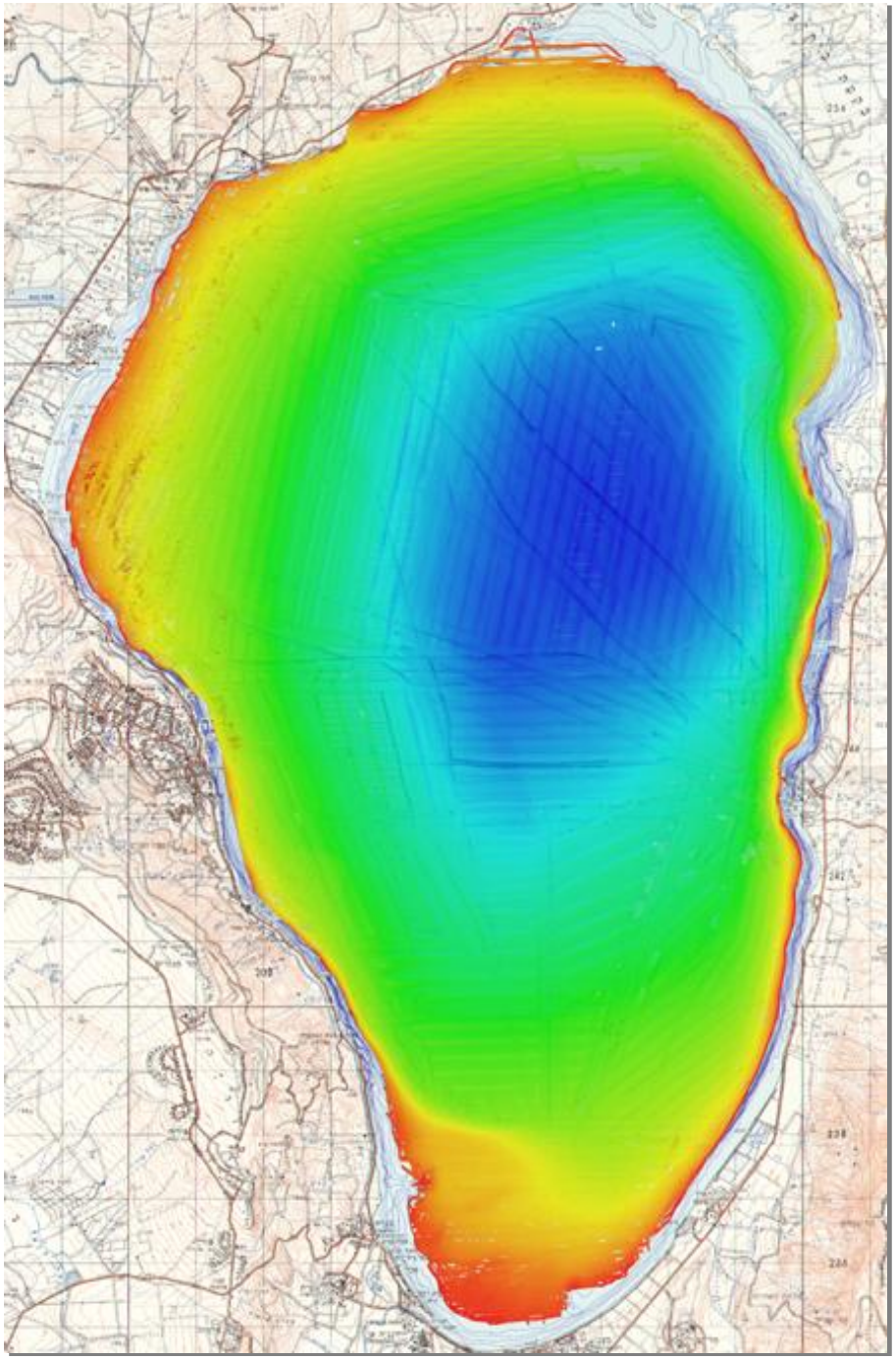


Multibeam Survey of the Sea of Galilee - Kinneret - 2008



TAHAL Survey - 1968





The survey lasted 7 weeks from end May to beginning of July 2008.

Track length was 1600 km. Some 38 million soundings were recorded.

325 hours of multibeam survey with an ELAC Seabeam 1180 with 126 beams at 180 kHz.

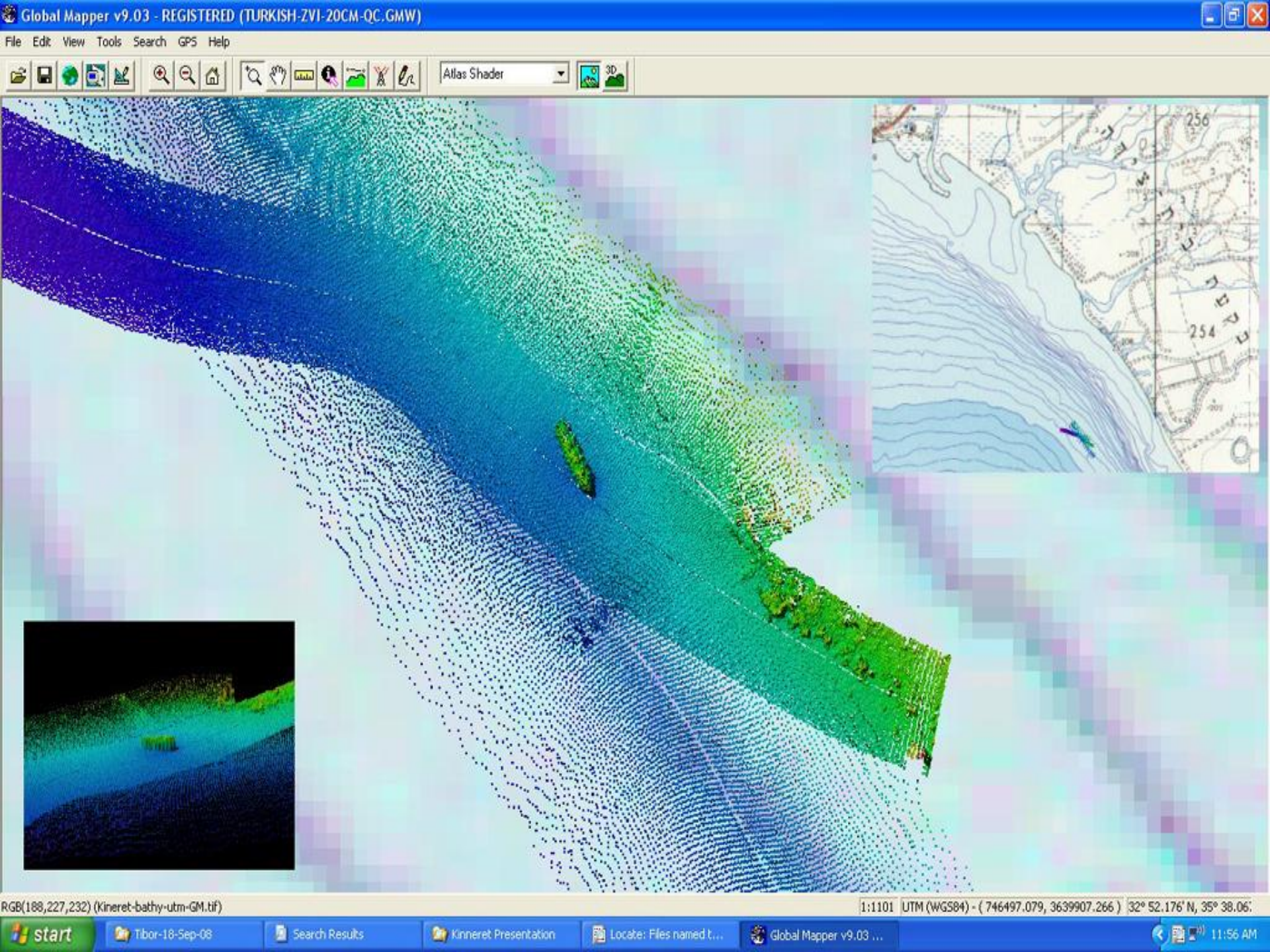
Depths from 5 to 40 m. Swath width about 5 times the depth under the transducer.

Sparker survey around the periphery – where gas does not produce an acoustic mirror.

Cesium magnetometer towed throughout.

A sparker survey was carried out on a tight grid, along with multibeam with a rented ELAC SeaBeam 1180 system, and Geometrics Cesium magnetometer.

The work day began at 5AM, and after a break during the windy afternoon, continued until late at night. Here the R/V Lillian is seen against the mountains above Tiberias.


Global Mapper v9.03 - REGISTERED (TURKISH-ZVI-20CM-QC.GMW)
File Edit View Tools Search GPS Help
Atlas Shader
3D
256
254
RGB(188,227,232) (Kineret-bathy-utm-GM.tif)
1:1101 UTM (WGS84) - (746497.079, 3639907.266) 32° 52.176' N, 35° 38.06'
start
Tibor-18-Sep-08
Search Results
Kinneret Presentation
Locate: Files named t...
Global Mapper v9.03 ...
11:56 AM

IAF hopes new searches will recover body of pilot missing 46 years

• By YAAKOV KATZ

YAKIR NAVEH

Close to half a century after he disappeared, the IDF believes it is closer than ever to recovering the body of missing air force pilot Lt. Yakir Naveh, who crashed into Lake Kinneret on a training flight in 1962.

Next week, the Israel Air Force team directing the searches will receive final sonar images from the crash site to analyze in an effort to locate the fuselage of the Fuga jet, where they hope Naveh's body will be found.

In May 1962, Naveh was an air force instructor flying with IAF cadet Oded Kuton. Naveh's aircraft was part of a three-plane formation that was flying low over the Kinneret.

Naveh's Fuga suddenly hit the water and while Kuton, who was the pilot, tried to pull up, it dipped back down and was eventually swallowed by a massive wave. Naveh was 23 at the time.

Rescue teams were immediately dispatched, but they only recovered bits and pieces of the plane. Almost a year later, a fishing boat's anchor got stuck on something heavy on the seabed; it turned out to be the pilot's seat with Kuton still strapped into it.

Parts of the Fuga turned up over the years, but the searches for Naveh did not produce results. Recently, however, under the command of Lt.-Col. Zohar, the IAF's Unit for the Location of Missing Servicemen renewed the searches, believing that with new and advanced technology it would be possible to finally retrieve Naveh.

"Our responsibility is to the soldier," Zohar told *The Jerusalem Post* on Thursday. "And we will do everything we can to locate the missing serviceman and bring him to a Jewish burial."

Zohar does not hide his optimism that Naveh may be found by the end of the year. Next week he will meet with representatives of the navy, which recently surveyed the crash site with a new three-dimensional sonar system.

"Once we get the map of the scene we will search for objects that look like they may be a chair or the body of the plane," he said.

The next stage, which Zohar said he hoped would take place by November, would be to send divers to retrieve the pieces of the craft and hopefully Naveh's body. The next two months are the ideal time for diving in the Kinneret since from November the water becomes too murky to continue.

"My wish is to send the divers down and find Yakir sitting in his chair like the day he took off," Zohar said. "We know, however, that it will not be that easy."

לאיתור הטייס שהתרסק לפני 46

צל מפלס הכינרת הנמוך: סיכוי חדש

שוב צפון

התעלומות

הכינרת מעולם לא היתה במצב גרוע יותר, אבל במעבדה לחקר האגם דווקא מפגינים אופטימיות ■ הסיבה: תהליך מתוכנם של מיפוי הקרקעית שהתבצע החודש בכינרת עשוי לשפוך אור על שתיים מהפרשות המסתוריות בתולדותיה

דודו בזק

האם אחת הפרשות המסתוריות של הכינרת בדרך לפענוח? בחודש האחרון צילמו ומיפו אנשי המעבדה לחקר הכינרת את האגם באמצעות גלאי מתקדם תת־ימי, במטרה לחבין מפה שתארי את קרקעיתו. תוצאות המיפוי הועברו לארה"ב, ובעוד בחודש צפויים להגיע לארץ פענוחי התצלומים, שעשויים לשפוך אור על היעלמותו של ממוס הפונה של יקיר נווה לפני 46 שנה, ואולי גם לסייע בחקר היעלמותו של הדייג מאיר דהאן.

בחודש האחרון עמלו אנשי המעבדה לחקר הכינרת והמכון הגיאולוגי במימון רשות המים על פרויקט תיעוד קרקעית הכינרת. מטרת הפרויקט היא לצייר מפה טופוגרפית שתראה כיצד נראית במציאות קרקעית הימה. עד לפני כשבוע מיפו אנשי המכון, בראשות פרופ' גדעון טיבור, את הקרקעית שגודלה כ־167 קמ"ר, במכשיר מיוחד בשם אקו־ביט, שבאמצעותו יצרו מפה טופוגרפית של הקרקעית. מכשיר האקו־ביט נגרר על ידי סירה, שולח אותות ומצלם כל פיסת קרקע בשילוב ציון ג'י־פי־אס מדויק. הצילומים הועברו לפענוח בארצות־הברית, ובין היתר מקומים אנשי המעבדה יחד עם אנשי מנהלת הכינרת למצוא רמז להיעלמותם במצולות הימה של נווה ושל דהאן.

נווה ז"ל היה מדריך בבית הספר לטיסה של חיל האוויר. ב־6 במאי 1962 יצאו המדריך נווה והחניך עודד קוטון ז"ל לטיסת אימונים במטוס פוגה. המטוס התרסק לכינרת, ובמהלך החיפושים נמצאה גופתו של קוטון בלבד. במשך השנים לא הירפו אנשי חיל האוויר והים מהחיפושים, אך המטוס והטייס טרם נמצאו.

יקיר נווה

מאיר דהאן

פרשה נוספת שמסתתרת במצולות הכינרת היא הירעלמותו של הדייג מאיר דהאן בצפון האגם. דהאן, מלווה בחבר הדייג אלי מרק, יצאו במארס 2003 לדוג בכנרת באזור כפר־נחום. תנאי מזג האוויר הקשים טלטלו את הסירה והשניים נטבעו. 18 חודשים לאחר שנעלמו אותרה גופתו של מרק על ידי צוות חיפושים מחיל הים. גופתו של דהאן לא נמצאה עד היום ונרתה בגדר תעלומה.

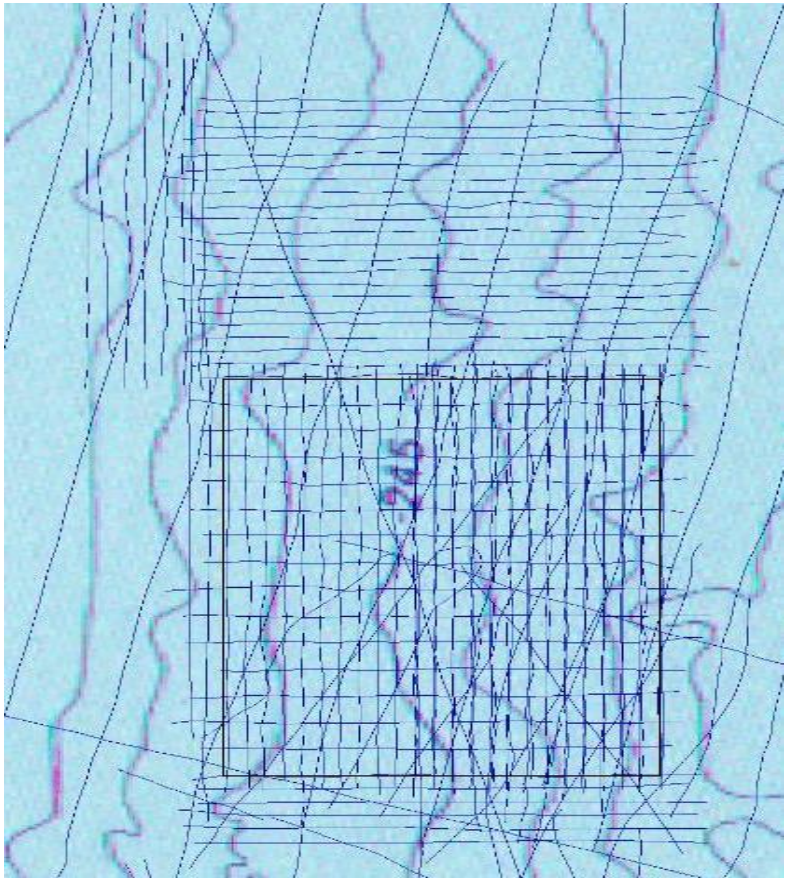
הגופות טרם נמצאו. חיפושים באזור לפני מ

"Maariv" - 14.7.2008

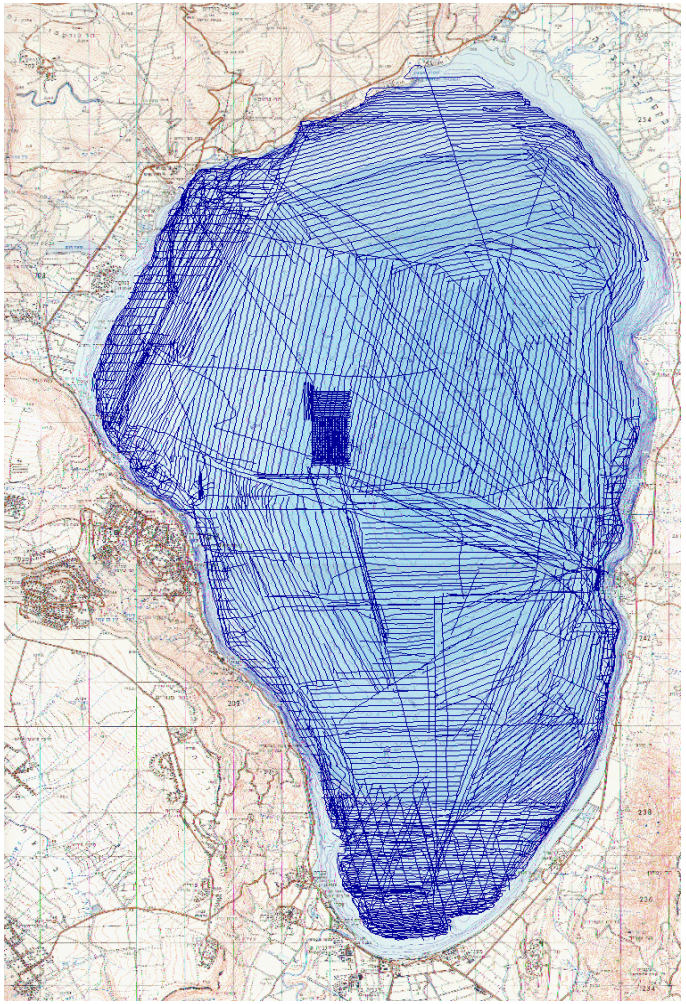
Since 1962 the Israeli Air Force (IAF) has been searching for the remains of a Fouga Magister training jet which crashed into the Kinneret in May 1962. One pilot's body was recovered but the second one is still missing. The survey was to locate the remaining sections of the aircraft and the second ejection seat and parachute.

Field Work Carried Out

- 3 survey days (29 June, **30 June**, 1 July 2008)
- 104 survey lines (17, **57**, 30)



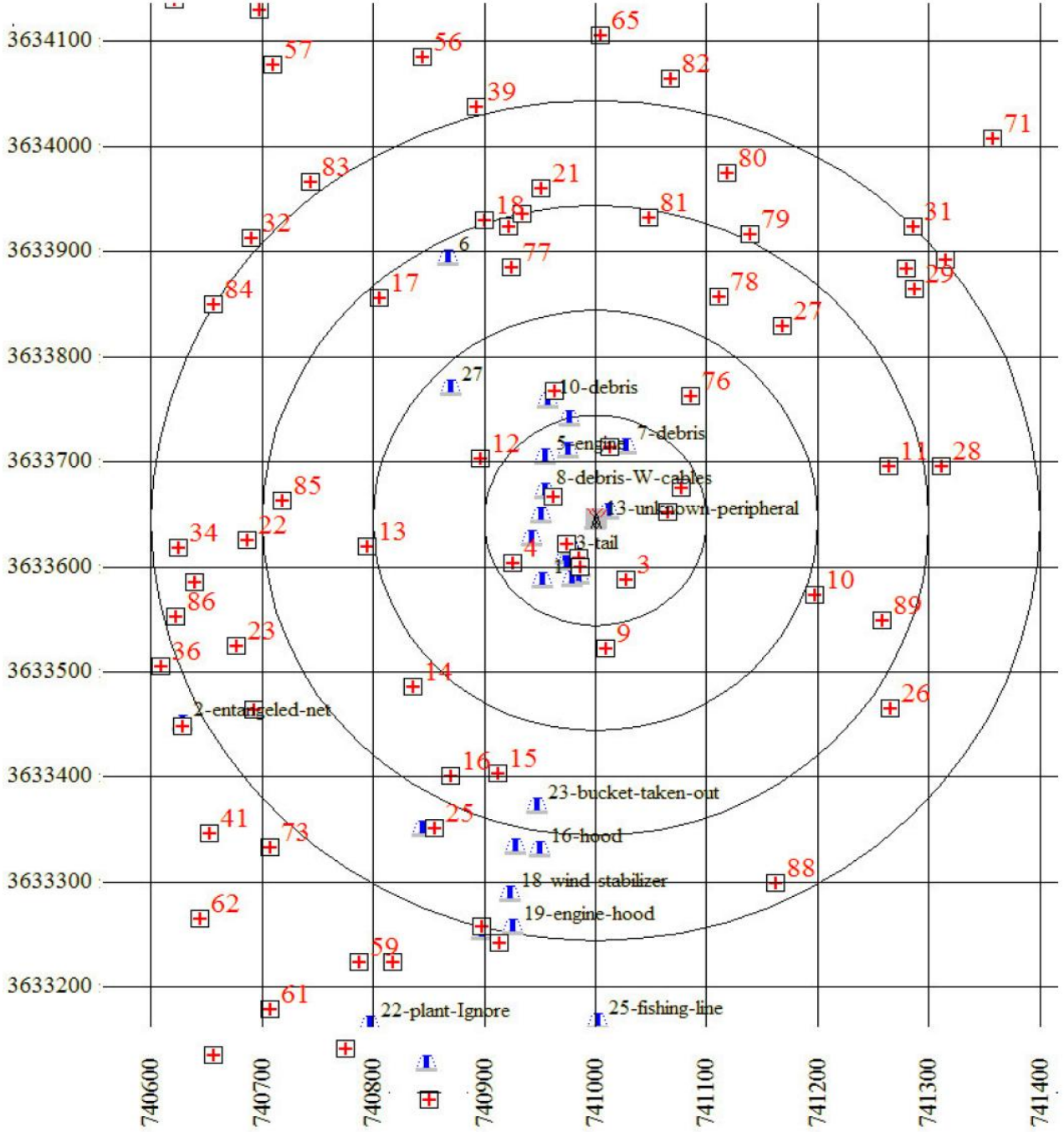
SurveyTrack lines in the Search Box

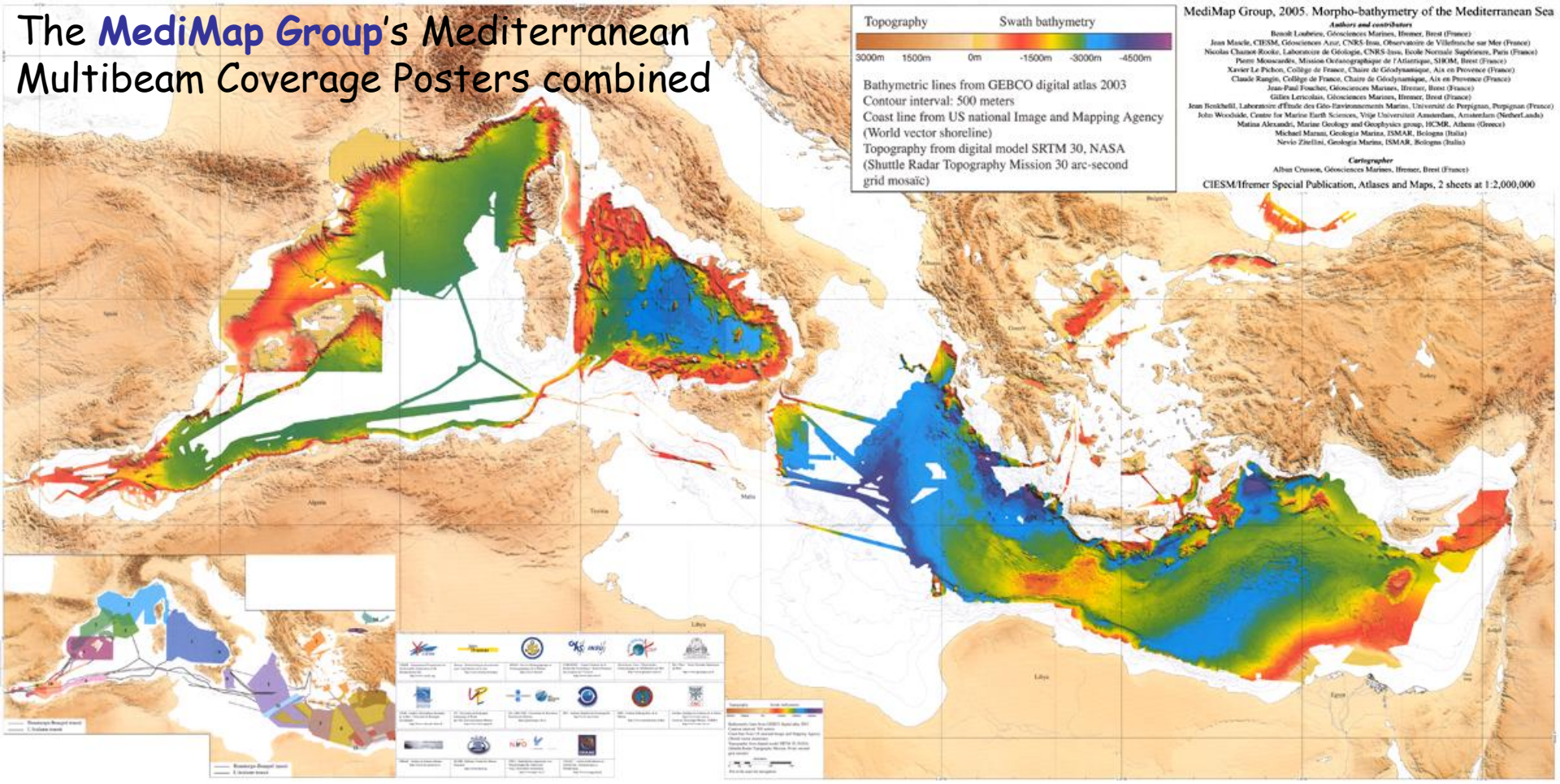


Kinneret Survey Track Lines

Final Target Summary

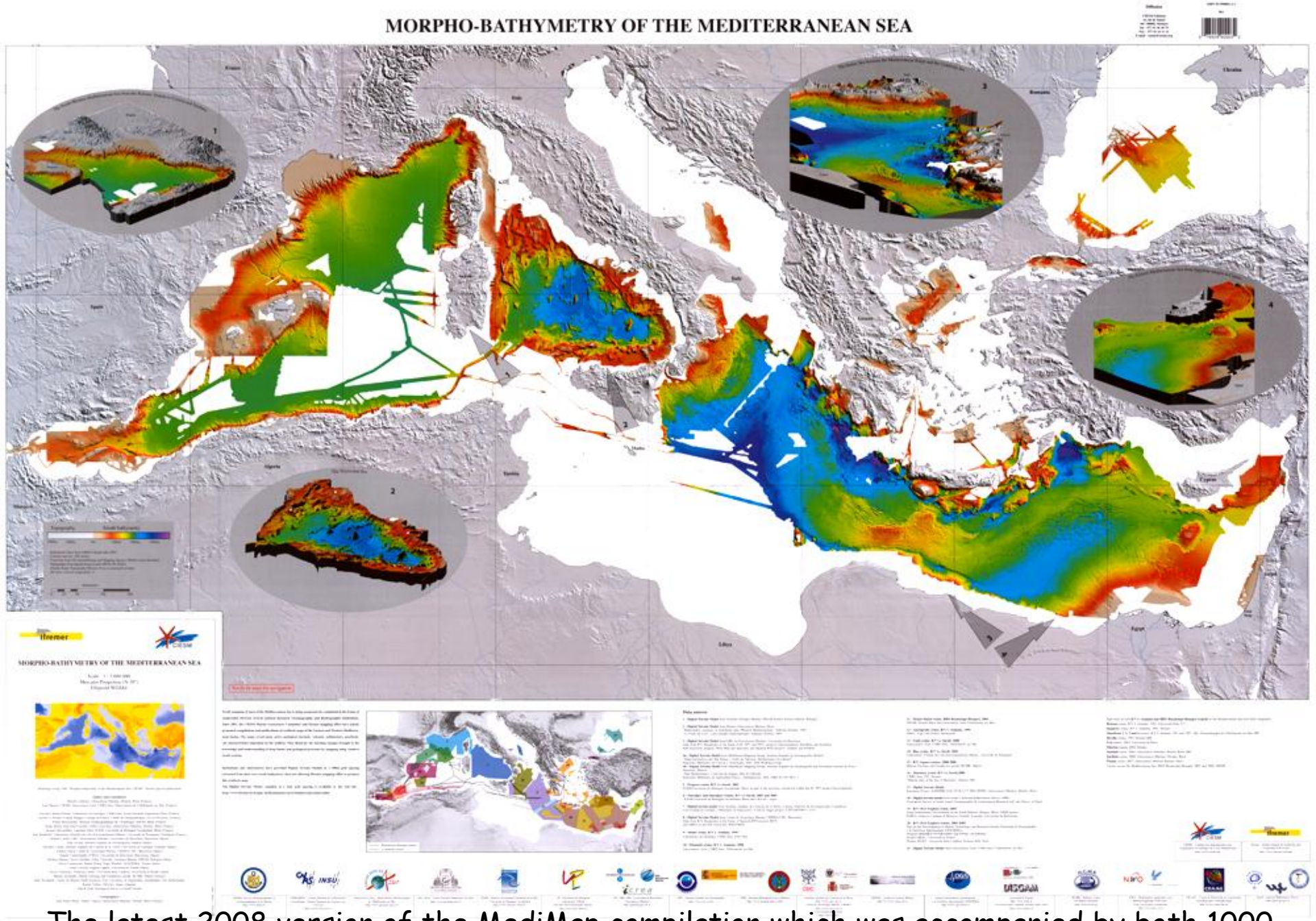
Submitted to the IAF in September 2008



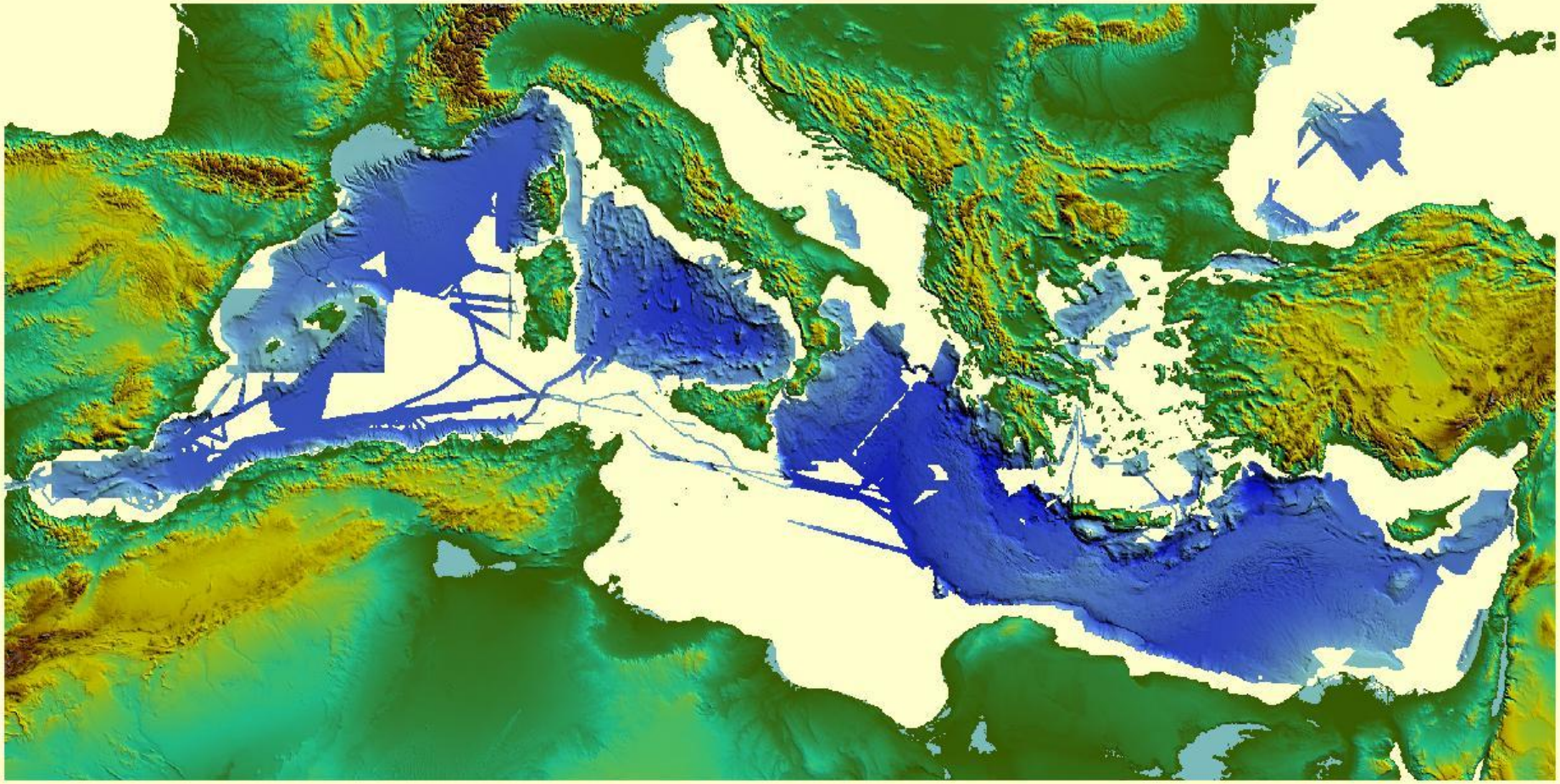


The IHO-IOC IBCM-II 0.1' Bathymetric Grid for the Mediterranean (and Black) Sea

Dr. John K. Hall - Geological Survey of Israel (Retired)
Vice Chairman, IBCM – International Bathymetric Chart of the Mediterranean
Editor – IBCM-II bathymetric/topographic grid at 0.1'
(The Late) Prof. Carlo Morelli – Universita degli Studi di Trieste, Trieste, Italy
Chairman, IBCM – International Bathymetric Chart of the Mediterranean



The latest 2008 version of the MediMap compilation which was accompanied by both 1000 and 500 m grids. The partners do not want to release finer grids.

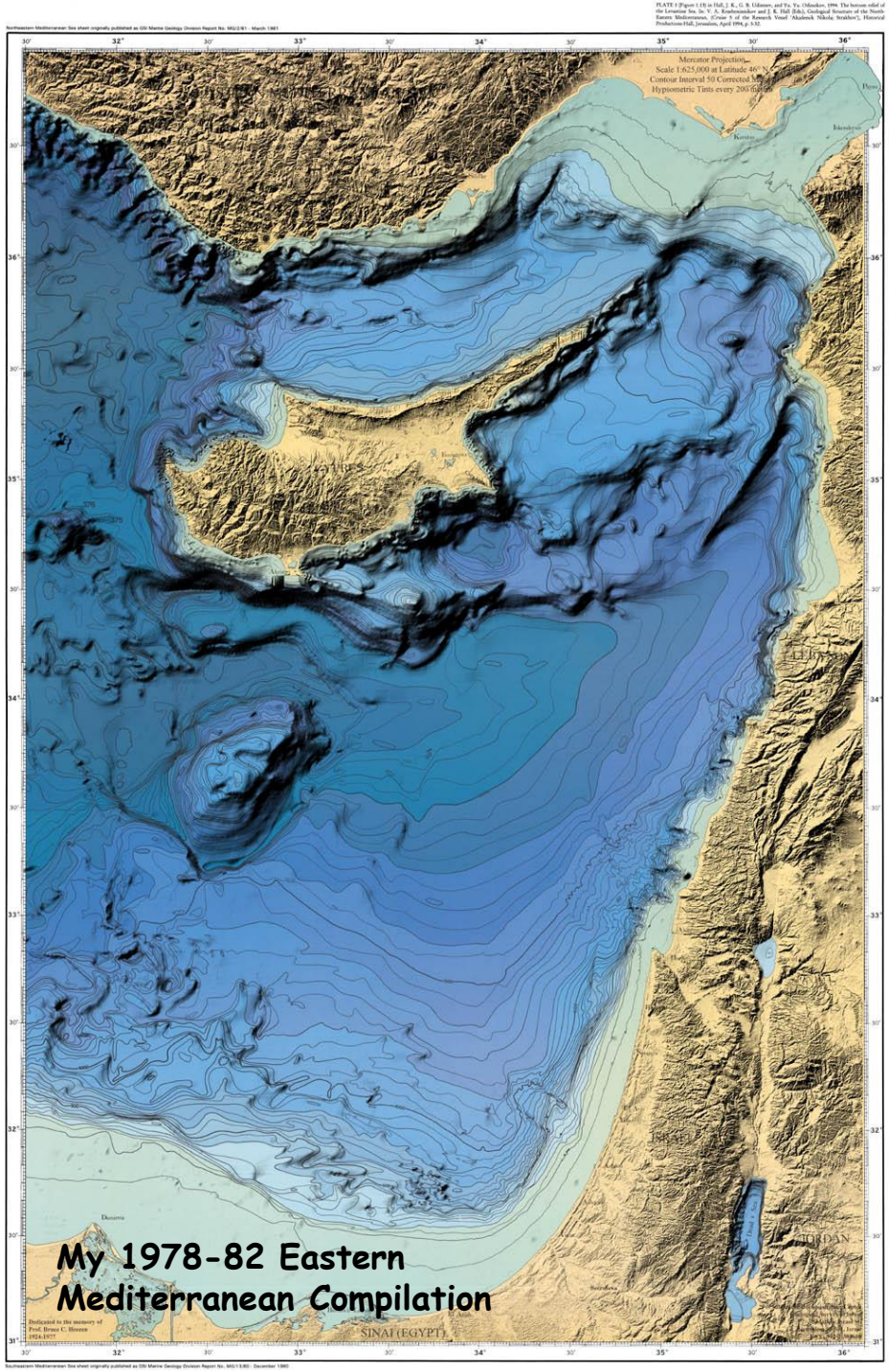


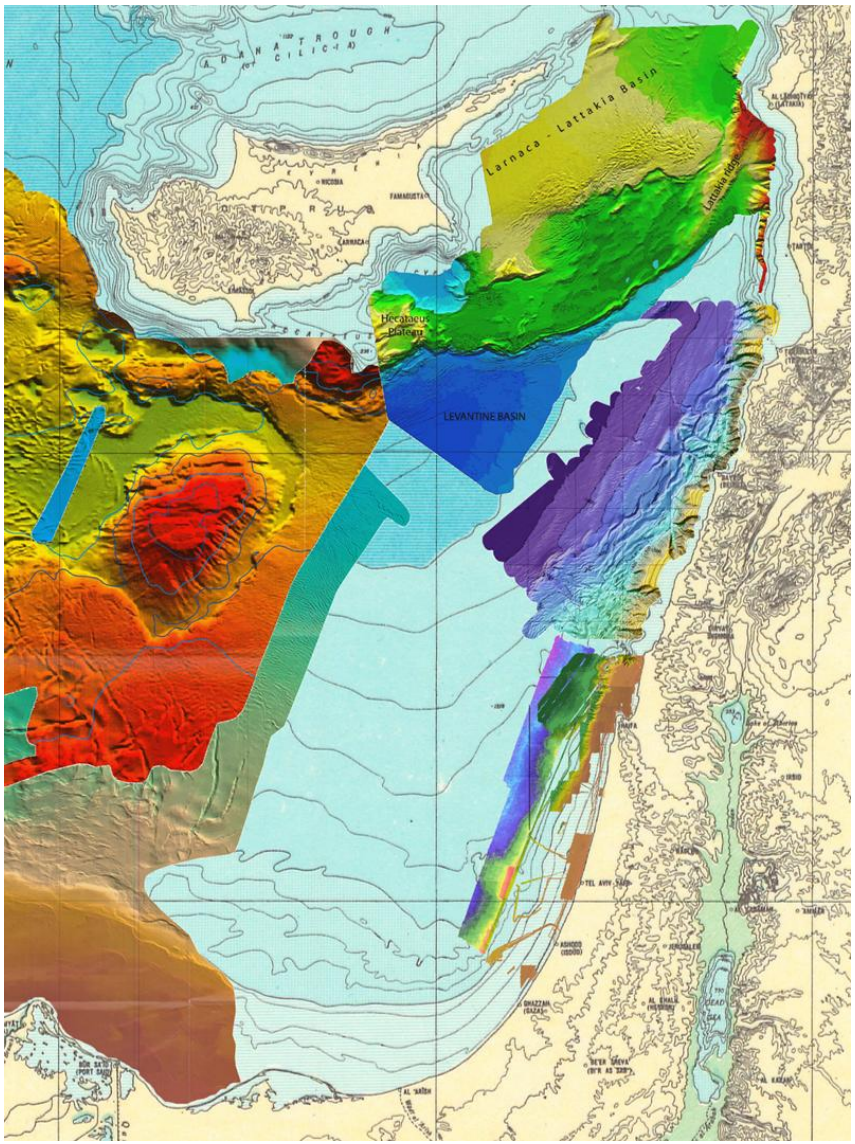
At this time the swath mapped areas constitute about 50% of the Mediterranean and less of the Black Sea.

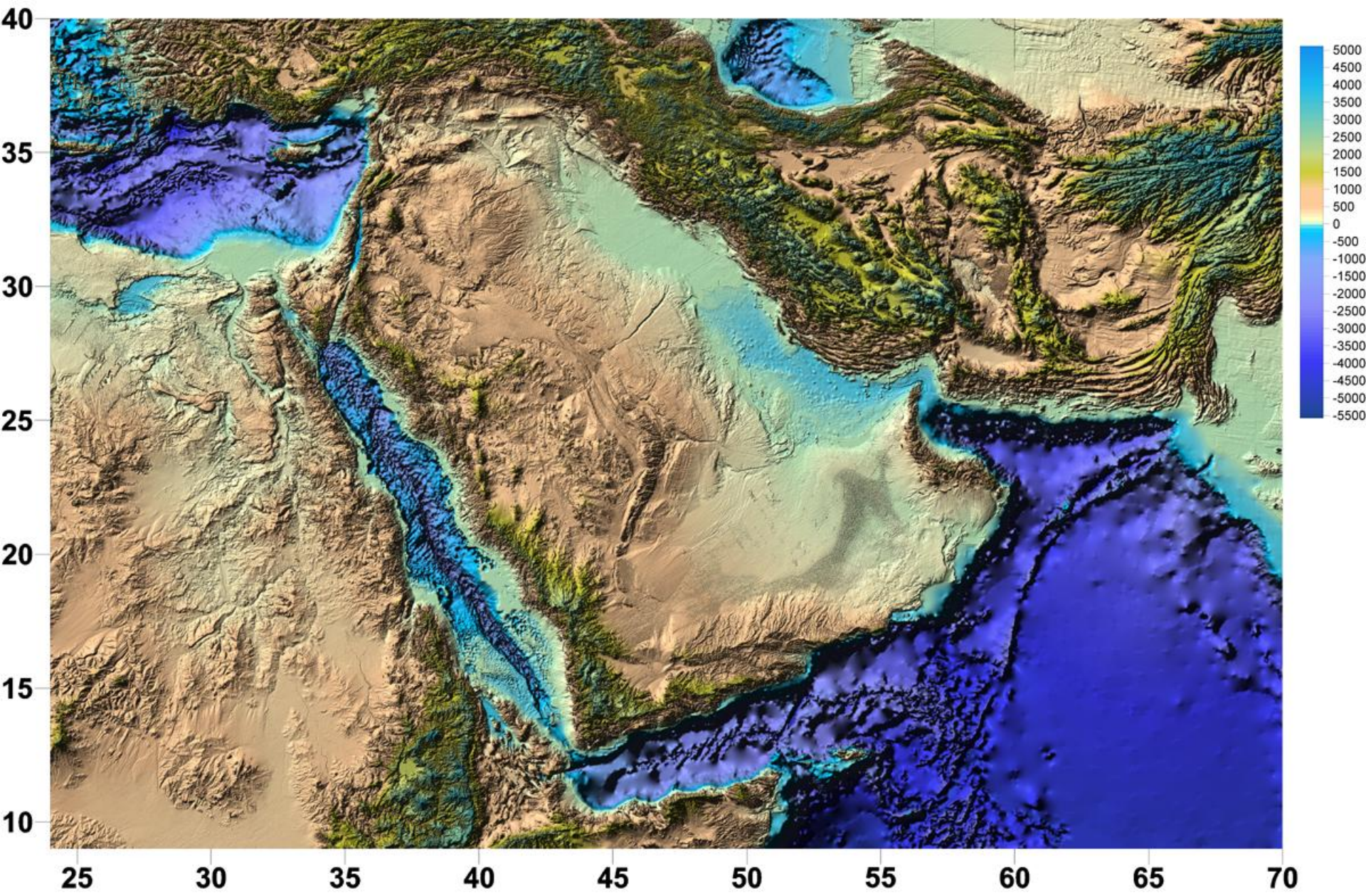
My principal task will be generating a 0.1′ grid of the shallow areas from soundings and surveys for navigational charts. There is some 46,000 km of shoreline, along which the SRTM data on land needs to be clipped and then merged in with the soundings from the continental margins..

Eastern Mediterranean Situation

Background is the 1:5 Million version of the International Bathymetric Chart of the Mediterranean (and Black) Seas (IBCM).







The other "puddles" that I take responsibility for, under the 107 year old GEBCO (General Bathymetric Chart of the Oceans) project, which recently became Google OCEAN.

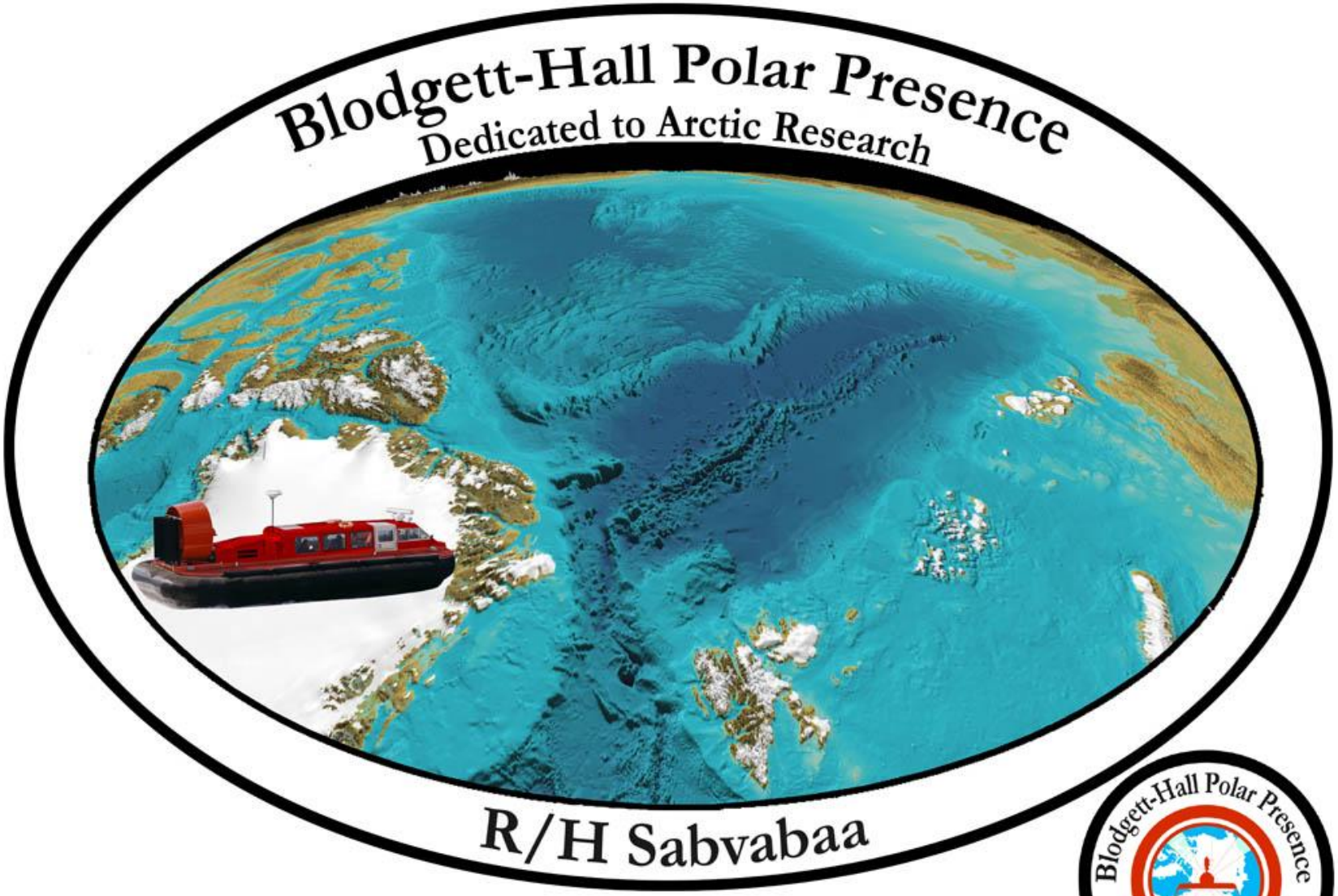
Between 14 May 1962 and 15 Sept 1974 (4507 days or 12.34 years) T-3 drifted 23,561 km. The average drift was 5.2 km/day. The cost of the station, run by the US Navy, was quoted as being one million dollars per year – i.e. $524/km in 1967 dollars.

INTERPOLATED DRIFT TRACK - FLETCHER'S ICE ISLAND (T-3)

MAY 1962 TO SEPT 1974

This was the area of my 1970 PhD thesis at Lamont-Doherty Geological Observatory. There must be a better way of studying the Arctic Ocean.

Thus was born the Blodgett-Hall Polar Presence Project,
Named for my grandparents and parents who made it all possible.



Design ideas courtesy Ms. Inês Jakobsson www.desines.se

Finally, Sea-trials in the Solent south of Southampton in October 2007

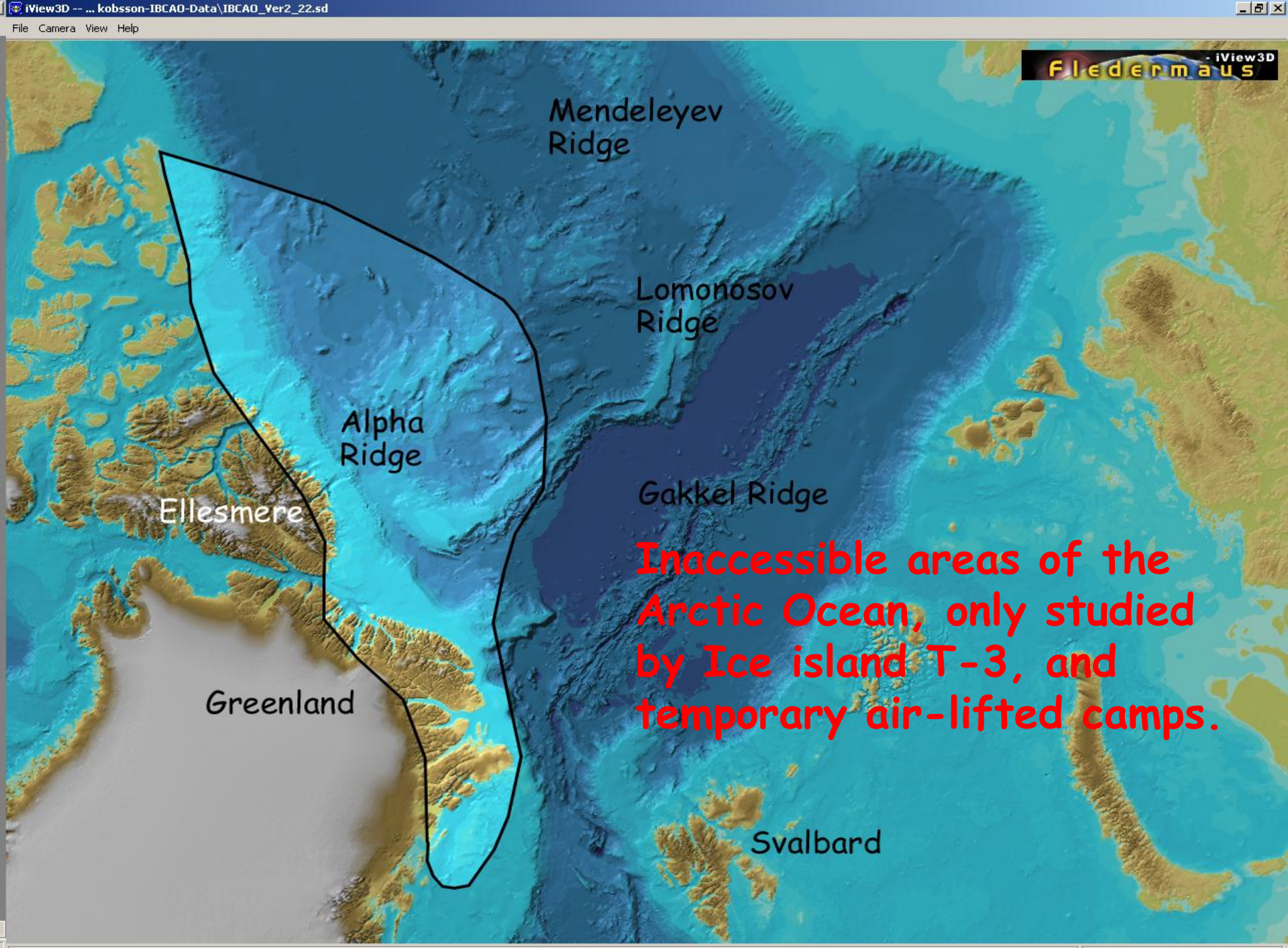
Sabvabaa is a Griffon 2000TD Mark III hovercraft.
Length 12.7m, Breadth 6.1m, Height 3.93m, Maximum hover clearance 73 cm, Weight ~ 5000 kg
Payload 2200 kg, Max speed, 43 kts, Max fuel consumption 45-85 l/hr.
Powered by a Deutz water-cooled 440 hp diesel engine. Our craft is specifically outfitted for Polar research.


Settee which can convert to bunks
Laptops with Gigabit LAN
CHIRP and E/S electronics below

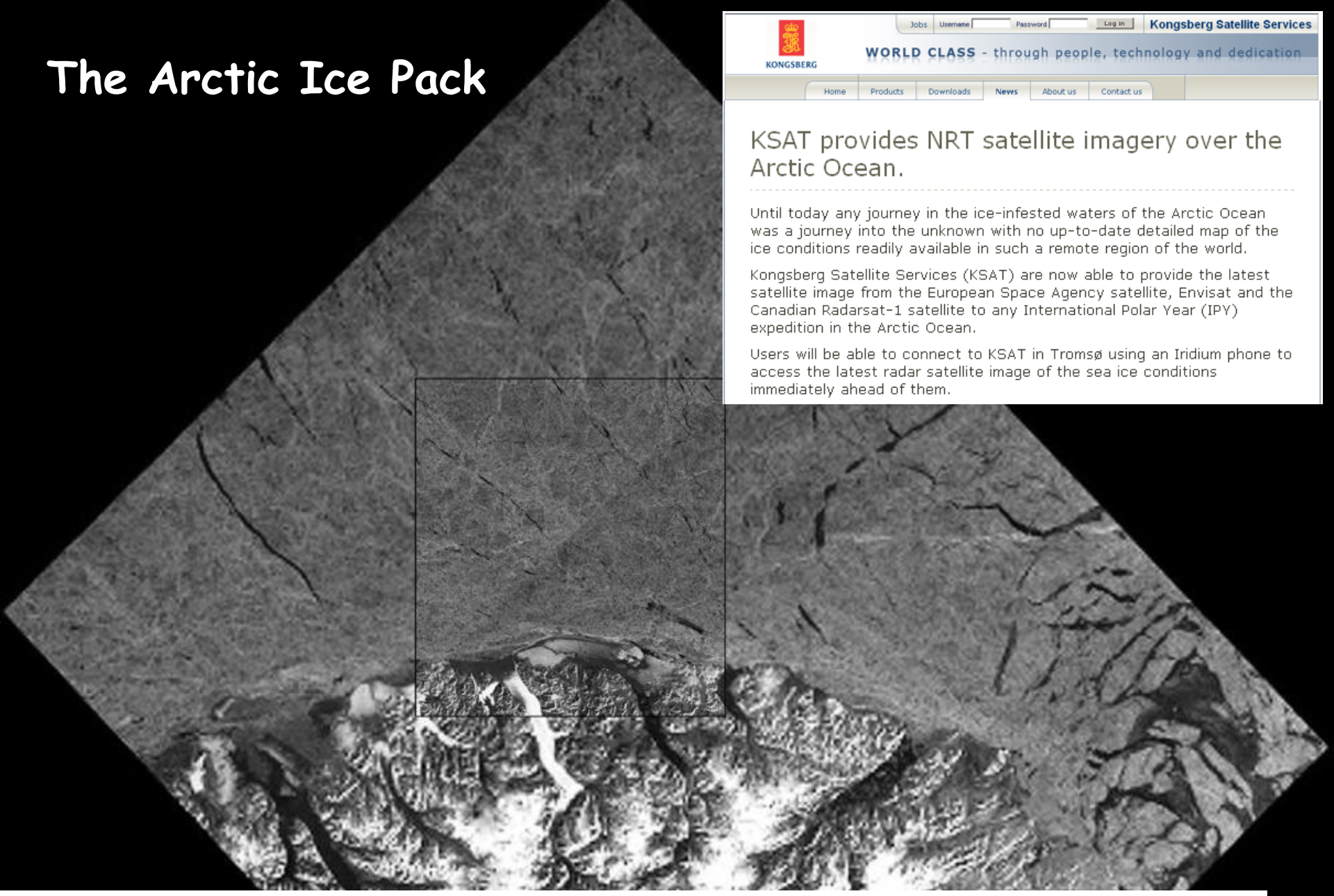

HOT!
HOT!

University Center in Svalbard – UNIS - 350 students

Svalbard Science Centre © Monica Sund


iView3D -- ... kobsson-IBCAO-Data\IBCAO_Ver2_22.sd
File Camera View Help
iView3D
Fledermaus
Mendeleyev Ridge
Lomonosov Ridge
Alpha Ridge
Gakkel Ridge
Ellesmere
Greenland
Svalbard
Inaccessible areas of the Arctic Ocean, only studied by Ice island T-3, and temporary air-lifted camps.
Geo Coords (x,y,z) -> (575120.61, -361257.08, -3612.97)
Vertical Exaggeration: 10.00000

The Arctic Ice Pack



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KSAT provides NRT satellite imagery over the Arctic Ocean.

Until today any journey in the ice-infested waters of the Arctic Ocean was a journey into the unknown with no up-to-date detailed map of the ice conditions readily available in such a remote region of the world.

Kongsberg Satellite Services (KSAT) are now able to provide the latest satellite image from the European Space Agency satellite, Envisat and the Canadian Radarsat-1 satellite to any International Polar Year (IPY) expedition in the Arctic Ocean.

Users will be able to connect to KSAT in Tromsø using an Iridium phone to access the latest radar satellite image of the sea ice conditions immediately ahead of them.

ENVISAT ASAR (Advanced Synthetic Aperture Radar) wide-swath scene available to the Bancroft Arnesen Explore team showing the extent of ice fracturing on the Lincoln Sea on 4th March.© raw data ESA 2007 /processed by KSAT 2007

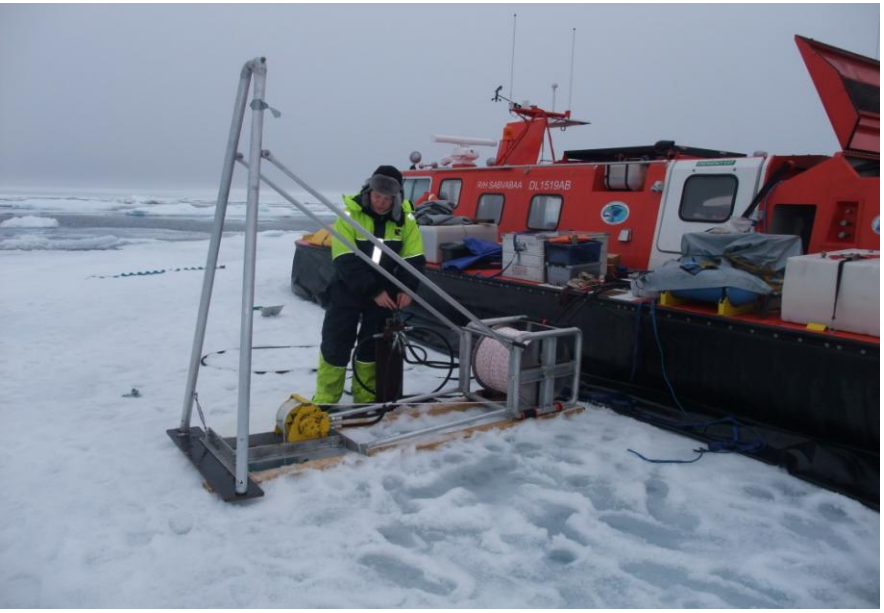

DL1519AR


Griffon

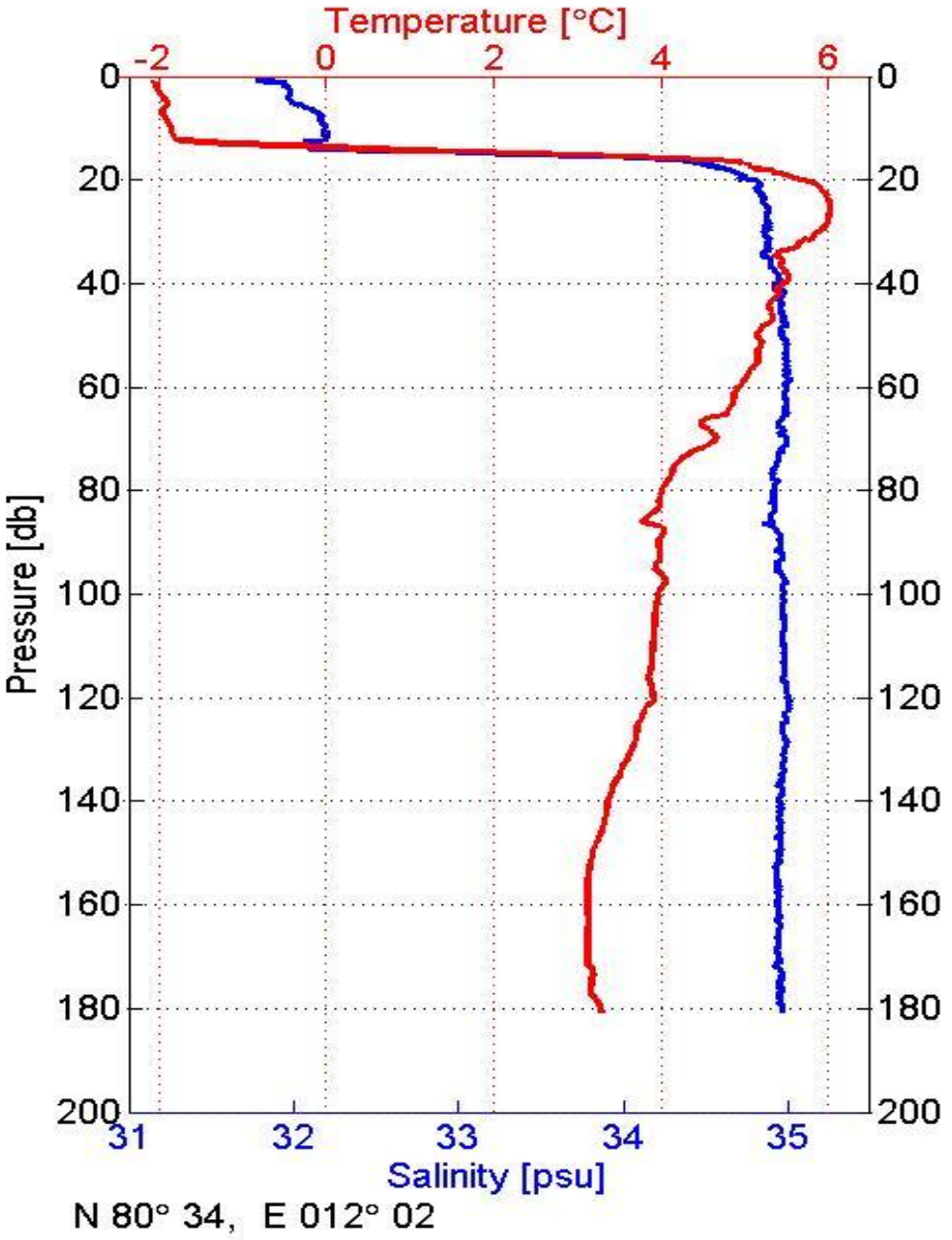

FURUNO


HOT!

Oceanography during Nansen's Drift



Oceanography from Hovercraft 2008



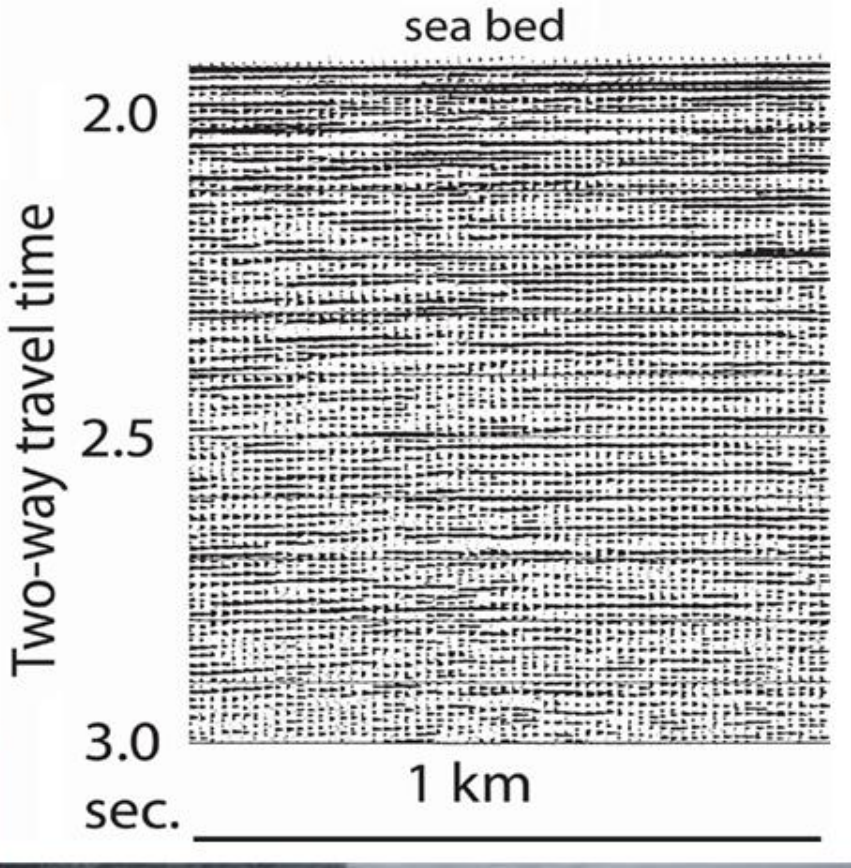
The six degree excursion is NEW

Hydrohole Operations

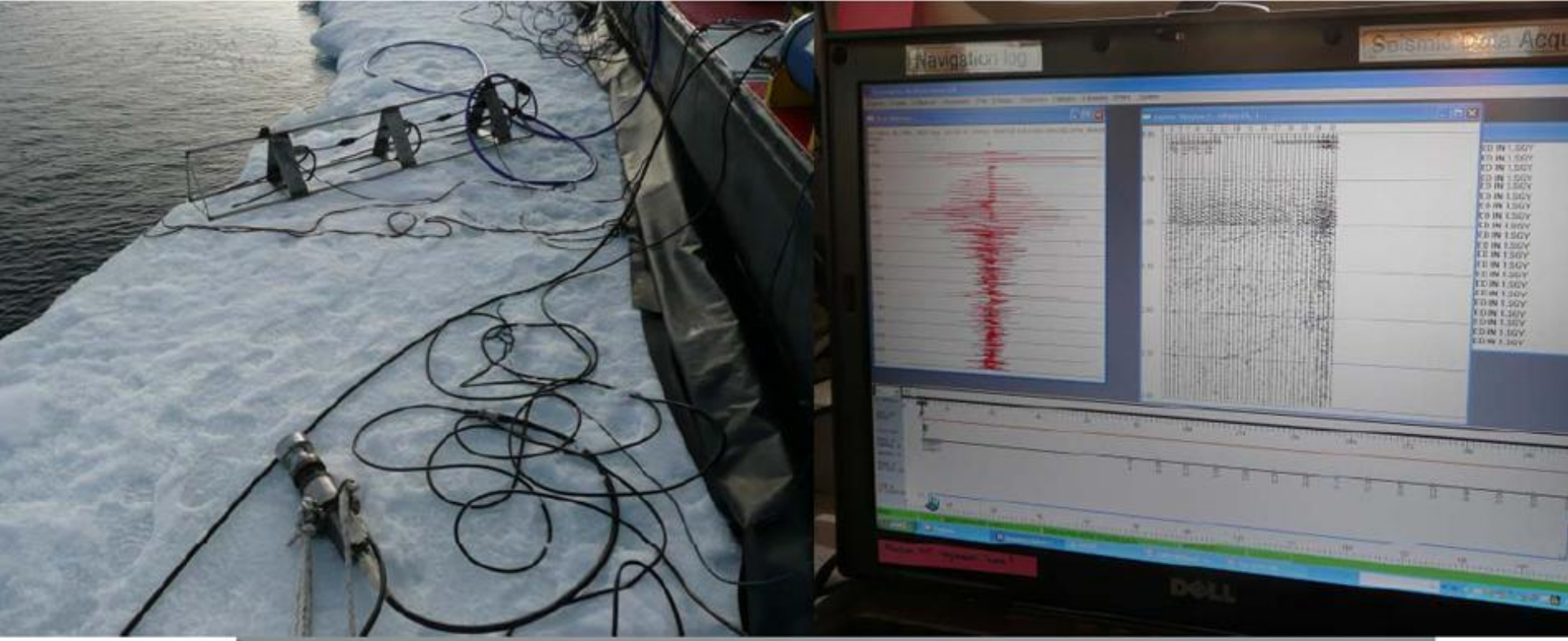
Mid-July 2008 - R/H Sabvabaa testing its coring and CSP capability on the Yermak Plateau.
The wind generator and solar cells are powering an autonomous drifting seismic profiling buoy which is currently being tested with excellent results.

Compare the above with the diorama of the Russian station NP-1 set up by Ivan papanin in 1937.

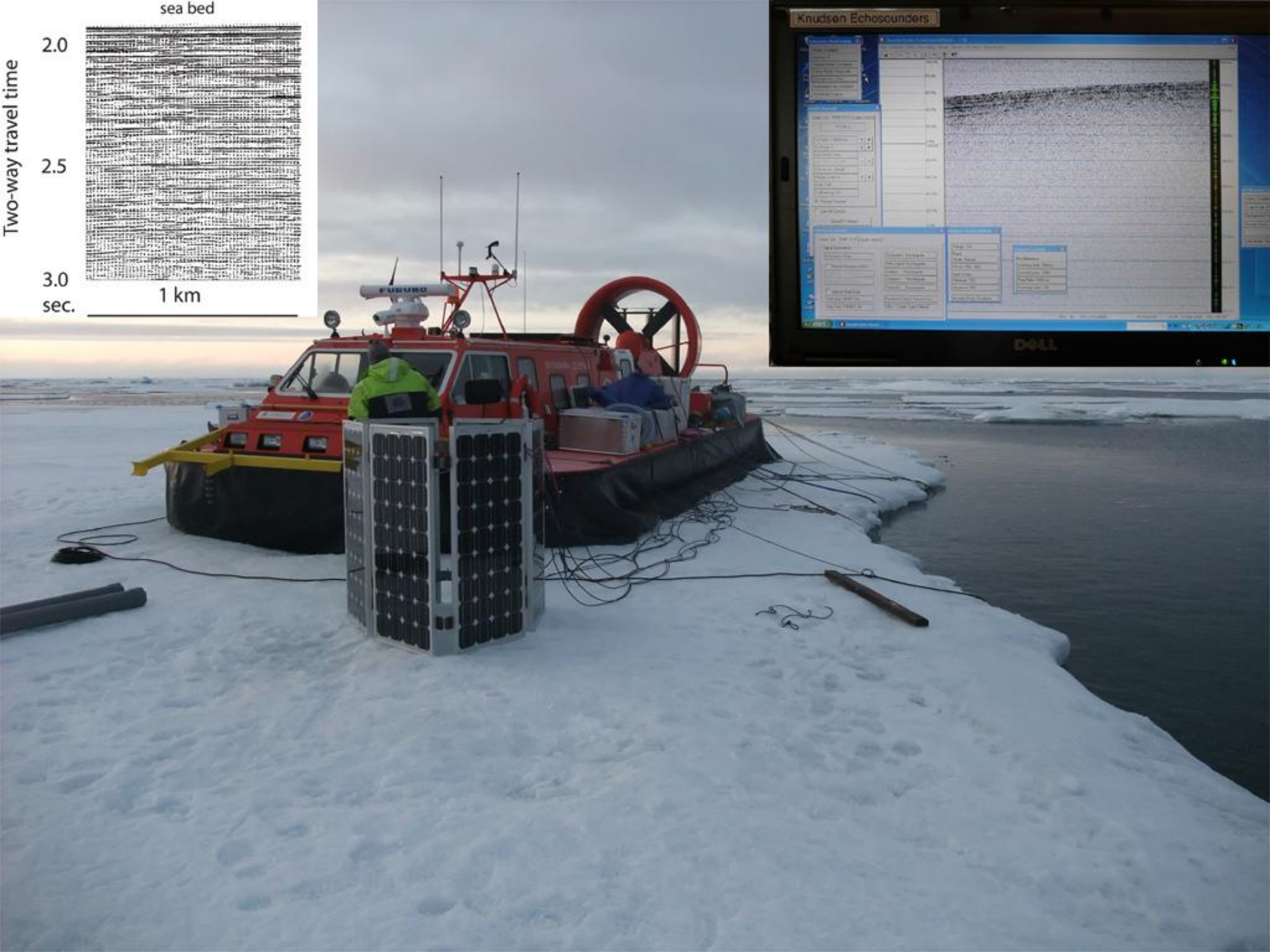
Tent provides work area over a hydrohole


sea bed
2.0
2.5
3.0
sec.
Two-way travel time
1 km


/H SABVABAA


Navigation log
DELL


Tests of geophysical equipment


sea bed
Two-way travel time
2.0
2.5
3.0
sec.
1 km
Knudsen Echosounders
FURUNO
DELL

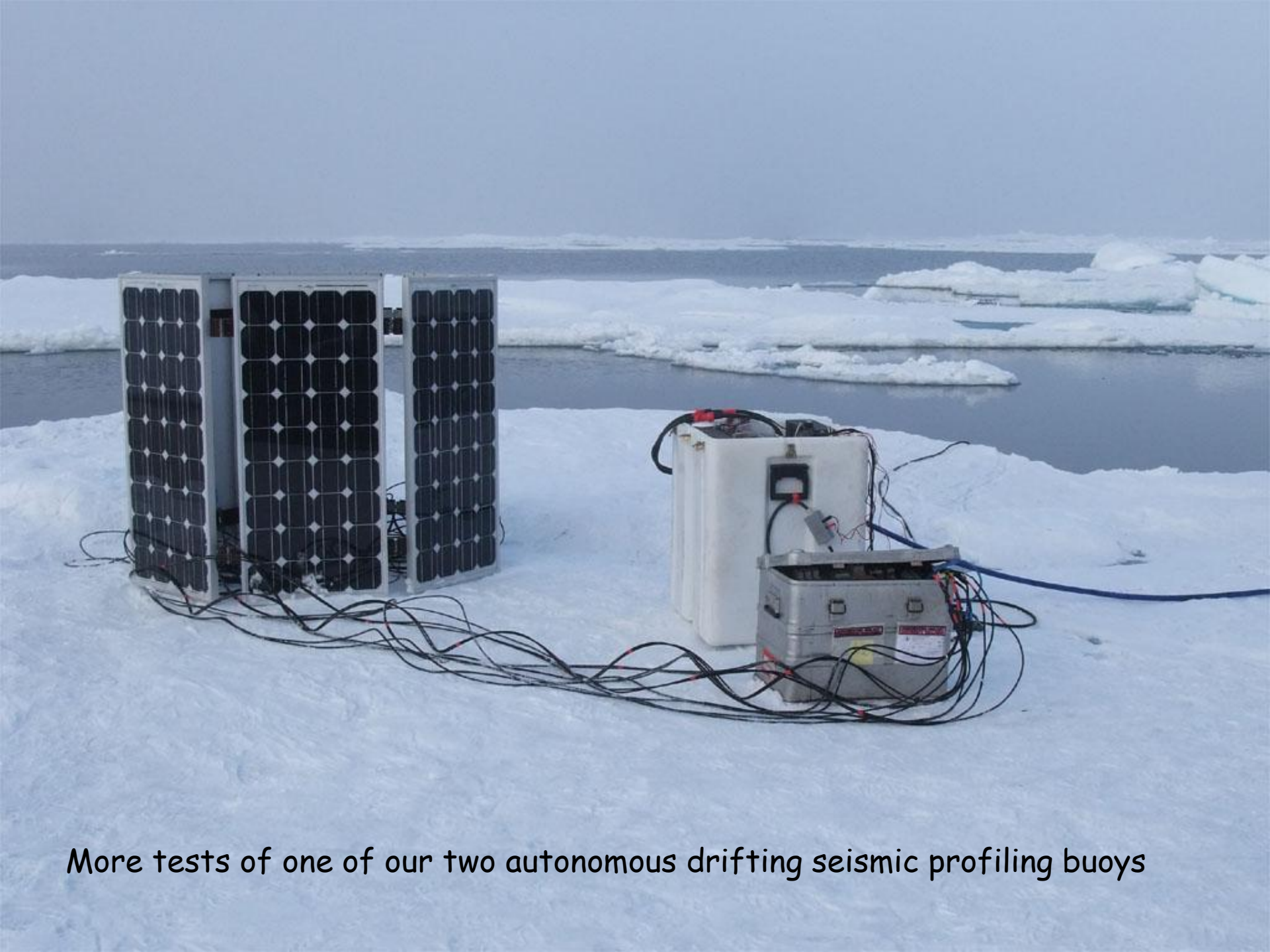
June 2009 Additions to the R/H Sabvabaa: Andreaa Seaguard AACP; rugged stainless steel dredge; Geonics EM-31 electromagnetic ice thickness measurements; Sea Bird SBE 19plus v2 CTD and 500 m single conductor cable on hydraulic winch.

Some scenes from the Summer 2009 activities

A CTD lowering through a seal's breathing hole

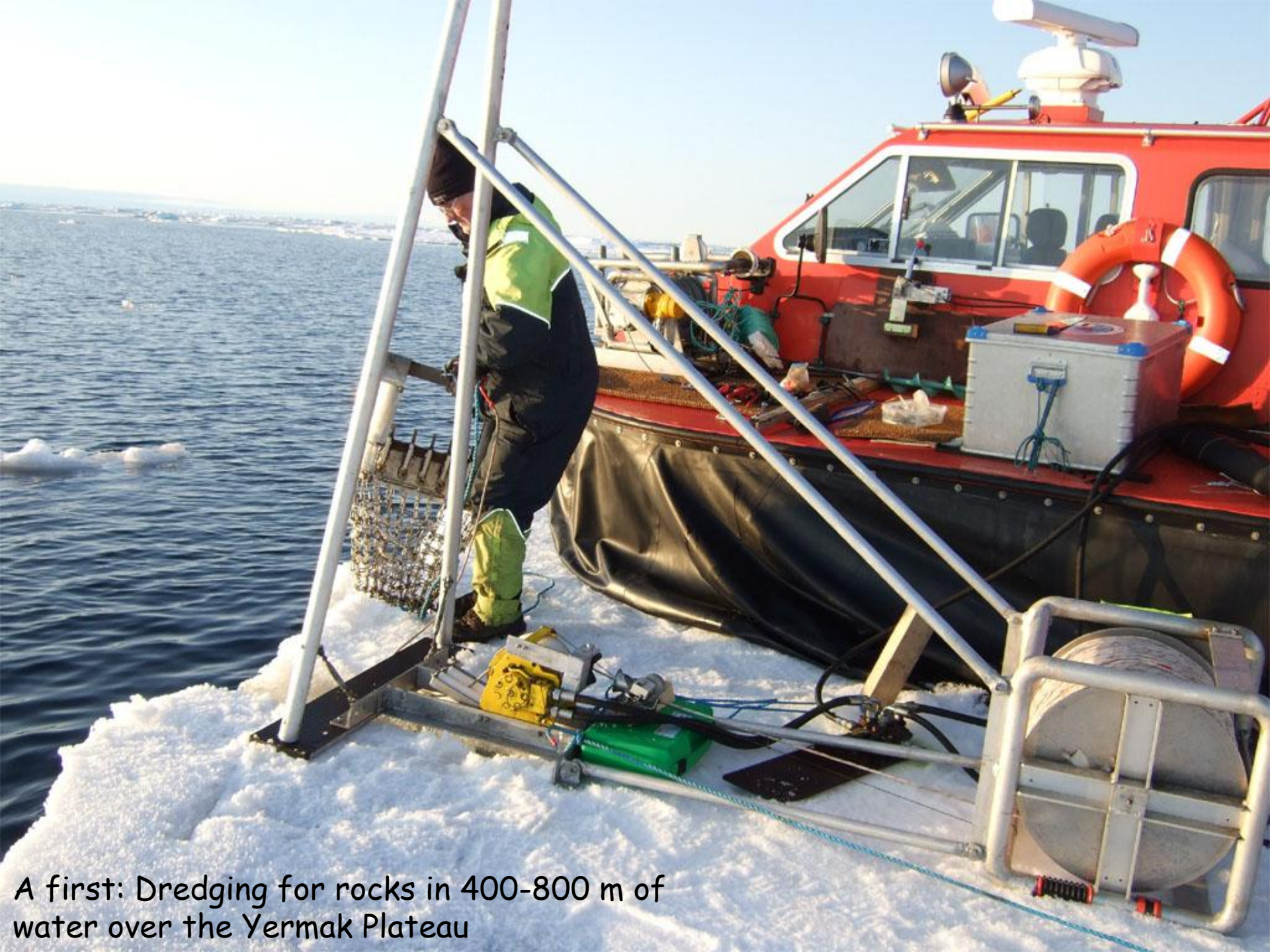

R/H SABVA

The Aagaard ADCP Current Profiler being set up for measurements while the crew sleeps



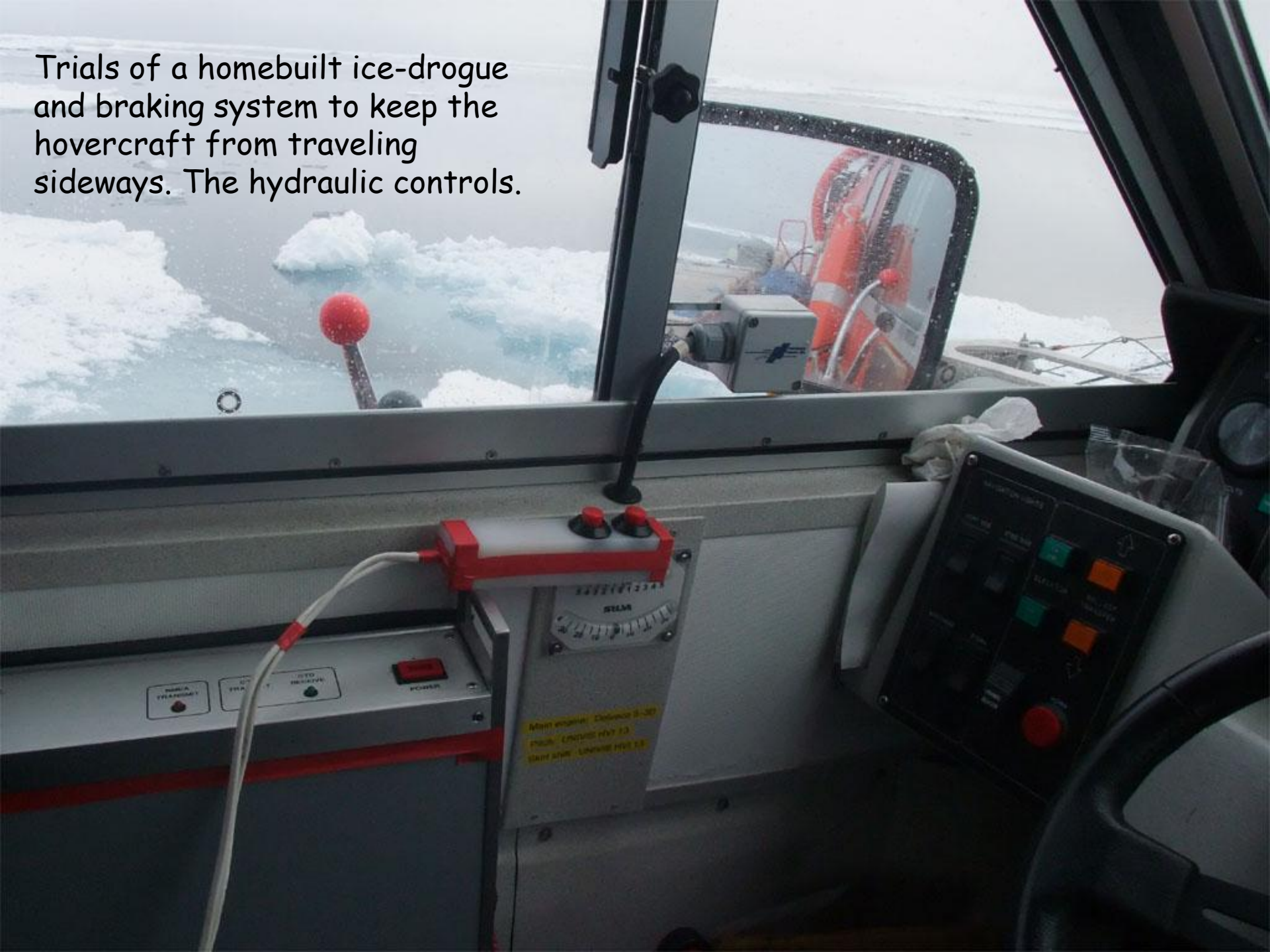
More tests of one of our two autonomous drifting seismic profiling buoys

On the last trip our payload was raised by 50% - we carried 2500 liters of diesel – note fuel bladder in addition to the 1500 liters in Vetus tanks



A first: Dredging for rocks in 400-800 m of water over the Yermak Plateau


Griffon
Hovercraft


Trials of a homebuilt ice-drogue and braking system to keep the hovercraft from traveling sideways. The hydraulic controls.


R/H SABVABAA DL1519AB

Blodgett-Hall Polar Presence - A hovercraft for polar research

SABVABAA - Inuit word meaning: "flows swiftly over it"

A hovercraft dedicated to Arctic Ocean research

Sea trials at Southhampton

Our website is updated regularly: http://www.polarhovercraft.no

Our Website: http://www.polarhovercraft.no

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To support the operations and maintenance of the R/H Sabvabaa, I have set up a non-profit corporation which can provide funds which are tax-deductible in the US. This is according to the US Internal Revenue Service Code 501(c)(3).

This is similar to AF/IOLR, the American Friends of the IOLR, which is supporting the work of the R/V Etziona.

AURORA BOREALIS - Technical Specifications

- Heavy Icebreaker (IACS Polar Class 1), year-round operations, all polar waters, multi-year ice.
- Multi-disciplinary vessel for all disciplines of polar and marine research.
- 120 berthing capacity, 90 days operational endurance.
- DP system for ice and open water.
- Helicopter: ILS, 2 helicopters, 1 Bell Agusta tilt-rotor VTOL Aircraft/helicopter equivalent.
- Max. 90 MW propulsion power.

High energy efficiency:

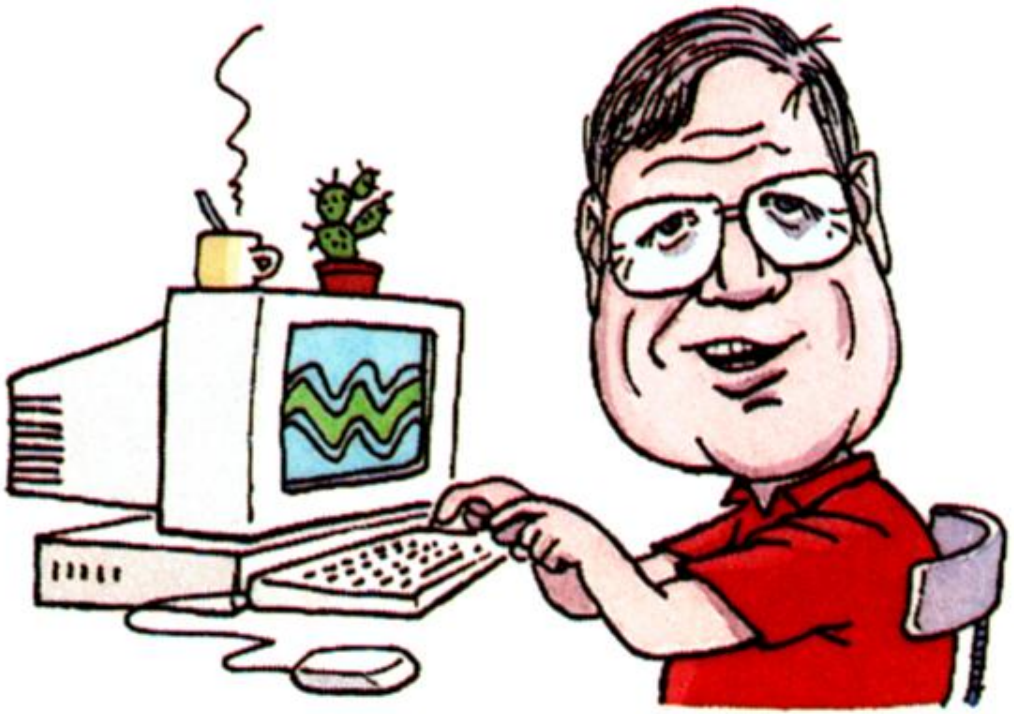
waste heat recovery systems

Engine power management

flexible engine configuration

Thank you for your attention

Photo courtesy Dave Monahan, UNH-CCOM-GEBCO/Nippon



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Thank you for your attention