R/V *Bat-Galim - a n*ew governmental research vessel

Israel Oceanographic & Limnological Research

IRSO 2018 Barcelona - Oct. 2nd , 2018

Israel Oceanographic & Limnological Research (*Since 1967)*

National Institute of Oceanography - NIO

Kinneret Limnological Laboratory - KLL

National Center of Mariculture - NCM

Annual budget: ~ $ 16 million

Staff: ~ 160 scientists (50 PhDs), engineers, technicians and support staff

~ 70 MSc. & PhD. students

~ 75 publications in scientific peer-reviewed journals and 150 Reports

~150 research projects (40 International and 25 National Funds)

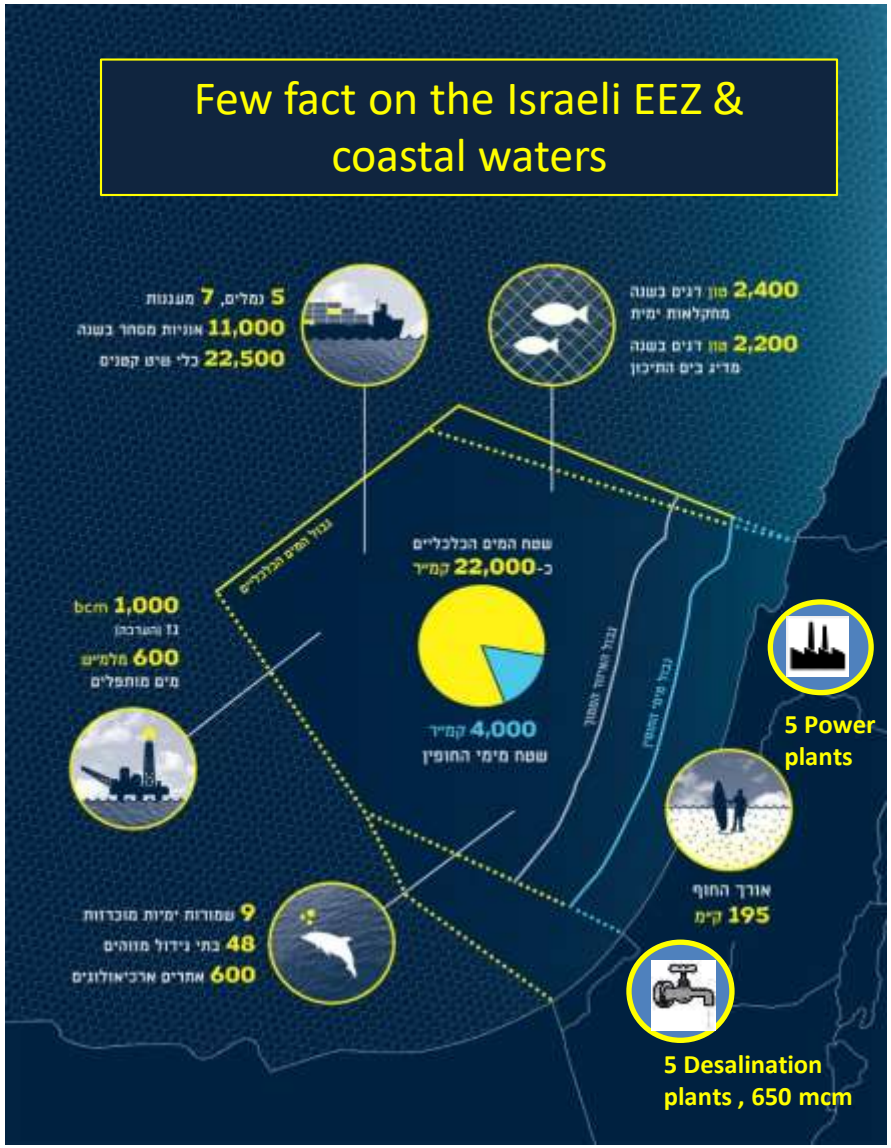
> 6500 high school students (lectures, field and laboratory experiments)

חקר ימים ואגמים לישראל
Israel Oceanographic & Limnological Research

http://www.ocean.org.il

IOLR Core Activities:

- **Oceanographic research** - physical, chemical, geological and biological;
- **Monitoring** and assessment of human impacts on marine and coastal ecosystems and resources;
- Development of **Operational Oceanography -**observing and modeling systems to provide timely environmental information and predictions;
- **Mapping, environmental risks, geo-hazards and multidisciplinary studies** - marine surveys, data collection and organization of environmental data bases, process studies;
- Operation of the **Israel Marine Data Center** as the national repository and dissemination facility for oceanographic data and data products. (https://isramar.ocean.org.il)



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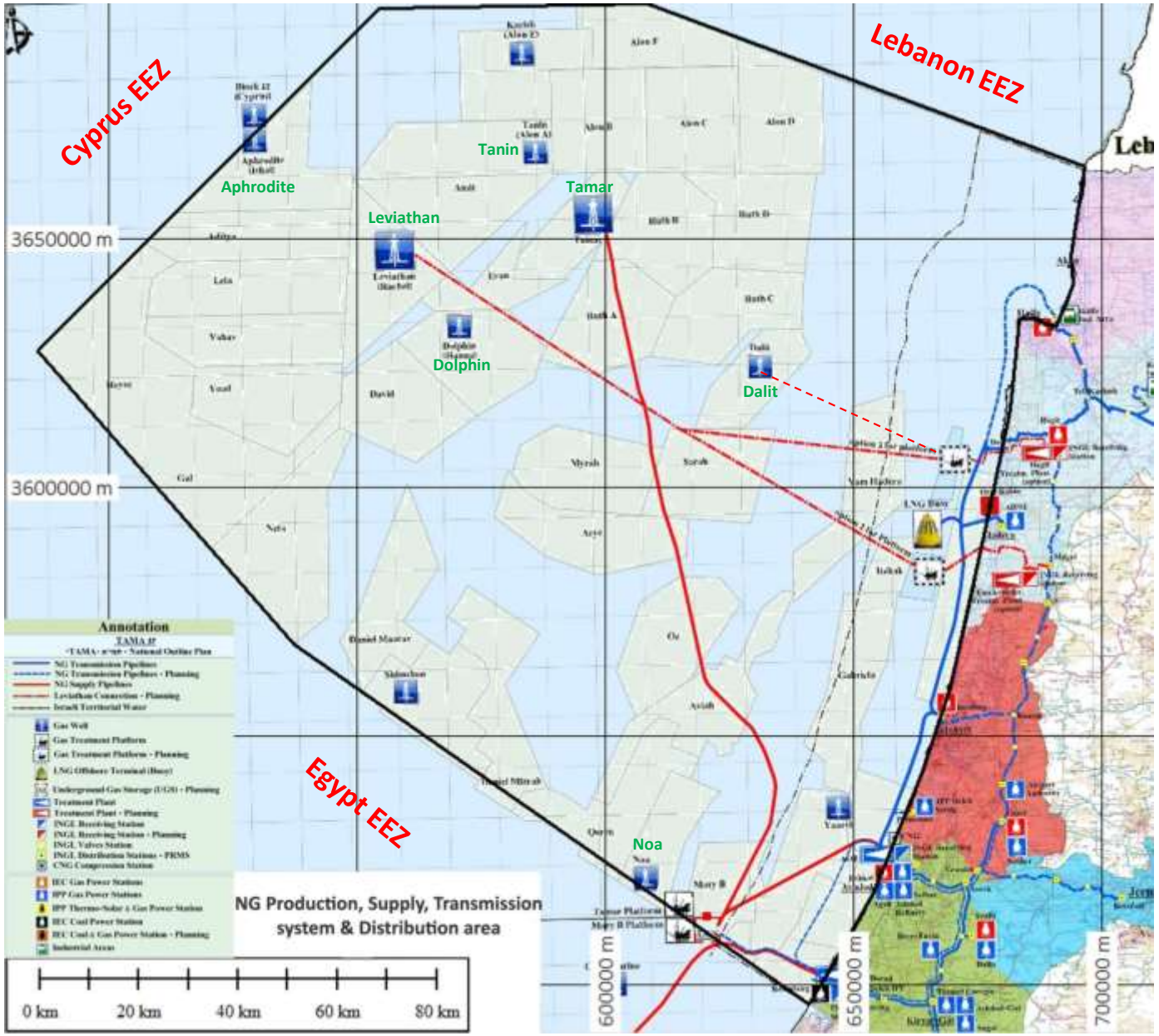
Israel Exclusive Economic Zone (EEZ)



The recent (2009) large-scale natural gas (~ 1,000 BCM) and oil discoveries in the deep sea of the Israeli EEZ stressed the need of a National Research Vessel capable of working in the deep EEZ.

On **February 2012** - Governmental decision to build/purchase research vessel (budget ~ $ 5 M)

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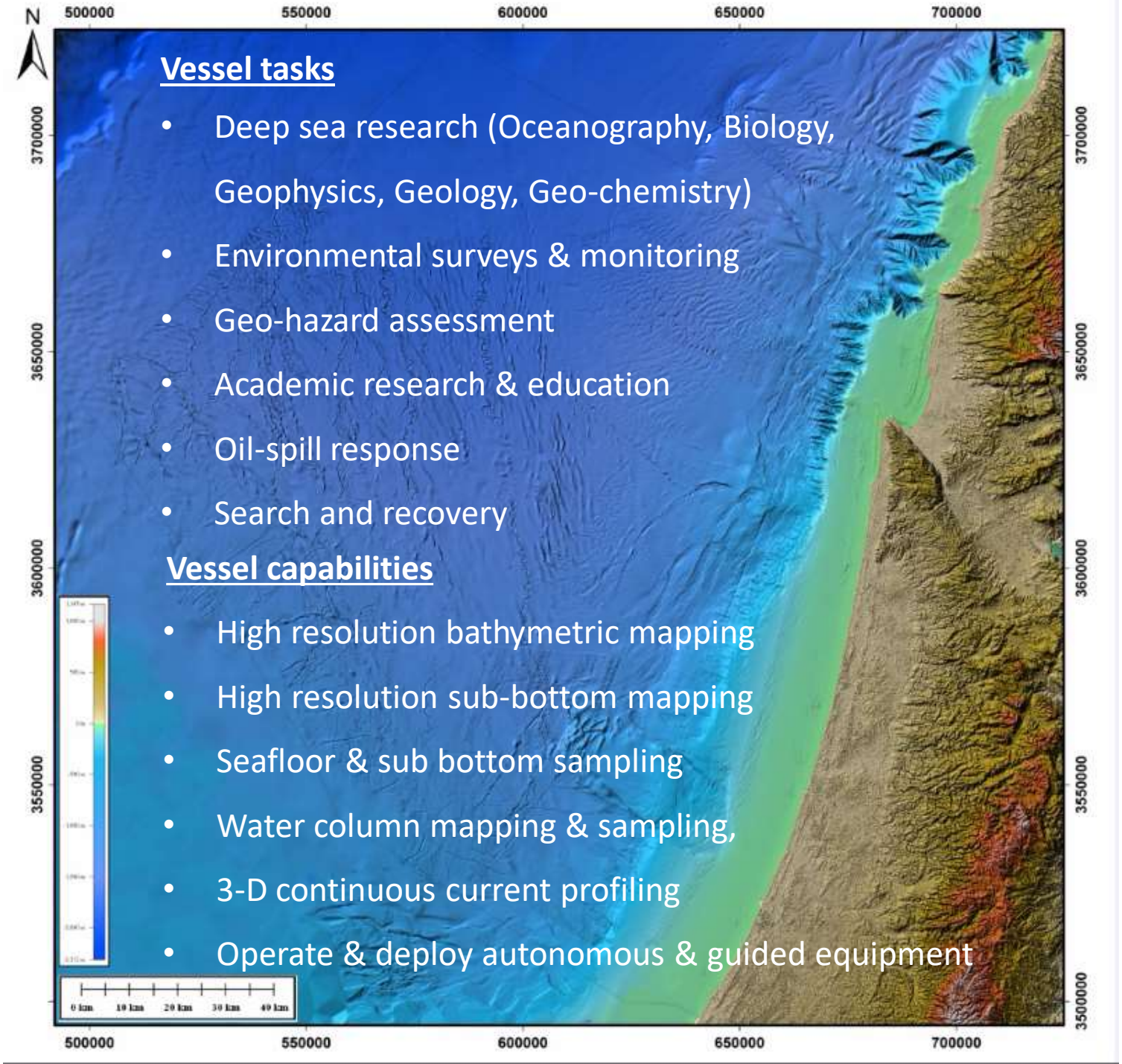

Vessel tasks

- Deep sea research (Oceanography, Biology, Geophysics, Geology, Geo-chemistry)
- Environmental surveys & monitoring
- Geo-hazard assessment
- Academic research & education
- Oil-spill response
- Search and recovery

Vessel capabilities

- High resolution bathymetric mapping
- High resolution sub-bottom mapping
- Seafloor & sub bottom sampling
- Water column mapping & sampling,
- 3-D continuous current profiling
- Operate & deploy autonomous & guided equipment

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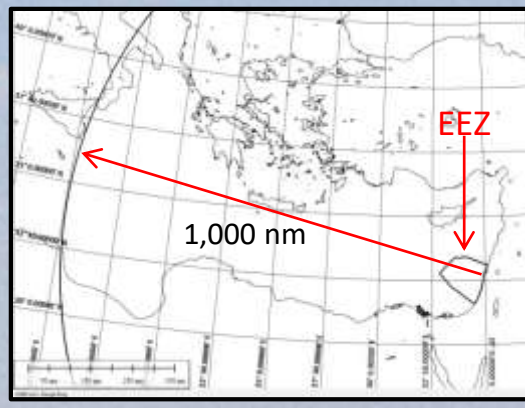
German-built Klein-Klasse support vessel

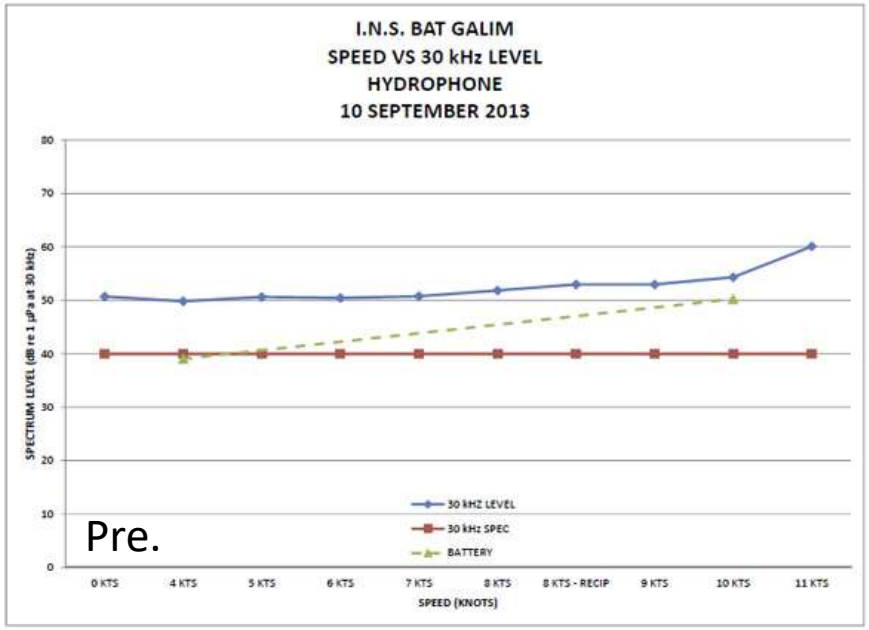
Purchased from the Israeli Navy June 1st, 2014

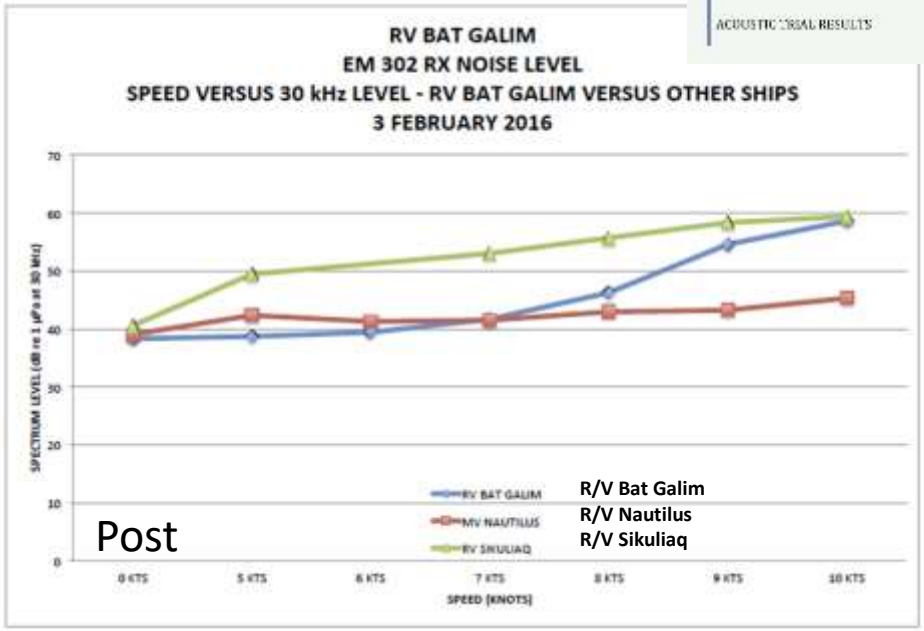


Hull material	Steel	Max. draft	3.45 m	Endurance at sea	**14 days**
LBP	34.6m	FB	3.1m	Operational range	**~ 1,000 nm**
LOA	**38.55m**	Max speed	12.7 knots	Propulsion	2X208 HP jets & single propeller
Max. displacement	**528 ton**	Crew + Scientists	14 (**26**)		
Deutz Generators	2X 124 kW	Built:	**1990**	Propulsion system	890 KW Deutz engine

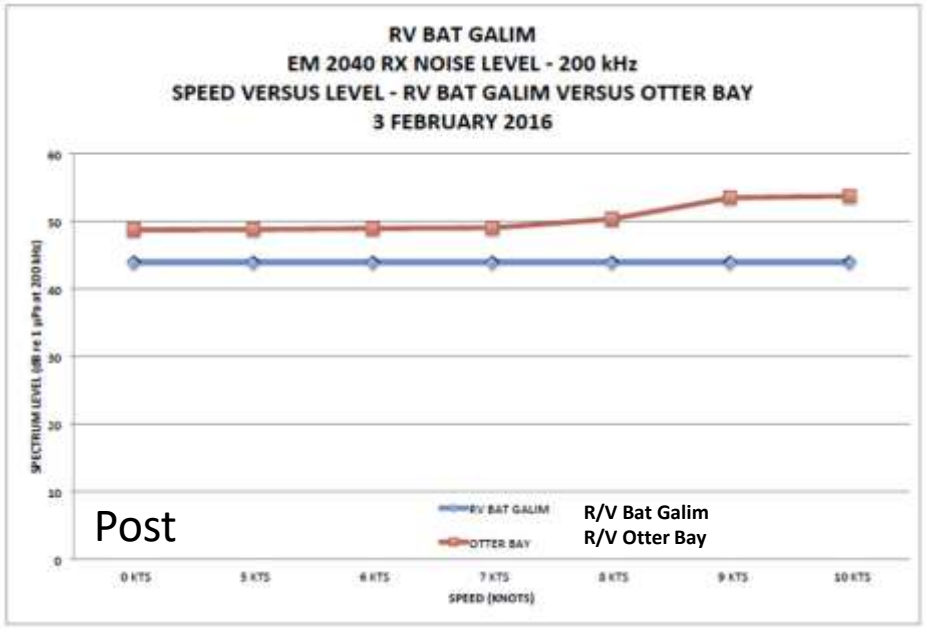
Acoustic tests - Pre. & Post Gondola installation (http://mac.unols.org/reports)

GATES ACOUSTIC SERVICES
I.N.S. BAT GALIM
ACOUSTIC TRIAL RESULTS





- The *BAT GALIM* was determined to be a relatively quiet platform for MBS data collection.
- Propeller cavitation characteristics are good up to 8 knots and no machinery noise was noted that will impact sonar data.
- Bubble sweep down impacts were not detected at any time during the acoustic test.
- The acoustic levels measured during normal ship operations up to 8 knots are similar to other vessels equipped with mid-depth MBS systems



Guidelines for setting a modern Research Vessel

The refitting of the *Bat Galim* into a modern research vessel follows most of the **guidelines set in the Science Mission Requirements (SMR) for Regional Class oceanographic vessels** that were developed as part of the Academic renewal efforts by the University-National Oceanographic Laboratory System

- National Science Foundation – Division of Ocean Sciences
- Office of Naval Research
- National Oceanic and Atmospheric Administration
- United States Geological Survey
- Minerals Management Service
- Department of Energy

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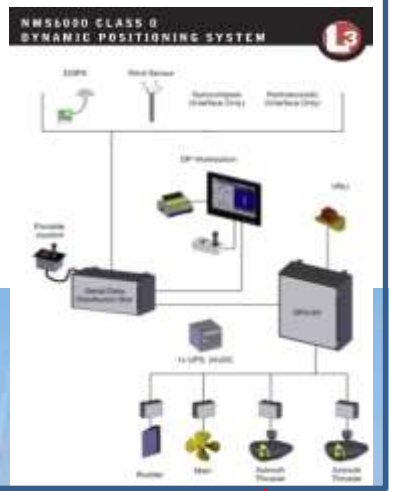
(June 2014-June 2016)
Refitting from military vessel to modern R/V

Dynamic Positioning

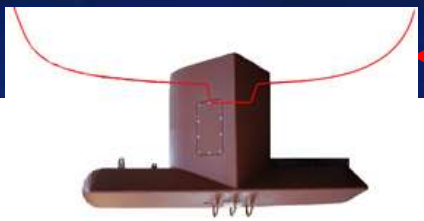


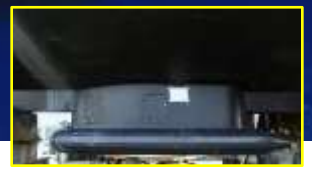
Labs

Telescopic A Frame

2 Cranes

winches





Gondola

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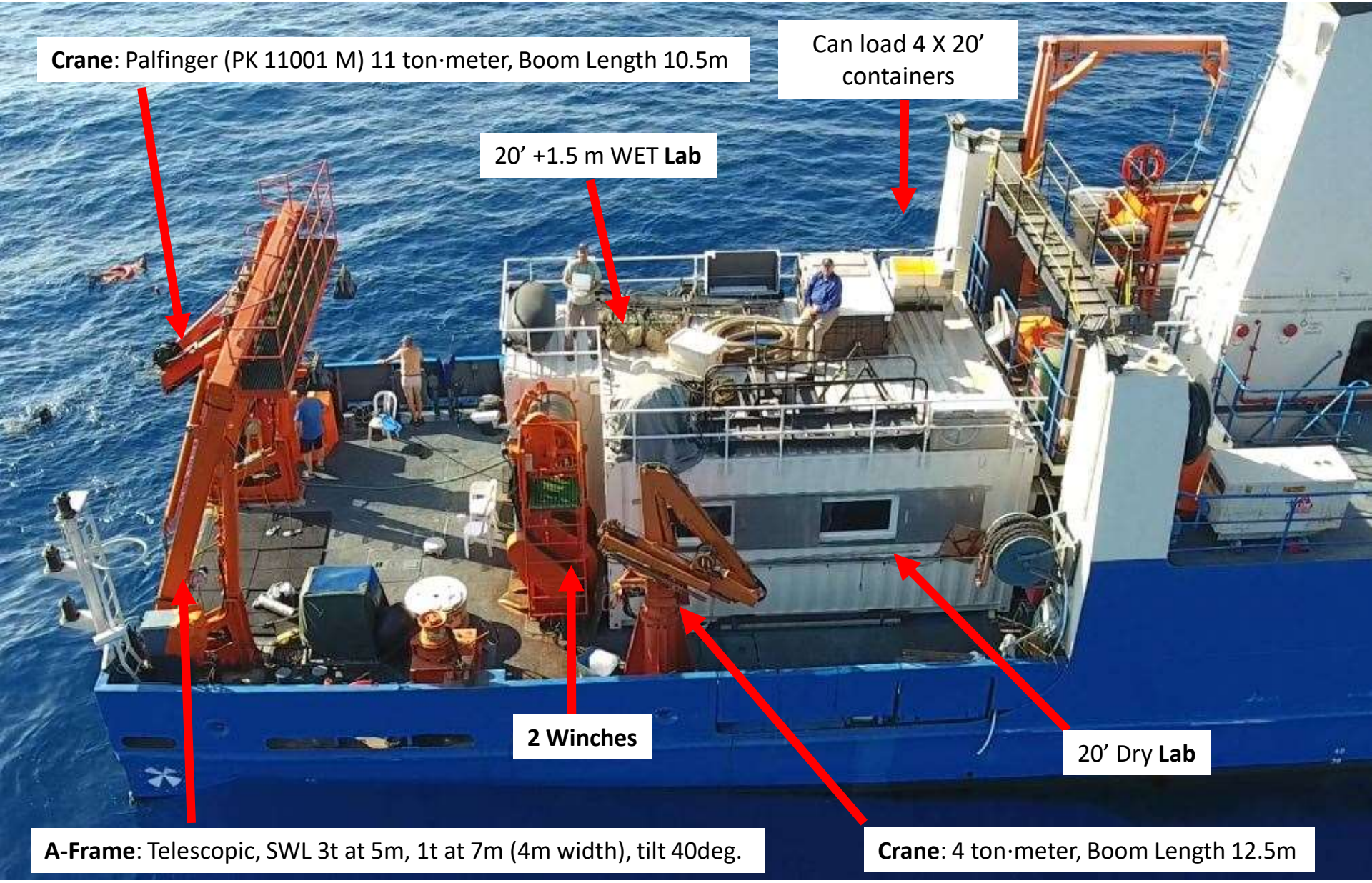
R/V Bat Galim **Aft Deck** (~ 14 m long X 10 m wide)



R/V Bat Galim: Research & other Capabilities

- **Map the sea floor and the water column** - Two multibeam systems WD 10 - 7,000 m
- **Map the sub-bottom in a very high resolution** – two systems: CHIRP and Sparker
- **Sample the sub-bottom** – two systems: Box Core and Piston/Gravity Core (up to 9 m long)
- **3-D continues current profiling** – ADCP system up to 700 m below the vessel
- **Sample the water column** – CTD and Rosetta
- **Data and sample analysis**– Hydrographic lab/Wet/Dry/Isotope/Processing capabilities/Geophysical labs
- **Operate & deploy autonomous and guided equipment** – AUV and ROV
- **Oil spill response** - Spray oil dispersants & clean with oil spill skimmer
- **Search and recovery of missing aircraft & vessels**- Pinger locator, Side scan Sonar, ROV

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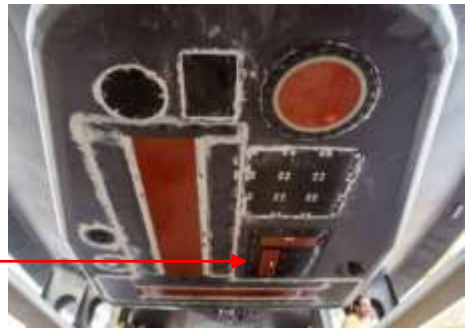
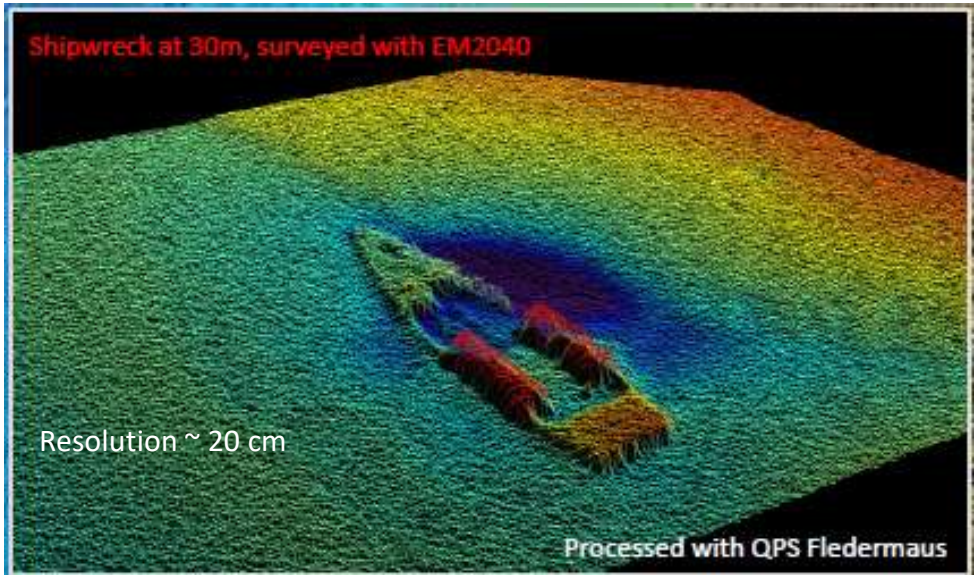
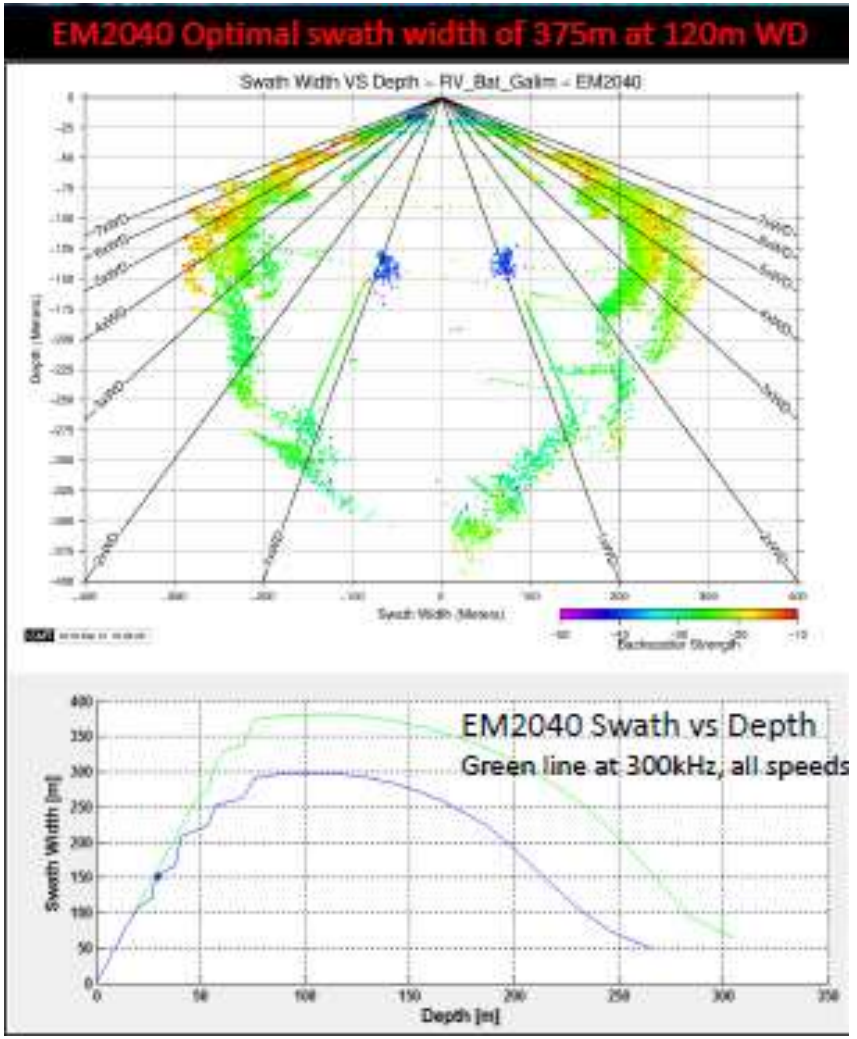
High resolution sea floor mapping (WD ~< 300 m)



EM 2040

- Frequency range: 200 to 400 kHz
- Max ping rate: 50 Hz
- Swath coverage sector: Up to 140° (±70°) (single RX) / 200 ° (±100°) (dual RX)
  - 07 deg. TX by 0.7 deg. RX





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EM 302
30 kHz multibeam echo sounder

KONGSBERG

EM 302 performance data

Operating frequency..... 30 kHz
Depth range..... 10-7000 m
Swath width ..... 5.5xDepth, to approx 8 km
Depth resolution of soundings .....1 cm

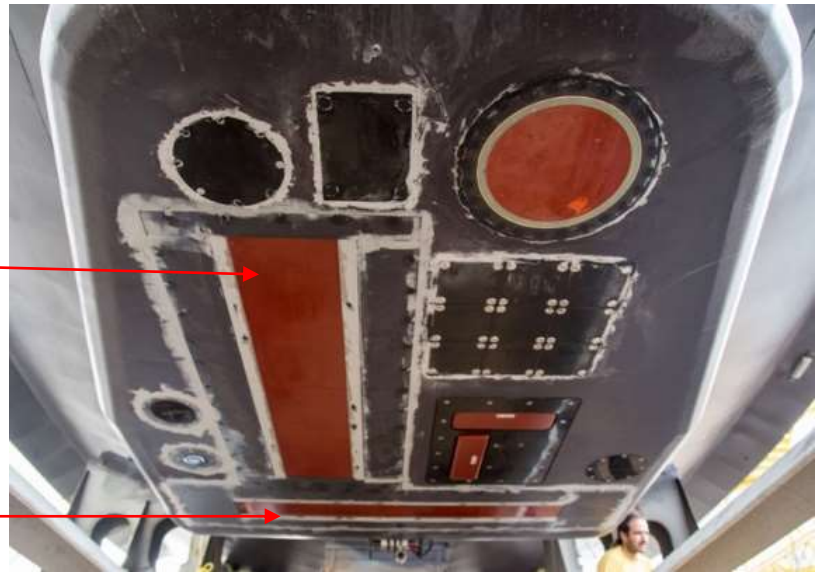
System version	2 x 2
Transmit array [deg]	150 x 2
Receive array [deg]	2 x 30
No of beams/swath	288
Max no of soundings/swath	432
Max no of swaths per ping	1
Max no of soundings/ping	432

Deep water sea floor mapping (up to 7,000 m)

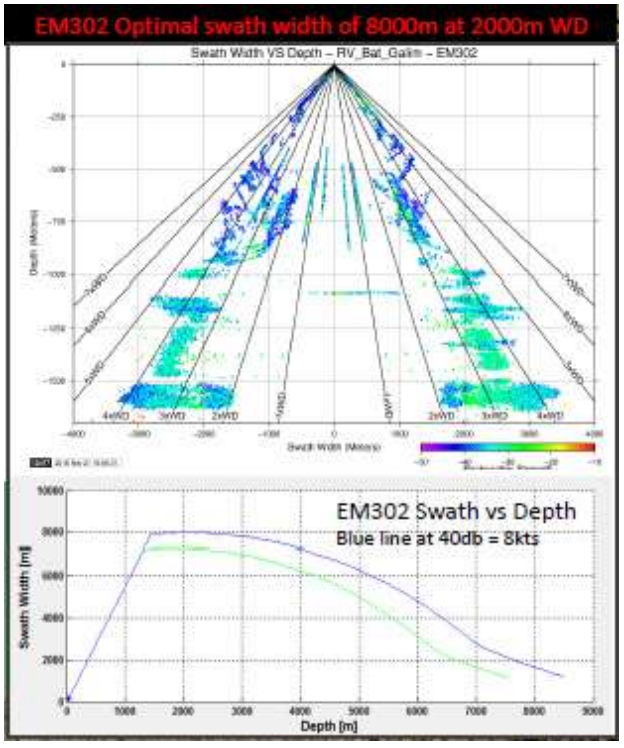
Transmit

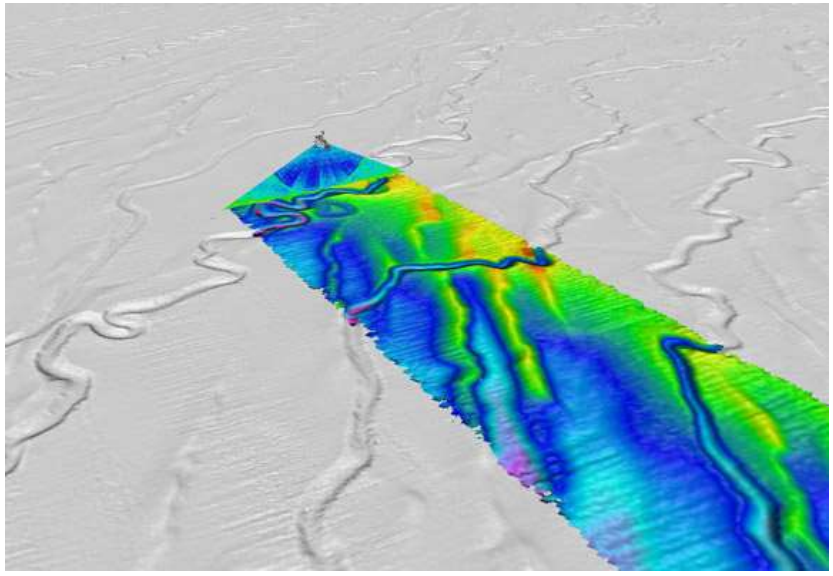
2 deg. TX by 2 deg. RX

Receive



Gondola





Example of submarine deep channels (WD~ 1,700 m)

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A New Multibeam Bathymetric Map of the Israeli Exclusive Economic Zone

The Levantine Basin is a zone of compression and strike-slip tectonics as Africa pushes into Eurasia. These forces operate on a half kilometer of Messinian evaporates and over a dozen kilometers of sediments to produce a complex seafloor morphology. The margin is cut by numerous slumps and canyons, while the basin is traversed by deep sea channels emptying into the moat around Eratosthenes Seamount farther north.

The Israeli Exclusive Economic Zone (EEZ) covers an area of ~ 25,950 sq. km. and reaches a maximum water depth of 2,107 m.

The multibeam mapping was done in three phases:

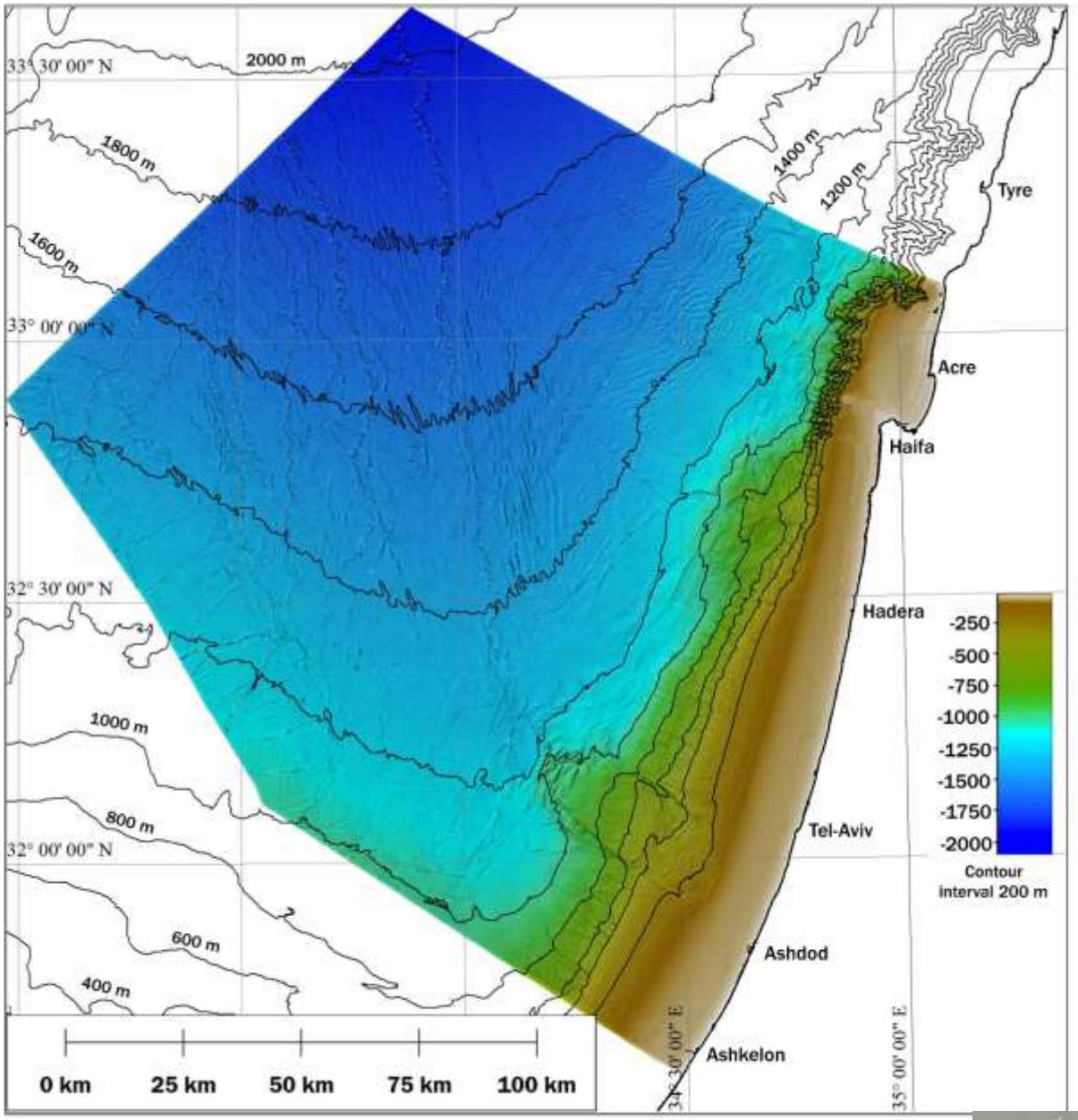
I. Years 2001-2008 using Kongsberg EM1002 installed on the *R/V Etziona*, covering depths from 10 to 600 m

II. Oct.-Nov., 2010 using Elac SeaBeam 3050 installed on the *R/V Mediterranean Explorer* covering depths from 500 to 1,600 m.

III. Aug.-Sept., 2016 using Kongsberg EM302 installed on the *R/V Bat Galim* covering depths from 1,400 to 2,110 m.

The multibeam bathymetric mapping of the EEZ was done in the framework of the National Bathymetric Survey (NBS) that was privately funded (Phases I and II). Phase III was financed by the Israel Ministry of National Infrastructures, Energy and Water Resources following the recent oil and gas discoveries in the Levant Basin, and to support governmental agencies and academia in studying and monitoring the EEZ.

Processing of the multibeam data was done with CARIS HIPS and ultimately QPS Qimera.

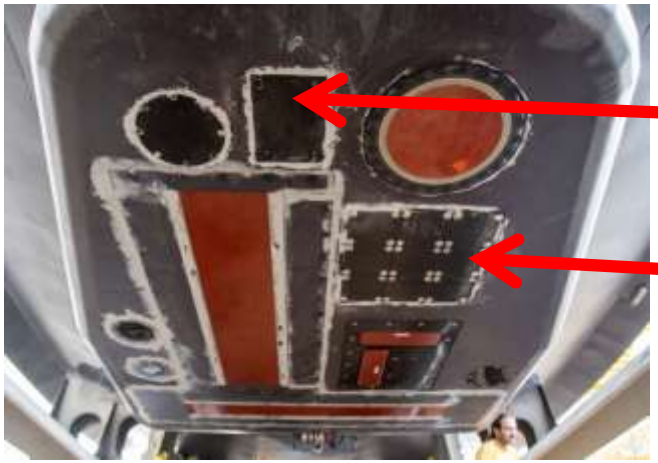


Hall, J.K. [1], Tibor, G. [2], Kanari, M. [2], Sade, A.R. [2], Sade, H. [2], Golan, A. [2] Amit, G. [2], Gur-Arie, L. [3], Ketter, T. [2]

[1] Geological Survey of Israel, 30 Malchei Israel, Jerusalem 95501, Israel; [2] Israel Oceanographic & Limnological Research Ltd., Tel-Shikmona, P.O.Box 80[illegible] Israel; [3] Survey of Israel, 1 Lincoln, Tel-Aviv 14171, Israel

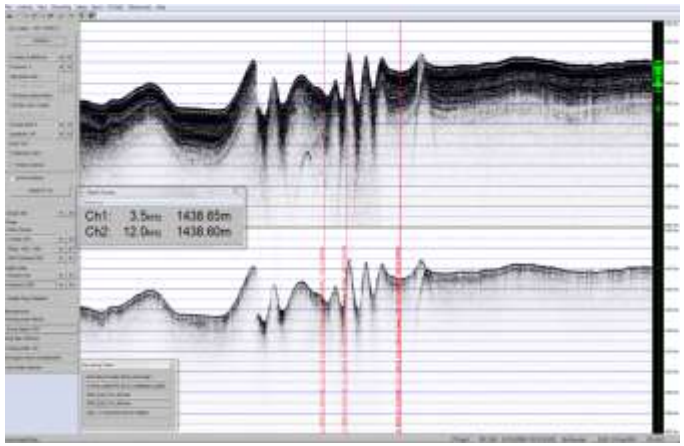
Ministry of National Infrastructure, Energy and Water Resources
www.energy.gov.il

Map the sub-bottom in very high resolution – CHIRP 3260



12kHz transducer

9 X 3.5 kHz transducers



Example of submarine deep channels (WD~ 1,440 m) in the EEZ

Technical Specifications:

Available Channels
- Up to 4 channels

Frequency
- All channels: 3.5kHz - 210kHz

Output Power
- Up to 10kW on Channel 1 (6kW in four channel configuration)
- Up to 2kW on Channels 2, 3 and 4

Input Power
- 85 - 265 VAC

Pulse Length
- Up to 64ms

Gain
- Manual, automatic (AGC), and time varied (TVG)
- 96db range of programmable analog gain

Ranges
- 5, 10, 20, 50, 100, 200, 500, 1000, 2000, 5000

Phasing
- Manual and automatic (up to 50% overlaps)

Units
- Meters, Feet, or Fathoms

Resolution
- 1cm (0-99.99), 1dm (100-999.9), 1m (>1000)

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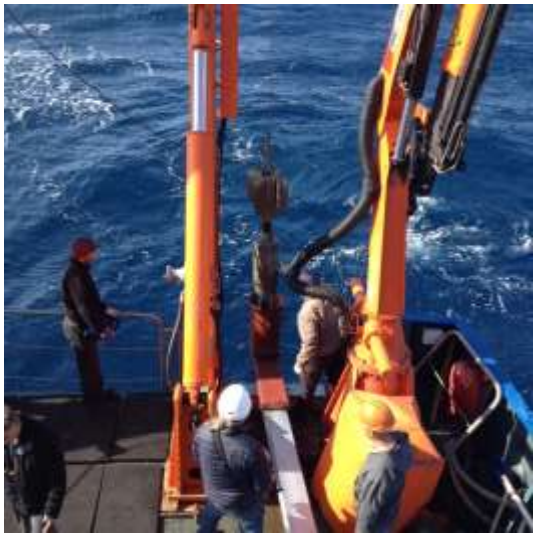
Sample the sub-bottom sediments

Woods Hole; USGS

Vibro Core



9 m Piston Core

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A Teledyne RD Instruments **Marine Measurements** Datasheet

3-D Continues current profiling

Teledyne RD Instruments

Ocean Surveyor

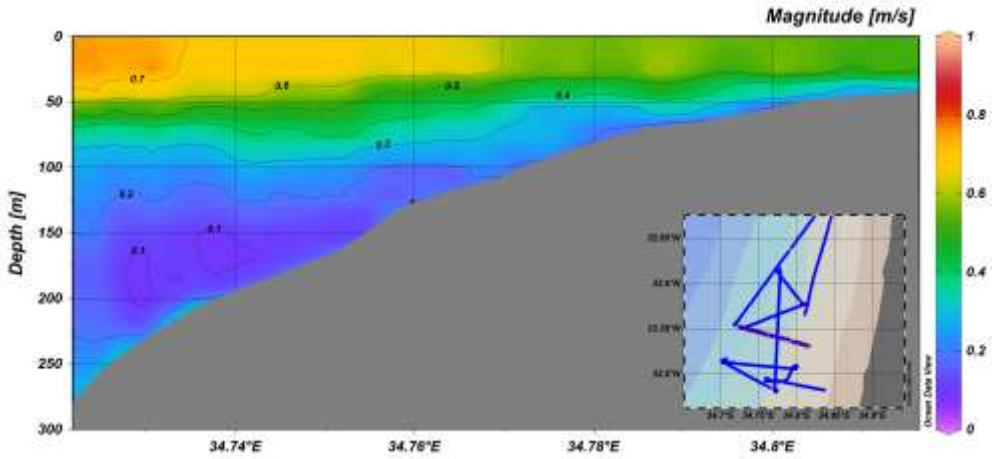
Vessel-Mount Long Range 3-D Current Profiling

Explore New Depths with Proven ADCP Technology

For over thirty years, Teledyne RD Instruments has been the preeminent supplier of Acoustic Doppler Current Profiling (ADCP) instrumentation for open ocean applications. Teledyne RDI's vessel-mounted OCEAN SURVEYOR family of ADCPs are the only instruments capable of collecting detailed maps of the distribution of water currents and suspended materials through the water column and along the ship's path—at depths and resolutions previously considered unattainable. In real time, the ADCP is also used to aid in situ decision-making, to adapt fiel operations, and to understand current regime characteristics.

Frequency	Range (m)	Cell Size (m)
38kHz	800-1000	24
75kHz	560-700	16
150kHz	375-400	8

ADCP in the Gondola



Current magnitude, Training cruise offshore Hadera, June 2016 (Tal Ozer)

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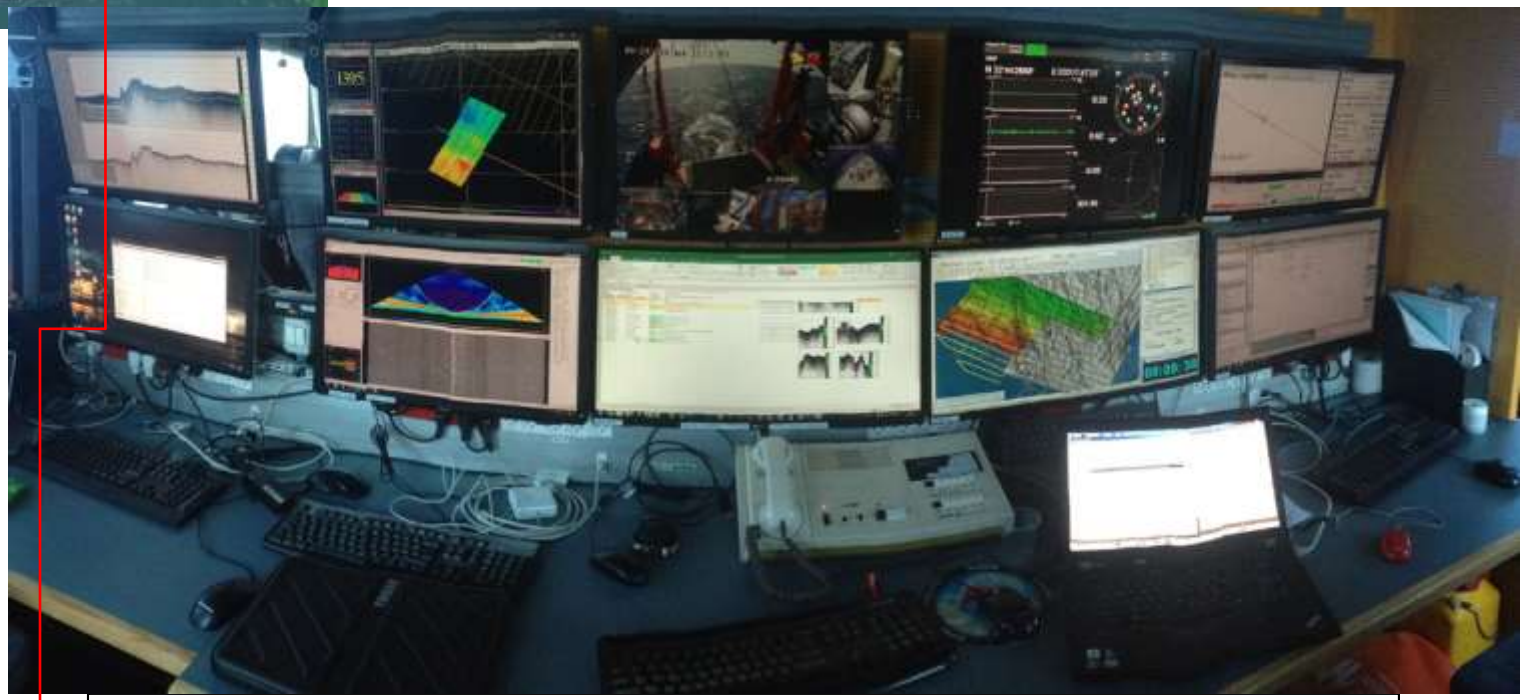
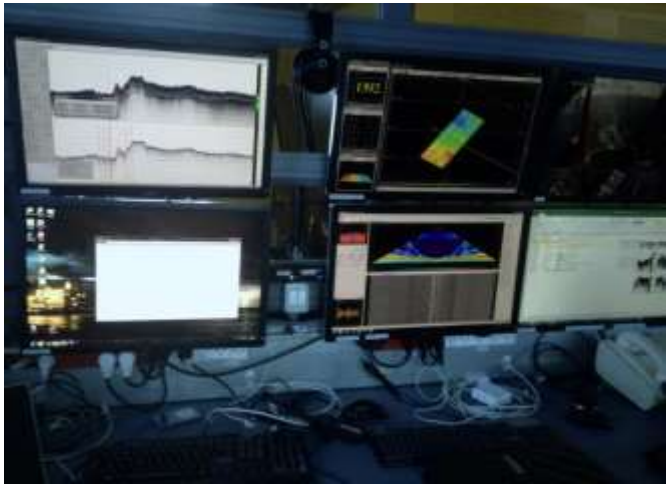
Hydrographic lab. - Real time data acquisition & processing



Controls & operates the: navigation, multibeam, ADCP, Chirp, Camera etc.



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Stern deck 120 sq. m.
Up to 4 X 20’ containers

Dry/Wet and isotope labs.

Wet Lab. ~ 18 sq.m.

Dry Lab. ~ 15 sq.m.

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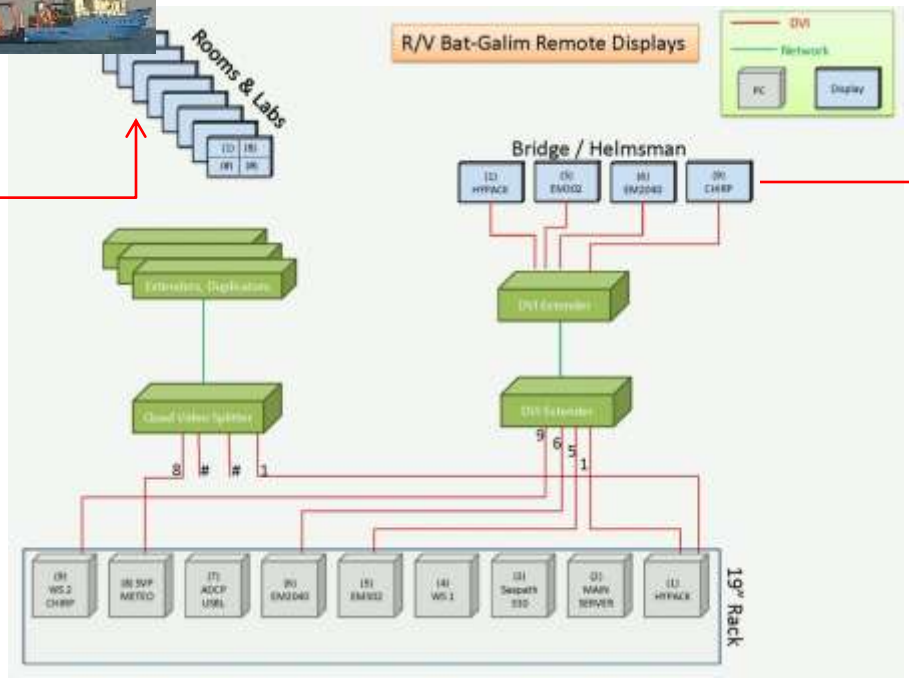
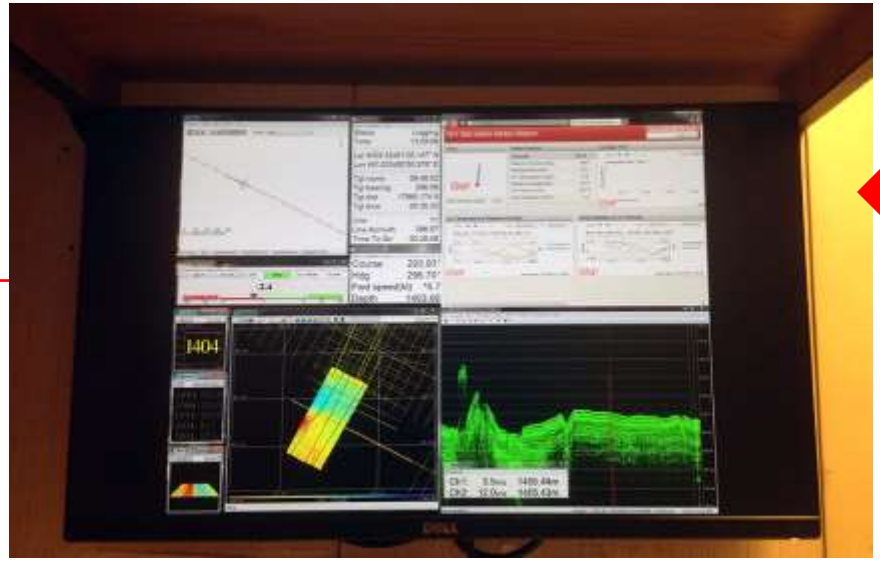
Isotope Lab. ~ 2.5 sq.m.

Remote displays & processing capabilities in each Lab. & room



Data screen bridge



Split data screen in each room.

In each room:

- Split data screen
- High speed intranet connection to main computer to enable individual data processing

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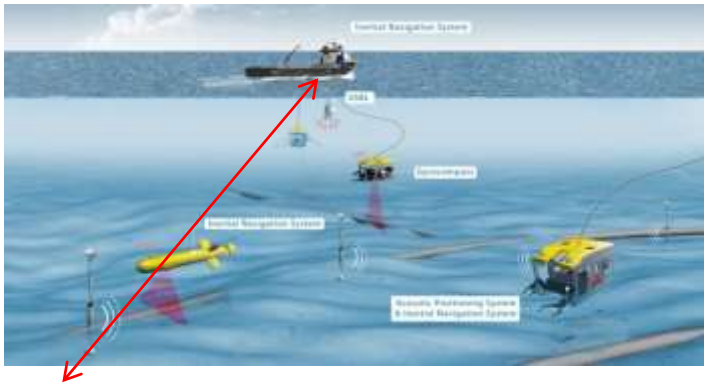
Operate & deploy autonomous and guided equipment – AUV, ROV, mooring buoy's etc.

Buoy deployment

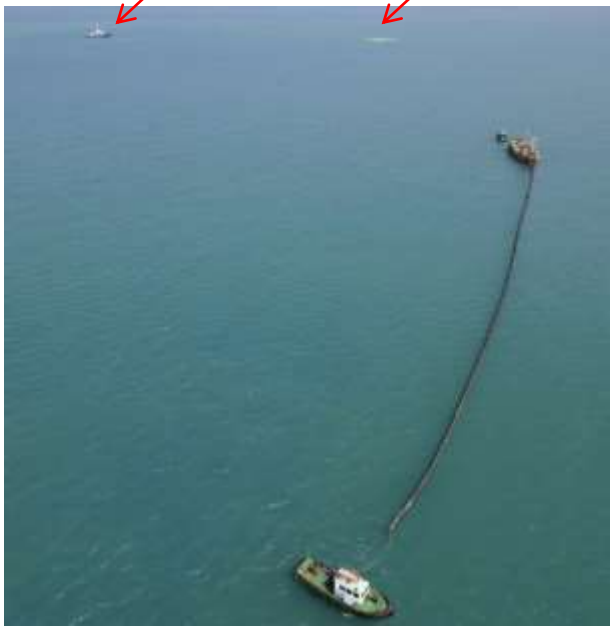


USBL (ultra-short baseline underwater acoustic positioning) **& DP** (dynamic positioning)

Seaeye Leopard 3000m ROV

Autonomous **U**nderwater **V**ehicle (AUV)
ECA Group A18D

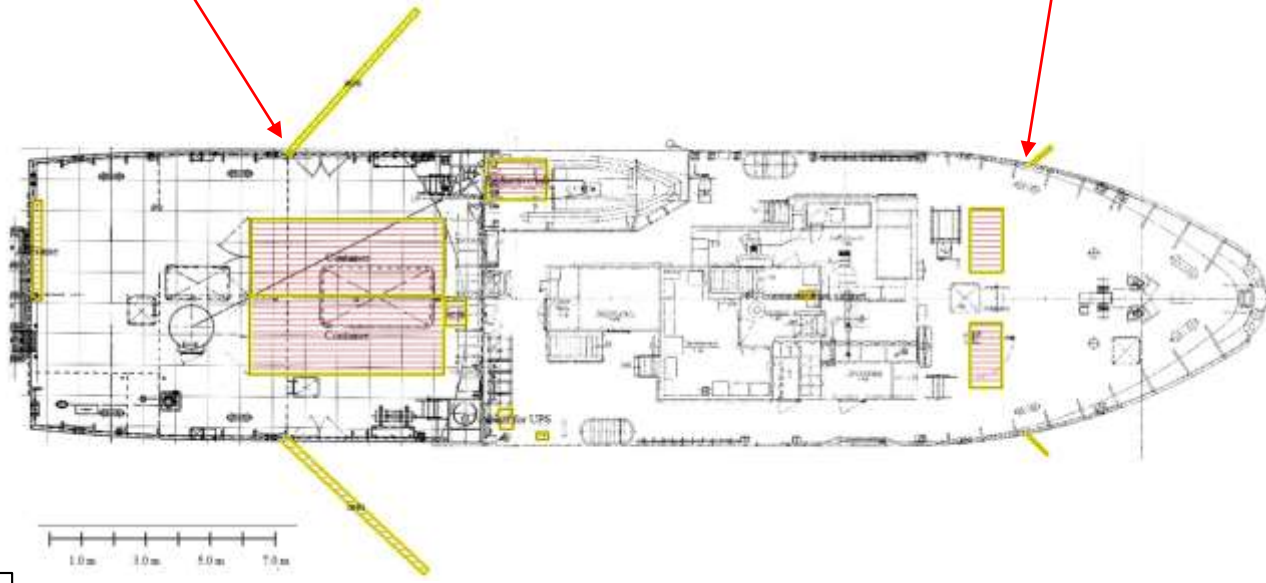
Bat Galim spill



Oil spill skimmer

Oil spill dispersant

Oil spill drill June 21, 2016



Bat Galim control room June 21, 2016

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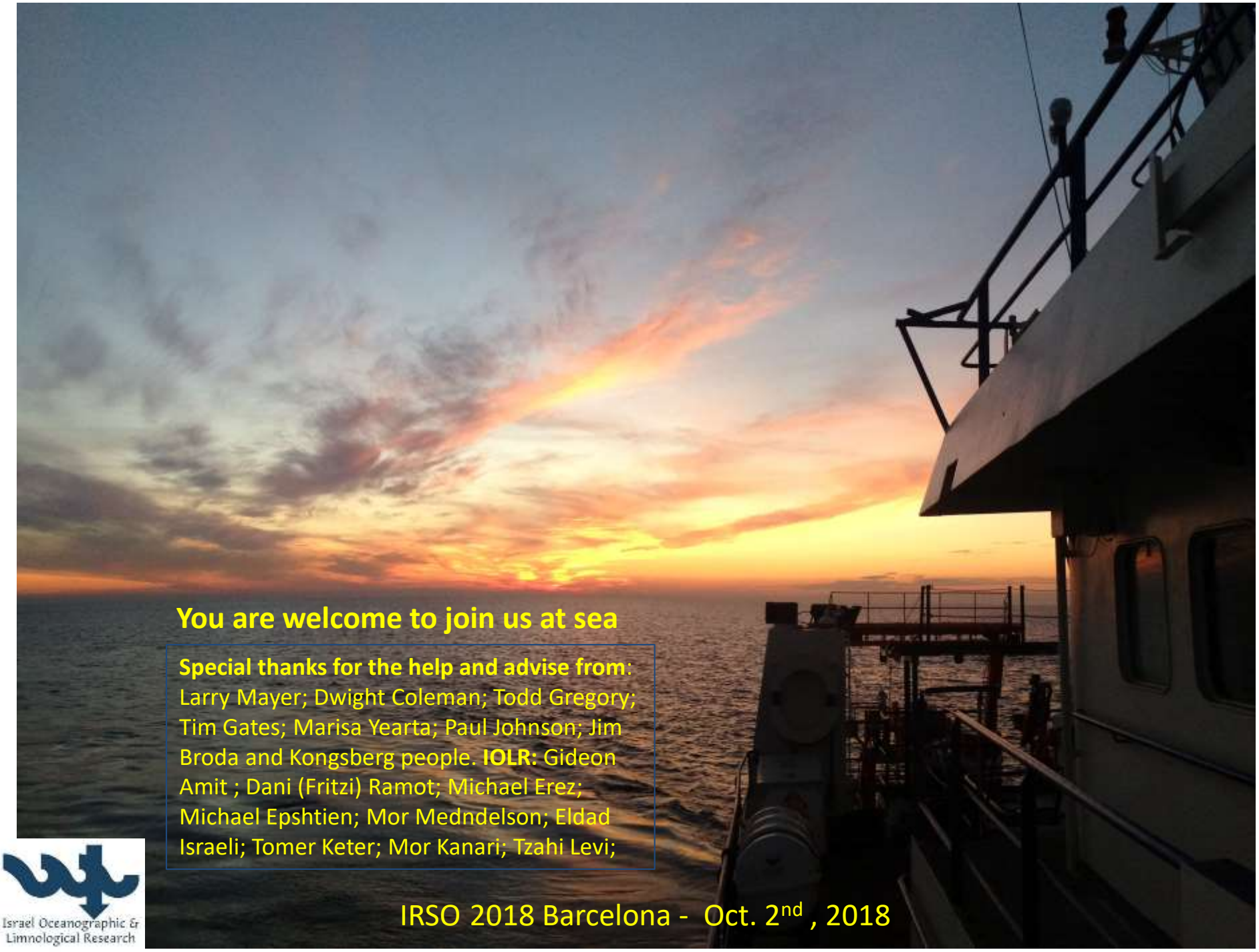
המשרד להגנת הסביבה

Marine and Coastal Environment Division Ministry of Environmental Protection



You are welcome to join us at sea

Special thanks for the help and advise from: Larry Mayer; Dwight Coleman; Todd Gregory; Tim Gates; Marisa Yearta; Paul Johnson; Jim Broda and Kongsberg people. **IOLR:** Gideon Amit ; Dani (Fritzi) Ramot; Michael Erez; Michael Epshtien; Mor Medndelson; Eldad Israeli; Tomer Keter; Mor Kanari; Tzahi Levi;

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IRSO 2018 Barcelona - Oct. 2nd , 2018