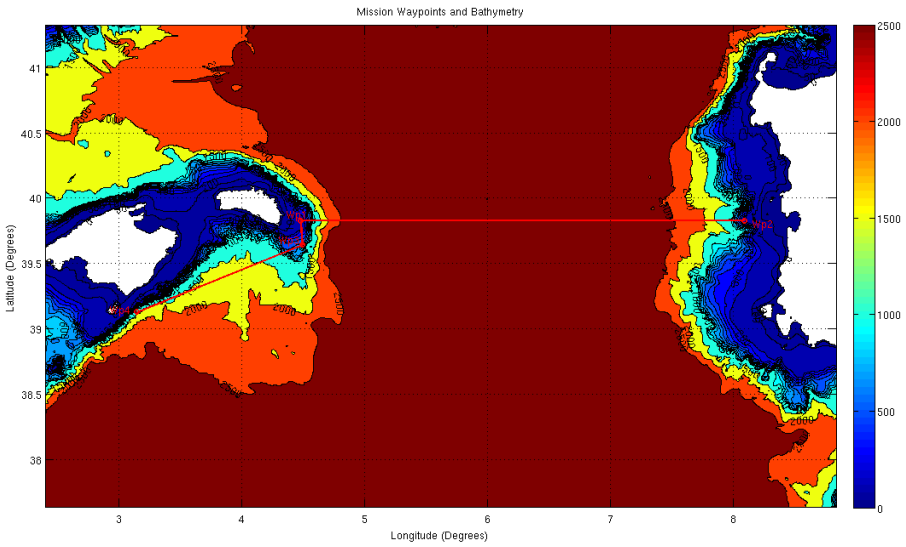
CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS

Balearic Islands Coastal Observing and Forecasting System

GLIDER MISSION DEFINITION

Reference: *GF-MD-0012*



Platform:	*GLIDER SEAGLIDER*
Platform ID:	*sdeep02 (Unit538)*
Mission:	*JERICO TNA SARDINIA OCT12*
Date:	*October, the 23rd , 2012*

Issue:	Glider Pre-mission Report
Description:	This document summarizes the mission definition, preparation, and logistics for the scientific mission *JERICO TNA SARDINIA OCT12* responding to JERICO TNA Call_1_8, and SOCIB glider facility monitoring operations.
Authors:	Miguel Martínez, Simó Cusí
Involved Personnel:	Simó Cusí, Marc Torner, David Roque, Miguel Martínez, Benjamín Casas, Carlos Castilla, Irene Lizarán, Guillermo Vizoso, Joan Pau Beltran, Sebastián Lora, David March, Emma Heslop, Simón Ruiz, Ananda Pascual, Jose Luís Lopez Jurado, Rosa Balbín Chamorro, Joaquin Tintoré, Alberto Ribotti, Antonio Olita

DOCUMENT

VERIFICATION AND DISTRIBUTION LIST

	Name	Facility	Date
Checked By:	Miguel Martínez	GF	10 August 2012 5 October 2012 22 October 2012
Distribution	Benjamín Casas, Joan Pau Beltran, Joaquin Tintoré		
	Name	**Facility**	**Date & Signature**
Approved and Accepted by	***B. Casas***	***ETD***	
Approved and Accepted by	***J.P. Beltran***	***DC***	
Approved and Accepted by	***J. Tintoré***	***OD***	

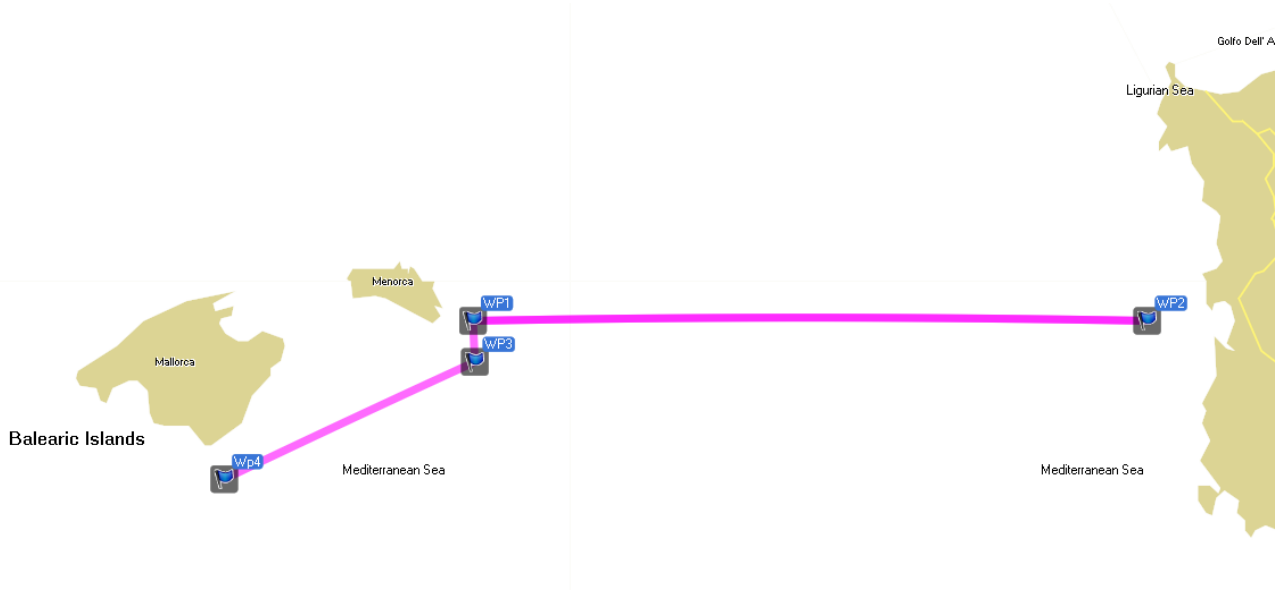
I MISSION

Mission Area: Western Mediterranean Sea - Mallorca to Sardinia
Mission Objective: JERICO TNA Agreement CSIC-CNR
Deployment date: 23 October 2012
Recovery date: 10 December 2012 -tentative-
Mission Duration: 49 days
Glider: sdeep02 (Unit 538)
Glider backup: sdeep03 (Unit 541)
Route Distance: 414nm (766km)
Profiles: 550 approx.

Mission Waypoints

Latitude	Longitude	Name
39º 49.457' N	4º 28.855' E	***WP1***
39º 49.457' N	8º 05.486' E	***WP2***
39º 49.457' N	4º 28.855' E	***WP1***
39º 38.603' N	4º 29.442' E	***WP3***
39º 07.617' N	3º 08.910' E	***WP4***

Minimum Distance to Shore: 8.4nm (at Wp1)



Mission route

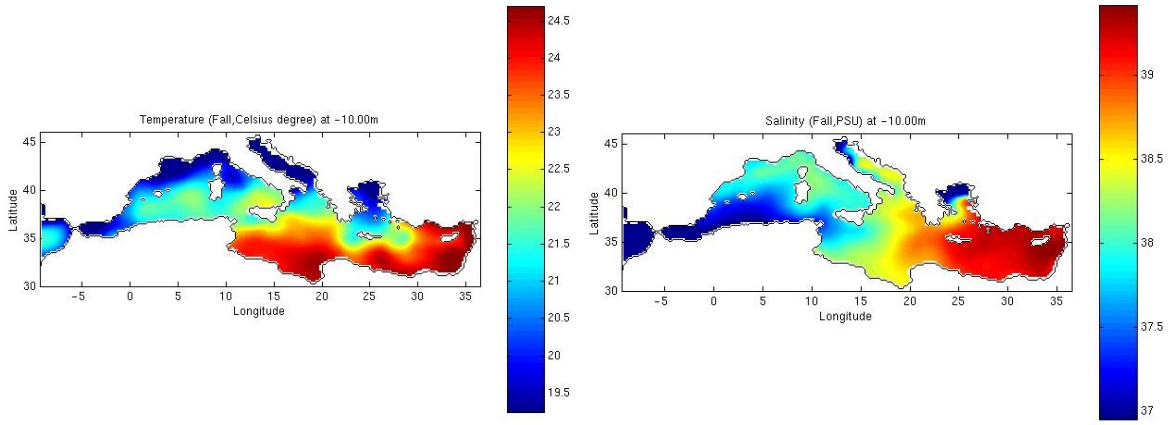
II ENVIRONMENTAL PROPERTIES

Expected water properties

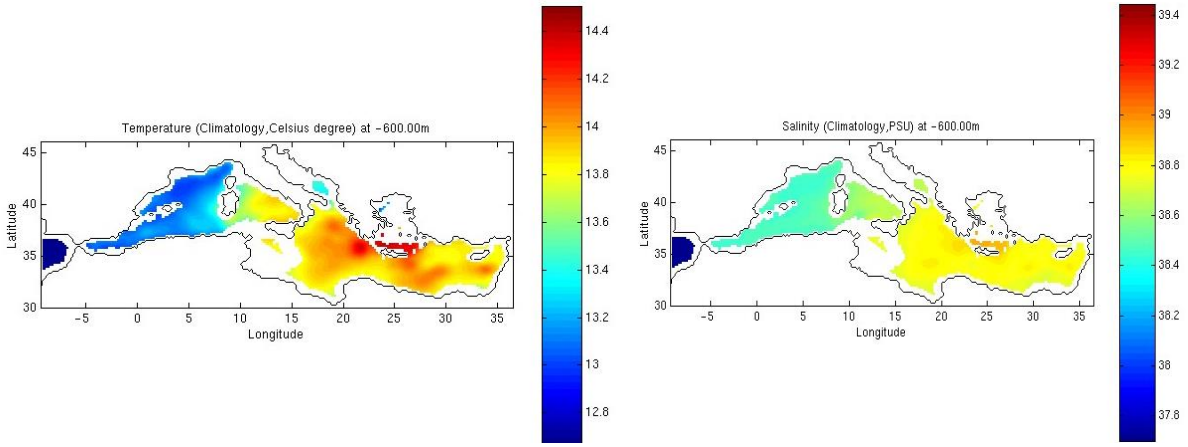
- Surface in-situ Density: 1025.95 Kg/m3 (given by CNR: Oct. 2007, 22.44ºC, 37.44psu, 0m)
- Bottom in-situ Density: 1033.48 Kg/m3 (given by CNR: Nov. 2011, 13.12ºC, 38.49psu, 1000m depth)
- Average Density: 1029.71 Kg/m3

Glider Ballasting

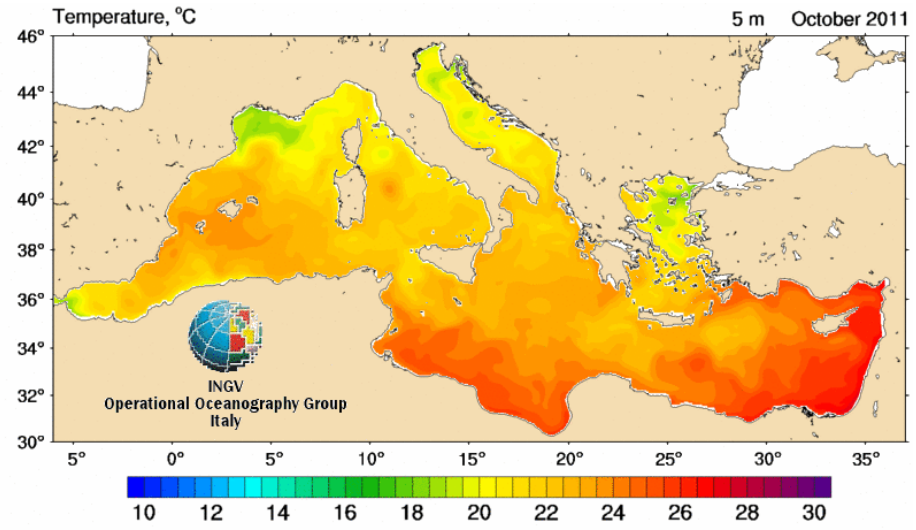
- Glider Density Range: [1025,4 1033,3]Kg/m3
- Glider Average Density: 1029,35 Kg/m3



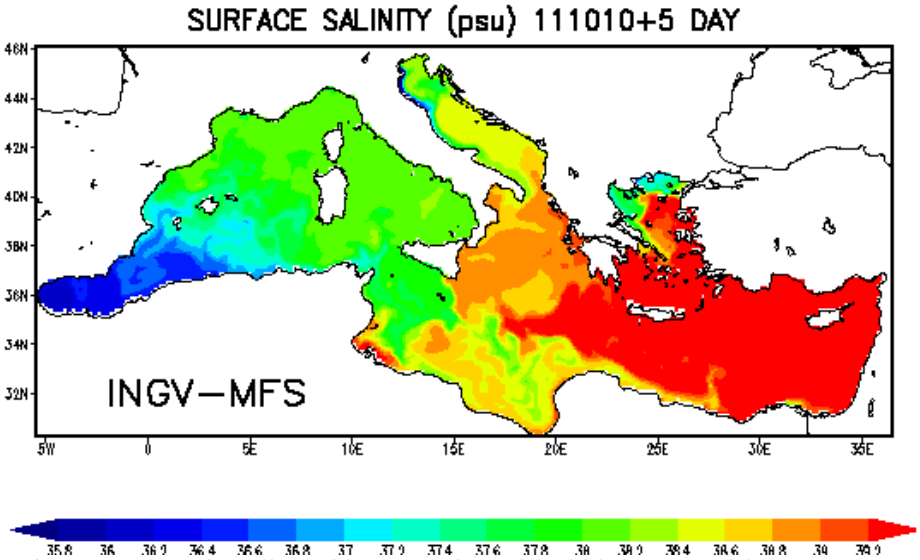
Seasonal (Autum) Temperature and Salinity MEDAR Climatology at ~10m depth



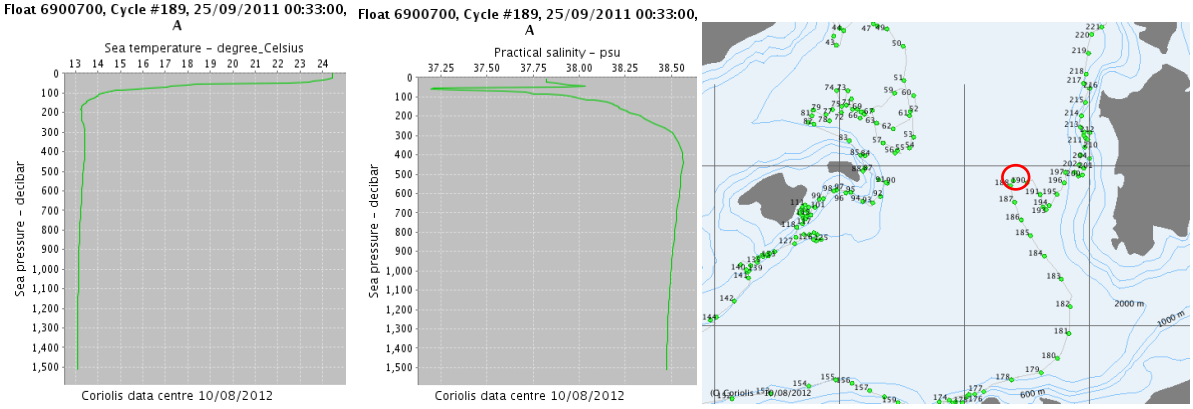
Temperature and Salinity MEDAR Climatology at ~600m depth



Temperature October 2011 from http://gnoo.bo.ingv.it/mfs/analysis_archive.htm



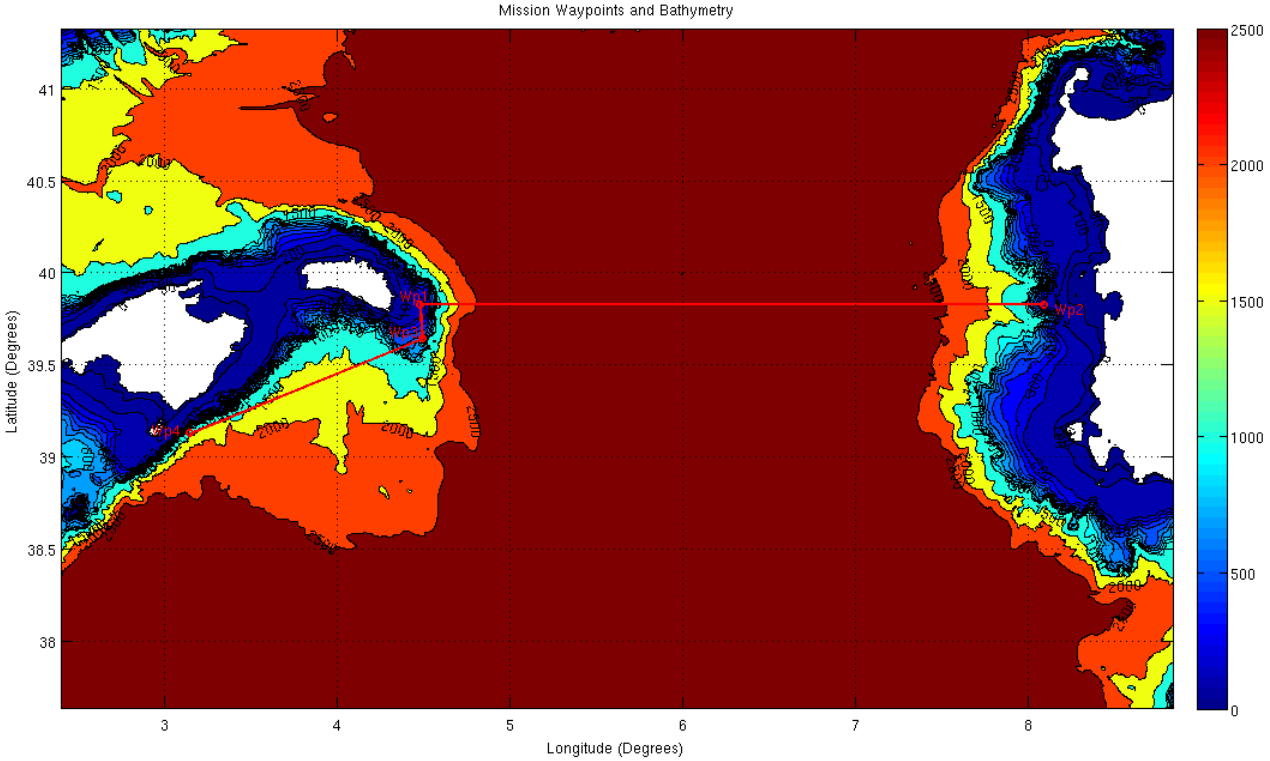
Salinity October 2011 from http://poseidon.ogs.trieste.it/cgi-bin/opaopech/myocean?20111015SRS



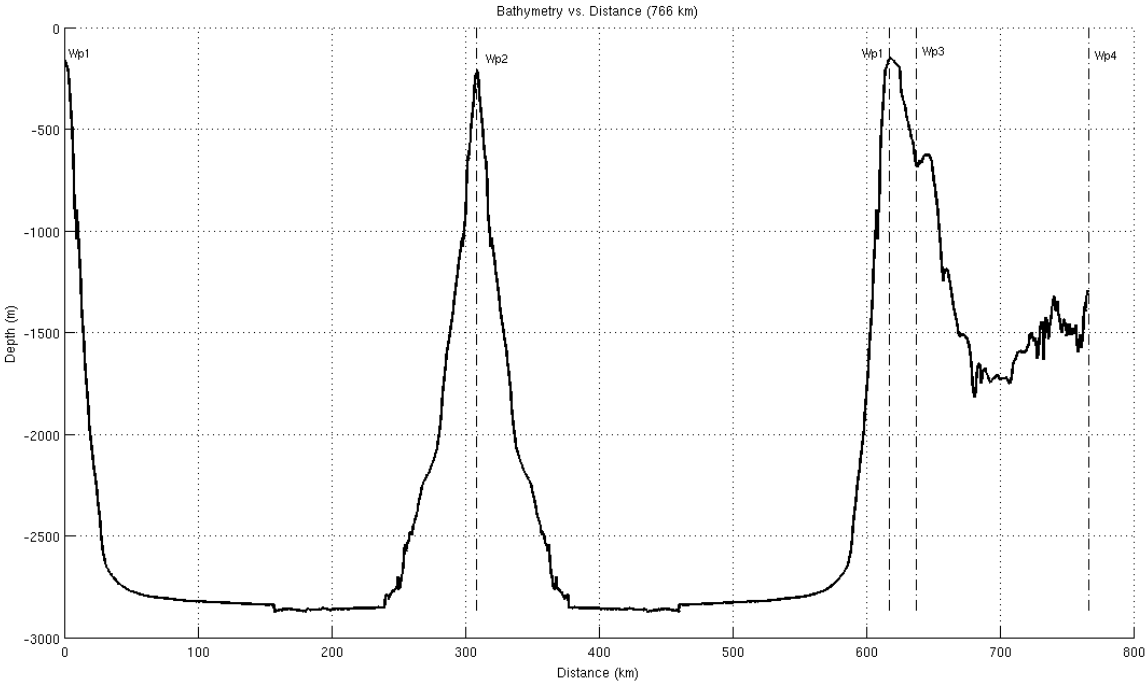
PROVOR Profiling Float 6900700 Temperature, Salinity and Position for 25 Sept. 2011 from http://www.ifremer.fr/co-cartography/jsp/cartography.jsp?mode=float&ptfCode=6900700&lang=en

Mission Depth

- Depths: min 150.0 [m], max 2874.4 [m]

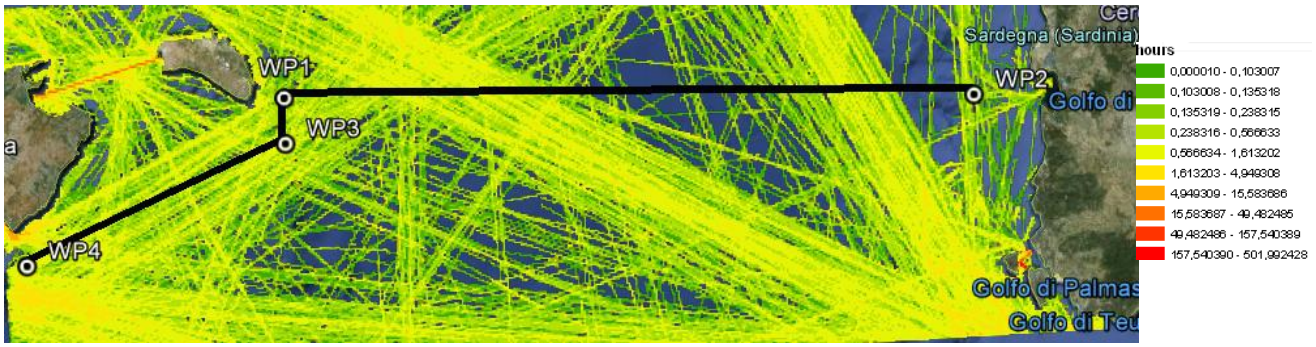


Mission bathymetry

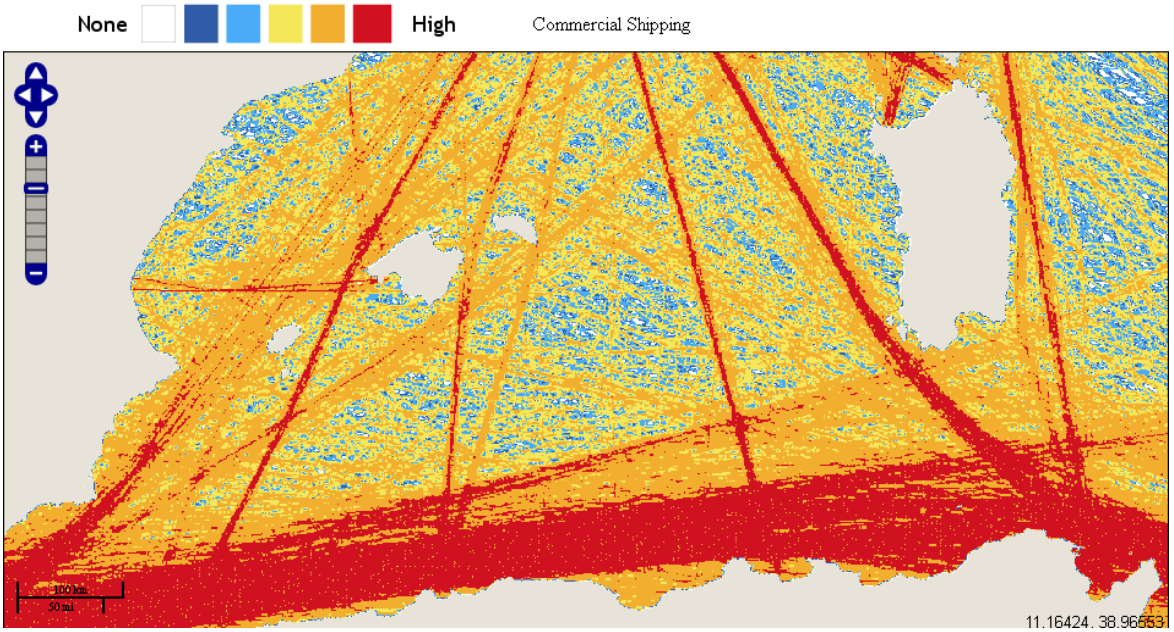


Mission depth vs. distance

III MARITIME ROUTES



Marine traffic density (number of hours occupied by ships in every cell of 1km x 1km) between Mallorca and Sardinia (one month of AIS data, August 2012)



Commercial shipping routes (available at: http://globalmarine.nceas.ucsb.edu/)

IV INSTRUMENTAL SETTINGS

Navigation Behaviour

Surfacing events

-Every inflection
-Mission aborted

Movement

-Distance to seabed: 30.0 m
-Maximum depth: 975.0 m (see Note 1)
-Angle of inclination: 20º (see Note 2)
-Approx. vertical speed: 0.1 m/s (see Note 2)
-Approx. horizontal speed: 0.17 m/s (see Note 2)

Scientific Data Sampling and Transmission

Sensors Sampling (see Note 3)

CTD (conductivity, temperature and pressure)
-Sampling state: diving and climbing
-Sampling frequency: 1/4 Hz (approx. 1 sample/0.4m)
-Sampling depths: [0, 1000]m

Oxygen
-Sampling state: diving and climbing
-Sampling frequency: 1/4 Hz (approx. 1 sample/0.4m)
-Sampling depths: [0, 300]m (see Note 4)
-Sampling frequency: 1/8 Hz (approx. 1 sample/0.8m)
-Sampling depths: [300, 1000]m (see Note 5)

FLNTU (fluorescence and turbidity sensor)
-Sampling state: diving and climbing
-Sampling frequency: 1/8 Hz (approx. 1 sample/0.8m)
-Sampling depths: [0, 300]m (see Note 5)

Sensors Transmission (Real-Time mode)

Data measured will be transmitted through Iridium to verify sensors, sampling and navigation behaviour of the glider. Real time data transmission will be done at least every day (approximately 1 dive

transmitted every 4 dives performed) to minimize costs and surface time. All data will be downloaded by cable once mission finishes (delay mode).

Notes

1. During deployment the navigation depth will be increased in consecutive changes (increases of 200m approx.) to ensure correct glider behaviour and navigation minimizing the probability of damage of the glider in case of error.

2. The piston buoyancy and pitch angle will be changed during mission to optimize glider flight, reduce consumption and to adapt the glider velocity to the currents of the mission zone. Those changes will vary the vertical and horizontal velocities.

3. To verify correct sensor measurement and behaviour all sensors will be measured up to 1000m (at least during one dive). The configuration of the sensors sampling will be changed during mission to verify glider and sensors integrity and behaviour.

4. The Oxygen sensor will be measured at a frequency of 1/4Hz up to 300m and at 1/8Hz from 300m to 1000m to reduce power consumption. FLNTU (Wetlabs) sensor will be measuring up to 300m to minimize the power consumption.

5. The Oxygen and FLNTU sensor sampling frequency and depth might have to be changed during mission to reduce power consumption depending on battery capacity.

V LOGISTICS

Deployment: 23 October 2012
Recovery: 10 December 2012 –tentative-
Mission Duration: 49 days
Glider: sdeep02 (Unit 538)
Glider backup: sdeep03 (Unit 541)

Tasks and Calendar

Mission preparation

Task	Personnel	Date
Glider ballasting verification	Simó Cusi, Joaquin Tintoré	24-28 September
Glider verification	Simó Cusi, Miguel Martinez	8-10 October
Navigational Warning	David Roque, Guillermo Vizoso	8 July
Deployment material load	Simó Cusi, David Roque, Benjamin Casas, Miguel Martínez	10 July

Deployment (Menorca)

Task	Personnel	Date
Glider deployment	Carlos Castilla, David Roque, Benjamin Casas, Guillermo Vizoso, Miguel Martínez	23 October
Glider remote control	Simó Cusí, Simón Ruiz, Ananda Pascual	23 October
Vessel	TMOOS Valiant	23 October
Vessel pilot	David Roque, Benjamín Casas	23 October
Vehicle	SOCIB Mercedes Sprinter	23 October
Calibration CTD Cast - SBE 25	David Roque, Guillermo Vizoso	23 October

Mission tracking

Task	Personnel	Date
Glider following, control and mission updates responsible	Simó Cusi, Miguel Martínez, Benjamín Casas, Guillermo Vizoso, Joaquin Tintore	23 October - 10 December
Glider pilot backup	Marc Torner, Simón Ruiz, Ananda Pascual	23 October – 10 December

Data Management

Task	Personnel	Date
Real Time Data retrieval	Simó Cusi, Guillermo Vizoso, Miguel Martínez	23 October - 10 December
Real Time Data verification	Marc Torner, Emma Heslop, Simon Ruiz, Ananda Pascual, Joaquin Tintoré	23 October – 10 December
Delay Mode Data retrieval	Simó Cusi, Benjamín Casas, Guillermo Vizoso, Miguel Martínez	10 December
Delay Mode Data verification and export	Marc Torner, Emma Heslop, Simon Ruiz, Ananda Pascual, Joaquin Tintoré	10 December

Recovery (South Mallorca)

Task	Personnel	Date
Glider recovery	Marc Torner, David Roque, Benjamin Casas, Guillermo Vizoso, Miguel Martínez	10 December
Glider remote control	Simó Cusí, Simón Ruiz, Ananda Pascual	10 December

Vessel	SOCIB ZODIAC	10 December
Vessel pilot	David Roque, Benjamín Casas	10 December
Vehicle	IMEDEA TMOOS Nissan PickUP	10 December

Emergency plan

Task	Personnel	Date
Emergency Decision	Miguel Martínez, Benjamin Casas, Joaquin Tintoré, Guillermo Vizoso	23 October - 10 December
Emergency recovery glider pilot	Marc Torner, David Roque, Benjamín Casas, Miguel Martínez	23 October - 10 December
Emergency recovery glider remote control	Simó Cusí, Simón Ruiz	23 October - 10 December
Emergency Vessel and Vehicle	-Depending on disposability-	23 October - 10 December

Notes

-Deployment:

The deployment has been postponed from 15 Oct to 23 Oct due to bad weather conditions at Menorca.

The deployment will be carried out by Benjamín Casas, Miquel Martínez, Guillermo Vizoso, David Roque and Carlos Castilla at East Menorca to reduce the consumption of the glider and minimize the scientific mission start-up time. This deployment will be done using the vessel TMOOS Valiant on date 23 October. The material will be carried by ferry using the SOCIB Mercedes Sprinter on 8 Oct. The material will be: two Seagliders (538 and 541), power supply, communication cables, magnets, tools, Benthos pinger and CTD SBE-25. A CTD cast will be done during deployment.

-Recovery:

The recovery will be done at South Mallorca approximately day 10 December. The vessel SOCIB ZODIAC must be available for recovery during these dates. The vessel would departure from Calanova Station to East Cabrera Island. The vehicle IMEDEA TMOOS Nissan PickUp must be available.

In case of low battery capacity, the recovery will be done near Menorca as soon as possible. Vehicles and vessels needed for an emergency recovery will be available.

VI DATA MANAGEMENT

Basestation Primary: 67.207.130.126
Basestation Secondary: 67.207.130.126
Primary Iridium Phone: 881600005201 (Rudics)
Secondary Iridium Phone: 881600005201 (Rudics)

The data from this mission will be available in Real Time and Delay Mode.

Real Time

The data will be received at the iRobot Basestation through Iridium satellite communications every glider surface. The log and binary data obtained will be then transferred to SOCIB Data Center for mission tracking. Pre-processing of log files will be carried out creating NetCDF files and images that will be available for public download at SOCIB thredds data discovery portal. The scientific sensors data will be processed by glider technicians that will represent the scientific variables and generate images for verification.

All files from basestation will be synchronized according to the following properties:

-Origin: ftp://67.207.130.126/../sg538
-Target:
/home/glider_public/deployments/sg538/20121015/basestation_01
-Download frequency: every 60 minutes.

The data will be accessible for the general public at the following location with read only access:

-Host: ftp://ftp.socib.es
-User: glider_public
-Password: **** (hidden)

The data files will be transmitted in the future to EGO server, Coriolis, and MyOcean2 portal (when available). Attention will be given for all theses data to be available to the GTS (Global Telecomunication System, WMO).

Delay Mode

Once the mission is finished, the data will be downloaded to the SOCIB Data Center where pre-processing and Quality Control and Validation will be carried out and NetCDF files and images will be created (process at present ongoing, estimate to be available at the start of 2013).

The data files will be finally included in JERICO portal.

VII GLIDER SETUP

Batteries

Battery endurance is calculated with the Excel Spreadsheet provided by iRobot (SG Endurance). The estimation is done for the scientific valuable navigation transects (WP1-WP2-WP1) as the glider could be recovered after completing these transects without the need of reaching WP4.

Glider navigation and behaviour parameters are set as follows:

	Inputs			Units	Description
Dive Profile	vertical velocity	=	0,1	m/sec	Desired vertical velocity during ascent and descent. This and $MAX_BUOY determine $T_MISSION for respective $D_TGT
	$MAX_BUOY	=	200	CCs	Multiply MAX_BUOY*2 for total number of CCs pumped at Apogee due to error in calculations used later
	$SM_CC	=	400	CCs	Surface Maneuver minimum buoyancy
	$N_NOSURFACE	=	0	int	0 to disable; must be > 1 (-1 and 1 illegal values)
	Roll retries	=		float	Average number of retries per roll event.
	Pitch retries	=		float	Average number of retries per pitch event.
Pump Config	$T_BOOST	=	0	sec	Time (seconds) to run boost pump. (must be 0 if SBE)
	$D_BOOST	=	0	m	The depth (meters) above which only the boost pump will run.
	VBD retries apogee	=		float	Average number of retries per pump event.
	VBD retries surface	=		float	Average number of retries per pump event.
	EBE or SBE	=	1		0=SBE 1=EBE
Navigation Config	$NAV_MODE	=	2	int	select navigation method (values 0 - 3)
	$KALMAN_USE	=	2	int	Kalman filter use 0 - 2 (2 to disable)
Comms	$CALL_NDIVES	=	1	int	The number of profiles (dive/climb cycles) to perform before attempting communications. (range 1 - 10)
	$CAPUPLOAD	=	0	int	upload capfile for current dive (0 = no, 1 = yes)
Battery Config	24V Starting Capacity	=	53	Amp/hrs	Standard (new battery) = 145
	10V Starting Capacity	=	34	Amp/hrs	Standard (new battery) = 95

Glider science parameters are set as follows:

Science File (all cells need to be defined)			
Depth	Sample Interval	Sample Multiplier	GC Interval
50	5	1 2 1 0 0 0	60
100	5	1 2 1 0 0 0	60
150	5	1 2 1 0 0 0	60
300	5	1 2 1 0 0 0	60
500	5	1 0 2 0 0 0	300
1000	5	1 0 2 0 0 0	300

The resulting consumption estimated for both batteries is:

depth	50	100	150	300	500	1000	
24V: Ahr/dive	0,083339	0,097464	0,105339	0,116464	0,130808	0,166667	
10V: Ahr/dive	0,025082	0,045628	0,066839	0,130475	0,185276	0,243969	
mission dives	12	4	8	16	12	144	**TOTAL Ahr**
consumption 24V	1,00007	0,389857	0,842713	1,863425	1,569693	24,00004	**29,6658**
consumption 10V	0,30099	0,18251	0,534715	2,087595	2,223314	35,13149	**40,460616**

With the planned setup, the glider will consume 29,7 Ahr of the 24V battery pack, meaning that a 16% of the 24V battery capacity will remain as a backup. The 10V battery pack needs 40,5 Ahr so that it is missing 6,5 Ahr to complete the mission.

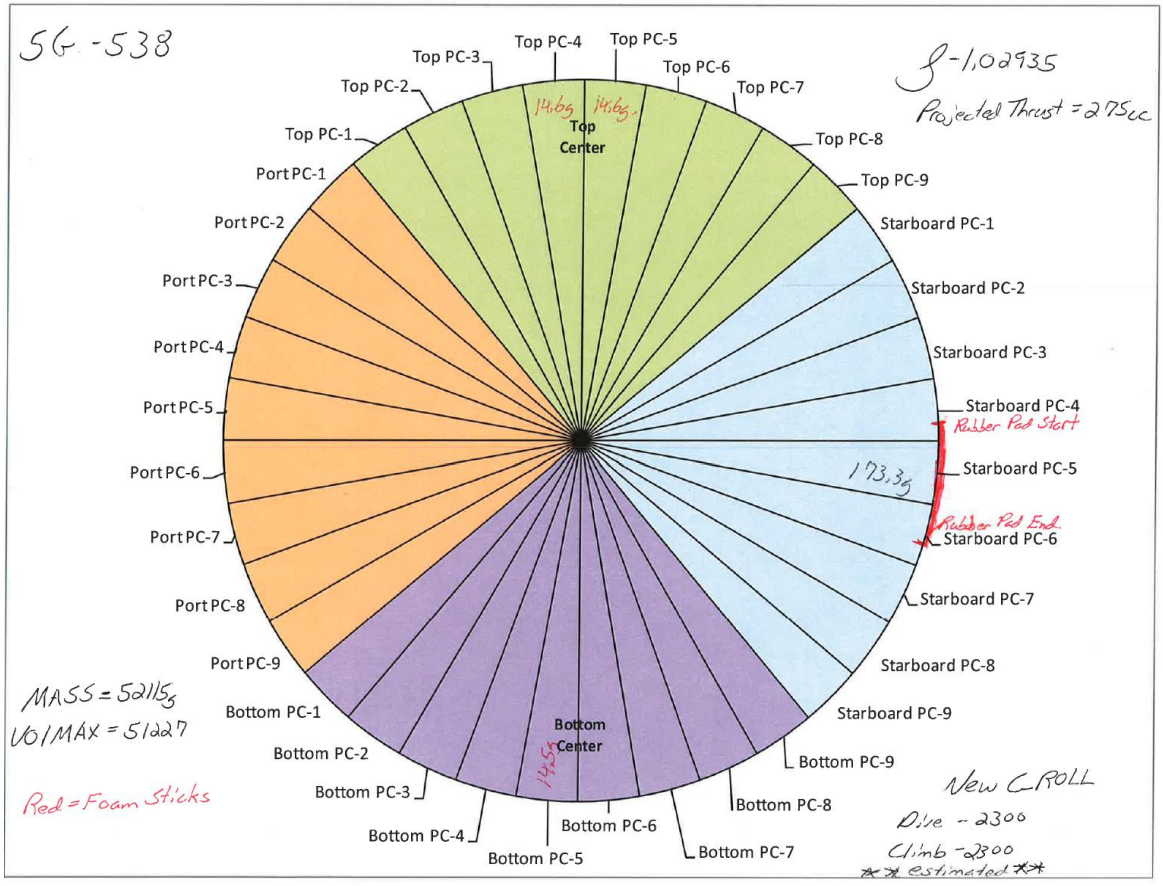
Previous missions showed that this sensor configuration was consuming the 10V battery pack at the same rate as the 24V battery pack so that the 40,5 Ahr hour estimation seems too conservative. However, this mission configuration and consumption estimation was verified by iRobot, indicating we can perform the mission with the remaining batteries.

The mission allows flexibility in sampling frequencies and depths for both WetLabs and Aanderaa sensors (the most consuming ones). This gives a margin to correct excessive 10V battery consumption during the mission.

Ballasting

The expected average density for the waters the glider will dive in is 1029,71 kg/m^3 and current glider's density is 1029,35 kg/m^3. Therefore, there is no need to reballast the glider.

In the next figure it can be seen the pinwheel diagram performed by iRobot showing where the weights and foams are placed on the pupa. Also it shows the glider's total mass (52115 g) and the glider's maximum volume, with oil bladder inflated (51,227), that gives a minimum density for the glider equal to 1017,33 kg/m^3. The final glider density range is from 1025,4 kg/m^3 to 1033,3 kg/m^3. All glider weights and their distribution are shown in (SG Trim).



Pinwheel diagram of ballasting for determining the weights and foams and their location