INFOMAR
Integrated Mapping for the Sustainable Development of Ireland's Marine Resource

Survey report for KRY10_01Dublin Bay, Co. Dublin

For:

Geological Survey of Ireland (GSI)

Suirbhéaracht Gheolaíochta Éireann

&

Marine Institute (MI)

Foras na Mara

July 2010

GSI
Geological Survey of Ireland
Suirbhéireacht Gheolaiochta Éireann

NDP
National Development Plan 2007 - 2013

Marine Institute
Foras na Mara

Executive Summary

Survey operations were focused in DublinBay and Approaches extending from the Howth Head in the north of the bay to DalkeyIsland in the south. DublinBay was surveyed by the RV Keary for the INFOMAR programme on a leg designated KRY10_01 from March to June 2010. This survey was conducted under INFOMAR standards while doing trials on the new vessel. Several calibrations were performed by the INFOMAR team along with the Kongsberg Simrad engineers and the systems were found to be within all standards applied.

INFOMAR: **IN**tegrated mapping **FO**r the sustainable development of Ireland's **MA**rine **R**esource			
Survey Summary			
Survey Vessel:	R.V. Keary	**Survey Leg:**	KRY10_01
MobilisationPort:	Dun Laoghaire	**DemobilisationPort:**	Dun Laoghaire
Survey Area/s:	DublinBay	**Survey Duration:**	16/03/2010 to 18/06/2010
UKHO Admiralty Charts	44 (1:100,000), 1410 (1:200,000), 1411 (1:200,000), 1415 (1:25,000), 1447 (1:7,500), 1468 (1:100,000)		
Key References	KRY10_01 Survey Leg Report		
Survey Statistics			
Minimum Water Depth (LAT):	0.55m above LAT	**Maximum Water Depth (LAT):**	34.98m below LAT
Area Covered:	76 km^2	**Survey Line Kilometres:**	982 km
Number of Groundtruthing Samples:	0		

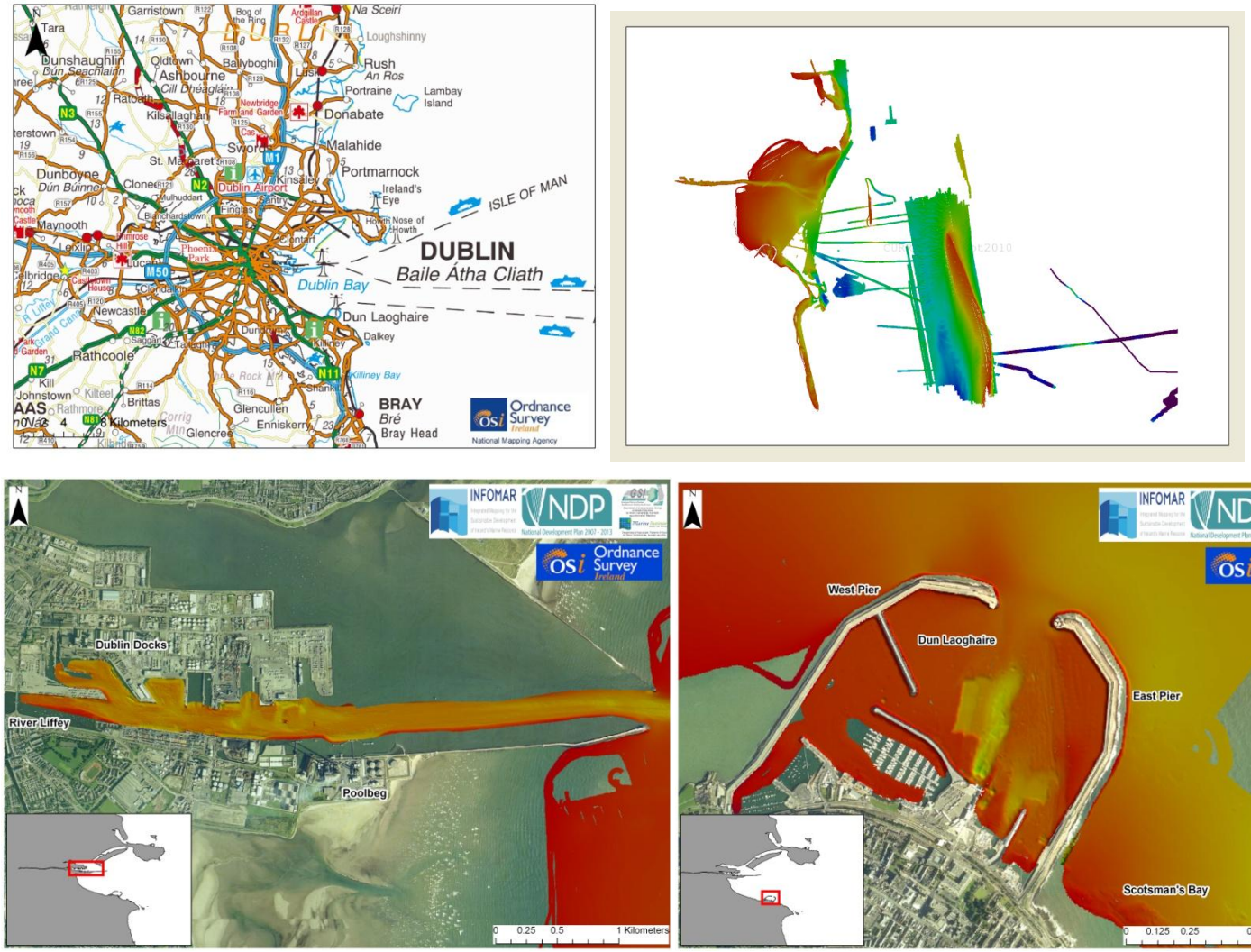


Fig. 1 Highlight Images (Clockwise from Top Left): Overview map of DublinBay; Overview of multibeam sonar coverage achieved from KRY10_01 in DublinBay and Approaches; Detail of coverage achieved in Dun LaoghaireHarbour; Detail of coverage achieved in DublinPort.

Table of Contents

1. Overview

1.1Project Overview

The INFOMAR (Integrated Mapping for the Sustainable Development of Ireland's Marine Resource) project is an equal partnership between the Geological Survey of Ireland (GSI) and the Marine Institute (MI).

INFOMAR is a 20 year exchequer funded, NDP supported programme. Phase 1 of the programme will see 26 priority bays & 3 coastal areas covered between years 2006 – 2015. Phase 2 of the programme will see the remaining Irish marine territories covered between years 2016 – 2025.INFOMAR will produce integrated mapping products covering the physical, chemical and biological features of the seabed.

More information about the project can be found online at www.infomar.ie

1.2 Survey Platform

The RV Keary (call sign is EIGO9) is a purpose-built, nearshore aluminium survey vesselbuilt by Veecraft Marine, Cape Town, South Africa. She is 15.5m in length, 5.6m wide, and she draws 1.9m draft. She is an asymmetrical catamaran, with two 500 HP Cummins engines. She has 2 fuel tanks with total capacity of 2000 Litres. She has a top speed of 23 knots, although her multibeam survey speed is 8 to 10 knots and a sidescan sonar survey speed of 3 to 5 knots.

Fig. 2: Survey platform RV Keary.

Survey equipment includes a Kongsberg Maritime EM3002D multibeam echosounder, anEA 400 Kongsberg Maritimesinglebeam echosounder, anEdgetech shallow seismic Chirp, Marine Magnetics magnetometer, Edgetech side scan sonar and a Georesource 200 seismic sparker. Navigation and Position information is provided by an Applanix POS MV inertial navigation system.

The RV Keary is an aluminium catamaran built specifically for the INFOMAR survey. The vessel is owned and run by the Geological Survey of Ireland (GSI).

Length OA	15.5 m
Length (hull)	14.6 m
Beam (moulded)	5.6 m
Draught	1.7 m
Engines	2 x Cummins QSC 8.3 – 500 INT
Power output	368 kW/2600 RPM
Speed	23 knots
Fuel	2000 lt Diesel
Generator	Cummins Onan 13.5 kva
Max passenger and crew	12 souls

Multibeam and single beam echosounders are synchronised and a ‘chirp’ sub bottom profiler is continuously logged with little interference.

System	Type	Comment
Multi Beam ES	Simrad EM3002D	300 kHz
Single Beam ES	Simrad EA 400	48 & 200 kHz
Chirp Sub Bottom Profiler	Edgetech 216 chirp	2 to 16 khz
Positioning system	POS-MV INS	With PosPac PPP software
Differential GPS	Hemisphere RTCM DGPS	Coastguard broadcast
RTK GPS	Leica GPS	Shore based logging (PPP)
USBL positioning	Sonardyne	
Sound Velocity Probe	AML SVP ‘smart probe’	Mounted with MBES
Sound Velocity Probe	AML SVP	Stationary drop probe
Side Scan Sonar	Edgetech 4200	400 & 600 kHz

1.3 Geodetic Parameters

Geodetic Parameters	
Datum	ITRS89
Spheroid	World Geodetic System 1984 (WGS-84)
Semi-Major Axis (a)	6378137.000 m
Semi-Minor Axis (b)	6356752.314 m
First Eccentricity Squared (e^2)	0.0066943800
Inverse Flattening (1/f)	298.257223563
Local Datum Geodetic Parameters	
Datum	ETRS89
Spheroid	World Geodetic System 1984 (WGS-84)
Semi-Major Axis (a)	6378137.000 m
Semi-Minor Axis (b)	6356752.314 m
First Eccentricity Squared (e^2)	0.0066943800
Inverse Flattening (1/f)	298.257223563
Projection Parameters	
Grid Projection	Universal Transverse Mercator
Central Meridian Zone 29 (CM)	009º West or 003º West (depending on survey site)
Origin Latitude (False Lat.)	00.0°
Hemisphere	North
False Easting (FE)	500000.0 m
False Northing (FN)	0.0 m
Scale Factor on CM	0.999600
Units	Metres

1.4 Survey Vertical Datum

The GSI has been permitted to utilise the UKHO sea surface model known as VORF (Vertical Offshore Reference Frame). This model allows the use of 'GPS tides' and the GSI has gridded this model to a 1km resolution around Ireland to 15km offshore for reducing all soundings to Lowest Astronomical Tide -LAT (VORF).

By utilising 'GPS tides' there is no requirement to adjust for draft or squat as the water level is modelled by VORF over the seabed as measured to the WGS84 ellipsoid.

1.5 Survey Data Work Flow

Data Acquisition Software

Kongsberg Seafloor Information System (SIS)	Version 3.6
QPS QINSy	Version 8.0
Kongsberg Simrad EA400 SBES software	
Edgetec Chirp 3100 software	
Multilog	Version 2.0
MV-POSview	Version 5.1.0.2

Echosounder Settings

MBES data is acquired in "raw.all" format using Kongsberg's SIS software which is also used to control line numbering, R/T Sound velocity and the MBES operational settings including sensor offsets and draft. SBES data is acquired in standard Simrad ".raw" format using default system settings and records depth information on dual frequencies at 38 and 200 kHz. CHIRP data is also acquired using default system settings, and one of four separate frequencies between 3 and 12 kHz.

MBES Settings

Offsets	Sonar offsets entered into SIS software
Draft	Waterline entered into SIS software
Sector Coverage Sonar Head 1	Port 68-70 / Stbd 10
Sector Coverage Sonar Head 2	Stbd 68-70 / Port 10
Coverage (m)	100 / 100 (200m if auto mode activated)
Angular Coverage Mode	Manual (Swath width controlled by outer beams)
Beam Spacing	HIDENS EQDIST (High density equidistant)
Beam Width	Normal
Ping Rate	Highest

Position, Motion, Timing and Online Navigation

Position, motion and timing is provided using the Applanix POS-MV system which outputs position, attitude, and timing information, directly to the EM3002D MBES equipment. The POS-MV is also interfaced with QPS QINSy software which allows it to provide the same information indirectly to the other survey systems onboard. QINSy software is used to control online survey navigation, line planning, autopilot, AIS display and data outputs to other survey systems and software.

2. Survey Operations

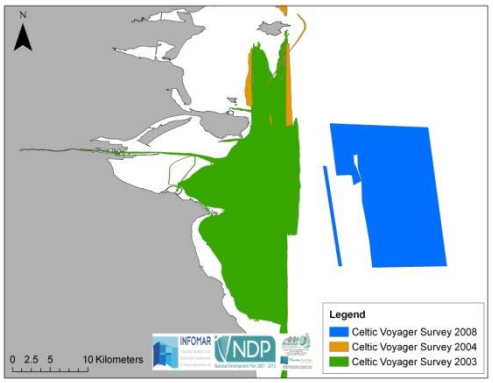
2.1 Survey Extents and Operations

DublinBay and Approaches is situated on the east coast of Ireland in Co. Dublin. The survey area for KRY10_01 extended as much as practicable in the gap in coverage between existing data collected in 2003 by the Celtic Voyager and the coastline. The area surveyed is covered by the United Kingdom Hydrographic Office charts44 (1:100,000), 1410 (1:200,000), 1411 (1:200,000), 1415 (1:25,000), 1447 (1:7,500), 1468 (1:100,000).
DublinBay, an INFOMAR priority bay was covered within this area.

Fig. 3: Location ofDublin Bay, Co. Dublin with the extent of the UKHO Chart 1415 overlaid on KRY10_01 multibeam coverage.

Surveying began on 16th March 2010 with initial surveying concentrated in the outer east side of DublinBay, joining up to the existing CV03_01 data.Weather conditions permitting the Burford Bank was surveyed as this was a shallow gap area within the CV03_01 dataset. The Kish Bank further

east was also surveyed in similar fashion. Finally infill and crosslines were completed with surveying ending on 18th June 2010.



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Details of Surveys in Dublin Bay

Year	Vessel	Leg	Location	Area Covered
2008	Celtic Voyager	CV08_03	Area around the Kish Bank to the east of Dublin Bay	269 km²
2004	Celtic Voyager	CV04_01	Area to the north of Dublin Bay around Howth	438 km²
2003	Celtic Voyager	CV03_01	Outer Dublin Bay and Approaches	198 km²

Remaining areas of Dublin Bay to be surveyed by INFOMAR in the near future

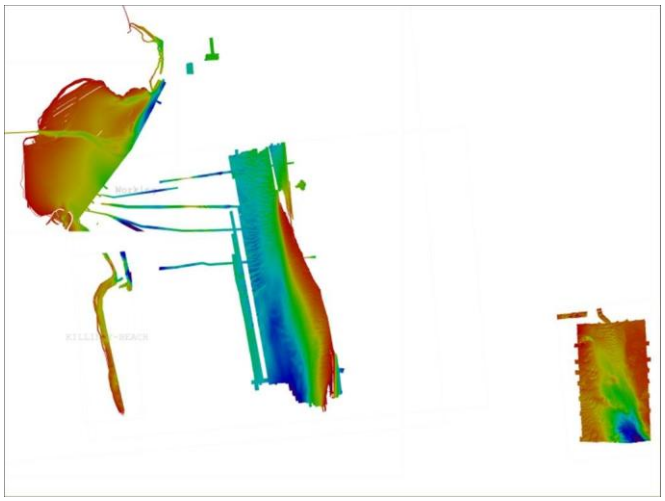

Fig. 4Highlight Images (Clockwise from Top Left): Overview map of Dublin Bay's survey prior to 2010; Coverage achieved by CV03_01, Cv04_01, and CV08_03 in Dublin Bay and Approaches; Detail of coverage achieved in Dublin Bay and Approaches during the KRY10_01 survey.

2.2 Daily Survey Log

Project: INFOMAR			
Survey: KRY10_01 DublinBay			
Vessel: RV Keary			
Duration: 16/03/2010 to 18/06/2010			
Date	**Time (UTC)**	**Event**	**Comment**
16/03/2010	12:27	L0001 to 0002	Surveying (JD075)
23/03/2010	10:42	L0003 to 0012	Surveying (JD082)
25/03/2010	09:47	L0013 to 0021	Surveying (JD084)
12/04/2010	12:02	L0022 to 0025	Surveying (JD102)
13/04/2010	09:45	L0026 to 0035	Surveying (JD103)
14/04/2010	11:16	L0036 to 0042	Surveying (JD104)
15/04/2010	09:38	L0043 to 0053	Surveying (JD105)
16/04/2010	09:38	L0054 to 0071	Surveying (JD106)
	14:00	L9997 - L9998	Wreck survey
19/04/2010	08:42	L0072 to 0093	Surveying (JD109)
20/04/2010	13:58	L0094 to 0112	Surveying (JD110)
21/04/2010	09:14	L0113 to 0119	Surveying (JD111)
			Applanix PC failure - No surveying
22/04/2010	14:47	L0121 to 0125	Surveying (JD112)
23/04/2010	11:30	L0126 to 0134	Surveying (JD113)
09/06/2010	11:30	-	Calibration (JD159)
12/06/2010	11:30	-	Calibration (JD163)
14/06/2010	11:30	-	Calibration (JD165)
15/06/2010	15:03	L0135 to 0148	Surveying (JD166)
16/06/2010	08:45	L0149 to 0182	Surveying (JD167)
17/06/2010	15:03	L0183 to 0245	Surveying (JD168)
18/06/2010	12:13	L0246 to 0259	Surveying (JD169)
	-	-	Finish surveying
21/06/2010	10:30	-	Transit to KinsaleBay

Table 1: Daily log for survey KRY10_01 Dublin Bay and Approaches.

2.3 Equipment Settings, Offsets and Calibrations

Vessel dimension survey parameters from the initial Kongsberg engineer survey were used for offsets values.

2.3.1 POS View Settings

>Lever Arm and Mounting Angles

All fields left blank initially except for 'Ref to Primary GPS* lever arm' where the following inputs were made;

X = 1.855 m
Y = 1.475 m
Z = -2.907 m

* where Primary GPS on the RV Keary is the STBD receiver

>Sensor Level Arms

Following move of IMU, 'Sensor 1' was used to perform level arm corrections for motion measurements to avoid issues with processing True Heave data using the SIS and Caris software combination. For this reason, 'Sensor 1' was configured to be at the same location as the PORT EM3002D head (i.e. Sonar 1 in SIS).

With this configuration, motion coming out on COM2 of the POS is referenced to PORT EM3002D head. Navigation fixes coming out on COM1 are referenced to the IMU location.

The values used to achieve this are;

X = 1.6133 m
Y = -0.3713 m
Z = 3.8472 m

>GAMS Parameter Setup

Values entered in this interface were;

2 Antennae Separation = 3.285
Heading Calibration Threshold = 0.5

>Baseline Vector

Values entered were automatically derived from GAMS procedure;

X = 0.025 m
Y = -3.285 m
Z = 0.0 m

2.3.2 SIS Settings

Nomenclature within SIS;

'Sonar 1' = PORT head
'Sonar 2' = STARBOARD head
X = along ship and positive towards bow
Y = across ship and positive towards starboard
Z = vertical and positive downwards

> Configuration after IMU move

SIS Central Reference Point (CRP) is 'Sonar 1'.

Motion coming in on serial (Attitude COM2) is already referenced to this location by POSview software so no offsets need be applied.
Position coming in over serial (Pos COM1) is referenced to IMU position so offset from IMU to 'Sonar 1' is required.

(i) 'Sonar 1' Configuration (SIS CRP) so offsets are;

X = 0.0 m
Y = 0.0 m
Z = 0.0 m

(ii) 'Sonar 2' Configuration offsets are;

X = 0.044 m
Y = 0.418 m
Z = 0.005 m

i.e. the separation between 'Sonar 2' and 'Sonar 1' (SIS CRP)

(iii) IMU to 'Sonar 1' offset applied to Pos COM1 are;

X = 1.613 m
Y = -0.371 m
Z = 3.847 m

(iv) Waterline

Initially set to zero for several weeks to simplify operations on the helmsman display and safety so that depths seen in SIS were from the transducer head. With time it was noticed that this had a deleterious effect on sound velocity (SV) calculations and so was changed to correct value to avoid refraction issues. These values were;

24/06/2010 10:45 > Draft value adjusted to 1.798 m in SIS
24/06/2010 13:15 > Draft value adjusted to -1.6 m in SIS and EA400

2.3.3EA400 Settings

Draft = 0.0 m (later updated to true value as for SIS waterline above)
Forward (X) = 0.16 m
Downward (Z) = 3.9768 m
Starboard (Y) = 0.1882 m

2.3.4Qinsy Settings

In Qinsy the POSmv IMU remains the CRP for all purposes. On Keary, Qinsy mainly used as a line planning and string forwarding tool with main data logged by instrument specific software.

2.3.5Chirp Settings

The chirp system receives position of CRP (POSmv) over serial from Qinsy with current settings of;

X = 0.06 m
Y = 0.14 m
Z = 3.94 m

2.3.6Calibrations

> Angular Offsets before Calibration

	Roll	Pitch	Heading
Sonar Head 1	29.51	0.05	359.66
Sonar Head 2	-31.17	-0.44	0.02

The nearby wreck site of the Lusitania was chosen as an ideal site to do a calibration on the MBES system with relatively deep water and well defined object on the seabed. The calibration was completed on 29th June 2010 using the SIS calibration tool. The results were as follows;

> SIS Auto Calibration Results

Roll

Head 1	AutoCal	0.03
Head 2	AutoCal	-0.126

Heading

Head 1	AutoCal	0.2
Head 2	AutoCal	0.2

Pitch

Head 1	AutoCal	0.6
Head 2	AutoCal	0.8

> Angular Offsets following Calibration

	Roll	Pitch	Heading
Sonar Head 1	29.54	0.65	359.86
Sonar Head 2	-31.296	0.44	0.22

2.4 GPS Base Stations

2.4.1Overview

Lecia GPS systems (1 x GPS 1200 and 1 x GPS 500) were set up at two independent locations onshore to provide rinex data used to correct POS MV data collected onboard. The GPS systems were set up over control points established using Ordnance Survey of Ireland passive stations. The systems operated on uninterrupted 230 volt mains supply and logged static observations every five seconds for the duration of the hydrographic survey.

2.4.2 GPS Base Stations

For the survey of DublinBay, the GPS systems were located at the Ferry Pier adjacent to the Harbour Masters office in Dun Laoghaire harbour and on the roof of the Geological Survey of Ireland at Beggars Bush in Dublin 4.

Station Name	Station Type	Latitude (DMS)	Longitude (DMS)	Ellipsoid Height (m)
Dun Laoghaire Ferry Pier	GPS Base Station	53 17 49.34186	-6 07 53.05324	60.0564
GSI Roof	GPS Base Station	53 20 09.410673	-6 14 04.456514	85.106

Table 2. Location and co ordinates of GPS Stations used for DublinBay survey.

The control points for the ferry pier at Dun Laoghaire was surveyed using the Ordnance Survey of Ireland (OSI) passive control point D150 on the east pier on Dun Laoghaire harbour. The control point on the roof of the Geological Survey Ireland (GSI) was established on a previous survey.

Station Name	Station Type	Latitude (DMS)	Longitude (DMS)	Ellipsoid Height (m)
Dun Laoghaire D150	OSI Passive Control Point	53 17 36.90995	-6 07 44.32756	61.9542
GSI Roof	GSI Control Point	53 20 09.410673	-6 14 04.456514	85.106

Table 3. Location and co ordinates of the OSI and GSI control point used to establish the GPS base station control points.

2.4.3 DataRange and Quality

Rinex data was exported from each dataset without issues. Dun Laoghaire rinex data was chosen as primary dataset due to its proximity to the survey area and uninterrupted time series.

2.4.4 GPS Control Point Survey Results

Lecia GeoOffice was used to process the baseline GPS surveys of the GPS base station control points. These are presented below;

(a) Dun Laoghaire Ferry Pier

Project Information

Project name:	DunLaoghaire_FerryPier
Date created:	03/15/2010 14:13:31
Time zone:	0h 00'
Coordinate system name:	WGS 1984
Application software:	LEICA Geo Office 7.0
Processing kernel:	PSI-Pro 2.0
Processed:	03/15/2010 14:17:05

Point Information

	Reference: dlosid150	Rover: dlhmp001
Receiver type / S/N:	SR530 / 134137	SR530 / 134094
Antenna type / S/N:	AT502 Tripod / -	AT502 Tripod / -
Antenna height:	1.1770 m	1.0980 m
Initial coordinates:		
Latitude:	53° 17' 36.90995" N	53° 17' 49.32883" N
Longitude:	6° 07' 44.32756" W	6° 07' 53.00457" W
Ellip. Hgt:	61.9500 m	57.1170 m

Processing Parameters

Parameters	Selected	Used	Comment
Cut-off angle:	15°	15°	
Ephemeris type (GPS):	Broadcast	Broadcast	
Ephemeris type (GLONASS):	Broadcast	Broadcast	
Solution type:	Automatic	Phase: all fix	
GNSS type:	Automatic	GPS	
Frequency:	Automatic	Automatic	
Fix ambiguities up to:	80 km	80 km	
Min. duration for float solution (static):	5' 00"	5' 00"	
Sampling rate:	Use all	2	
Tropospheric model:	Hopfield	Hopfield	
Ionospheric model:	Automatic	Klobuchar	
Use stochastic modelling:	Yes	Yes	
Min. distance:	8 km	8 km	
Ionospheric activity:	Automatic	Automatic	

Satellite Selection

Manually disabled GPS satellites (PRNs):	None
Manually disabled GLONASS satellites (Slot Id):	None

Final Coordinates

	Reference:dlosid150	Rover:dlhmp001
Coordinates:		
Latitude:	53° 17' 36.90995" N	53° 17' 49.34186" N
Longitude:	6° 07' 44.32756" W	6° 07' 53.05324" W
Ellip. Hgt:	61.9500 m	60.0564 m

Solution type:	Phase: all fix
GNSS type:	GPS
Frequency:	L1 and L2
Ambiguity:	Yes

Quality:	Sd. Lat: 0.0001 m	Sd. Lon: 0.0001 m	Sd. Hgt: 0.0002 m
	Posn. Qlty: 0.0001 m	Sd. Slope: 0.0001 m	

(b) GSI Roof

GSI Roof control point was established pre-2006 and no processing report exists for the control point.

2.4.5 Data

(i) Raw GPS observations are available at

G:\Tides_GPS_and_Control\GPS_Surveys\RVKeary_GPS_BaseStation_Data\RawGPS_Data\2010\Dublin_Bay

Where G = NTSEABED

(ii) Processed Rinex datasets are available at

G:\Tides_GPS_and_Control\GPS_Surveys\RVKeary_GPS_BaseStation_Data\Rinex_Outputs\2010\Dublin_Bay

Where G = NTSEABED

(iii) Base Station control point survey datasets are available at

G:\Tides_GPS_and_Control\GPS_Surveys\RVKeary_GPS_BaseStation_Data\RawGPS_Data\2010\Dublin_Bay\Dun_Laoghaire_BS_CP_Survey

Where G = NTSEABED

6. Local Contacts

(a) GSI Roof	(b) Dun Laoghaire Ferry Pier
	Dun Laoghaire Harbour Police *
01 6782000	01 2801130

* To access the control point permission was sought from the Harbour Master in Dun Laoghaire and registration on Harbour Police system is necessary. The main desk is in the ferry terminal building where visitor and vehicle passes are issued allowing access to the pier.

3. Data Processing

3.1 Multi beam sonar data

Thesemultibeam echosounder (MBES) data were cleaned to meet Order 1in the bay area and Special Order specification in the Dublin Port approach.

3.1.1 Data Processing Status

>All MBES and SBES data were loaded into Caris into the usual manner.
>All GPS, heave and GPS tide data were processed in the usual manner.
>Cleaning of this data was performed using Subset Editor and new Caris 7 live-updating-grid functionality.

Depths have been reduced to LAT (Lowest Astronomical Tide) as defined in the UKHO VORF package. The horizontal datum is ETRS89.

All data are finalised and available for download from www.infomar.ie.

3.2 Single beam sonar data

All single beam data collected was processed in Caris.

3.3 POS MV navigation and position data

All Navigation data acquired was processed in the usual manner with initial processing using OSI rinex data from active base station in Tallaght, Co. Dublin. Final rinex from INFOMAR base stations data was applied.

3.4 Sound Velocity Profiles

Sound velocity profiles were recorded using a Valeport Monitor sound velocity profiler, recording continuously at 8 Hz through the water column. These profiles are processed in Qinsy and SIS and applied to single beam and multibeam for real-time quality control.

Project: INFOMAR **Survey: KRY 10_01 DublinBay** **Vessel: RV Keary** **Duration: 16/03/2010 to 18/06/2010**					
Date	**Time (UTC)**	**Event**	**Latitude N (DMS)**	**Longitude W (DMS)**	**Water Depth (m)**
16/03/2010	13:14	SVP16032010_1	N/A	N/A	28.7
23/03/2010	11:51	SVP23032010_01	N/A	N/A	10.9
12/04/2010	12:59	SVP12042010_01	N/A	N/A	3.86
16/04/2010	12:09	SVP16042010_01	N/A	N/A	3.8
21/04/2010	10:00	SVP210410_02	N/A	N/A	34.7
23/04/2010	11:53	SVP23042010_01	N/A	N/A	32.2
11/06/2010	10:46	SVP20100611_01	N/A	N/A	27.6
12/06/2010	16:36	SVP20100612_01	N/A	N/A	20.3
15/06/2010	11:00	SVP20101506_01	N/A	N/A	16.7
16/06/2010	10:32	SVP210616_01	N/A	N/A	23.4

Table 4. Dates, times, locations and water depths for sound velocity profiles recovered during KRY10_01.

4. Marine Mammal Observations

The waters of Ireland's Exclusive Economic Zone (EEZ) represent one of the most important cetacean (whales, dolphins and porpoise) habitats in Europe. To date 24 species of cetacean have been recorded in Irish waters.All cetacean species in Irish waters are protected by the Wildlife Act 1976 and Wildlife Amendment Act 2000 and Irish waters, including the EEZ were declared a whale and dolphin sanctuary in 1991. All cetacean species are protected under the EU Habitats Directive with bottlenose dolphins and harbour porpoise listed under Annexe II. This requires the designation of Special Areas of Conservation (SAC's) for their protection.

Qualified Marine Mammal Observers (MMO) recorded cetacean observations during this cruise during daylight operations.In accordance with the Code of Practice for the Protection of Marine Mammals during Acoustic Seafloor Surveys in Irish Waters, a general search (pre-start scan) commenced daily at 0700 UTC for 30 minutes. Having had no sightings of cetaceans during this watch period, a soft start of the multibeam EM3002D (MBES), singlebeam EA400 and pinger commenced at 0730 UTC for approximately 20-25 minutes. During this period there were no sightings and full power of the equipment was reached at the end of the soft start period.

Qualified MMO onboard: Ronan O'Toole

5. Metadata Summary

Survey Name: DublinBay and Approaches

Vessel: RV Keary

Leg Number: KRY10_01

General Area:DublinBay and Approaches extending from the Howth Head in the north of the bay to DalkeyIsland in the south. Seaward to meet existing Celtic Voyager coverage from 2003. All within the extent of UKHO chart 1415.

Start Date:16th March 2010

End Date: 18thJune 2010

Minimum Water Depth:0.55m Above LAT

Maximum Water Depth:34.98m Below LAT

Number of SVP's taken: 5

Datasets Acquired:

> Multi beam sonar data
> Single beam sonar data
> Chirp shallow seismic data

Equipment Used:

> Kongsberg Maritime EM3002Dmulti beam
> Kongsberg Maritime EA400 single beam
>Edgetech 3200XS Chirp shallow seismic chirp
> Applanix POS MV Inertial GPS position and navigation systems
> Valeport Monitor SVP

Sonar Data Processing:

> All processed in Caris 7 with up to date hot fixes

Position and Navigation Data Processing:

> All processed in POSview software version 5.3
> Initial QC using Ordnance Survey of Ireland (OSI) rinex data from established active station in Tallaght, Co Dublin.
> Post processed using rinex from locally established active stations collected using Leica GPS 500 and 1200 systems.

6. Deliverables

6.1 Multibeam echosounder deliverables
> Raw .all files
> Caris project
> XYZ files
> Geotiff images (shaded relief and backscatter)
> ESRI grids

6.2 Singlebeam echosounder deliverables
> Raw SB files
>Processed SB files

6.3Chirp shallow seismic deliverables
> Raw .jsf files

6.4Navigation and Position deliverables
> Raw POS MV files
> Processed Nav files
> Raw GPS observations
> Processed rinex data

6.5Sound Velocity Profiles
> SVP .asvp files

SURVEYAREA	SOL_LAT	SOL_LONG	EOL_LAT	EOL_LONG	MBES_Files
Dublin-Howth	53.35884804	-6.05024165	53.41711579	-6.07961227	0001_20100316_125738_Keary.all, 0001_20100316_122736_Keary.all
Dublin-Howth	53.41725892	-6.07873553	53.38652117	-6.03839662	0002_20100316_131829_Keary.all
Dublin-Howth	53.29866718	-5.98703948	53.21256145	-5.96605874	0014_20100325_101859_Keary.all
Dublin-Howth	53.21166806	-5.95937164	53.32746727	-5.98623203	0015_20100325_110444_Keary.all
Dublin-Howth	53.32723178	-5.98426356	53.21150555	-5.95730191	0016_20100325_120434_Keary.all
Dublin-Howth	53.21172928	-5.95552035	53.32799125	-5.98212949	0017_20100325_131954_Keary.all
Dublin-Howth	53.33029693	-5.98037113	53.21178729	-5.95312254	0018_20100325_141649_Keary.all
Dublin-Howth	53.21224767	-5.95090726	53.32795258	-5.97788264	0019_20100325_153935_Keary.all
Dublin-Howth	53.32849107	-	53.21195042	-	0020_20100325_163155_Keary.all

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Dublin-Howth	53.21318000	-5.94494637	53.32965996	-5.97176302	0023_20100412_131840_Keary.all
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Dublin-Howth	53.20565627	-5.93886452	53.32999323	-5.96760519	0025_20100412_151322_Keary.all
Dublin-Howth	53.32976174	-5.96557277	53.20215920	-5.93612016	0026_20100413_094242_Keary.all
Dublin-Howth	53.20175857	-5.93424876	53.33070200	-5.96383893	0027_20100413_104227_Keary.all
Dublin-Howth	53.32773360	-5.96102221	53.20152824	-5.93161161	0028_20100413_115406_Keary.all
Dublin-Howth	53.20204852	-5.93017081	53.32899436	-5.95935460	0029_20100413_124617_Keary.all
Dublin-Howth	53.32926101	-5.95715896	53.19804511	-5.92675158	0030_20100413_141901_Keary.all, 0030_20100413_135557_Keary.all
Dublin-Howth	53.19836131	-5.92554441	53.33057807	-5.95580417	0031_20100413_145454_Keary.all
Dublin-Howth	53.33406507	-5.93925921	53.31051697	-5.93675806	0032_20100413_160215_Keary.all
Dublin-Howth	53.31041826	-5.92879540	53.31097041	-5.92692844	0033_20100413_161501_Keary.all
Dublin-Howth	53.31301223	-5.93656590	53.29527707	-5.93444287	0034_20100413_163431_Keary.all
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Dublin-Howth	53.40837016	-6.07140714	53.40986315	-6.09620135	0189_20100617_110403_Keary.all
Dublin-Howth	53.41026452	-6.09723142	53.40803893	-6.07161434	0190_20100617_111428_Keary.all
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Dublin-Howth	53.40738659	-6.07153325	53.41048780	-6.09832655	0197_20100617_122529_Keary.all
Dublin-Howth	53.41027038	-6.09821700	53.40734560	-6.07108057	0198_20100617_123530_Keary.all
Dublin-Howth	53.40726230	-6.07085793	53.41202903	-6.09716433	0199_20100617_124456_Keary.all
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Dublin-Howth	53.40690227	-6.07098066	53.41115378	-6.09921551	0201_20100617_130531_Keary.all
Dublin-Howth	53.40637331	-6.08954909	53.40712461	-6.07152220	0202_20100617_131656_Keary.all
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Dublin-Howth	53.41050819	-6.10064385	53.40762306	-6.07109271	0204_20100617_133744_Keary.all
Dublin-Howth	53.40677536	-6.07277076	53.39446809	-6.06656743	0205_20100617_135958_Keary.all
Dublin-Howth	53.39664144	-6.06560515	53.40672781	-6.07131527	0206_20100617_140703_Keary.all
Dublin-Howth	53.40594558	-6.07495292	53.39358201	-6.06833271	0207_20100617_141621_Keary.all
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Dublin-Howth	53.40644605	-6.07577215	53.39340068	-6.06854842	0209_20100617_143244_Keary.all
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Dublin-Howth	53.40637309	-6.07590069	53.39343698	-6.06894637	0211_20100617_145000_Keary.all
Dublin-Howth	53.39342732	-6.06959047	53.40650981	-6.07642711	0212_20100617_145653_Keary.all
Dublin-Howth	53.40548540	-6.07566430	53.39338224	-6.06909267	0213_20100617_150603_Keary.all
Dublin-Howth	53.39446319	-6.06963562	53.40766654	-6.07086077	0214_20100617_151231_Keary.all
Dublin-Howth	53.40615929	-6.07105591	53.40366566	-6.06979817	0215_20100617_152202_Keary.all
Dublin-Howth	53.40410552	-6.06973570	53.40547863	-6.06991196	0216_20100617_152440_Keary.all
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Dublin-Howth	53.40440316	-6.06979708	53.40544552	-6.06977265	0218_20100617_152920_Keary.all
Dublin-Howth	53.40651108	-6.07780696	53.40949073	-6.09723544	0219_20100617_153301_Keary.all
Dublin-Howth	53.40904505	-6.09647575	53.40652587	-6.08892838	0220_20100617_154243_Keary.all
Dublin-Howth	53.40650070	-6.09026673	53.40774792	-6.09791989	0221_20100617_154707_Keary.all
Dublin-Howth	53.40865413	-6.08883584	53.40859326	-6.08187248	0222_20100617_155250_Keary.all

Dublin-Howth	53.40623910	-6.07476667	53.38880470	-6.05327578	0223_20100617_155712_Keary.all
Dublin-Howth	53.38949293	-6.05452692	53.41046716	-6.05589635	0224_20100617_160832_Keary.all
Dublin-Howth	53.40715502	-6.05780723	53.39332782	-6.05586244	0225_20100617_162058_Keary.all
Dublin-Howth	53.39434526	-6.05588420	53.40697723	-6.07212993	0226_20100617_163046_Keary.all
Dublin-Howth	53.40648872	-6.07227377	53.40106097	-6.06914496	0227_20100617_164119_Keary.all
Dublin-Howth	53.39959473	-6.06821869	53.39572642	-6.06420393	0228_20100617_164355_Keary.all
Dublin-Howth	53.39828429	-6.06641541	53.40685024	-6.07251784	0229_20100617_164723_Keary.all
Dublin-Howth	53.40684740	-6.07324560	53.39968165	-6.07086581	0230_20100617_165427_Keary.all
Dublin-Howth	53.40109872	-6.07399817	53.40659342	-6.07602275	0231_20100617_165907_Keary.all
Dublin-Howth	53.40572574	-6.07623365	53.40204954	-6.07412539	0232_20100617_170341_Keary.all
Dublin-Howth	53.40356004	-6.07603208	53.40589751	-6.07615172	0233_20100617_170700_Keary.all
Dublin-Howth	53.40405149	-6.07620472	53.40196766	-6.07489419	0234_20100617_171005_Keary.all
Dublin-Howth	53.40610774	-6.07703054	53.40642822	-6.07722442	0235_20100617_171211_Keary.all
Dublin-Howth	53.40593146	-6.07303142	53.39801925	-6.07079951	0236_20100617_171600_Keary.all
Dublin-Howth	53.40136773	-6.07110557	53.40604272	-6.07330953	0237_20100617_171926_Keary.all
Dublin-Howth	53.40497618	-6.07296023	53.40019104	-6.07124982	0238_20100617_172535_Keary.all
Dublin-Howth	53.40122405	-6.07156662	53.40672600	-6.07362087	0239_20100617_172945_Keary.all
Dublin-Howth	53.40615706	-6.07391023	53.40270082	-6.07193063	0240_20100617_173417_Keary.all
Dublin-Howth	53.40202516	-6.07204721	53.40648678	-6.07446851	0241_20100617_173707_Keary.all
Dublin-Howth	53.40600717	-6.07408619	53.40485152	-6.07363262	0242_20100617_174144_Keary.all
Dublin-Howth	53.40542925	-6.07138583	53.40677532	-6.07160446	0243_20100617_174350_Keary.all
Dublin-Howth	53.40344295	-6.07093519	53.39228436	-6.05927200	0244_20100617_174623_Keary.all
Dublin-Howth	53.39248742	-6.05883916	53.39484219	-6.06704663	0245_20100617_175340_Keary.all
Dublin-Howth	53.33182029	-6.07480147	53.34591414	-6.22670540	0246_20100618_121339_Keary.all
Dublin-Howth	53.34590836	-6.22554203	53.34209483	-6.14749117	0247_20100618_125622_Keary.all
Dublin-Howth	53.34231749	-6.14709612	53.34608600	-6.22688926	0248_20100618_132551_Keary.all
Dublin-Howth	53.34592875	-6.22671681	53.34451912	-6.19787007	0249_20100618_135335_Keary.all
Dublin-Howth	53.34458944	-6.20266629	53.34625339	-6.21038520	0250_20100618_140753_Keary.all
Dublin-Howth	53.34529552	-6.21227639	53.34458658	-6.21685309	0251_20100618_142540_Keary.all
Dublin-Howth	53.34485731	-	53.34829551	-	0252_20100618_145915_Keary.all

		6.20867869		6.22195398	
Dublin-Howth	53.34805114	-6.22199266	53.34574663	-6.22270706	0253_20100618_150622_Keary.all
Dublin-Howth	53.34534595	-6.22212535	53.34817118	-6.22068055	0254_20100618_151354_Keary.all
Dublin-Howth	53.34810770	-6.22049275	53.34415704	-6.20937181	0255_20100618_152004_Keary.all
Dublin-Howth	53.34355787	-6.20793210	53.34122918	-6.14995296	0256_20100618_154029_Keary.all
Dublin-Howth	53.34389280	-6.14461250	53.34394483	-6.20476075	0257_20100618_160915_Keary.all
Dublin-Howth	53.34374260	-6.20007911	53.34383731	-6.19684302	0258_20100618_162812_Keary.all
Dublin-Howth	53.34433109	-6.19696819	53.34106917	-6.14947761	0259_20100618_163843_Keary.all

Appendix A: List of cetacean species recorded in Irish waters.

Atlantic White-Sided Dolphin	*Lagenorhynchus actus*	co / os / br
Beluga	*Delphinapterus leucas*	va / arc
Blue Whale	*Balaenoptera musculus*	uc / os / se
Bottlenose Dolphin	*Tursiops truncatus*	co / br
Common Dolphin	*Delphis delphis*	co / br
Cuvier's Beaked Whale	*Ziphius cavirostris*	uc / os
False Killer Whale	*Pseudorca crassidens*	uc / os
Fin Whale	*Balaenoptera physalus*	co / se
Gervais' Beaked Whale	Mesplodon europaeus	va / st
Harbour Porpoise	*Phocoena phocoena*	co / is / br
Humpback Whale	*Megaptera novaeangliae*	ra / se
Killer Whale	*Orcinus orca*	sp / br$^{?}$
Minke Whale	*Balaenoptera acutorostrata*	co / br$^{?}$
Northern Bottlenose Whale	*Hyperoodon ampullatus*	uc / os
Northern Right Whale	*Eubalaena glacialis*	va / os
Pilot Whale (long-finned)	*Globicephala melas*	co / os / br
Pygmy Sperm Whale	*Kogia breviceps*	uc / os
Risso's Dolphin	*Grampus griseus*	co / br
Sei Whale	*Balaenoptera borealis*	uc
Sowerby's Beaked Whale	*Mesplodon bidens*	uc / os
Sperm Whale	*Physeter macrocephalus*	co / os / br$^{?}$
Striped Dolphin	*Stenella coeruleoalba*	uc / os
True's Beaked Whale	*Mesplodon mirus*	uc / os
White-Beaked Dolphin	*Lagenorhynchus albirostris*	uc / os

co – common; os – offshore species; br – breeds in Irish waters; va – vagrant; arc – arctic species; uc – uncommon; se – seasonal; st – known only from strandings; is – inshore species; sp – sporadic.