KINGDOM OF BAHRAIN
NATIONAL REPORT
ERSAHC 2014

Introduction

The Kingdom of Bahrain is an independent Arab State situated centrally on the southern shores of the Arabian Gulf, with the mainland of Saudi Arabia on the west and the peninsula of Qatar on the east.

Kingdom Of Bahrain Statistics

Bahrain is an archipelago of over 33 islands and island groups which cover a total area of 702 km^2. It has territorial waters of some 10,000 $km^{2,}$ much of which are generally shallow and contain many coral reefs. Bahrain have two ports, Mina Salman which is located south of the capital city of Al Manama and the new Khalifa Bin Salman port (KBSP) on the eastern side of Al Muharraq. A natural channel leads from the central Gulf to this main port.

In 1992 Bahrain became a member of the International Hydrographic Organization (IHO). The Kingdom of Bahrain Hydrographic Survey Directorate (HSD) has to date surveyed some 65% of the Exclusive Economic Zone (EEZ).

The Hydrographic Survey Directorate (HSD)

The Hydrographic authority for Bahrain was established in 1978 as a Section within the Survey Directorate of Ministry of Housing. But since

2008 the Hydrographic Section became a Directorate within the Survey and Land Registration Bureau.

The Hydrographic Survey Directorate (HSD) main duties include traditional bathymetry, tidal analysis and tidal stream measurement within the territorial waters of Bahrain and producing appropriate charts for the EEZ.

(HSD)Activities

Since the mid 1990ties all hydrographic data have been transformed into digital format. The Directorate has approximately 95% of all data needed for chart production in some type of digital form and uses a comprehensive pool of networked PCs during its data processing and quality assurance/control. As a member in IHO and the United Nations it is its role to provide safe water passage for all ships approaching our ports according to UN resolution regarding International Law of the Sea especially Safety of Life at Sea (SOLAS).

(HSD) Core Business

To secure International Maritime Safety through its obligations to IMO, to publish charts, tide tables, tidal stream atlas, and survey the Exclusive Economical Zone (EEZ) of Bahrain including the Bahrain Approach Channel.

Improve Bahrain's Infrastructure & Economy by ensuring safe navigation, monitoring of sand projects and reclamation

Assist National and International stakeholders by providing customised charts and tidal data, and by quality assurance of private surveys. Approximately 80% of non oil goods is imported to and exported from Bahrain by sea. Bahrain, and Khalifa Bin Salman (KBSP) Port in particular, is well-positioned geographically to serve, and compete with ports in Oman, Dubai, Abu Dhabi & Dammam, as a centralised regional hub for large and

small container shipping. The largest Panamax container ships will require a draft of 13-14m, and the approach channel is currently being dredged and upgraded to accommodate these. HSD has a critical role in this infrastructure expansion by overseeing international marine obligations to ensure safe navigation within its waters, including the approach channel, ports and holding areas. HSD is currently the only Bahrain Authority with the mandate, authority, certification and capability to carry out these tasks.

1. International Commitments

- **International Hydrographic Organisation (IHO) – membership,**
- **Participate in IHO regional hydrographic commission RSAHC (ROPME Sea Area Hydrographic Commission)**
- **International Centre for Electronic Navigational Charts (IC-ENC) – membership through UKHO**
- **United Kingdom Hydrographic Office (UKHO) – 5 year agreements**
- **United States Naval Office (NAVO)/National Geospatial Intelligence Agency (NGA) - 5 year agreement on sharing resources.**

2. Products

HSD currently produces:

- **12 charts in digital and hard copy**

Chart No.	Title	Published	Scale	Datum
1501 INT7258	Mina' Salman and Approaches	New Edition Feb 2012	1:15000	WGS 84
1502 INT7259	Mina Manama and Approaches	New Edition Feb 2012	1:15000	WGS 84
1503 INT7261	Khalifa Bin Salman Port	New Edition Feb 2012	1:15000	WGS 84

2001	**Sitra to Umm Jalid**	**New Edition Feb 2012**	**1:20000**	**WGS 84**
2502	**Hawar**	**Mar 2004**	**1:25000**	**WGS 84**
5001	**Sitrah to Tighalib**	**New Edition Feb 2012**	**1:50000**	**WGS 84**
5002	**Hidd Al Jamal to Hidd Al Theeb**	**New Edition Dec 2008**	**1:50000**	**WGS 84**
5003	**Al Baynah al Saghirah to Ra's Al Barr**	**New Edition Feb 2012**	**1:50000**	**WGS 84**
1509 INT7255	**Approaches to Bahrain**	**New Edition Feb 2012**	**1:50000**	**WGS 84**
5006	**Hayr Shutayah to Khawr Fasht**	**New Edition May 2011**	**1:50000**	**WGS 84**
6501 INT7254	**Outer Approaches to Bahrain**	**New Edition Feb 2012**	**1:65000**	**WGS 84**
10001	**Khawr Fasht to Janan**	**New Edition Feb 2012**	**1:10000**	**WGS 84**
P700	**Tide Tables**	**Annual Updating**		
P701	**Tidal Streams Atlas**	**Sep-97**		
P702	**Symbols, Abbreviations & Terms Used on charts - Chart 1**	**Apr-06**		

- **Electronic Navigation Charts (ENC) 1501, 1503, 5006, 6501 to IHO S57 Standards**
- **Customised Charts, soundings, tidal and water temperature data**
- **Annual Tide Tables**
- **Tidal Stream Atlas**
- **Chart 1 – Symbols, Abbreviations & Terms Used on Charts.**
- **List of Lights – can be produced from database**
- **List of Underwater obstacles – can be produces from database**

- **List of Corrections to Charts – can be produced from database.**
- **In connection with the upcoming dredging of the Approach Channel HSD is working on the production of 4 new large scale charts to improve the mariners' safety.**

HSD forwards ENC data cells to IC-ENC, who market these data to 6 VARs (Value Added Resellers) that sell the data to worldwide customers.

In contrast to paper charts, ENC's are sold as a license, which means that they are renewed each year. This license renewal is undertaken by IC-ENC.

HSD has an agreement with the UKHO for selling paper chart adapted by the UKHO in their chart portfolio. For this HSD is paid a royalty fee from UKHO.

3. Work Program

- **Update and production of Electronic Navigation Charts (ENC)**
- **2500sq km from N Bahrain to the Iran Maritime Border (approx 2 years). Most properly it will be outsourced.**
- **Resurvey of the Approach Channel (approx 60km x 260m) following phase 2 dredging and route alteration.**
- **Northern waters around Bahrain's north coast in coordination with USACE for Bahrain ring road project and GCC Rail link project.**
- **Resurvey of all Bahraini waters with new equipment.**
- **Sub bottom profiling survey around Bahrain to chart the sand resources**

4. Equipment, Technology, Software

The survey boats Al Masaha and Al Masaha 2 are operational. Al Masaha 1 is sold as it became obsolete and non-operational. Access databases have been developed by HSD to accommodate data and integrate with CARIS software. Multi-beam Echo Sounders have been used in partnership with the US Navy to produce comprehensive (100%)

bathymetry of port areas and Approach Channel until March 2010 when a R2Sonic 2022 system was purchased and installed in Al Masaha. A joint survey with US Navy was conducted in November 2012 at few navigationally critical areas. CARIS HIPS (Hydrographic Information Processing System) software is used for the processing of multi-beam and single beam data. CARIS GIS is used for production of paper charts. CARIS S57 Composer is used to convert paper chart information to vector- based Electronic Navigation Charts (ENC). Presently HSD is using the Caris Bathy Database system for bathymetric management. In 2012 an Applanix POS MV system was installed in Al Masaha

4.1 R2Sonic

The R2Sonic Multi-beam was commissioned on board Al Masaha March 2010 which meets the criteria of undertaking the survey operations around Bahrain territorial waters to the highest IHO standards. Specially designed for use in water depths up to 200 meters R2Sonic Multi-beam echo sounder is ideal for bathymetric surveys and for use in support of Dredging operations. (Operating at the frequency 200 KHz – 400 KHz). The Multi-beam can accurately measure a profile area of sea floor across the width that is 3.5 times the measured water depth.

4.2 Sub Bottom Profile (SBP)

It is commissioned on onboard Al Masaha in 2010 along with the R2sonic MBES. An extensive sand search survey has been planned to be undertaken from 2013 to map the natural resources of Bahrain.

5 Bahrain Tidal Network (BTN)

The objective of the BTN is to obtain tidal data anytime and anywhere within Bahrain Waters. Currently 3 tide gauges have been installed, with plans for an eventual 12 gauges covering the entire coast of Bahrain. The tide data would be made available online for prospective customers and HSD would have access to all these tide stations through SLRB website. The installation of this system is going to take place in April 2014.

(BTN) Benefits

- **Total tidal coverage of Bahrain coastal water.**
- **Data collection and organizing through website.**
- **Provides access to authorized users through Internet.**
- **Providing private sector & governments authorities with necessary information.**
- **Updating SLRB data base and nautical charts.**

(Local) Beneficiaries

- **Bahrain Metrological Directorate.**
- **Bahrain Coast Guard.**
- **Ministry of Interior.**
- **Royal Bahrain Navy.**
- **Bahrain Defense Force.**
- **Public Commission for the Protection of Marine Resources, Environment and wild life.**
- **General Directorate of Environment & Wild life Protection.**
- **Marine Resources & Fisheries Directorate.**
- **University of Bahrain.**
- **Ministry Of Information.**
- **Arab Shipbuilding & Repair Yard (ASRY)**
- **Bahrain Petroleum Company (BAPCO)**
- **Aluminum Bahrain Company (ALBA)**
- **Gulf Industrial Investment Company (GIIC)**
- **Gulf Petrochemical Industries Plant (GPIC)**

International Beneficiaries

- **Gulf cooperation Council (GCC).**
- **Other Arab Countries.**
- **International Maritime Community**

- **Maritime business Companies.**
- **Foreign Companies for Survey, Construction, Dredging/Reclamation, Oil exploration.**

6 Inter-tidal Zones – LIDAR & Satellite Bathymetry

Bahrain has approximately 1000sq km of inter-tidal zones. International boundaries are defined by the low astronomical tidal line (LAT). The surveying of these zones by conventional single beam echo sounder is slow, limited by tidal access and short (3 hours) tidal windows in a fortnightly cycle. These areas could be more comprehensively surveyed using Light Detection & Ranging (LIDAR) and Satellite Bathymetry combined with tidal data. Bahrain is planning to obtain data for the complete inter tidal zones and near shore areas using these methods.

7 Staffing including Recruitment & Training

Staffing in hydrography is dependent upon the oil prices; it can be almost impossible to recruit/compete when oil prices are high. The requirement for Hydrographic and Senior Hydrographic Surveyors is now critical both for operations and succession planning.

HSD is divided into 2 divisions, Marine (Seagoing) and Production (Office).

8 FUTURE WORK

Bahrain Hydrographic Survey Directorate (HSD) with the assistance of the maritime related international organization and friendly countries is progressing well. The proposed survey for the next two years effectively would be updating the bathymetry in the Approach channel (after dredging (planned 2014). The other immediate project will be undertaking sand search for obtaining marine resources data for reclamation. HSD will also assist other governmental authorities in their projects in the marine environment.