

MARIDAN APS

PRODUCT SPECIFICATION – MARIDAN 600



Maridan Specification

WHAT IS AN AUV ?

Autonomous Underwater Vehicles (AUVs) are unmanned, self-powered vehicles without any cable connection to the surface. The vehicles are without the need for externally applied signals or any tracking by a support vessel. The MARIDAN AUV is a high-tech free-swimming robot that can collect survey data and undertake inspections. It functions as a platform for carrying sensors in the most cost-efficient way.

The MARIDAN AUV is designed to be flexible: suitable for a wide range of underwater missions covering both civilian and military requirements. On a completely autonomous mission the vehicle performs a pre-programmed survey. Alternatively, the vehicle can be observed with an operator control through an acoustic link to the support ship within a distance of 2 kilometres. The communication channels provide the operator with continuous vehicle status. Since an acoustic modem cannot provide stable communication under all conditions, the system is designed to take on different transmission options e.g. the system can be switched from high to low data rate. The positioning of the AUV is transmitted in all “send message” updates.



When developing the AUVs, Maridan takes into consideration all the requirements of the possible customers.

APPLICATIONS

The MARIDAN AUVs offers high quality data. The deployment sea state is 5 and the recovery sea state is 6. The vehicle is designed for several applications, including:

- Offshore oil and gas field surveys
- Mineral field surveys
- Telecommunication cable route surveys
- Offshore pipeline pre-lay route surveys and post-lay inspections
- Military surveys
- Wind mill park construction surveys
- Search & Recovery
- Oceanographic surveys

VEHICLE DESIGN

The MARIDAN AUV is designed as a fully autonomous vehicle suitable for a wide range of applications with a depth rating down to 600 m. The design has been based on the adoption of state-of-the-art AUV technology, combining aerospace and high industrial standards and specifications.

The MARIDAN AUV is a hydrodynamic design with a low-drag, flatfish shape. The design was selected to give the vehicle a large deck area for down-looking sensors and to give exceptional stability in pitch, roll and heading for critical measurement applications. The vehicle can be equipped with front ailerons and an overall control system that provides high responsiveness (i.e. fast lift) for obstacle avoidance and terrain following when flying close to the bottom.

The modularity of the AUV has been accomplished by designing a hull, where emergency drop weight, batteries, computer systems, payload, launch and recovery system, propulsion system and buffer battery are located. Furthermore, the electronics are housed in sealed compartments, thereby ensuring that the vehicle can survive a partial flooding. The

Maridan Specification

electronic compartments are pressure tubes connected by wetcables into which both power and signals are combined to reduce the overall number of cables and hence reduce both the cost and the risk of leakage.

In its current configuration, the vehicle length is 4.5 m and the dry weight of the vehicle, including batteries and standard payload sensors, is 1,700 kg. The central payload bay is designed to allow most payloads to be mounted flush within the profile of the vehicle. The payload bay is large enough to easily accommodate additional instruments.

The modularity of the vehicle helps Maridan and the customers obtain easy maintenance and repair. It makes it easy to replace a defected element without taking apart the entire AUV. The modular network also allows for easy upgrade of software components. Additionally, the modularity makes it easier to transport the vehicle.



NAVIGATION SYSTEM

The MARIDAN AUV is equipped with a high-performance, Doppler-inertial positioning system known as MARPOS®. The system provides outstanding performance in terms of positioning, navigation and attitude control.

At the heart of MARPOS® is a strap down inertial platform including a 3-axis ring-laser-gyro with a triad of high performance single-axis pendulous accelerometers to provide inertially derived position, velocity, attitude and attitude rate in all six axes of linear and rotational freedom. Once initialised, the MARPOS® provides high accuracy position and attitude data and, although a robust self-contained system in its own right. The system can be used in

conjunction with Long Baseline (LBL), Ultra-Short Baseline (USBL) and Synthetic Long Base Line (SLBL) (patented system by Maridan) acoustic positioning systems moored to the seabed.

ACCURACY

The positioning accuracy of MARPOS® is dependent on the accuracy of the initial position fix provided to the system. The initial position fix must be provided after diving to commence the mission proper. It can be provided autonomously by MARPOS® or by an external acoustic positioning system depending on the depth and the accrued inertial drift error during the dive.

The position error relative to the initial position fix depends on the survey pattern as well as geographic latitude, updating intervals and the time available for a priori calibration of the system at the surface prior to the dive. For a "Lawnmower" survey pattern, performing the turns bound the sensor drift. For a linear survey pattern, with a minimum of dynamic input to the INS, the accuracy is heavily dependent on the DVL aiding provided to the INS.

The MARPOS® system offers a position accuracy of 0.03% of the travelled distance.

In addition to reporting precise position and attitude data MARPOS® provides high integrity motion data to the Autopilot ensuring a precise path following system for the AUV.

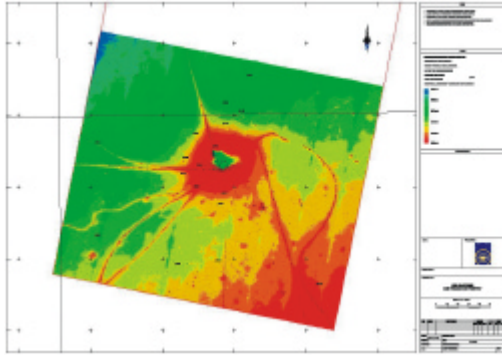
PAYLOAD

MBE

The Reson SeaBat 8125 is a wide-sector, wide-band focused multi beam sonar ever to be deployed. Utilising 240 dynamically focused receive beams, the system measures a 120° swath across the seafloor, detects the bottom, and delivers the measured ranges at a depth resolution of 6 mm. The unit measures a swath width of 3.5 times the water depth, when in depth of 0 to 60 meters



Maridan Specification



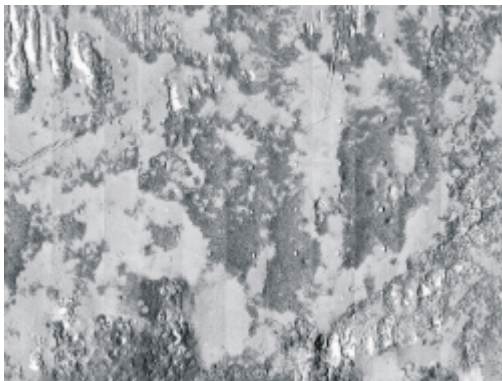
SSS

The side scan sonar is a digital, single beam, simultaneous dual frequency 100 kHz/500 kHz nominal (120 kHz, $\pm 10\%$ / 400 kHz, $\pm 10\%$ actual) from the Klein 2000 series.

The usable range on 100 kHz will be in excess of 300 m range, depending on environmental conditions.

The usable range on the 500 kHz will be in excess of 100-meter range, with maximum range depending on the environmental conditions.

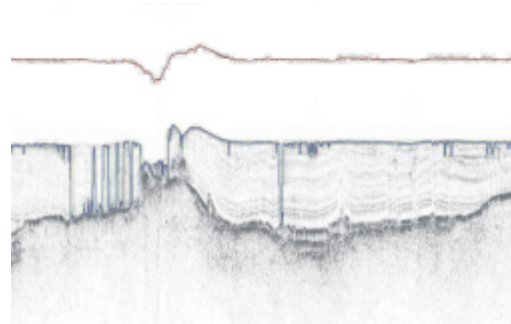
The sonar system operates with true simultaneous ensonification by discrete 100 kHz and 500 kHz transducer elements combined in a single array.



SBP

The modified GeoAcoustics GeoChirp is a sub-bottom profiling system for high-resolution shallow geophysics, combined

with state of the art electronics with standard proven technology. The chirp uses advanced frequency modulation (FM) and digital signal processing (DSP) techniques to attain good penetration of the sub-bottom layers and achieving higher resolution. The system uses frequencies 2- 7 kHz for high penetration and 1.5 – 11.5 kHz for penetration.



SENSOR INTEGRATION

All of the vehicle's information is organised in and distributed through a dynamic database, which provides a well-documented interface for adding payloads ("Payload Plug and Play"). The Blackboard data representation (database where all of the vehicle's sensors share information) allows the input of position information from the sensor payloads to the navigation PC. Furthermore it allows vehicle status information to be sent to any of the on-board sensor processors. When the MARIDAN AUV surfaces, the file of complete survey data can be transmitted to the operator's PC using an Ethernet connection.

All payload sensors are PC-based and equipped with a hard disc drive to maintain their own logs. An optional Payload Control hard disc can store files of survey data. All logs can be retrieved off-line after the survey or during a "hot swap" battery exchange; using a 10 Mb/s radio based Ethernet.





SUMMARY SPECIFICATION

Speed Range	0.5 – 4.0 knots
Survey Speed	3.0 knots
Current Range (Side and Counter)	3.0 knots
Minimum Speed	0.5 knots
Turn Radius	15 m
Maximum Operational Depth	1500 m
Survey Endurance	7 hours (Lead Acid Batteries) with all payload systems active. 20 hours (D-Cell Alkaline Batteries) with all payload systems active.
On Deck Turn Around Time	½ hour
Primary Navigation Sensors	MARPOS® is an inertial navigation system with a Velocity Doppler Log, DPGS, CTD and Pressure sensor.
Secondary Navigation Sensors	Synthetic LBL, LBL and USBL
Data Transfer	Acoustic modem, 12 kHz
Mechanical Layout	Modular
Altitude Keeping – Flat Terrain	± 0.5 m
Operating Modes	Fully Autonomous, Remote Controlled
Emergency Systems	ARGOS Pinger Strobe Light VHF Beacon Emergency Pinger (USBL type) Drop Weight
Handling System	Standard 20 feet containers are used for both AUV and batteries. A 30 ton metre crane.
Support	24 hours hotline support. 24 hours at site support at all areas in the North Sea, Gulf of Mexico and along the Pacific Rim. 36 hours at site support in rest of the world.
Payload Instruments	Client specific

MARIDAN Aps
Agern Alle 3
DK-2970 Hoersholm
Denmark

[Phone] +45 45 76 40 50 - [Fax] +45 45 76 40 51

[Web] www.maridan.dk - [E-mail] maridan@maridan.dk