Hydro-Lek Ltd

Press Information

April 2013

HyBIS – providing a versatile and cost-effective platform for deep ocean operations

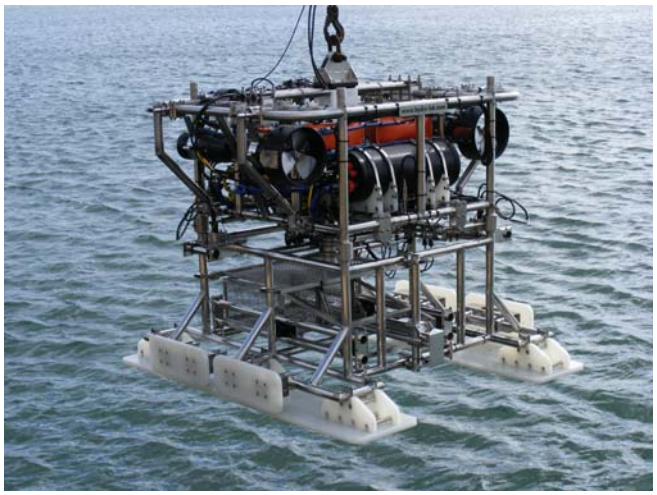
HyBIS is a simple, cost effective and highly versatile, manoeuvrable underwater platform capable of deployment to 6000m.

A mnemonic for Hydraulic Benthic Interactive Sampler, HyBIS is manufactured by remote tooling specialists, Hydro-Lek in England. It is designed to operate in conjunction with existing deck handling and cable systems carried by most research and survey vessels.

The HyBIS concept was originally developed in collaboration with the National Oceanographic Centre (NOC) in Southampton to survey and interact with the deep-ocean floor without recourse to expensive and complex work-class ROV technology and specialist crew. Unlike a conventional ROV, HyBIS does not have any floatation, rather it is suspended by its umbilical cable directly from the ship with the advantage that it can recover or deploy a payload up to its own weight of 750kg.

Measuring 2.2m high by 1.4m wide by 1.5m long, HyBIS is a fully modular 'plug and play' system comprising two modules: the **Command Module** which carries the power management, cameras, lights, hydraulics, thrusters and telemetry; and a variety of lower hydraulic and mechanical **Tooling Modules**. Currently these consist of a sampling grab; a manipulator and tool sledge; a winch for instrument recovery; and an ocean bottom seismometer (OBS) and Ocean Bottom Electromagnetic receivers (OBEM) deployment module. All tooling modules are able to be separated on command,

allowing the tool module or payload to be accurately deployed or, in the event of an emergency, jettisoned.



HyBIS showing Hydro-Lek 5-function manipulator in stowed position

The Command Module

The Command module is an open-chassis structure with a footprint of 1700 x 14500mm and height of 930mm and carries all hydraulic and electrical power and distribution. Fabricated from 316-grade tubular stainless steel, the cross-braced open-frame structure ensures an even spread of the load across the chassis that in turn forms the template for the docking system to which the various tool modules are attached. The suspension point is adjustable in two horizontal axes to allow for changes in centre-of gravity when different tool modules are attached. Attached to the command module are two 3-phase thrusters, two hydraulic power packs, two hydraulic valve packs, two dry space pods, an oil-compensated transformer, three cameras, several lights and a hydraulic pan and tilt system.

Electrical Systems

The system is operated from a 7Kw 380-440V single phase power source at the surface via the umbilical cable. All 3-phase power and control supplies for lighting and instrumentation are contained in 6000msw housings. Two reversible thrusters, which are oil-filled and pressure compensated, produce 40 kg of thrust from 1.5Kw motors and are generally able to provide a radius of operation of between 10% and 3% of water depth. HyBIS control is via a fibre optical link which carries all command telemetry for remote operation of all hydraulic and electrical functions

including switching for cameras and other ancillary equipment including television cameras and lighting.

The Tooling Modules

Bulk Sample Module

The basic tool module comprises a clam-shell grab with a 0.3 cubic metre capacity for collecting samples of small rocks or seafloor sediments with a 30cm penetration depth. Fabricated from aluminium with stainless steel semi-circular braces around the outside of each shell, the grab has a footprint of 0.5 square metres (1000cm by 50 cm). It is mounted in an open chassis fabricated from 316 stainless steel tubing and stands 900cm tall. Its upper square frame docks with the lower square frame of the command module via the hydraulic release pins allowing for it to be jettisoned if required. Four hydraulic rams drive the grab shells with a closure force of 30,000N.

The grab module has been used by NOC to collect geological, biological, gas and other chemical samples from over 40 separate sites. In 2010, scientists used HyBIS on an expedition in the Cayman Trough to locate and study a new species of shrimp at a depth of 5 kilometres which they named Rimicaris Hybisae after the vehicle they used to discover them

Hydro-Lek Manipulator module

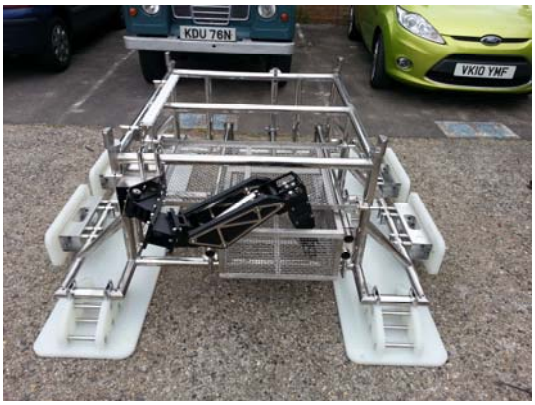
HyBIS can be adapted to deploy a manipulator for seafloor recovery or research applications.

Hydro-Lek has developed a tool sledge module in conjunction with the NOC which comprises a Hydro-Lek 5-function manipulator arm and a retractable sample tray which has rollers top and bottom on both sides that are located within tubular rails. Fabricated from stainless steel and surrounded by stainless steel mesh, the tray retracts into a 'drawer' with a stainless steel mesh top. This ensures that the samples are fully secure within the retracted tray to prevent their loss or damage in the splash zone when the HyBIS is being recovered.

.

Attached to the front lower starboard side of the Tool Sledge is the HLK-RHD5 five function manipulator arm with an 80kg lifting capacity (when actuated with 160bar hydraulic pressure) at its full reach of 943cm. It has a continuous 360° rotating jaw with embedded 12mm diameter cable cutter. The arm is located on a slew plate, mounted 15° from horizontal, such that the arm can reach the sea floor in a 270° arc in front of the vehicle as well as reaching upwards to within 30°

from vertical. Because our hydraulic valve packs do not have flow control, we reduce the operating hydraulic pressure supplied by one of the two valve packs to 60bar. This enables relatively slow, and hence fine, control of the manipulator arm and jaw. The option remains to activate the second hydraulic pump, which is set to 100bar, to increase the capabilities of the arm's functions allowing heavier lifting capacity and jaw closure pressure.



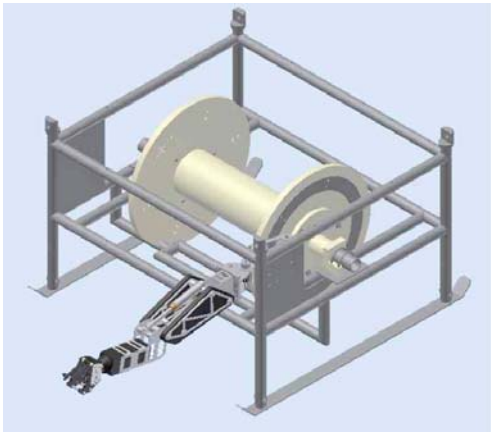
HyBIS Manipulator Module

As in all tooling modules, the hydraulic hoses attached to the manipulator arm are connected to the Command module by 'Quick Disconnect' fittings to ensure fast, uncomplicated interfacing.

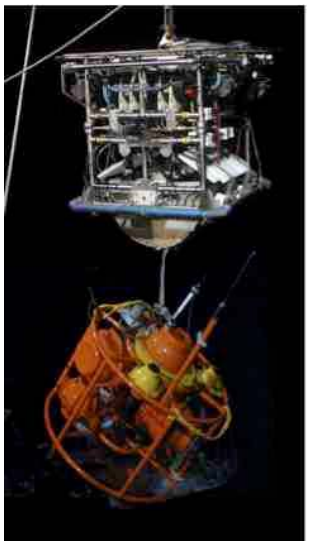
Instrument Recovery Module

HyBIS has also been required to recover relatively heavy instruments from the sea floor. One of these was a 4 tonne benthic observatory deployed in 400m of water in the Arctic. Limitations set by the vessel operators for this task includes a restriction on deployment of more than one umbilical cable to be deployed over the side of the ship at any one time. As a result, a solution was developed that would involve the HyBIS Command module deploying a Lander Recovery module carrying a passively-driven drum of 600m-long lifting with a 4000kg SWL and 200,000N breaking strain. The Lander Recovery module was fabricated in 316 stainless steel tubing forming an open chassis structure. It was fitted with a Hydro-Lek HLK-HD5 five function manipulator arm from the Tool Sledge module that carried a lifting hook, attached to the jaw of the arm via a T-bar, and spliced onto the lifting warp. This warp was then attached to the 4 tonne lander and the HyBIS instrument recovered to the ship while the lifting warp spooled off from the drum. The drum had both a friction clutch and a restriction on the spooling of the lifting warp to ensure the warp remained tightly wound on the drum. In the event of the lifting warp fouling causing the vessel to become anchored

to the lander via the HyBIS vehicle, two options were retained: the capacity to cut the lifting warp with the manipulator arm cable cutter or to jettison the entire Lander Recovery module.



Isometric view of the Lander Recovery module showing the position of the five function manipulator arm and the passive recovery line drum. The drum carries 600m of 20 tonne lifting warp attached to a steel lifting hook and latch.



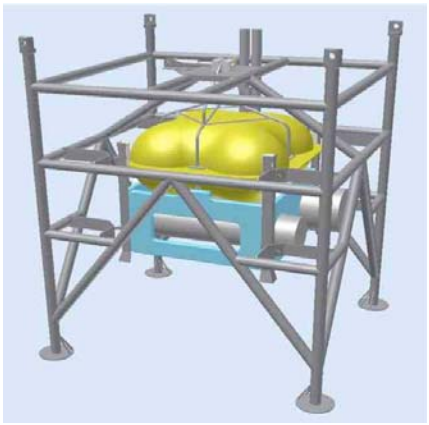
The *Myrtel* lander after being recovered by the HyBIS from a depth of 2200m.

HyBIS has had prior experience with recovering landers, but not as heavy as the 4 tonne one in the Arctic. In 2008, on its first trials cruise, HyBIS recovered a benthic lander from 2200m of water in a location off the coast of Tenerife. This lander was a long-term monitoring system with CTD and acoustic Doppler current profilers (ADCP) as part of its expensive scientific payload. It was designed with two independent acoustic releases and glass sphere buoyancy such that it should have jettisoned its anchor weights and returned to the surface on command. Unfortunately, at the end of its trial mission, the lander failed to release its anchors and became stuck on the sea floor. By

acoustically ranging to its sonar transponders, its position on the sea floor was triangulated to within a few tens of metres. Deployed from a non-DP ship, the HyBIS vehicle managed to sweep a path towards the lander's position and located it after a search across 500m of seabed.
Although the HyBIS was only equipped with its grab module, a line and grapple was attached to the lander and the entire assembly recovered to the surface, thus salvaging equipment of roughly similar value to the HyBIS itself.

OBS & OBEM Deployment Module

Like the other modules, the OBS Deployment module is an open-frame chassis comprising 316 tubular stainless steel and attached to the Command module via the four-point docking release system. The module was specifically designed to deploy ocean bottom seismometers (OBS) and electromagnetic receivers (OBEM). These instruments have a common footprint size and rely on an anchor weight to hold them to the seafloor attached to glass floatation via an acoustic and timed release system to return them to the surface.



Isometric drawing of the Deployment module for NOC showing the position of one of the OBS instruments carried in its delivery position. The EMR instruments are taller and have four antennae extending from the mid-point of the instrument, hence the tall nature of the deployment module. A hydraulic ram and pin holds and releases the instruments from a position at the top of the module. Like the other modules, this one also attaches to the HyBIS command module via the four docking plates and release pins located at each corner.

Traditionally seismometers have been randomly dropped from the side of a ship into the ocean. However, modern geophysical studies require instruments to be placed on solid parts of the seabed, with a precise position and preferred orientation. The challenge for HyBIS was to deploy a module that would enable the instruments to be positioned on the seafloor, navigated by Ultra-Short Baseline (USBL) transponders, and placed on level, and well consolidated parts of the sea floor. A 100mm stroke cylinder was implemented at the top of the Deployment module forming a

retractable rod through which the bottom instruments are held. Once a suitable area of sea bed is located, and the position is acceptable, then the HyBIS rotates (via its thrusters) until the instruments are oriented in the required way. The hydraulic ram is then activated and the pin withdraws, releasing the instruments onto the sea floor. Post emplacement inspection than confirms the orientation and coupling of the instruments to the sea floor.

Based on the success of HyBIS to target, and accurately position and orientate deep sea instruments, GEOMAR Helmoltz Centre for Ocean Research in Kiel have commissioned a new HyBIS for further seabed mining exploratory research.

HyBIS with OBS deployment module for Geomar (left) and NOC (right)

Docking Interface System

To meet the requirements to control a variety of tools, HyBIS has a built-in hydraulic latching mechanism controlled via the command module which allows different tooling options to be deployed. Four hydraulic cylinders are positioned at each corner of the lower module to act as a release mechanism for the various tooling modules .

Detail showing the hydraulic release mechanism for various tool modules

Surface Control Console

Interaction with the HyBIS is through the Surface Control console, providing the HyBIS pilot with an open view of the HyBIS environment and the controls to enable accurate manoeuvring of the vehicle. Four video streams can be received simultaneously by the console and displayed on an integrated widescreen showing one video stream full screen, or all four streams in a split-screen format, Positional data including heading, depth and GPS sits next to critical system information such as voltage and hydraulic pressure on a comprehensive on-screen status bar.

All the information received by the console from the subsea module is converted into video format and stored by a digital video recorder allowing more than 300+ hours recording. Recorded data can then be transferred via a USB stick to a PC for easy documentation and reviewing.

For control, an intuitive joystick box plugs into the console to give precise control over the positional thrusters, hydraulics, lights and cameras and includes safety key-switches to ensure safe operation. Enclosed inside a medium sized ruggedized, splash-proof case protects the Surface Control console against the elements found on-board making it thoroughly fit for use in marine deployments.

Figure 9: Hydro-Lek's Portable Surface Control Console for HyBIS

As a result of its small footprint and relatively simple configuration, HyBIS requires only two operators, making it both cost effective and readily accessible to the scientific community. Unlike a conventional ROV which involves a team of specialists, operation of the HyBIS usually requires just a pilot (usually a scientist) and winch driver (usually a ship's crew member).

The versatility of HyBIS has been repeatedly demonstrated by the NOC who have used HyBIS on over 100 dives during the last 4 years it has been in service. It's most notable achievement was in 2009 when it was used to discover, film and sample the world's deepest hydrothermal vents - ***some 6,000m deep*** **-** in the Cayman Trench. These vents are considered to be the highest pressure, hottest and most copper-rich seafloor hydrothermal systems known to date.

About Hydro-Lek

Hydro-Lek is a leading supplier of remote handling systems for the subsea, nuclear and defence industries. Products range from simple hydraulic components to fully integrated telemetry-controlled remote manipulator systems for integration onto ROV's and remote access platforms. The company employs a team of experienced design engineers to provide a specialist turnkey project engineering and build service from its facilities in Berkshire England. Hydro-Lek's durable lightweight and inexpensive manipulators are currently used worldwide on a wide range of ROVs and manned submersibles for different applications.

Ends.

For further information please contact:

Wendy Glover
PR & Communications
Hydro-Lek Ltd
Falcon House
Ivanhoe Road
Hogwood Lane Industrial Estate
Finchampstead
Berkshire
RG40 4QQ
Tel +44 (0) 118 9736903
Mobile +44 (0) 7795 243998
Email: enquiries@hydro-lek.com

www.hydro-lek.com

Kenneth Cast
Sales Director
Hydro-Lek Ltd
Falcon House
Ivanhoe Road
Hogwood Lane Industrial Estate
Finchampstead
Berkshire
RG40 4QQ
Tel +44 (0) 118 9736903
Mobile +44 (0) 756 8129179
Email: enquiries@hydro-lek.com

www.hydro-lek.com

Authors:

Dr Bramley J Murton, Senior Geologist, National Oceanography Centre, Southampton, England

Wendy Glover, PR/Marketing Manager, Hydro-Lek Ltd, Finchampstead, Berkshire, England