



International Submarine Engineering Limited

ISE ROV TOOLS

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1 INTRODUCTION

A list of recommended tools, applications and supplier is provided below. For ISE tools please see the attached brochure. For other manufactures, please see the suggested website.

General Use:

1. Cutter (Soft line) - ISE
2. Cutter (Hard line) - ISE
3. Grinder/Wire Brush – ISE
4. Jetting /Cleaning Pump – ISE

Offshore/Construction:

5. Seal Insertion/Removal Tools - ISE
6. Hot Stabs & Manifold – Oceaneering (www.oceaneering.com)
7. TornadoTorque Tool – Oceanworks (www.oceanworks.com)
8. Flying Lead Orientation Tool - Oceanworks (www.oceanworks.com)
9. BOP Actuating Tool – Specialist ROV Tooling Services (www.specialistrov.co.uk)

Survey/Cable Detection

10. Multibeam Profiling Sonar - Imagenex Delta T (www.imagenex.com); and Boom - ISE

Cable Laying

11. Jetting Skid - ISE



Figure 1: Hysub 130 with Science Skid and Hyperbaric Isothermal Clathrate Sampler

2 MODULARITY, INTERCHANGEABILITY AND INNOVATION

The value of an ROV is increased by its adaptability to different missions and its ability to conduct the most work in a single dive with the greatest efficiency. ROV transit time to and from operating depths are typically non-productive stages of a dive, so the ratio of transit time to time at depth must be minimized. Hence the more work that can be accomplished within a single dive, the greater the value of the configuration.

ISE provides this value by offering spare hydraulic valves and dedicated tooling valve packs to drive hydraulic tools. Spare analog, digital, and serial I/O channels are available for providing electrical power and control. Isolated HPU circuits (10-25 hp typical) are also available for tooling. This will prevent contamination of the main hydraulic circuit used for propulsion.

Tools and toolsleds are optimally configured to suit mission objectives and are interchangeable with minimal effort. Tools can be mounted on the ROV mainframe, a manipulator, or in a toolsled. Hydraulic power is available through quick release fittings. Bolt-on attachment points are easily accessed by the open frame architecture.

Toolsleds provide an extension of the ROV and are also available as integrated mission packages. ISE tools and toolsleds are supported by the provision of surplus electric and hydraulic power; and computer I/O channels in analog, digital and data formats.

Some of the more common tools available from ISE are described in the following paragraphs. Tools not found here can be made available upon request, or custom designed to fit specific requirements. ISE's innovative staff, combined with their extensive experience in subsea operations provides the capability required for developing methods and tools to solve mission task problems.

3 TOOL VALVE PACKS

ISE offers valve packs for providing hydraulic feeds of variable pressure and flow to hydraulic tools.

Valve packs are available to house solenoid, rate, servo and proportional valves of various sizes. The manifolds are powered by 24 VDC (nominal) and controlled through RS232 or RS485 interfaces.

We have provided many different configurations to customers over the years and can deliver whatever meets the requirements.

Our most versatile tooling valve pack includes 7 valves divided into two banks, which can be set at separate pressures. The flow through the valves can be controlled individually. Pressure feedback is provided to the control system.

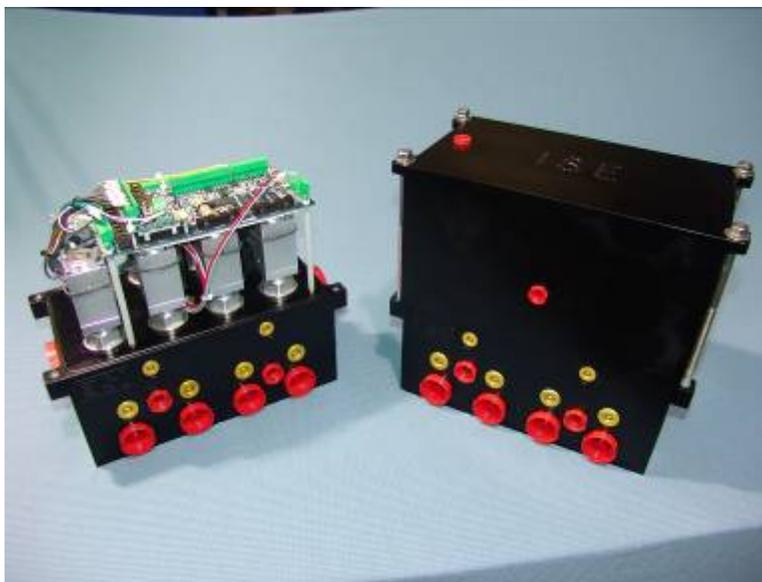


Figure 2: ISE Typical Tool Valve Pack

4 TOOLS

4.1 Basic Work Tools

Work tools are valuable to assist manipulators in accomplishing tasks. A good inventory of these inexpensive tools is recommended to enhance an ROV's productivity. The following sections list some basic work tools that ISE provides.

4.1.1 Hooks and Toggles

Hooks and toggles are used for manoeuvring lines and cables. Typical items are shown at the right.

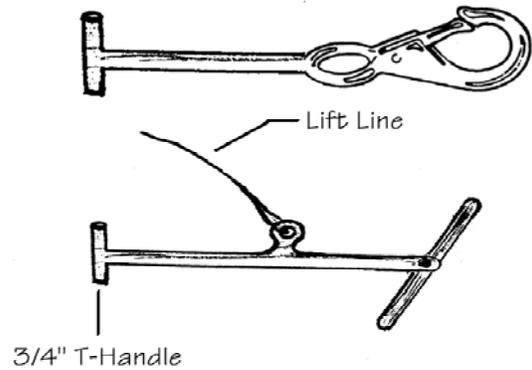


Figure 3: Hook and Toggle

4.1.2 T-Handle Tool Adapters.

T-handle tool adapters assist the manipulators with manoeuvring objects. Examples of tool adapters are shown below.



Figure 4: Valve Tool Adapter



Figure 5: T-handle Tool Adapter

4.1.3 Grippers

Gripping tools are designed for an ROV to grip and lift steel cables from the ocean floors. While these tools operate hydraulically, mechanical locks can also be provided.



Figure 6: ISE Parallel Jaw Gripper

4.1.4 Softline (Rope) and Wire Cutters

A typical softline cutter and cable cutter is shown below. The cable cutter is a modified part from Webtool (<http://webtool-subsea.com>).



Figure 7: Typical Cable Cutter (38mm)

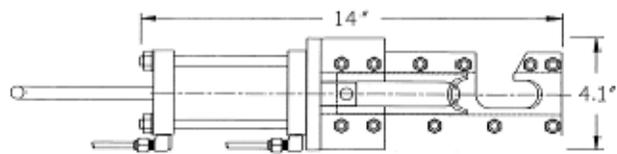


Figure 8: Typical Softline Cutter (1000 psi)

4.1.5 Grinders and Wire Brushes

ISE modifies Stanley Grinders (<http://www.stanleyhydraulics.ca>) for fit with the ROV and manipulator. The Stanley GR29 Grinder is used for top, face, and side grinding using 9 inch (228.6 mm) diameter wheels. Wire brushes can also be used and depressed-center wheels with an optional adapter. A general arrangement of the modified grinder is provided below. The Grinder input is 140 bar @ 34 lpm.



Figure 9 Modified Stanley Grinder with ire Brush

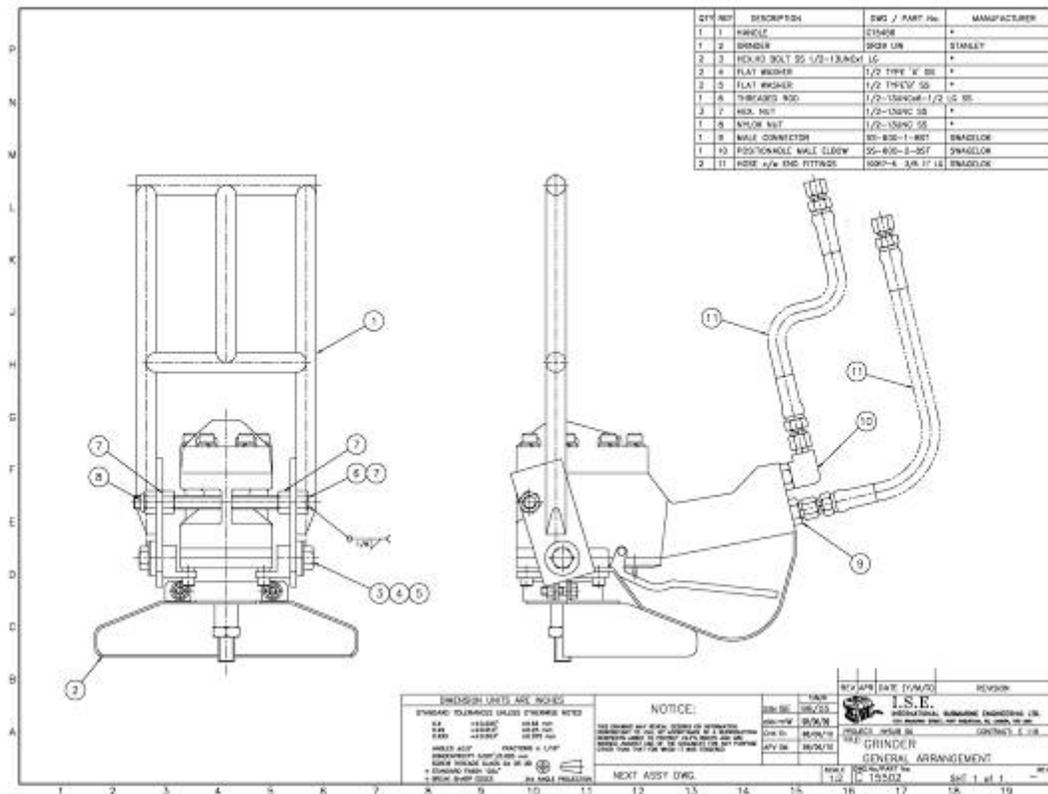


Figure 10 Grinder General Arrangement

4.1.6 Pumps

ISE provides water jet pumps and dredge pumps. Water jet pumps help with loosening and breaking clay in the seabed; specifications for a typical 15 hp pump are: input 172 bar @ 15 lpm; output 3 bar @ 300 lpm. See also section 0 for information on specialized Jetting Skids.

A dredge pump (30 hp typical) with a 2"-3" diameter hose and suction nozzle direct the loosened seabed away from excavation area.

ISE pumps are based on the trash pumps from Stanley Hydraulic Tools (www.stanleyhydraulics.ca). A pressure intensifier is added to raise the pressure for the jet pump.

4.2 Specialized Tools

4.2.1 Seal Installation Removal Tool

Seal installation and removal tools are available for various seals sizes. Typical Arrangements for these are provided below.

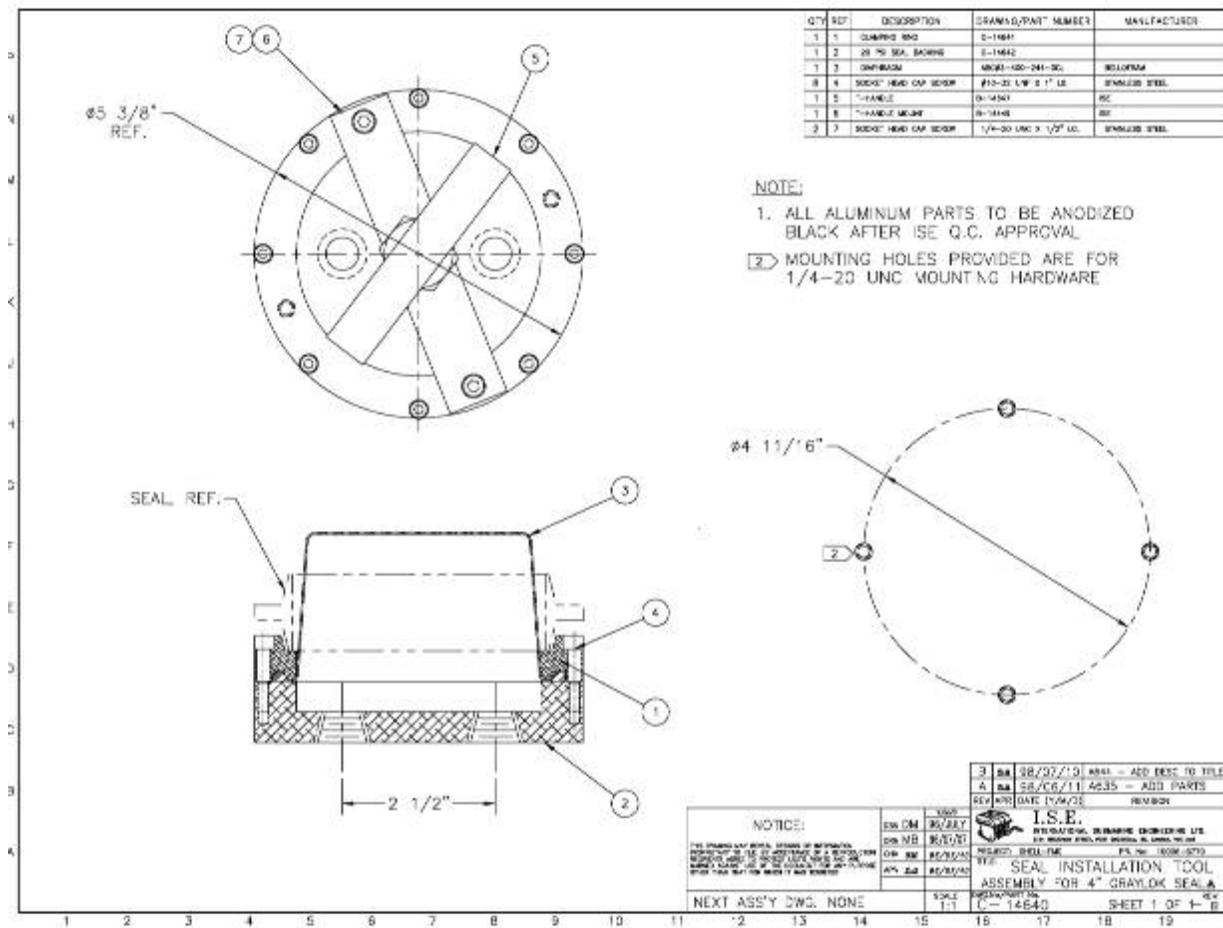


Figure 11 Typical Seal Installation Tool

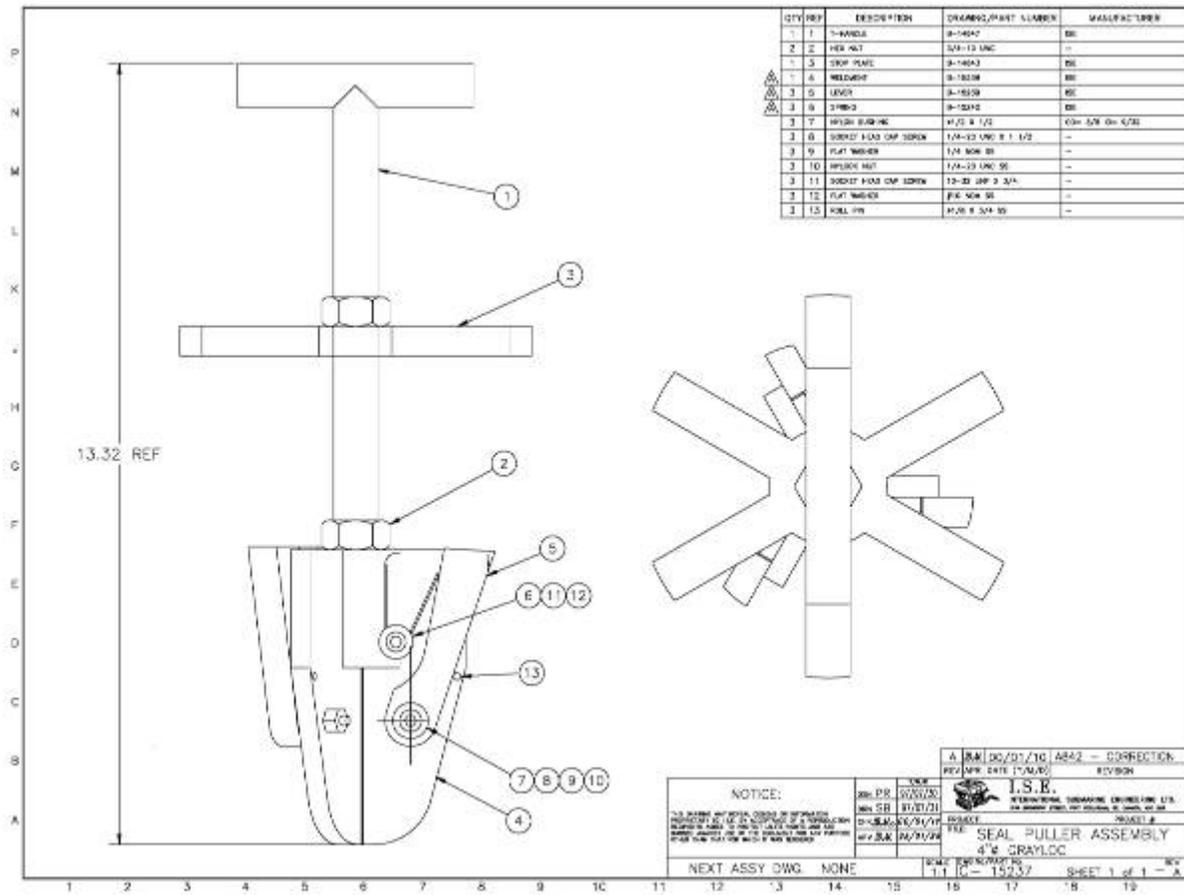


Figure 12 Typical Seal Puller Tool

4.2.2 Recovery Clamps

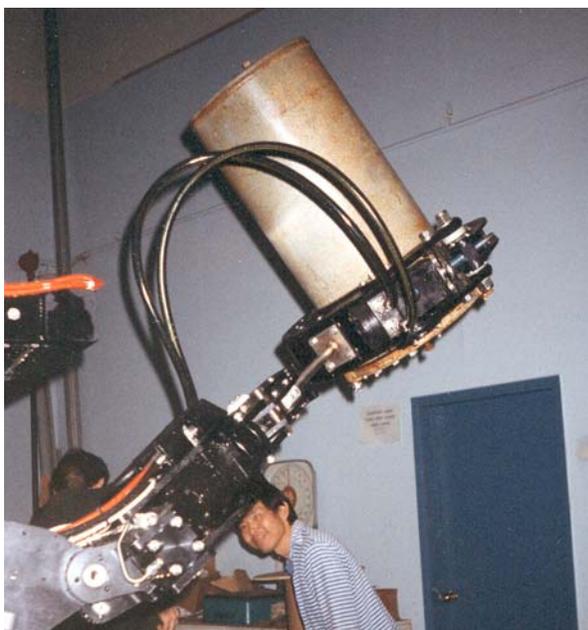


Figure 13 Submarine Rescue Pod

ISE provides clamps of various sizes to suit the mission requirements. The clamps are actuated by worm drives or hydraulic cylinders, and are controlled using ISE's Magnum Manipulators.



Figure 14 Torpedo Recovery Clamp

4.3 Science Tools



Figure 15 Push Core Sample

ISE offers a variety of tools to assist in science expeditions, including benthic and resource sampling.

Examples of science tools available are:

- conductivity, temperature, depth (CTD) sensor;
- sample collection drawer;
- push core and quiver;
- tube (push) core rack (quiver) to hold up to 6 samples (30 cm length);
- high flow suction samplers;
- 5-bucket carousel rotary samplers (1.5 l);
- 12-bucket 5 l rotary sampler;
- detritus Samplers – two racks of two units which are mountable on the swing arms; and
- gas collector (six ports).



Figure 16 CTD Sensor



Figure 17 Push Core Rack

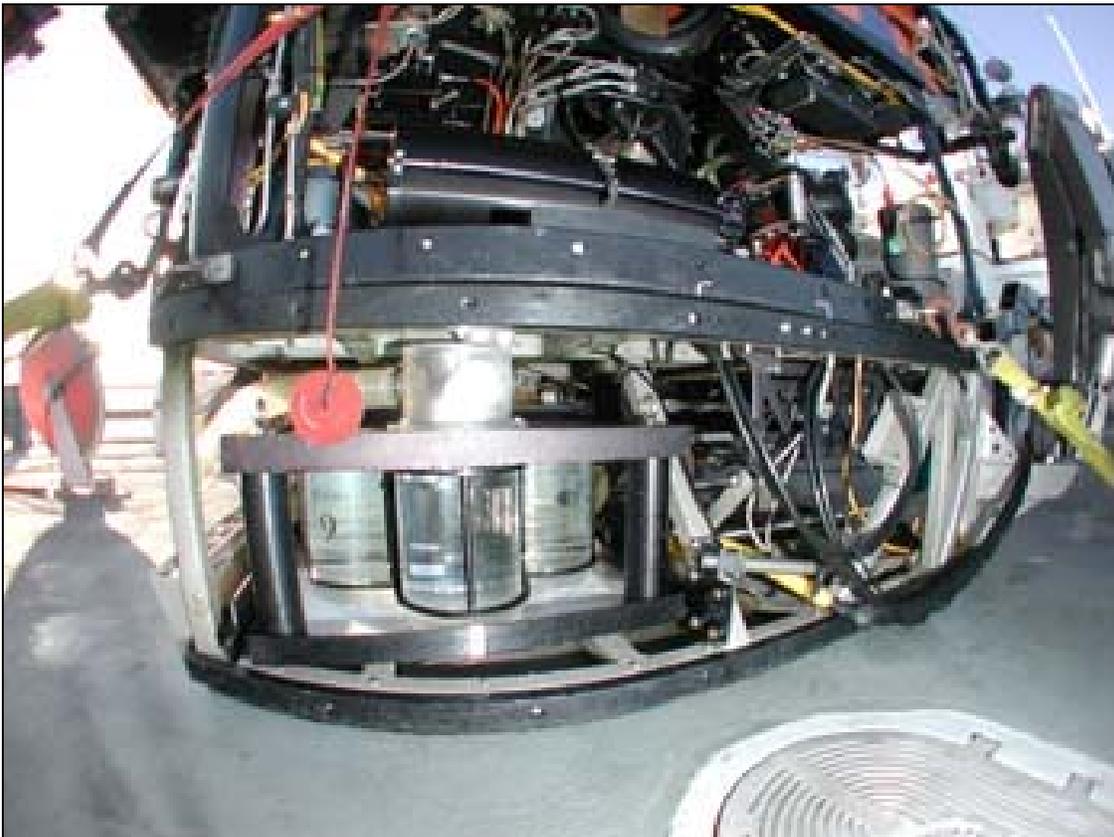


Figure 18 Five Carousel Suction Sampler

4.4 Isothermal Hyperbaric Clathrate Sampler

Designed for science/research, ISE's proprietary Hyperbaric Isothermal Clathrate Sampler (Clathrate Sampler) is the newest in ISE's suite of recovery equipment and tools.

Gas hydrates are deposits of frozen methane located on or under the deep ocean floor. Highly recognized as an alternate source of energy, the frozen gas hydrates are collected by way of the Clathrate Sampler's unique and successfully designed hyperbaric isothermal chambers.

The Clathrate Sampler provides a stable environment for transporting pressure and temperature sensitive Clathrate formations from the sea floor to the surface. Each hyperbaric chamber maintains up to 4000 meters of sea water pressure on a push core sample. It is also insulated to ensure thermal stability of the sample during ascent and while the assembly is removed from the ROV when on deck.



Figure 19 Hyperbaric Isothermal Clathrate Sampler

5 SLEDS & SKIDS

5.1 Sledframe Options

ISE offers sled frames to suit the customer's need, optimized for flexible mission configurations.

5.2 Populated Sled Options

The customer can choose frames and the tools to populate it. Examples of sled options are described below.

5.2.1 Drill Core Sleds

Drill core sleds are available for drilling into clay or rock, allowing access to otherwise unreachable samples. Drill core sleds are custom designed, depending on the ROV configuration and type of seabed.

5.2.2 Benthic (Seafloor) Sled

Benthic sleds are equipped with the tools needed for surveying the Benthic environment. These sleds typically house the following equipment:

- A sample collection drawer.
- Two swing arms.
- Detritus samplers – two racks of two units which are mountable on the swing arms.
- Tube (push) core rack to hold 6 samples (30 cm length), mountable on the swing arms or front of sample collection drawer.
- Space and mounting to accommodate second rack of two detritus traps or a second 6-sample tube core rack.
- A high flow suction sampler with a 5-bucket carousel rotary sampler (1.5 l), or a 12-bucket 5 l rotary sampler.
- Gas collector (six ports).
- One low-light camera with integrated pan and tilt for viewing sampling operations.
- Quart halogen lights as required.
- Quick connections to supply power and control.
- Space and mounting for two Isothermal Hyperbaric Clathrate Samplers.

Images of some of the tools that are included with the benthic sled in are provided in section 4.3. The detritus, suction and push core sample containers are sealable, transparent, and accessible by camera for visual inspection of acquired samples. If an individual sample is not satisfactory it may be discarded and a new sample taken. The sample collection drawer can be configured to hold water or drain upon recovery as dictated by the objects that are collected. This selection is manually configured at the beginning of a dive.



Figure 20 Hysub 130 with Science Sled Fitted with Sample Drawer

5.3 Jetting Skids

ISE provides jetting skids to suit the customer requirements. The jetting skid shown here is equipped with the following main components:

- Low pressure high volume pump
- Skid valve pack (to drive hydraulic cylinders for jet leg position)
- Mounting for manipulators (alternate from main ROV frame)
- Two center mounted jet legs with vertical and lateral positioning
- Two forward mounted fixed position surface jets
- Buoyancy foam packs.



Figure 21 Hysub 150 with Jetting Skid - Side View



Figure 22 Hysub 150 with Jetting Skid - Front View