SEABED TRENCHING
OVERVIEW
# MIAH TRENCHERS
## MILLENIUM CLASS
### SUBSEA HEAVY DUTY ROCK TRENCHERS

<table>
<thead>
<tr>
<th>Hydro-jet Rock Trencher</th>
<th>MLS-7000</th>
<th>MLS-8000</th>
<th>MLS-9000</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WATER DEPTH:</strong> 4 – 50m</td>
<td><strong>WATER DEPTH:</strong> Onshore-Beach - 500 m</td>
<td><strong>WATER DEPTH:</strong> Onshore-Beach – 600 m</td>
<td><strong>WATER DEPTH:</strong> Onshore-Beach – 600 m</td>
</tr>
<tr>
<td><strong>TRENCH WIDTH:</strong> 0.35–1.5M</td>
<td><strong>TRENCH WIDTH:</strong> - 0.5 - 3 M</td>
<td><strong>TRENCH WIDTH:</strong> - 0 - 4 M</td>
<td><strong>TRENCH WIDTH:</strong> - 1 - 2 M</td>
</tr>
<tr>
<td><strong>TRENCH DEPTH:</strong> 0 – 5M / Optional Prefatigue System©</td>
<td><strong>TRENCH DEPTH:</strong> 0 – 3M</td>
<td><strong>TRENCH DEPTH:</strong> 0 – 4M</td>
<td><strong>TRENCH DEPTH:</strong> 0 – 4M</td>
</tr>
<tr>
<td><strong>ROCK HARDNESS:</strong> 90 MPa</td>
<td><strong>ROCK HARDNESS:</strong> 90 MPa</td>
<td><strong>ROCK HARDNESS:</strong> 90 MPa</td>
<td><strong>ROCK HARDNESS:</strong> 350 MPa</td>
</tr>
<tr>
<td>Diesel Hydraulic – To 1500kw</td>
<td>Diesel Hydraulic – To 1500kw</td>
<td>AC Electric – To 1500kw</td>
<td>AC Electric – To 1500Kw</td>
</tr>
<tr>
<td>Requires support vessel</td>
<td>No support vessel req’d to 4m water depth-manned</td>
<td>Requires support vessel</td>
<td>Requires support vessel</td>
</tr>
<tr>
<td><strong>WEIGHT:</strong> 80 Tonnes</td>
<td><strong>WEIGHT:</strong> To 125 Tonnes</td>
<td><strong>WEIGHT:</strong> To 100 Tonnes</td>
<td><strong>WEIGHT:</strong> To 100 Tonnes</td>
</tr>
</tbody>
</table>

SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE

MIAH INC
SALEM, OREGON USA

info@miahtrenchers.com
www.miahtrenchers.com
TEL. 503-581-1988
Sub-Sea Hydro-Jet Rock Trenching System

The Miah Sub-Sea Hydrojet Rock Trenching System, is a high production trenching system and a dramatic improvement of present conventional methods of excavating rock in the ocean floor for purposes of burying pipelines, submarine electrical cables, fiber optic cables, etc. Present subsurface excavation methods in solid rock include dredging, ripping and blasting, which in many cases extensively disturb the biological environment in which they are utilized.

One major objective in developing The Miah Underwater Trenching System included reducing environmental damage while subsurface work is being accomplished and to be able to restore the ocean floor as closely as possible to its natural state. To accomplish this, highly sophisticated telemetry equipment is utilized to insure and verify restorations of the ocean floor.

The rock-trenching sled is comprised of a hydraulically driven cutter assembly mounted on a sturdy steel structured sled which is pulled along the ocean floor during operation by a barge on the surface. Power is supplied by a power unit mounted on the vessel through an umbilical supported by a sturdy steel extension structures to the trencher sled. The sled is equipped with an injector system that removes the overburden on top of the solid rock strata enabling the sled to sit on the rock surface. The rock trencher trenches down into the rock from the rock surface. The Miah rock trencher is utilized in conjunction with a more conventional water injector unit that will clean the ditch prior to laying the pipe in a separate operation. Water currents will carry sediments into the trench to cover the pipe and keep it in place. The well-defined ditch configuration produced by the trencher will perfectly confine the pipe protecting it from drift, iceberg scouring, dragging anchors and fishing gear. The actual trenching activity will take place within the housing of the sled, which will confine the sediments keeping the surrounding environment from being disturbed.
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HYDRO-JET
SUBSEA ROCK TRENCHER
MLS7000 ROCK DREDGER/TRENCHER

SEABED TRENCHING
OVERVIEW
Trenching Beach Landings and Shore Crossings in Tidal Zones

Trenching or Dredging in Tidal Zones, Beach Landings and Shore Crossings in less than 4 meters of water depth, Miah, Inc. offers a self contained, self leveling land based machine with the diesel power module, operators cab & diver platform elevated above the water level to accommodate 4 meters water depths. This configuration allows the trencher/dredger to operate in shallow water without a support vessel. The trencher is equipped with the Prefatigue Rock Trenching System that will capable of trenching up to 10 feet wide at varying depth in a single pass. The cab, operator & diesel power supply are situated above the water line connected through a short hydraulic umbilical to the trencher and chassis below.  

[Link to MLS-7000 VIDEO]
Projects requiring trenches up to ten feet wide in a single pass or wider trenches with multiple passes, Miah, Inc. offers our “Subsea Vessel Mounted Rock Trenching Chassis” (See Illustration). The “Subsea Vessel Mounted Rock Trenching Chassis” supports the extra wide cutter assembly allowing it to make multiple cuts when necessary and provide tractive effort from the trench floor. Configured to trench up to 10 feet wide in a single pass, the trenching process can make multiple passes to achieve wider cuts.

The Trenching Chassis is attached to the support barge through an umbilical supported by sturdy steel extension structures. The hydraulically powered chassis supports the stackable extension columns providing access to the support barge.

The cutter head assembly is supported by the powered chassis. Instead of utilizing a more conventional type of mounting system, as with most land based rock trenchers, the “Subsea Vessel Mounted Rock Trenching Chassis” can attach to the infrastructure of the “Miah Prefatigue Rock and Permafrost Trenching System” cutter assembly, providing superior support making the trenching process much more efficient and faster. Once placed in position, the self-leveling chassis levels the trencher and lowers the cutter bar into the ocean floor as it starts trenching to make the initial cut. As the trencher, with the barge proceeds forward, the cutter bar continues to be lowered creating an approximately 30 degree decent ramp. The powered chassis tracks behind the cutter assembly in a perfectly level prepared Right Of Way made by the cutter head. Once full depth is reached, the cutter head is raised to level the trench bottom to grade. Advantages of basing the chassis on the trench bottom include providing a level and rigid right of way in the seabed assisting the trencher in cutting a straight vertical trench. Conventional sleds must negotiate the unleveled, un-sturdy seabed topography with transverse grades adversely affecting the trenching process.

A video of our ML7000 series trench with our Powered Stabilizer Chassis can be viewed at video. The
video depicts a similar concept however situated on a land-based machine with the stabilizer chassis only assisting the main trencher by providing additional support.
SELF CONTAINED SHORE END TRENCHER WITH ELEVATED CAB AND POWER UNIT. CHASSIS TRACKS ON THE PREPARED ROW TRENCH BOTTOM.

Once in position, the self leveling chassis levels the trencher and opens the cutter run into the ocean floor to make the initial cut. As the trencher proceeds forward, the cutter bar continues to be lowered creating an approximately 20 degree descent ramp. The chassis tracks behind the cutter assembly in a level prepared ROW made by the cutter head. Once full trench depth is reached the cutter head is raised to level the trench bottom to grade.

TRENCH FLOOR PROFILE - MINOR DROPS ON TRENCH FLOOR PROVIDE RAIL TRACKING FEATURE FOR THIS CUT. OFF-SET SUPPORT CUTS PERIODICALLY ALOUSED. RAILS ALSO PROVIDE STABILITY ADJUST FOR 1ST CUT.

THE MIAH PREFATIGUE ROCK & PERMAFROST TRENCHING SYSTEM TRENCHING 10 FEET WIDE.

HYBRID-JETTING NOZZLES W/ HIGH PRESSURE WATER WASH EXCAVATED MATERIAL TO THE SIDES. NOZZLES A TROUGHING SYSTEM NOT SHOWN FOR CLARITY.

TRENCH BOTTOM

40 FEET

DIRECTION OF TRAVEL

20-1/2 FEET

10-1/2 FEET 1ST CUT

20-1/2 FEET

10 FEET 2ND CUT

SECTION A A
<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>ENGINE</td>
<td>1700-2500BHP</td>
</tr>
<tr>
<td>WEIGHT</td>
<td>300,000LBS</td>
</tr>
<tr>
<td>TRACK ROLLERS</td>
<td>7-12EA SIDE</td>
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<tr>
<td>UNDERCARRIAGE</td>
<td>CUSTOM</td>
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<tr>
<td>DIGGING TRANS</td>
<td>HYDRAULIC</td>
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<tr>
<td>TRENCH WIDTH</td>
<td>10FT</td>
</tr>
<tr>
<td>HEIGHT</td>
<td>27FT</td>
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<tr>
<td>WIDTH</td>
<td>10FT</td>
</tr>
<tr>
<td>LENGTH</td>
<td>34FT</td>
</tr>
<tr>
<td>GROUND CL:</td>
<td>18&quot;</td>
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Subsea applications dictate that the vehicle/sled must be held level during the trenching process to provide a vertical trench and to make the trenching process more productive. Since a level right of way is not possible to expect with most seabed conditions, the MLS8000 In-Trench Based Rock Trenching System, prepares a level right of way as the sled rests within the confines of the trench. Trenching or working from the trench bottom or floor, MLS8000 operates similar to a tunneling boring machine.
The trench provides a stable level right of way from which to operate, free from being affected by adverse transverse grades, rock outcroppings, pools and other unknown ordinances present on the seabed floor. The trenching unit, slides on the trench floor, the cutter head cuts through outcrops and pools without the machine being affected by pitch and rolls of the changing seabed. In contrast, a tracked vehicle or a seabed surface sled trying negotiate uneven terrain, while trenching in rock, is very problematic.

The IN-TRENCH BASED SLED SYSTEM, consists of a foundation sled which rests on grade or the trench bottom, a cutter head assembly, a gripper box with thrust cylinders, electric/hydraulic subsea power modules and electrically driven high pressure water pumps. The foundation sled supports the hydraulically driven cutter head, which is mounted and attached to the front end of the sled. A hydraulic driven gripper box with gripper shoes and thrust assembly provides forward and reverse motion utilizing thrust cylinders. For use in solid rock, the principle of the gripper is both the most simple and most effective technique. The single gripper braces itself against the rock using two gripper plates. Then, hydraulic cylinders push the cutter head into the rock face at high pressure, grinding it with cutter bits.

The foundation sled components are powered by electric/hydraulic power modules attached to top of the sled platform. Utilizing this type of power module makes the machine capable of working in water depths up to 500M. Electric AC power is provided through a flexible electric umbilical from the support vessel on the surface.

While this design provides a viable solution to the prescribed seabed problems it also provides advantages for trenching in extremely hard massive rock formations. Inherently by design, utilizing our patented staggered chain design, the sled can generate and stabilize extreme loading forces on the cutter head which makes it possible to utilize our hybrid trenching head making the machine capable of economically trenching massive abrasive rock formations up to 350 Mpa (50,000psi).
**SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Metric 1</th>
<th>Metric 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trench Depth</td>
<td>8.2 FT</td>
<td>1.5 M</td>
</tr>
<tr>
<td>Trench Width</td>
<td>6.5 FT</td>
<td>2 M</td>
</tr>
<tr>
<td>Length</td>
<td>24 - 36 FT</td>
<td>7 - 11 M</td>
</tr>
<tr>
<td>Width</td>
<td>12 FT</td>
<td>3.66 M</td>
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<tr>
<td>Weight</td>
<td>60 TONS</td>
<td>54 TONNES</td>
</tr>
<tr>
<td>HP Electrical/Hydraulic</td>
<td>868 HP</td>
<td>647 Kw</td>
</tr>
<tr>
<td>Water Depth</td>
<td></td>
<td>500 M</td>
</tr>
</tbody>
</table>

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MLS8000
MIAH TRENCHERS

MLS-9000
SEABED
VERTICAL DRUM TRENCHER

SPECIFICATIONS
Water Depth: Onshore - 500M
Trench Width: 1 - 2 M
Trench Depth: 4 M
Hybrid Trenching System
Rock Hardness: 350 MPa
AC Electric/Hyd: 1500kW
Requires Support Vessel
Weight: 100 Tonnes

*May be powered by hyd: module from support vessel up to 50M water depth.
In a separate operation an injector shoe with HP water is utilized for clearing trench debris. Hydrojet
injector technology will fluidize debris within the confines of the trench removing material just prior to
laying the cable or pipe. The injector shoe is supported from top side by the barge and lowered into the
trench. HP water is supplied from pumps located on the barge. The injector and the barge follow the
trench route.
Vertical Injector

Specifications:
- Water Depth: 400M
- Trench Depth: To 7.5 - 10M
- Product Bend Radius: 1.5M or custom 100mm
- Sealed: Backfill, Sand, Overburden, Clay, Mud

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