

# Deepwater Abrasive UHP Waterjet Cutting

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## Introduction

**UHP Waterjet** is a generic term used to describe equipment that uses an ultra-high pressure stream of water for cutting, blasting or cleaning purposes. **Abrasive waterjetting** is an erosive cutting process. It is a subcategory of waterjet in which abrasive is introduced to accelerate the cutting process. It is extremely aggressive and is capable of cutting most naturally occurring material on earth.

Pure waterjet and water-only cutting are phrases for specifically distinguishing waterjets that do not use abrasive. Waterjet technology has been in industrial use since the mid-1980s; however, its use has been primarily land-based. In the last few years **Chukar WaterJet, Inc.** updated this land-based waterjet technology and has taken it into the deepwater subsea space.

Chukar Waterjet first introduced subsea waterjet technology in emergency response to the 2010 Gulf of Mexico oil spill, and has since advanced its unique technology to be operational to depths in excess of 3000 meters. Chukar's ROV-operated deepwater subsea waterjet equipment can be used to increase the effectiveness of emergency response, salvage and maintenance operations. The technology can work in 5000 psi ambient pressure with simple subsea stationary equipment with various ROV-operated tools.

This technology, developed in 2010 during the Oil Spill in the Gulf of Mexico, allows operation of UHP waterjet equipment in the deepwater subsea space for waterjet cutting and blasting applications such as flow-line cutting, and removal of weight and epoxy coatings.

Waterjets are fast, flexible, reasonably precise and either diver or ROV operated. Opportunities to increase effectiveness of emergency response, salvage, and maintenance operations stem directly from this technology. This technology is unique in its kind and several patents are pending.

## Basic UHP waterjet principles

UHP Waterjets are fast, flexible, reasonably precise, and in the last few years have become friendly and easy to use. In this technology, ultra high-pressure water is forced through a small hole (typically called the "orifice" or "jewel") to concentrate an extreme amount of energy in a small area. The restriction of the tiny orifice creates ultra high pressure and an ultra high-velocity beam.

The inlet water for a waterjet is pressurized between 20,000 and 60,000 Pounds per Square Inch (PSI) (1300 to 6200 bars). This is forced through a tiny hole in the jewel, which is typically 0.007" to 0.020" in diameter (0.18 to 0.4 mm). This creates an ultra high-velocity and thin beam of water (which is why

some people refer to waterjets as "water lasers"). As the thin stream of water leaves the jewel, abrasive is added to the stream and mixed. The high-velocity water exiting the jewel creates a vacuum which pulls abrasive from the abrasive line and is mixed with the water in the mixing tube. The beam of water accelerates abrasive particles to speeds fast enough to remove much harder material upon impact. The cutting action of an abrasivejet is two-fold. The force of the water and abrasive erodes the material, even if the jet is stationary (which is how the material is initially pierced). The cutting action is greatly enhanced if the abrasivejet stream is moved across the material and the ideal speed of movement depends on a variety of factors, including the material, the shape of the part, the water pressure and the type of abrasive. Controlling the speed of the abrasivejet nozzle is crucial for efficient and economical waterjet cutting.

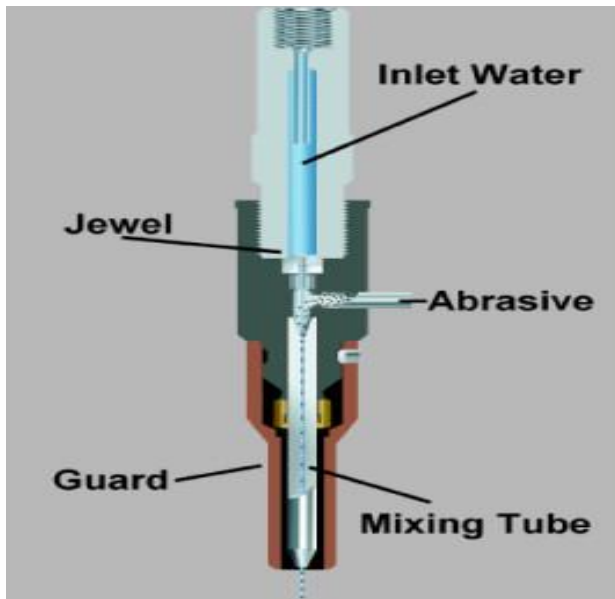


Fig 1- Inside Nozzle



Fig 2- UHP Waterjet Nozzle

- Limitations of the traditional surface-based waterjet systems used offshore
  - Limited to approximately 300-400m water depths.
  - Cutting can be accomplished from the surface. Must pump the abrasive from surface, to the cutting location. Basically a complex and very expensive method.

## Chukar Deepwater UHP Waterjet

A unique **Chukar WaterJet, Inc.** technology using unique sharp-edged abrasive suspension with the aid of a UHP waterjet that is designed to work in subsea with single cable (umbilical) over the side, Depth independence, multi-use system (cutting, blasting, cleaning, etc.), requires abrasive for efficient cutting, can pump seawater directly, can be deployed as stand-alone skid, or as attachment to ROV and can cut even high-strength steels up to 8" thick and reinforced concrete up to a meter in thickness, as well as a wide variety of other materials, effectively and precisely parted.

➤ The special features and benefits of the waterjet technique

- Cuts are made in a contact-free manner and may be operated remotely without diver intervention.
- Extreme cutting power can cut regardless of thickness and material in question. Proven to cut more than 10" of wall thickness and multiple layers.
- No significant heat generation or deformation from this cold cutting process and produces insufficient energy to ignite most highly flammable gases.
- Only very thin parting seams are produced, with low secondary waste.
- Operational friendly handling that reduces setup time between cuts.
- Does not impart internal thermal or mechanical stresses in the material being cut.
- Verification of cut by the use of the camera or hydrophones is available.
- Can do multiple cuts in one deployment.
- All tool function and controlled by the ROV.
- All tools can also be installed by divers.

On the bases of deepwater UHP Waterjet technology of CHUKAR WATERJET, Inc. has shown Chukar deepwater waterjet equipment and its tools in Offshore Technology conference (OTC) show 2012 in Houston, USA.

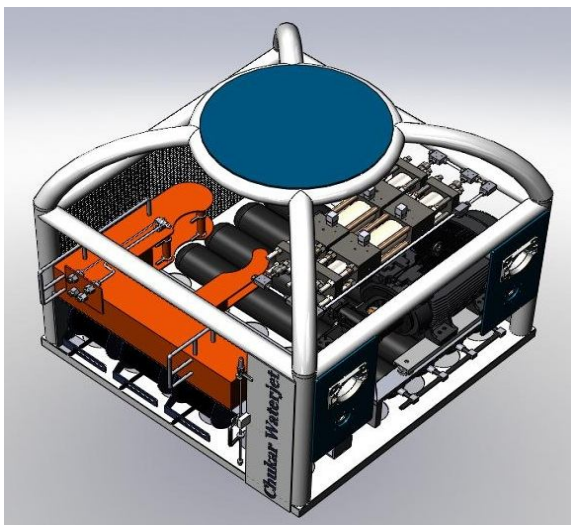


Fig 3- CHUKAR DEEPWATER WATERJET



Fig 4- Subsea Intensifier

**Why UHP Waterjet?**

- Deepwater abrasive suspension, specially designed for subsea use, is very aggressive and can cut anything used in typical subsea installations.
- This pump provides 60,000 PSI of water traveling up to Mach 2 with 1.09 GPM of water consumption through a different orifice size designed to work under 5000psi.
- Flexible - cut a variety of materials and boost your output with this variety of cutting scenarios.
- Cost-effective – expands the customer base with a reliable technology that will reduce cost and time.