

# W J T A

**Waterjet Technology  
Association**



# Jet News

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## A Fireboat In New York Harbor



# Robotic Removal Of Asbestos From Piping Using A Waterjet

Carnegie Mellon University (CMU) and the Robotics Institute's Field Robotics Center, through the sponsorship of the Department of Energy/Federal Energy Technology Center, developed an automated asbestos pipe-insulation abatement system, nicknamed BOA (Big On Asbestos). The BOA system is a self-propelling automated mini-enclosure, able to remove insulation from installed 4-inch O.D. and larger pipes. It requires minimal human assistance, while complying with all requirements for wetting, encapsulation, fiber-emissions and worker safety practices. Two operators, one at the abatement head and one at the cyclonic bagging station, can operate the system. The goal of the fully enclosed system is to allow workers to work free of enclosures and respirators. The

system is able to fully abate straight sections of piping. However, sections around hangers and obstacles (bends, junctions, tees, etc.) are left to be manually abated using the standard OSHA-approved glove bagging techniques.

BOA was demonstrated in August 1997 at the East Tennessee Technology Park (formerly K-25) in Oak Ridge, Tennessee. For demonstration purposes, an asbestos surrogate was used (calcium silicate) so that observers could view the interior of the abatement head. The equipment, including its 32 foot travel trailer, will remain in

(continued on page 4)



Photo courtesy of Carnegie Mellon University. Article by Elizabeth Rasor, Carnegie Mellon University.

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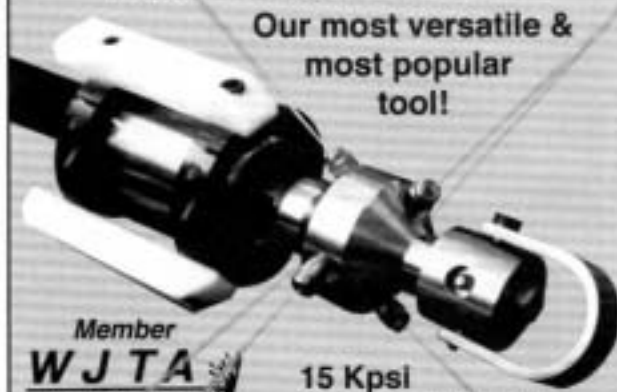
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## Waterjet Loom

Some looms use waterjets instead of a shuttle to propel fibers from one side of the loom to another in the process of weaving fibers into fabric. Waterjet looms are used only with synthetic fibers. Jet looms have been used for 35-40 years. For example, the Nissan Model LW41 was introduced in 1968. Approximately 7800 Nissan jet looms have been sold in the United States, of which 5,000 are still in production. Nissan has 60,000-80,000 jet looms in use around the world.

In these looms the jets propel the fiber across the loom at a rate in excess of 1,000 threads per second. The Nissan Model LW551 jet loom propels the yarn over two meters on a constant path with a very small deviation of jet concentricity.

For more information, contact Nissan Textile Machinery Corp. in U.S.A., P.O. Box 240803, Charlotte, NC 28224-0803; phone: (704)527-5400; Fax: (704)527-3743.

## Waterjet Propelled Vessels

Waterjets are used to propel a wide range of pleasure and commercial craft. CWF Hamilton & Company Ltd. of Christchurch, New Zealand, has been commercially producing jets to propel boats since 1975. The Hamilton organization has two divisions — HamiltonJet and HamiltonMarine. There are over 20,000 Hamilton jet units installed around the world. These jets are used to propel a wide range of high speed work and patrol boats, ferries, crew boats, fire boats, fishing vessels and landing barges. The current waterjet range includes models with power input from 150 to 3,000 kilowatts for vessels up to 60 meters long.

HamiltonJet can be contacted at Gate 4, Luns Row, Christchurch 4, New Zealand; phone: +64 (3) 3484179; fax: +64 (3) 3484969; e-mail: [marketing@hamjet.co.nz](mailto:marketing@hamjet.co.nz).

## In Memoriam

**A**ndrew R. Magnuson, who served as marketing director for NLB Corp. in Wixom, Michigan, died from lung cancer on December 1, 1997. He was 60 years old.

Before joining NLB, he served as advertising director for Aeroquip Corp. in Maumee, Ohio, for 30 years. He traveled the world throughout his career and while serving with U.S. Navy in the late 1950s. He graduated from Michigan State University in 1962.

He is survived by his wife of 38 years, Arnette; a daughter, Suzanne; a son Andrew M.; his mother, Pearl Magnuson; and a sister Marilyn Lynch.



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## Robotic Removal Of Asbestos From Piping Using A Waterjet, from pg. 2

Oak Ridge after the demonstration. The CMU developers trained Lockheed Martin Energy System operators to use the equipment, and those operators also performed the demonstration.

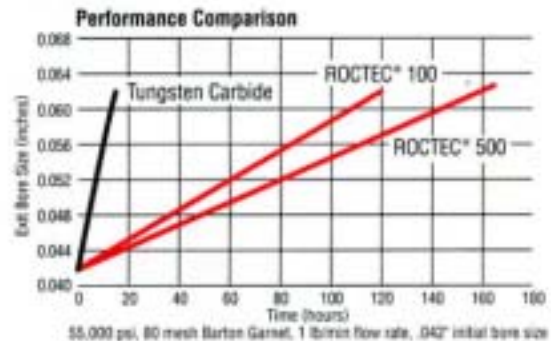
The BOA system consists of an on-pipe abatement head which removes the insulation at a rate of 30 feet per hour, and various stationary support systems including a HEPA vacuum, water filtration, cyclonic bagger, encapsulate supply and power. The abatement head itself consists of two sections. The locomotor and clamber section allows the unit to clamp onto and locomote along the pipe. The sealed remover section contains the cutting, water-blasting and sealant-spraying mechanisms, as well as the waste-chute and vacuum hose attachments. Three sets of clammers move the head in inch-worm fashion along the pipe. Endmill cutters and coaxial water-jet nozzles cut through lagging and wire materials, severing and lifting the insulation off the pipe and ejecting it into the waste-chute.

The robot is able to step past hangers and re-establish the abatement beyond the hanger, leaving the hanger and the remaining insulation untouched and fully encapsulated. In the case of obstacles such as bends and valves, the robot must be manually moved around the obstacle before continuing abatement on the other side. In either case, all exposed ends of insulation are fully wetted and encapsulated, thus leaving no fiber release conditions. A HEPA vacuum pulls cut insulation and lagging pieces through a water separator, where water is filtered and recycled for continued cutting. A short blast of high-pressure fan-sprayed water fully cleans the pipe. An internal set of wetting and encapsulation nozzles ensures all cutting processes occur under wet and high vacuum conditions, while sprayed encapsulate leaves all exposed pipe surfaces coated to trap any loose fibers. The de-watered waste material is sucked into a cyclonic separator where once filled, the waste is double bagged, taped off and readied for disposal. A pressurized water pump delivers the cutting water at 5000 psi to the abatement head. A stand-alone encapsulant system supplies the encapsulant to the abatement head via its own tether-section. A centrally located control box coordinates all actions and interfaces to a remote touch-pendant held by the operator located closest to the abatement head.

Questions regarding the robotic removal of asbestos should be directed to Dr. Hagen Schempff, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA 15213.

### Announcing ROCTEC 500 AWJ Nozzles

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ROCTEC 500 AWJ nozzles are available exclusively from your abrasive waterjet equipment manufacturer. Or for more information, contact Boride Products, 2879 Aero Park Drive, Traverse City, MI 49686. Phone: 1-800-662-2131 (U.S. only) or 1-616-946-2100. Fax: 1-800-662-2132 (U.S. only) or 1-616-946-3025.

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***"A mind stretched to a new idea never  
goes back to its original size."***

**—Oliver Wendel Holmes**

# New Boehler High Pressure Pump For Waterjet Cutting Applications

N. Herbig, G. Retschnik, F. Trieb

## Introduction

Waterjet cutting technology is one of the most innovative technologies. The increased reliability of high pressure pumps and cutting tables and robotic units has enabled this technology to spread rapidly. The high pressure pump is undoubtedly the heart of every waterjet cutting system.

The requirements for high pressure pumps can be summarized as follows: High reliability of all components and high ease of maintenance and service. Ready availability of high pressure pumps depends on the lifetime of its high pressure components. Lifetime is influenced by design and production processes and by the number of load cycles. The number of load cycles can be reduced by the design of the intensifier (diameter of the plunger and length of stroke). Also the ability to create a constant high pressure throughout the complete stroke has a positive effect on the lifetime of high pressure components and is a prerequisite for the application of this technology to cutting tasks.

## Aim Of New Developments

The object of the project during last year was to develop a new high pressure pump that will live up to future market expectations, feature an extended lifetime and improved reliability of all components and demonstrate a high ease of maintenance and service.

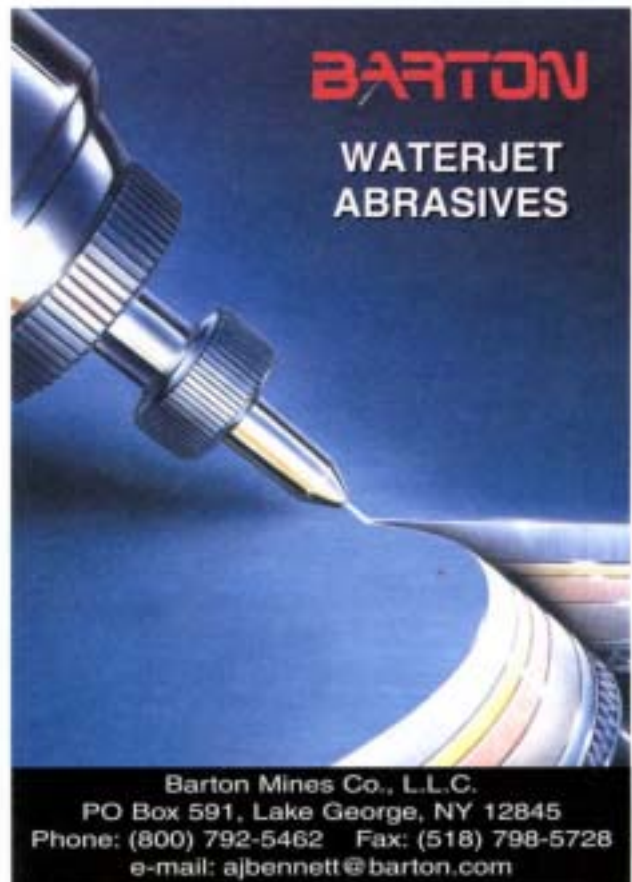
The market for waterjet cutting systems is showing a trend towards cutting systems with two or more cutting heads. The design of the intensifiers depends mainly on the flow rate (3.4 liters per minute or 0.9 gallon per minute) and the maximum pressure (400 megapascals or 58,000 psi). Allowances for reduction of load cycles (30 double strokes per minute) of high pressure parts have been taken into account by the design of plunger diameter and stroke length. Improvements in the maintenance of all wearing parts have been achieved by paying special attention to quick and easy accessibility during design while maintaining all technical requirements.

## Production Process Of High Dynamic Loaded Parts

The lifetime of high pressure pumps has been successfully increased by reducing the number of load cycles, improving the production process and by achieving a constant load on high pressure parts for each stroke. A number of technical problems in the past led to an analysis of the production process of these parts. Design errors or unfavorable load of these parts could be ruled out because these parts had already proved to be successful in use in other pumps. Parts produced by different procedures underwent long-term testing to determine their lifetime and the cause of failure. Surface texture is an extremely important criteria in terms of lifetime. The quality of the material used was also determined as being essential for a wearing part's lifetime.

## Hydraulic Drive

A constant load for high pressure parts can be achieved by adjusting the hydraulic drive to the behavior of the intensifier. A prototype was



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Fig. 1: Test field of the new standard high pressure pump DYNATRONIC® 403.



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## Jetting Systems Moves To New Location

**J**etting Systems & Accessories Inc. is relocating from the Hardison location to a new shop approximately 2-1/2 times the size. The extra area will make it easier to work on larger projects like shell-side cleaners, and

allow for staff expansion to better serve you. The new address is 4026 Trey, Houston, TX 77084, less than a mile from Clay Road and Hwy. 6, for those of you in the Houston area. Call (281)345-2248 for more information.

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## New Boehler High Pressure Pump For Waterjet Cutting Applications, from page 5

produced and modified until satisfactory results were realized. The improvement of the complete system is demonstrated by the reduction of pressure fluctuation. Numerous tests led to the identification and removal of several influencing factors.

By measuring the input power and the output power of the high pressure pump it was possible to calculate a 70% efficiency rate under rated load conditions. A comparison with other data from relevant literature showed, that this new development has led improved efficiency levels.

### Specification And Technical Data Of The New Standard Pump DYNATRONIC® 403

The exceptional features of the high pressure pump DYNATRONIC® 403 are:

- Hydraulic system in open loop design.
- High reliability and easy maintenance in connection with low number of wearing parts.
- The design of base frame allows easy access to all required components.
- Second intensifier as stand-by unit is installable.
- The hydraulic unit is equipped with an axial piston pump with high dynamic control characteristic.
- Oil cooling system including oil filter system is driven by noise reduced gear pump. The result of this design is a constant high oil quality and therefore long life time and reliability of the whole oil hydraulic system.
- The installed oil/air collar is equipped with integrated



Fig. 2: Standard High Pressure Pump DYNATRONIC® 403

thermostatic control. Ventilation of complete pump is supported by this special type of design.

- The switch over of hydraulic piston is done by a soft switching valve in connection with special control geometry.
- The minimum working pressure of high pressure system is 16 megapascals (2320 psi).
- Due to the use of a water hydraulic activated pressure release valve no pneumatic supply for the pump is required.

The feed water system is equipped with a booster pump. Therefore an independent use from the feed water pressure supply is possible. Also the usage of low pressure filter elements can be increased.

### Outlook

In addition to mentioned pump generation further types as DYNATRONIC® 402 and DYNATRONIC® 407 complete the product range. These pumps are available with a flow rate of 1.9 (0.5 gallon per minute) respectively 6.8 liters per minute (1.78 gallons per minute).

### Literature

Singh, P.J., Benson, D., "Development of phased intensifier for waterjet cutting," 11th International Conference on Jet Cutting Technology, 1992, p 305-318.

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Susam-Resiga, R., "Attenuator's volume influence on high pressure's pulsations in a jet cutting unit," Proceedings on the 11th International Conference on Jet Cutting Technology, Kluwer Academic Publishers, 1992.

Hu, F., Robertson, J., "Simulation and control of discharge pressure fluctuation of ultra high pressure waterjet pump," 7th American Water Jet Conference, August 28-31, 1993, Seattle, Washington, Paper 23, p 337-349.

Chalmers, E.J., "Pressure fluctuation and operating efficiency of intensifier pumps," Proceedings of the 7th American Water Jet Conference, August 28-31, 1993, Seattle, Washington, Paper 22, p 327-336.

### Technical Data\*:

• Power:	30 kilowatt	
• Maximum Permissible Pressure:	420 megapascals	60900 psi
• Maximum Continuous Pressure:	380 megapascals	55120 psi
• Maximum Flow Rate:	3.4 liters per minute	0.9 gallon per minute
• Length	1900 millimeters	74.8 inches
• Width	970 millimeters	38.2 inches
• High	1490 millimeters	58.7 inches

\*SI units and US units

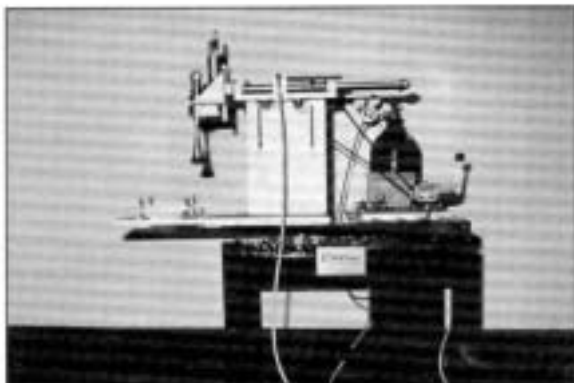
## An Apparatus For Testing Protective Apparel For Waterjetters

**T**he Wiseman Waterjet Test Unit recently developed by DuPont will help usher in a new era of protective apparel for waterjet workers.

For years, the waterjet industry was unable to accurately measure the effectiveness of waterjet protective apparel. The previous testing technique required that someone swipe a waterjet stream across the test fabric at a constant distance. Unfortunately, the water's force made holding the nozzle at a precise and constant distance impossible, so that accurate test data was unattainable.

But with introduction of the Wiseman Waterjet Test Unit, DuPont is about to change all that. The Wiseman system accurately measures the effect of hand-held high-pressure waterjet equipment on various materials, eliminating the guesswork of the previous testing technique. For the first time, critical variables such as "standoff"—the distance from the nozzle to the test sample—and "swipe"—the speed at which the nozzle moves across the fabric—can be controlled and measured with precision.

DuPont Senior Research Associate, Tim Wiseman, designed and developed this unique testing system. The unit is expected to spark dramatic changes in the waterjet safety market and provide a means to set safety standards for the industry. "Nothing could make me happier than to see the



The Wiseman Waterjet Test Unit was developed to accurately measure the effect of hand-held, high-pressure waterjet equipment on various apparel materials.

injuries in this industry greatly reduced," said Wiseman. "This test unit was developed to help achieve that goal."

The Wiseman Unit has already helped further the development of DuPont AquaShield™—a new line of protective apparel designed specifically for the waterjet market—and promises to foster ongoing advancements in waterjet protection.

For further details on the Wiseman Waterjet Test Unit, contact DuPont at (302)366-6827.



Critical variables such as "standoff"—the distance from the nozzle to the test sample—and "swipe"—the speed at which the nozzle moves across the fabric, can be controlled and measured with precision.

## Aqua-Dyne Names Schmidt General Manager

**C**harles (Charlie) A. Schmidt has joined Houston-based Aqua-Dyne, Inc. to serve as the company's new general manager with responsibilities in the sales management and the production operations of the company, announced George Rankin, president of Aqua-Dyne.

Schmidt, a native Houstonian, formerly served as president and chief executive officer of Schmidt Manufacturing, Inc. and Bob Schmidt, Inc. from 1981 to 1997. Bringing 24 years of experience to Aqua-Dyne, Schmidt's background includes his management responsibilities as comptroller, inside sales, outside sales, sales manager and executive management for both of the companies. Schmidt Manufacturing was established in 1972 and is a major manufacturer and technological innovator of abrasive blasting equipment including pressure blasters, bulk blasters, hopper and vacuum loading systems, moisture separators, airprep systems, specialized custom systems, valves and nozzles. Bob Schmidt, Inc. began operations in 1964 and is a leading industrial distributor of corrosion control equipment and supplies in the Gulf Coast market.

Rankin said, "Schmidt is an experienced and effective manager who has successfully directed business turnarounds, national and international sales and has a management style that integrates sales and marketing, administration, manufacturing and operations into a focused and competitive team. His experience in abrasive blasting and corrosion control equipment background will greatly aid Aqua-Dyne."



## Maxpro Technologies Introduces New Packaged Power System

New power packs designed to provide a compact, lightweight and economical method to generate pressure are now available from Maxpro Technologies. These self-contained units utilize standard shop air supply and are available for providing hydraulic power or water pressure for hydrostatic testing. Systems are available in varying sizes, including bench or larger cart-mounted models.

Maxpro power packs are available in a variety of pressure ranges, thus allowing the fulfillment of specific requirements. Packs are available from low pressures of 500 psi and 2,000 psi to high pressures of 30,000 psi and 60,000 psi. The stainless steel reservoir in all Maxpro power packs



Maxpro Power Packs

includes a fill/breather cap and connections for a sight gauge, drain and return line. These power packs are available with several options including a reservoir sight gauge, outlet

pressure gauge, dual outlet gauges, or pressure vent valve.

Maxpro Technologies offers a complete line of Maximator air driven liquid pumps, air amplifiers, and gas boosters. Packaged systems available include a gas booster system, air amplifier systems, hydraulic power unit and hydraulic test stands for pressure testing. Maxpro also offers cost-effective repair and refurbishing services, featuring original manufacture parts and guaranteed quality.

For more information, contact Maxpro Technologies, Inc., 2010 Filmore Avenue, Erie, PA 16506; phone: (814)838-1416; fax: (814)838-2730.

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## DuPont Introduces AquaShield™— A Breakthrough in Waterjet Safety Apparel

**D**uPont AquaShield™ is a new line of protective apparel designed specifically for those who use hand-held high-pressure waterjet equipment. This revolutionary new protective apparel can help significantly reduce the number and severity of injuries to waterjet workers that can occur, often with devastating results. Even a seemingly minor puncture wound can lead to severe internal tissue damage.



DuPont AquaShield™ is a new line of protective apparel designed specifically for those who use hand-held, high-pressure waterjet equipment.

AquaShield uses unique, multilayered fabric constructions to achieve outstanding levels of protection in lightweight clothing. Its outer layer is a coated fabric made with DuPont CORDURA® PLUS nylon, a strong, durable and abrasion-resistant fiber. The coating acts as a barrier to help keep waterjetters dry. The key to protection, however, lies in the inner

layers. TurtleSkin®, a proprietary fabric from Warwick Mills using DuPont KEVLAR® brand fiber, is combined with DuPont Wearforce® III fabric to help reduce the impact of waterjet streams.

Test results show that by using various fabric constructions, AquaShield apparel resists penetration of the waterjet stream from 10,000 psi (16 gallons per minute) to 36,000 psi (4.5 gallons per minute) as close as 4 inches standoff at a swipe speed of 7.5 feet per second. This is truly a breakthrough technology for today's waterjetters.

The benefits of DuPont AquaShield go far beyond its outstanding protective performance. AquaShield garments are exceeding lightweight— as much as 50% lighter than other waterjet protective apparel. The light weight dramatically enhances wearer

comfort, as does the uniquely designed shoulder pad that DuPont has incorporated into every AquaShield jacket. The pad softens the nozzle thrust of waterjet guns. AquaShield will not lose its effectiveness with normal use, and the efficiency of the new technology makes AquaShield protective apparel available at a reasonable cost.

Other features include:

- Coated fabric and sealed seams help keep waterjetters dry.
- Jacket and bib pants provide double-layer protection for vital body organs.
- Attached hood keeps head, neck and back dry.
- Long-leg zippers enable donning over footwear.
- Storm flaps protect zipper integrity.
- Adjustable hand guards help protect back of hands without impairing dexterity.
- Sleeve adjustment straps tighten at wrist, minimizing water entry.

AquaShield opens doors throughout the waterjet market for improved protection and offers wearers a choice of functional, safe and comfortable garments. Initial offerings of AquaShield products provide frontal protection only. AquaShield pants, jackets, bib pants, aprons, spats and hand covers are now available in both standard and custom sizes. Ongoing developments will result in additional types of protection.

AquaShield is available only from DuPont. It will be distributed through NLB Corporation, Wixom, Michigan.

For further details on AquaShield, contact DuPont: (302)366-6827. For purchase information, contact Jeff Shook at NLB: (248)624-5555.

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A detailed photograph showing a waterjet cutting process. A high-pressure water jet, appearing as a bright, glowing cone, is cutting through a thick, dark metal plate. The metal plate is held in place by a large, industrial-grade metal vise. The background is dark and slightly out of focus, emphasizing the cutting action. The text "Waterjet & Waterblast Products" is overlaid in a blue, sans-serif font in the upper left quadrant.

# Waterjet & Waterblast Products

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Proven designs, precision manufacturing and Just In Time delivery are the result of Autoclave's pursuit of Continuous Improvement in every facet of its business. This steadfast commitment to quality and reliability has positioned Autoclave as the world's premier manufacturer of high pressure valves, fittings and tubing.



## CRS Power Flow Expands Line of 40K Ultra High Pressure Tools

**C**RS Power Flow has expanded its line of 40K Ultra High Pressure (UHP) tools for water blasting. These products now include: air powered rotary ultra-lite control guns, three types of "tumble box" control valve systems, dump style 40K foot and hand guns (all are quick change, 60 second over-haul). Flex and rigid lances are made to order with a variety of thread connections available. High pressure fittings, flex and rigid lance nozzles (drilled and sapphire inserted) are available. To receive the new CRS Power Flow Ultra High Pressure Catalog, or obtain additional information, contact CRS Power Flow by phone: (800)580-3569, fax: (713)466-8155, website: [www.crspowerflow.com](http://www.crspowerflow.com).



## Aquajet Systems Achieves Highest Quality Approval

**A**quajet Systems AB, manufacturer and supplier of hydrodemolition equipment, has achieved quality approval from Lloyd's Register Quality Assurance (LRQA) to the international standard ISO 9002.

Aquajet Systems, the first manufacturer to gain approval in this business, is firmly committed to supplying the market with a consistent level of quality, service and delivery.

Stefan Hilmersson, managing director of Aquajet Systems says, "This approval is an important milestone for us. Putting our customers first was the motivating factor behind achieving ISO 9002. It is a quality security awarded for teamwork and communications. Getting it right the first time is a hallmark of effective management, engineering and quality control."

Aquajet Systems adopted ISO 9002 as a means of inspiring and maintaining the confidence of the hydrodemolition market. "Approval by a prominent independent body such as LRQA proves that Aquajet Systems takes quality matters very seriously — it is a voluntary commitment to become even better at what we do," adds Stefan Hilmersson.

For more information, contact Aquajet Systems AB, phone: +46 383 50801; fax: +46 383 50730; e-mail: [aquajet@aquajet.se](mailto:aquajet@aquajet.se); internet: <http://www.aquajet.se>

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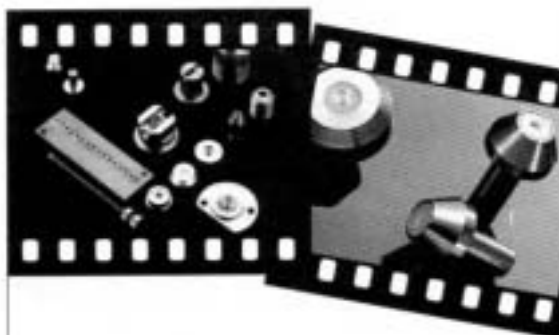
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## WJTA New Members

### Individual

#### Michael Boyd

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#### Robert Contreras

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Fax: (510)234-4695

#### Michael McCoy

McCoy Enterprises  
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Folsom, CA 95763  
Phone: (916)855-2297

#### Gabriel Pina

Tecnoservicios y Sistemas SACV  
Choapas 601  
Col. Petrolera  
Tampico 89110 Mexico  
Phone: [52](12)136474  
Fax: [52](12)133949

## Safety Committee Solicits Comments On Improvements To *Recommended Practices*

The WJTA Safety Committee solicits comments regarding improvements to the publication, *Recommended Practices for the Use of Manually Operated High Pressure Waterjetting Equipment*. While the *Recommended Practices* is reviewed periodically at the biennial conferences of the Waterjet Technology Association, your comments and suggestions for improving the publication are welcome anytime. We invite your comments and suggestions.

Please address your suggestions to: Safety Committee, c/o WJTA, 917 Locust Street, Suite 1100, St. Louis, MO 63101-1413

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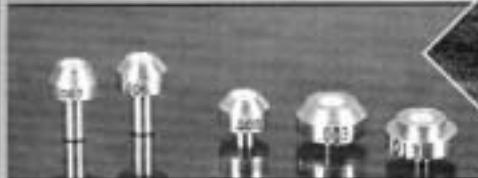
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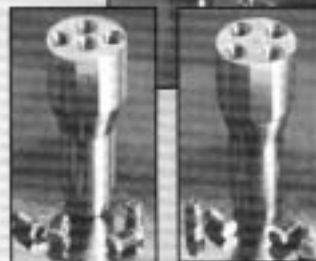
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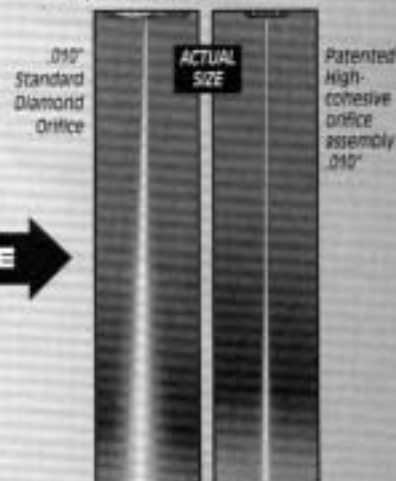
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## A New Sewer Cleaning Nozzle

**S**hamrock Pipe Tools®, Inc. has introduced new for 1998, the "Bayou Blaster." Other sewer cleaning nozzles recently introduced by Shamrock are the "Ice /Grease" nozzle, the "S.S.H.E." Stainless Steel High Efficiency nozzle and the "Boat" nozzle.



This rotating nozzle is heat treated stainless steel, polished and ground for maximum service life with hardened stainless steel, replaceable water inserts for optimum rotational speed and cleaning power. It is available in two (2) styles, the conventional rear impact jets, and forward impact jets, either style to accommodate 1/2 inch, 3/4 inch and 1 inch hose sizes. This rotator is rated 14-80 gallons per minute at 1,500-5,000 psi, is knurled for easy attachment, and requires minimum maintenance. In addition to all these outstanding features, this nozzle, like all of Shamrock nozzles, are manufactured in the USA.

For more information on this item or any of Shamrock's fine sewer cleaning products, call (800)633-7697 or fax: (800)777-0660.

## 1998 Calendar Of Events

- **April 20-25:** Hannover Fair '98, Hannover, Germany. For more information call: (609)987-1202.
- **June 1-5:** The Spanish National Association of Mining Engineers organizes the Mining and Metallurgy International Congress every four years in Spain. This year's event takes place in Valencia, Spain. For more information, call: 96-333-28-18, fax: 96-333-27-76, or e-mail: factoria@bemarnet.es.