



Moleing Accidents

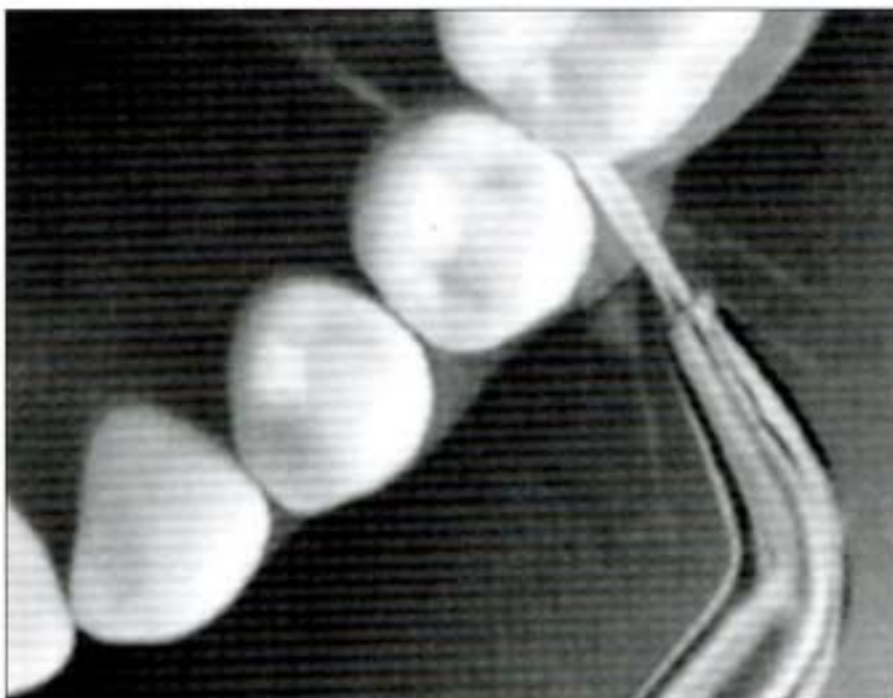
A pressurized flexible lance and/or mole out of control among the waterjet crew is the most hazardous situation confronting the waterjet cleaning industry today. It is universally recognized as a hazard in the industry. There have been at least two fatalities and many other accidents which have occurred because the crew lost control of the flex lance and/or mole while cleaning out a tube or pipe.

An out-of-control lance is extra hazardous because the lance/mole moves very quickly and unpredictably while carrying a high pressure waterjet which can maim or kill. People have been hit in the neck, chest, abdomen and leg. They have also been hit from the rear because the mole is often blown out of the pipe beyond the position of the nozzle operator.

Because of these hazards, the cleaning of tubes and pipes is automated where possible so that the waterjet crew is out of harms way. Several automated machines have been built for routine jobs such as cleaning heat exchanger tubes.

There are many jobs, however, for which no appropriate automated machine exists. It is universally accepted in the waterjet industry concerning these jobs that the crew must never lose control of the flex lance/mole. To this end, the industry suggests the use of methods designed to help prevent the lance/mole from

Waterjetting Between The Teeth



The WaterPik® oral irrigator uses a pulsating jet of water, mouthwash, or anti-bacterial rinse to remove food debris and reduce bacteria between teeth and under the gumline where brushing and flossing can't reach. Photo courtesy of Teledyne WaterPik.

reversing in the pipe and being expelled backwards from the pipe.

One method involves the use of a foot valve controlled by the nozzle operator.

The person inserting the mole should be the one who controls the foot pedal. This is universally recognized and followed in the industry. The reason is that the person feeding the lines into the

pipe is closest to the action -- he/she will sense a problem before

(continued on page 5)

Abstract Submission Date Extended

*Planning to submit an abstract for possible presentation at the 10th American Waterjet Conference in 1999?
See page 8 for details.*

Colliding Slurries

High speed collisions between particles suspended in thread-like fluid streams are used to create uniform suspensions of sub-micron-sized particles. These suspensions have many technological uses in the chemical, food, pharmaceutical, biotechnological, and cosmetic industries. One application is the creation of a stable suspension of sub-micron sized carbon particles for use in

an ink-jet printer (see article, "Ink Jets," on this page).

The impact of particles in colliding streams is effective in reducing the size of particles because the relative velocity with which the particles hit is double that obtained by impacting a stationary object. Colliding streams is the operative principle in the Microfluidizer®, a device manufactured by Microfluidics International of Newton,

Massachusetts. A high speed slurry stream flows through a hair-thin channel and is separated into two streams which, after getting progressively smaller and therefore faster, are forced to collide with each other as they recombine. The particles in the slurry are reduced to sub-micron size by forces of impact, sheer and cavitation acting simultaneously.

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Ink Jets

An ink jet printer jets small droplets of ink at a sheet of paper through an array of very small nozzles. The distribution and volume of ink distributed on the paper is determined by a computer that dictates the nozzles selected and the timing of the jetting in the nozzle array.

The array typically contains 300-600 nozzles, each with a diameter about that of the human hair. Each microjet discharges 10^{-8} milliliters of ink and creates a dot about 50 microns in diameter.

The pressure needed to fire the microjets is generated either thermally or by piezoelectricity. In thermal technology, a small heating element creates a pressure bubble which bursts and jets forth ink on to the paper. Piezoelectric printers have a piezoelectric crystal mounted on the ink reservoir. This crystal moves when it is electrically charged. The movement of the crystal pressurizes the ink to create a microjet.

Waterjet Robot For Small Spaces

Conjet AB has added the compact Conjet Robot 302 hydrodemolition machine to its comprehensive range of high pressure waterjetting equipment which selectively removes weakened and damaged steel reinforced concrete from numerous structures. The new Conjet Robot 302 is a remotely operated, computer controlled, high pressure waterjetting machine designed primarily for use in repairing concrete tunnels as small as 1.5 meters in diameter and other similarly confined spaces.

The small, lightweight, water resistant unit is exceptionally maneuverable and ideal for working in areas inaccessible to the standard larger Conjet robot waterjetting hydrodemolition equipment. It is exceptionally narrow and can pass through an 850 millimeter wide opening making the Robot 302 ideal for working in small tunnels, culverts, inside concrete box girder bridge decks and under quay wall parapets. The unit is also exceptionally efficient for use in numerous industrial cleaning applications, especially in small spaces and other areas of restricted access.

The Robot 302 consists of a crawler mounted undercarriage unit powered by a remote and separate CCU 176 computer controlled, electrically powered hydraulic unit, which allows progress of the hydrodemolition process to be safely controlled and monitored away from the hazardous cutting area. The CCU can be located more than 50 meters from the robot outside the tunnel, bridge deck box or on top of a dock or quay wall.

The remotely controlled tracked robot, which can adjust its tracks to suit the shape of the tunnel invert, carries a special hydraulically driven rotor complete with two or four high pressure waterjetting nozzles. The

rotor is mounted on a rotating and telescoping boom which allows the cutter head to constantly follow the tunnel wall profile and maintain the nozzles' preset angle of attack to the concrete. Maximum concrete removal depth with the rotor cutter is 50 millimeters. However, much deeper cuts can be made when fitted with the optional single nozzle mounted on an oscillating cassette and 1 meter long feed beam.

Water, at pressures of 1,000 bar (14,449 psi), 1,500 bar (21,735 psi) or 2,000 bar (28,980 psi) and respective flows of 180 liters per minute (47 gallons per minute), 120 liters per minute (32 gallons per minute) or 90 liters per minute (24 gallons per minute), is fed to the rotor from a 350 kilowatt diesel driven high pressure pump housed in a sound insulated standard 20 feet ISO container. The

(continued on page 4)

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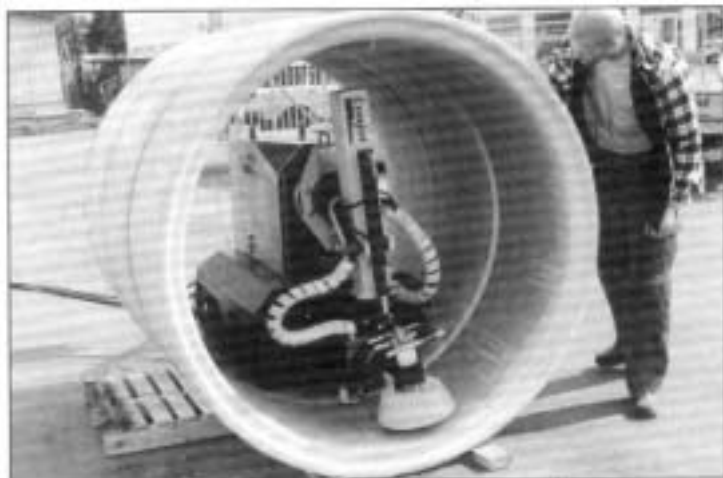
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Waterjet Robot For Small Spaces, from page 3

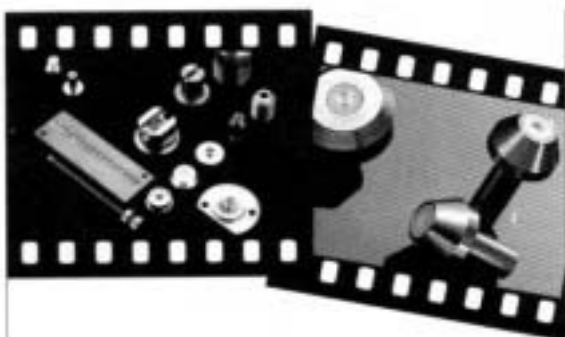
waterjet penetrates the damaged surface creating a hydraulic pressure in the concrete, which breaks and lifts away when the internal pressure rises above the tensile strength of the concrete.

All functions on the Robot 302 are operated by the CCU 176 hydraulic unit, which incorporates an advanced computerized closed loop control, monitoring and display system. This system is extremely flexible and very easy for the operator to use and optimize production. It displays and stores all the relevant parameters and machine performance data, which can be printed or downloaded to a PC for future reference or used in estimating future hydrodemolition projects.

The operator chooses one of several pre-loaded software programs to ensure that only the concrete to a predetermined quality depth is selectively removed in a continuous, uniform and safe operation. Additional programs are available on request to suit customers' individual requirements and the operator can also easily adapt and program the computer on site to match a specific operation or set the computer to memorize and save specific working settings for future use.



For further information, please contact Lars-Göran Nilsson or Carl Strömdahl at Conjet AB, P.O. Box 507, S-136 25 Haninge, Sweden, telephone: +46-8-741-3940, fax: +46-8-741-3960, e-mail: conjet@conjet.se, website: www.conjet.com.



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August 14*-17, 1999

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Abstract Submission Form

For each paper to be submitted for consideration, please complete this form, **attach a copy of the abstract**, and mail or fax to WJTA by December 31, 1998. Authors will be advised by February 3, 1999, regarding the decision of the Abstract Review Committee. Please send this form even if you e-mail your abstract.

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- ☐ Modeling (theoretical)
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- ☐ Contractor case study
- ☐ Manufacturing case study
- ☐ Software development
- ☐ Economic analysis
- ☐ Legal
- ☐ Other _____

Process

- ☐ Cutting
- ☐ Drilling
- ☐ Surface preparation
- ☐ Cleaning
- ☐ Stripping
- ☐ Safety
- ☐ Milling
- ☐ Jet-assisted
- ☐ Other _____

Related Industry

- ☐ Generic
- ☐ Shipyard
- ☐ Mining
- ☐ Construction
- ☐ Aerospace/Aircraft
- ☐ Automotive
- ☐ Oil/Gas/Refinery
- ☐ Quarrying
- ☐ Other _____

Jets

- ☐ Waterjet
- ☐ Abrasive-waterjet
- ☐ Abrasive suspension jet
- ☐ Pulsed
- ☐ Cavitation
- ☐ Polymer Jets
- ☐ Other _____

Material

- ☐ Metal
- ☐ Rock
- ☐ Glass
- ☐ Ceramic
- ☐ Composite
- ☐ Concrete
- ☐ Other _____

Environment

- ☐ Field work
- ☐ Factory work
- ☐ Submerged
- ☐ Nuclear
- ☐ Demilitarization
- ☐ Offshore
- ☐ Other _____

*August 14 is reserved for the Waterjet "Short Course" and Conference Welcoming Reception.

Mail completed form and abstract, **NO LATER THAN DECEMBER 31, 1998**, to: **Conference Coordinator, 10th American Waterjet Conference, Waterjet Technology Association, 917 Locust Street, Suite 1100, St. Louis, MO 63101-1413, USA, telephone: (314)241-1445, fax: (314)241-1449, e-mail: wjta@primary.net, website: www.wjta.org**

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Moleing Accidents, from page 1

anyone else in the crew. He/she will then be able to deactivate the mole faster than anyone else. The foot pedal acts as a "deadman" switch because stepping off the pedal immediately shuts off the water to the mole and eliminates the waterjet.

Section 10.9.1. of the *Recommended Practices for the Use of Manually Operated High Pressure Waterjetting Equipment* states regarding line moles or flex lances, "The feed assembly to the flexible lance or hose **shall** be fitted with either a dump system or a dry shutoff control valve. The operator inserting the nozzle **shall** maintain control of the dump system." These *Recommended Practices* were developed by the Waterjet Technology Association with extensive input from the waterjet industry. Most waterjet industry companies have safety manuals that also contain this rule.

A second method to help avoid these accidents is to use a length of rigid pipe (a stinger) on the flex lance just behind the mole to prevent the lance from reversing direction and shooting out the pipe.

A stinger should be used in line with the mole. Should the situation arise when the force on the mole becomes so configured that the mole is rotated toward the rear the stinger should become wedged crosswise in the pipe thereby preventing the mole from being repelled backward out of the pipe. The Contractors Safety Association of Ontario has publicized a safety manual, *High Pressure Water Blasting*. In section 7 of this manual, it states, "To prevent a nozzle from

reversing direction inside a tube and shooting its way back out with out warning a straight piece of pipe should be attached between the nozzle and the end of the hose." Most safety manuals of waterjet companies contain a similar requirement for the use of stingers in line moleing.

A third method to help avoid these accidents is to install a lance retention device on the pipe entrance.

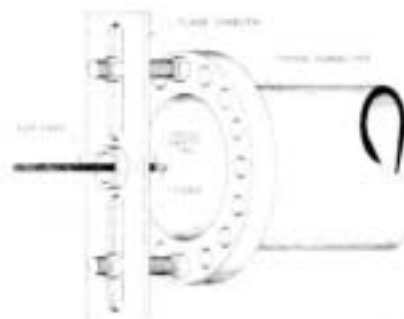
A retention device at the end of the pipe (similar to those shown in Figures 1 and 2) is a third way to help prevent the line mole from exiting the pipe while under pressure. The use of a retentive device is especially critical because it represents the last opportunity to contain an out-of-control lance.

The most recent advance in waterjet safety is the development of safety suits using the fiber Kevlar®.

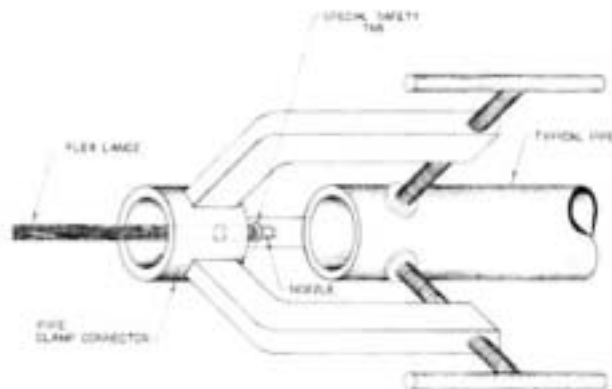
These suits were described in the March 1998 issue of *Jet News*. They are designed to protect waterjet workers from being cut

Figures 1 and 2

1. Flange end application:



2. Non-flange end application:



In both cases, these tools will prevent the line mole from being pulled out under pressure and potentially causing injury to the worker.

by high pressure waterjets traversing across the body such as could occur with an out-of-control line mole. And thus it is the last line of defense. These suits are presently being tested on the job by several waterjet contractors.

These safety suggestions have to be considered in conjunction with all other possible safety steps to design the safest system under your particular circumstances.

Illustrations reprinted courtesy of HydroChem Industrial Services, Houston, Texas, from HydroChem's *Safety and Operations Manual*, 6th edition.

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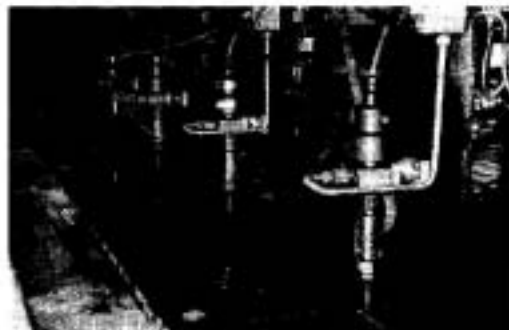
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Abstract submission deadline extended to December 31, 1998

Impressive progress and a fast-growing understanding of the diversified applications of waterjet technology are generating a growing excitement in the industry. New techniques and applications are being developed and current ones are being improved upon. Waterjet technology, now being used in nearly all types of industry — manufacturing, mining, construction, concrete, stone, aerospace, engineering, process, and medical industries — continues to expand at a rapid pace.

The 10th American Waterjet Conference will focus, from a practical and scientific viewpoint, on the most up-to-date industry advances in waterjetting equipment, techniques, and applications. Some of the areas to be addressed include but are not limited to:

- Abrasives, Water, and the Environment
- Advanced Industrial Applications
- Advances in High Pressure Technology
- Automotive Applications
- Cleaning and Coating Removal
- Components and Systems
- Construction and Non-Manufacturing Applications
- Contractor Applications and Processes
- Demilitarization, including removal of land mines (demining).
- Drilling Applications
- Excavation, Tunneling, and Mining Applications
- High Pressure Equipment and Systems
- Jet Mechanics
- Jet-Material Interaction
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- Market and Future Needs
- Novel Jets and Applications
- Process Modeling and Control Studies
- Rock Cutting
- Safety, Training, and Environmental Protection

To submit your abstract, see the Abstract Submission Form inserted in this issue of the *Jet News*!

Commercial and academic authors are encouraged to submit titles and abstracts for consideration. To submit an abstract(s), please complete the abstract submission form on the back of this sheet, attach a copy of your abstract(s), and forward to the attention of the Conference Coordinator at the Waterjet Technology Association. **The deadline date for submission of abstracts is December 31, 1998.**

An Abstract Review Committee consisting of four referees, chosen from the Organizing Committee and the International Advisors, will review the abstracts. Authors will be advised by February 3, 1999, regarding the decision of the Abstract Review Committee.

The 10th American Waterjet Conference is organized by the **Waterjet Technology Association** and is endorsed by the **International Society of Water Jet Technology**. The Waterjet Technology Association looks forward to providing this forum and to your involvement and participation.

1999 WJTA Conference Committee

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Waterjets To The Rescue

Superjet, a Brazilian waterjet company, used its ability to cut concrete to assist in the rescue of eight people buried in the debris of a collapsed building.

In February 1992, a five-story building on the beach of the city of Guaratuba collapsed, killing 12 people. The building became a 12-meter-high pile of debris. The debris was compressed by a concrete water reservoir perched precariously on top of the pile. It was feared that the reservoir would slip off the pile and cause additional damage to live people trapped under the debris and to adjacent buildings.

The dimensions of the reservoir were 6x3x2 meters, and the walls were 30 centimeters thick. The reservoir was made of reinforced concrete and was too heavy to be

lifted by the available cranes. It was decided, therefore, to cut the reservoir into pieces and to remove it piecemeal. Superjet used its waterjets to cut the concrete. The steel reinforced bars were cut with an oxyacetylene torch.

The removal of the tank took six hours, then Superjet started cutting the debris. The debris was removed by hand by 200 volunteers. Every 30 minutes the rescue work was stopped to listen for signals from survivors trapped in the debris. Some of the survivors were unconscious and made no response to the rescuer's calls.

The cutting operation was difficult because much of the concrete lay in difficult and dangerous positions. Care had to be taken to avoid vibration and dust and to shield the buried victims

(continued on page 10)



Figure 1. Superjet cutting concrete during rescue efforts in Guaratuba, Brazil. The concrete walls were cut with a 26,000 psi, 7 gallons per minute waterjet.

Photo courtesy of Eng. Luis Otavio Trotter

Classified Ads

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- Beam System - continuous motion for boiler cleaning, can operate two projects simultaneously.

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WANTED Water-jet Department Manager

Soheil Mosun Limited is a growing custom metal fabricator that provides water-jet cutting services and has an opening for a **Water-jet Department Manager**.

Must possess a minimum of (5) five years water-jet experience, with long term commitment. Engineering degree or diploma a definite plus.

A competitive remuneration package will be offered to the right candidate.

Please fax, courier or mail your resume and salary requirements to: **Soheil Mosun Limited, 34 Greensboro Drive, Main Floor, Toronto, Ontario, CANADA M9W-1E1, telephone: 1-888-446-6786, fax: (416)243-7132, website: www.sohailmosun.com**

FOR SALE Flow Quad Intensifier Unit

36,000 psi skid mounted Quad Unit. Recently fitted new Volvo TD7 Engine and new hydraulic pump. All in excellent operational condition. Ring Nick Handover in the UK on 01144 1285 740682.

Waterjets To The Rescue, from page 9

from the waterjet and cutting. After 24 hours of arduous work Luis and Christian Trotter of Superjet, working with police, firefighters and 200 volunteers, helped rescue eight people.



Figure 2. Rescue workers at Guaratuba, Brazil.
Photo courtesy of Eng. Luis Ortega Trotter



Figure 3. Superjet equipment at collapsed building at Guaratuba, Brazil.
Photo courtesy of Eng. Luis Ortega Trotter

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Ultra-high pressure and low flow (just 1.2 gpm, or 5.0 lpm) make the ULTRA-CLEAN 40 ideal for surface preparation, cleaning, cutting, abrasive cutting, and other applications.



Model 4030D has a 44 hp diesel engine.

Model 4030E
features a 30 hp
electric motor.



Key features include:

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- Compact and portable
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In Memoriam

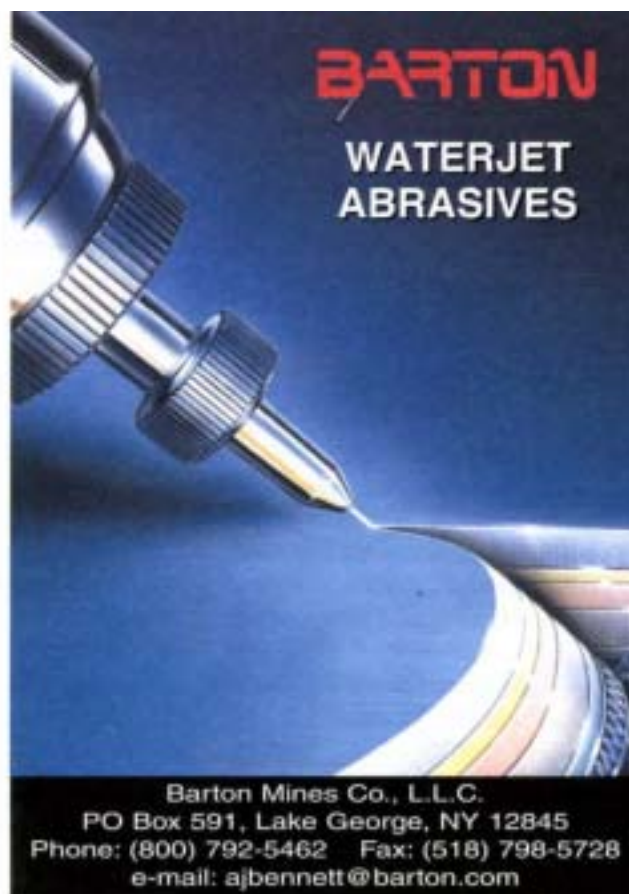
Mr. W.A. Summers, father of Dr. David A. Summers, Curators' Professor of Mining Engineering; Adjunct Professor of Nuclear Engineering; and Director of the Rock Mechanics & Explosives Research Center, passed away on July 27, 1998 in England at the age of 79 years. The funeral for Mr. Summers was on Friday, July 31, at the Anglican Church, St. Mary's and St. Cuthbert's in Chester-le-Street, England.

Dr. Summers is a fifth generation mining engineer and has been employed at the University of Missouri-Rolla since September 1, 1968.

A memorial, the W.A. Summers Mining Memorial Fund for Mining Students, has been established at the University of Missouri-Rolla. This memorial is set up to help mining students with costs associated with classes, such as books, supplies, materials, etc.

Donations to the memorial may be sent to:

Mrs. Vicki Snelson
Rock Mechanics & Explosives Research Center
University of Missouri-Rolla
1870 Miner Circle
Rolla, MO 65409-0660



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NLB 40,000 PSI Pump Features Low Flow, Low Maintenance, Long Component Life

The ULTRA-CLEAN 40®, the latest waterjet pump unit from NLB Corporation, gives contractors and industrial companies the advantage of ultra-high pressure — up to 40,000 psi (2,700 bar) — with flow of just 1.2 gallons per minute (5.0 lines per minute). A slow-running (just 200 revolutions per minute) triplex-plunger pump, designed for continuous duty, minimizes wear, downtime and operating costs.

Two models are available, both compact and portable. Model 4030D, powered by a 44 horsepower diesel engine, is 4 feet wide and 8 feet long (1.2 meters by 2.44 meters). Model 4030E features a 30 horsepower electric motor and is even smaller: 3 feet 4 inches by 6 feet (1.02 meters by 1.83 meters). Either can be mounted

on a skid or dolly; the 4030D can also be trailer-mounted.

The power and portability of the ULTRA-CLEAN 40® units make them ideal for many surface preparation, cleaning, cutting, and abrasive cutting applications. They can be easily moved from job to job, and fit in most elevators. Other features include water filtration, a 25-gallon (95 liter) water tank, and a programmable logic control (PLC) to alert the operator to problems or scheduled maintenance.

NLB manufactures a full line of quality water jetting systems and accessories for many uses, including paint booth cleaning, surface preparation, tank cleaning, descaling, concrete demolition, concrete and pipe cutting, and more.

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J.P. Lashmett

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Winchester, IL 62694

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Fax: (217)742-9503

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Diving & Hydroblasting De Colombia

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Bogota, Colombia

Phone: [57](1)2602262

Fax: [57](1)2602145

Samuel Wu

National Oil Well

12225 FM 529

Houston, TX 77041

Phone: (713)849-6464

Fax: (713)849-6479

Abrasive Machining System

Jet Edge will display their abrasive waterjet system at the Fabtech International '98 Conference and Exposition (Booth 858) in Cleveland, Ohio, on November 3-5, 1998. The system features a 30 horsepower intensifier pump along with a 30 inch x 30 inch table. The system has a positioning tolerance of ± 0.005 inch and a bi-directional repeatability tolerance of ± 0.001 inch. The company's technicians will be cutting a range of materials, from aluminum to stainless steel.

Also on display will be software used to optimize cutting speeds and surface finishes. The software provides enhanced features including, automatic acceleration/deceleration functions, automatic machine tool offset/compensation, enhanced scanned image conversion and a built-in CAD/CAM design system.

For further information, contact Jet Edge, 825 Rhode Island Avenue South, Minneapolis, MN 55426, telephone: (612)545-1477 or 800-JET-EDGE, fax: (612)545-5670.

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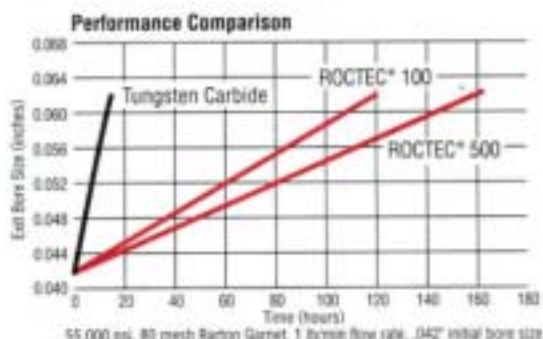
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New ROCTEC® 500 AWJ nozzles set an even higher standard for nozzle performance and overall AWJ system efficiency. While original ROCTEC 100 AWJ nozzles outlast tungsten carbide 10 to 20 times, ROCTEC 500 nozzles increase service life approximately 30% over ROCTEC 100 nozzles. And that means lowest total cutting costs per inch by increasing average cutting speed, reducing system downtime for nozzle changeouts, and maintaining cutting precision, predictability, and consistency.

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.

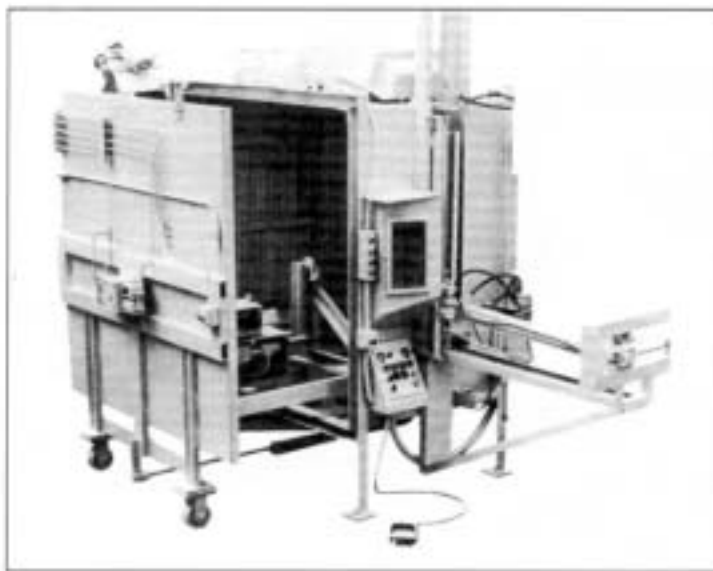
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Waterjet Cabinet

Aqua-Dyne, a manufacturer of *Water Energy™* pumps, systems, and accessories rated to 40,000 psi, offers a waterjetting cabinet for high pressure water energy cleaning (with or without abrasive additives) of castings, machined parts and other molded materials.



The 48 inch wide, by 80 inch long, by 70 inch high work area is viewed through a safety glass viewing port. A joy stick type control system manipulates the object inside the box into any desired position where water at 5 to 60 gallons per minute and at pressures of up to 20,000 psi easily removes greases, coatings, scale, and contaminants. Hydraulic power is used to operate the door, position the water nozzle, and manipulate the object inside the box. An optional conveyor system removes debris from the cleaning operation. The cabinet can be used in conjunction with all of Aqua-Dyne's waterjetting pumps.

High Pressure Rotary Unions

Aqua-Dyne also offers several models of its stainless steel rotary unions. These "In-Line Flow Swivels" permit the rotation of water hoses at speeds to 500 revolutions per minute, pressures to 20,000 psi and fluid flow rates to 200 gallons per minute. Rotation can be achieved by air, hydraulic or electric motor. Applications include, waterjet tools, jet

assisted drilling, articulation joints, rotary lancing and hydro-demolition.

Advanced technology polymer seals and triple heavy duty sealed combination radial and thrust load bearings ensure long, trouble-free operation for maximum flow and maximum pressure rating at temperatures of up to 250 degrees Fahrenheit.



For additional information call (800)324-5151, (713)864-6929, fax: (713)864-0313, e-mail: infor@aqua-dyne.com, or website: www.aqua-dyne.com.

WJTA Request For Proposals

The Waterjet Technology Association (WJTA) is requesting proposals for the preparation of reports on topics of interest to our membership. These reports will be literature searches, surveys, and data gathering activities only, not research and development work. These reports will then be made available to WJTA members at a minimal cost.

The following topics are of interest:

1. Spark hazard, or lack of, with abrasive waterjets.
2. The use of pipe threads and other pipes found in high pressure connections.
3. Concrete demolition rates using waterjets.
4. Market size for waterblast equipment or services.
5. An index of papers in WJTA publications, cross-referenced by subject and author.
6. Types of abrasives — characteristics and applications.

Please submit your proposals to: WJTA, 917 Locust Street, Suite 1100, St. Louis, MO 63101-1413.

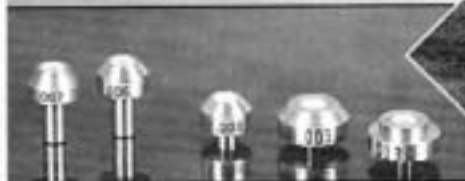
Include a description of the scope of work to be performed, total cost, author's credentials and anticipated time to complete the work. Proposals will be evaluated and funds committed by the WJTA Monograph Committee (John Wolgamott, Thomas J. Kim, Ph.D., Lydia Frenzel, Ph.D., and Mohamed Hashish, Ph.D.). Once a topic has been assigned, it will be announced in *Jet News* and members will be encouraged to submit information to the author(s). Proposals for reports on other topics will also be considered.

A total of \$5,000 has been budgeted for the first reports. The number of topics this will fund will depend on the cost of each report. If the initial reports are judged as worthwhile, more funding will be made available and additional reports will be solicited. WJTA members are encouraged to submit ideas for other topics to study.

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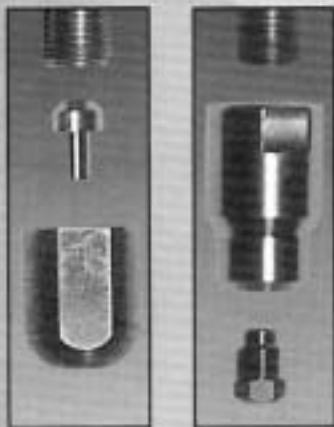
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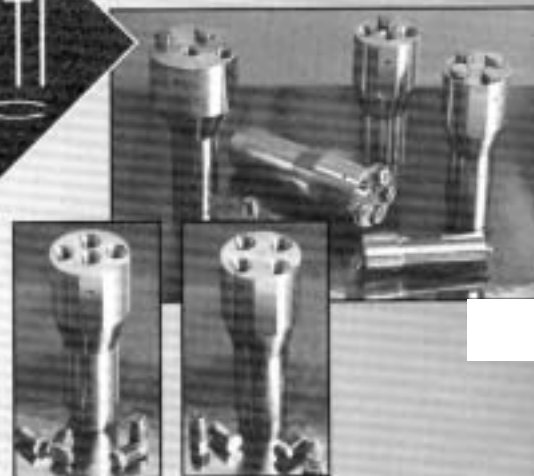
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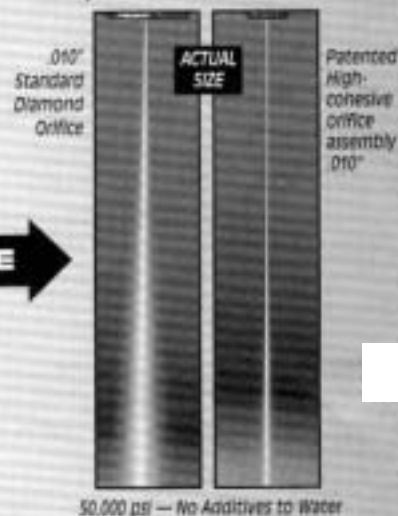
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