

W J T A

Waterjet Technology
Association



Jet News

DECEMBER 1997

*Published by the
Waterjet Technology
Association
for the benefit of its
members*

917 Locust Street, Suite 1100 • St. Louis, MO 63101-1413, USA • Telephone: (314)241-1445, Fax: (314)241-1449

Fountains



Waterjets are not only technologically useful, they are beautiful. Many public spaces, like gardens and city parks, have a fountain as the center of attraction. The Jet d'Eau in the center of Geneva, Switzerland was featured in the June 1997 issue of *Jet News*. Shown above are the waterjets of Butchart Gardens on Vancouver Island, British Columbia. The musical fountain in California Plaza in downtown Los Angeles, California is described on page 4.

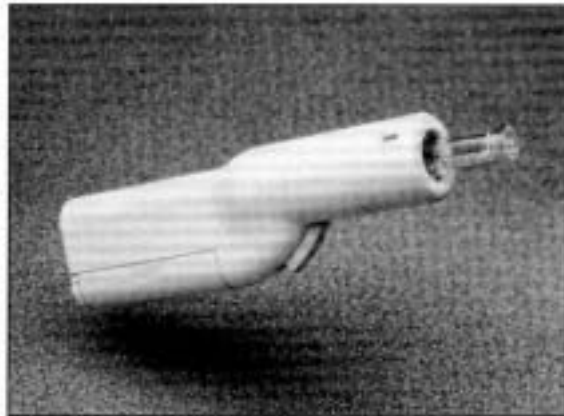
Butchart Gardens photograph courtesy of Dr. Glenn Howells.

Jet Vaccination

Bioject Inc. of Portland, Oregon develops, manufactures and markets jet injection systems for needle-free drug delivery. The Biojector® 2000 (shown in the accompanying figure) is a hand-held jet injection device powered by compressed carbon dioxide. It generates a jet which effectively penetrates the skin and delivers medications to the patient's tissues. It is used for intramuscular and subcutaneous injections of a wide variety of medications. The system is currently being used at public health clinics, hospitals, and physician's offices throughout the United States. It administered about 500,000 doses of flu vaccine during the 1996 flu season and has been used for hepatitis immunizations.

Jet injection has the following advantages over the conventional needle-syringe method. It boosts immunization rates by avoiding the patient's fear of needles; it eliminates the logistical problem of the safe disposal of used needles; and it eliminates the threat of needle-stick injuries to healthcare workers.

Boosting immunization rates is a challenge for public health professionals. One of the reasons for the lower-than-desirable rate of immunization attained in the US is the patient's fear of needles. Most toddlers and young children fear injection and may have to be restrained. Sometimes it is not possible to restrain older children so these patients cannot be vaccinated by needle injection. The Biojector 2000 offers a simple solution. Vaccinations



The Biojector® 2000, an advanced needle-free system for intramuscular and subcutaneous injections, was engineered by Bioject Inc. of Portland, Oregon.

can now be administered with minimum discomfort to the patient with this needle-free delivery system. Although the Biojector 2000 is not painless, it is less painful than a needle and syringe and it eliminates the visual effect of the needle on the patient.

Immunization clinic logistics are simplified by adopting a jet injection system. This eliminates the problem associated with having to discard hundreds of used needles and find a disposal site which will accept them as biohazardous waste.

Because of the AIDS and hepatitis epidemics, healthcare workers have a serious concern for their own health and safety. The once routine procedure of administering injections can be a life-threatening event. Infectious diseases have been transmitted to healthcare workers by needle-stick injuries. A healthcare worker stuck with a HIV-infected needle has a 1 in 250 chance that the incident will result in HIV-virus infection. Jet injection eliminates the risk of needle-stick injuries because no needle is used — a jet is used to carry the medication through the skin.

Woma Goes Internet

Woma Apparatebau GmbH, Duisburg, Germany, a worldwide active leading manufacturer of high-pressure waterjetting technology, can now be contacted via internet. Under the address <http://www.woma.de> extensive information about the company as well as about the product program can be found. The presentation contains a company profile, a review about Woma's high-pressure plunger pumps, high-pressure waterjetting systems and high-pressure water tools and accessories. Additionally, the application range of the waterjetting technology is addressed. A news-page, that will be actualized every second week, informs about new products and extraordinary site applications. The first issue introduces Woma's new high-pressure waterjet system "Impact Cleaner 1000-1" for mobile cleaning of pipe bundle systems.

Waterjet Connection Expands To Over 80 Systems Nationwide

Waterjet Connection continues to expand, offering the largest waterjet contract cutting service in the USA. It now has over 80 systems in operation, including several five axis abrasive systems. Waterjet Connection has quickly spanned the continental United States and is continuing to grow.

Made up of independently owned and operated waterjet job shops, Waterjet Connection has made it a goal to link potential waterjet clients with cutting service providers. Please direct all inquiries to Paula Genova at (888)633-7698.

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California Plaza

The California Plaza waterstage is a place of beauty in downtown Los Angeles where office workers can relax on their lunch hour. This waterstage puts on a show in which waves and jets of water move in time to music. The movement of the water is determined by an animation program which controls pneumatically operated butterfly valves.

The waterstage contains a wave generator, nozzles, and two weirs. A wave tank stores water used to create a wave effect. Water flows from the back of the waterstage out and over stone steps downward where it is collected for recycling.

The water supplies to the nozzles in the waterstage are controlled by a variable speed motor controller that varies the jet height in time with the music.



The waterstage at California Plaza. Photograph courtesy of California Plaza, Los Angeles, CA. The waterstage was designed by Wet Design, Inc., Los Angeles, CA.

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*WJ-1 is an international surface standard, ref. NACE No. 5/SSPC-SP 12.

Hydrodemolition On The Approach To The St. Gotthard Tunnel In Switzerland

The Northern lane of an 8 kilometers long section of the Highway A2 that guides drivers to the famous St. Gotthard tunnel for traveling through the Alps Mountains was under extensive renovation from March 1 until June 26, 1997. Many parts of this road are protected against avalanches by galleries. The gallery roofs are supported by conical, heavily reinforced concrete pillars located on the right side of the road in direction to the tunnel entry. These pillars are placed on a long horizontal concrete platform. The left side of the Northern lane is bounded by the mountain walls — they are supported by steel anchors and a concrete cover reinforced by wire grids. All those constructions required urgent maintenance because they were damaged by wear, chloride attack and corrosion.

A very tough part was a 700 meters long road section that covers three galleries and a bridge. The three galleries contain 111 reinforced pillars, each with a cross-section of 50 x 60 centimeters. The compressive strength of the concrete was about 50 megapascals. From these pillars concrete layers of a thickness between 2.5 centimeters and 6 centimeters were removed up to a height of 3 meters. The space between and behind the pillars was very limited and access restricted by bold rock and precipices. For the removal of the concrete an Aqua Cutter Hydrodemolition Robot HV-550 and a PP-480 power pack were used. The robot operates fully automatically on all sides of the pillars by computer controlled movement of the power head on the standard vertical mast assembly, removing the concrete to a preset depth without damaging the remaining structure. (for more information, see <http://www.aquajet.se>). The complete reinforcement was exposed and cleaned by the waterjet. After the casting of the new concrete was

completed, the pillars were wrapped by special steel plates to a height of 1.5 meters from the ground, for corrosion protection.

Additionally, 150 meters of the horizontal platform that carries the pillars was treated in order to remove the concrete covering the reinforcement bars. Concrete was removed at locations where reinforcement bars were damaged by chloride attack. The removal depth was about 2 centimeters. Part of this job was also done by using hand-held waterjet tools.

A 1200 meter area of concrete was removed from the left side wall by Aqua Cutter Hydrodemolition Robots, to a pre-set quality depth to secure removal of all deteriorated parts of the structure. Later, this area was sealed by flat coats and a top sealing. Additionally, small horizontal niches were cut into the concrete walls by waterjetting guns for hosting additional supply pipes and cables. The concrete beds of the rock supporting steel anchors were also removed by hydrodemolition since the anchors needed to be strengthened.

The bridge in this road section consists of two parts originally separated by a parting line that allowed the movement of the two bridge parts.



Gallery-pillars after the reinforcement is exposed by mechanized waterjetting. Photograph courtesy of WOMA Corporation.

After the construction settled down and no additional movements were expected the decision was made to realize a rigid connection between the bridge parts by additional reinforcement. Therefore, the fore-parts of the two concrete members were hydrodemolished up to 50 centimeters depth. For the upper parts of the members, the top sections of the fore-parts, and for any non-reinforced sections, this was done by conventional milling and jack-hammering on locations not sensitive for surrounding structural damage. In the more sensitive lower sections, the removal work was done by Hydrodemolition Robots only, since this method performs vibration-free, it will not cause any damage to the remaining structures.

Interestingly, the water consumed by the hydrodemolition units was pumped up directly from the river. It was collected after use and neutralized

(continued on page 6)

Hydrodemolition On The Approach To The St. Gotthard Tunnel, from pg. 5

before it was released back to the river again.

Concrete was replaced by the wet shot crete method and by cast in situ method.

Five Aqua Cutter Hydrodemolition Robots of different models were in action at the same time. The robots were powered by various high pressure power packs up to 600 horsepower. In addition several high pressure water jets were in operation with hand held guns for trimming and surface preparation.

This first phase of the giant project was finished in the short time limit because of the contractors' experience and the high quality and efficiency of all equipment used on site. Additional traffic problems in this important link to Southern Europe were avoided. The renovation work at this huge site will be continued on at Southern lane in

early Spring 1998 by the same contractors.

In the Swiss construction industry, where a very experienced and well organized hydro-demolition community is installed, many Aqua Cutter robots and high pressure power packs, of various models, are permanently under contract on heavy concrete rehabilitation projects.

Also several very flexible WOMA High Pressure and Ultra-High Pressure Systems "Ecomaster" and



Aqua Cutter Hydrodemolition Robot. Photo courtesy of Aquajet Systems AB.

"Twin Jet" for surface preparation, are very widely used in Switzerland (for more information, see <http://www.woma.de>).

All Hydrodemolition equipment from Aquajet Systems AB supplied by Birchmeier-Atlumat AG in 5444 Künten, Switzerland.



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Letters To The Editor

Dear Jet News:

I am a member of WJTA, and I have a question.

Do you have an equation to compute the "impact force" or "cleaning effect" for high pressure cleaning machines?

In the Taiwan market many companies selling high pressure cleaning machines only mention the pressure to the customer without the water flow.

For example, they will recommend a machine with the following specifications: 10,000 psi with 5 gallons per minute 40 horsepower. However, if we use a machine with 6,000 psi and 10 gallons per minute, we can get better cleaning effect.

Thanks,

Thomas Lee

Dear Mr. Lee:

This is in response to your letter regarding the cleaning effect of waterjets. The cleaning effect of a waterjet is dependent on its pressure and flow rate. Pressure determines the hardness of the deposit that can be removed. Higher pressure jets can remove harder materials than lower pressure jets. The flow rate of the jet determines the rate with which a deposit can be removed. The higher the flow rate you have the faster the deposit is removed provided the jet has enough pressure to remove the material in the first place.

The selection of the pressure and the flow rate to use depends upon the properties (hardness) of the surface you are cleaning. You must first determine the threshold pressure, i.e.,

the pressure needed to begin to remove the coating. You should then multiply this pressure by three to determine the pressure needed to effectively remove the material. Pressures higher than three times the threshold pressure are not necessary so the remainder of the available pump power should go into providing the maximum flow rate possible at this pressure in order to maximize the material removal rate.

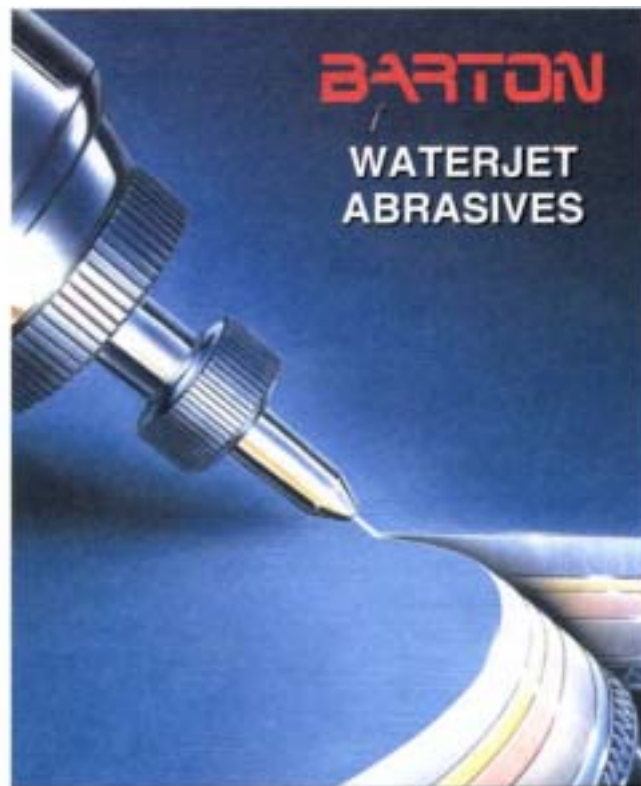
In the example you cite, a 6,000 psi, 10 gallons per minute machine would clean better than a 10,000 psi, 5 gallons per minute machine if the threshold pressure needed to remove the deposit was less than 2,000 psi. The threshold pressure was above 2,000 psi, the 10,000 psi, 5 gallons per minute jet would be the better choice

Sincerely yours,

George A. Savanick, Ph.D.

Dear Jet News:

Previously I reported¹ on the complete and incisive cutting of Vistanex by a 0.3% solution of Super-Water[®] but without abrasives. (Vistanex, Exxon Chemical, is a soft, very viscous [Brookfield Viscosity: 47,500-68,500 cycles per second @ 350°F],



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permanently tacky, clear yellow to water-white semi-liquid).

By inclusion of abrasives this incisive cutting technique has now been extended to other materials. Thus 304L stainless steel and aluminium, two materials differing widely in their physical properties from Vistanex, can now be cut by Super-Water[®].

STAINLESS STEEL

The work was conducted at the facilities of Bar le Duc, France.

The equipment and conditions used were:

Weber Lubrifiants Sa, Intensifier Injection System for Super-Water[®].

Ingersoll Rand (IR) intensifier type SL II, fitted with an Autoline cutting head.

Target material: 304L stainless steel (10 millimeters thickness).

Pressure: 3,000 bar.

Fluid flow rate: 1.85 liters per minute.

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Letters To The Editor, from pg. 7

Nozzle diameter: 0.25 millimeters.
Stand-off time: 4 millimeters.
Cutting speed: 143 millimeters per minute.
80 mesh (Australian) Barton abrasive (by Venturi induction).

Cutting used 30 kilograms per hour of abrasive when plain water was used.

However only 16 kilograms per hour of abrasive was required when using a 0.3% solution of Super-Water®.

The 47% decreased abrasive consumption with Super-Water® was accompanied by a smaller kerf and better cut quality.

ALUMINUM

At Ronneby, Sweden, similar results were obtained.

The equipment and conditions used were:

Weber Lubrificants Sa, HSSW®.
IR intensifier type SL IV with proprietary cutting head.
Target material: aluminium (thickness 25 millimeters).
Pressure: 3,500 bar.
Fluid flow rate: 1,800 liters per minute.
Sapphire nozzle: 0.25 millimeters.
Focusing tube diameter: 1.05 millimeters.
Stand-off distance: 3 millimeters
Cutting speed: 67.5 millimeters per minute.
80 mesh Quality GANEX (by Venturi induction).

The cutting used 400/500 grams per minute of abrasive when plain water was used.

Cutting with a 0.3% solution of Super-Water® required only 200/250 grams per minute of abrasive.

The 50% decreased abrasive consumption with Super-Water® was accompanied by a better cut quality.

These data parallel earlier results by Howells² on the increased abrasive cutting efficiency using Super-Water®. He reported that Super-Water®, in conjunction with 100 grit copper slag as an abrasive, cuts laminated glass (13/16 inch thick), aluminum (1/4 inch thick) and stainless steel (up to 1 inch in thickness) 20% faster than with

copper slag/plain water. No data was given on abrasive consumption. Howells² believes that these improvements in "standard" abrasive cutting by Super-Water® are due to two phenomena. These are improved jet coherence and more effective momentum exchange between the viscous Super-Water® solution and the abrasive particles.

Because wetting is a relatively slow process, he thinks it highly unlikely that substantial wetting of abrasive occurs in the transient contact between abrasive and fluid in the "standard" abrasive mixing chamber. However the surfactants present in Super-Water® should promote wetting of the abrasive particles and this too should increase the overall efficiency.

Howells also predicts^{2,3} that introduction of the abrasive as a suspension in Super-Water® would further increase performance efficiency. This would occur by markedly reducing or eliminating air intake into the mixing chamber. Then the necessity of mixing a 3-component system, i.e., air, liquid and abrasive, would be reduced to mixing a liquid and abrasive, ostensibly a simpler task.

Daniel Weber

Chief Executive Officer
Weber Lubrificants Sa
Post Box 46
Rixheim Cedex 68171 France

1. D. Weber, letter to the Editor, *Jet News*, February 1997, p. 12.
2. W.G. Howells, "Additive Improves Abrasive Jet Cutting," *Jet News*, December 1995, pp. 5 and 10.
3. W.G. Howells. Personal communication, October 11, 1997.

Dear Jet News:

From my recent publication¹ I have concluded, for an annual purchase of

\$200.00 for Super-Water®, that: **Decoustics Limited was provided a return on investment of 2,000 to 1.**

My work gives an unambiguous demonstration of the economic advantages of using this additive in ultra-high pressure waterjet cutting.

Relative to plain water Super-Water®:

- Improved the quality of cut²: i.e., little or no subsequent edge sanding required.
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- Increased cutting speed by 30%-200%.
Estimated annual production increase = \$420,000 in receivables.
- Reduced intensifier operating and maintenance costs by 38%.
(\$11.12 per hour [1993] to \$6.86 per hour [1996] = \$4.26 per hour reduction)
Estimated annual operating savings = \$1,025³.

My results are for cutting fiberglass acoustical panels, ranging from 1/8 inch (3.2 millimeters) to 4 inches (101.6 millimeters) thick (Decoustics Limited, Etobicoke, Ontario, Canada), using a Flow International intensifier.

I would be pleased to answer any questions on the technical aspects of this work (telephone number: (800)387-3809 or (416)675-3983).

My results parallel those previously published for precision cutting of natural-, synthetic-, silicone-, and foam-rubber⁴ as well as synthetic materials such as Vistanex⁵ and shoe soles⁴.

(continued on page 10)

Vulcan Waterjet Announces Hazardous Material Cutting Service

Vulcan Waterjet Cutting Services recently announced a valuable new environmentally responsible capability—cutting hazardous materials. Antimony, Arsenic, Asbestos, Barium, Beryllium, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Silver, Thallium, and Zinc are among the materials that can now be cut with environmental safety and waterjet precision.

Charles Yanke, President of Vulcan Lead Products Co., the parent company of Vulcan Waterjet, discussed the environmental impact of the new service in a recent interview. "Our innovative Closed Loop Water and Kerf Recovery System captures all the water and hazardous material kerf," Yanke explained. "Even the smallest particles are removed. The wastewater treatment system is so efficient, that we are classified as a no-net consumer of water, that is, no

water goes down the drain," he stated. Yanke also stressed the cost-effective aspects of the process. "In addition to the benefits Vulcan Waterjet customers realize from the supersonic, cool erosion process, the notable reduction of costs related to hazardous waste disposal can be truly significant."

The sophisticated closed loop system cleans the water down to particles **less than .5 microns** in diameter. The water is then reused to cut more product. All the abrasive and kerf from the hazardous material is sealed and stored in hazardous waste drums before it is sent to either an EPA approved RCRA part B recycling center or an EPA authorized disposal facility.

A complete cradle-to-grave manifest tracking system follows the material and its waste to ensure that any and all environmental issues are covered and environmental liability is prevented. Vulcan has been audited by the EPA

for proper waste disposal and was found to be in **complete** compliance.

Vulcan Waterjet Cutting Services provides customers with the advanced technology of high-speed abrasive cutting on virtually any material, including those designated "hazardous", up to 5 inches thick. The Vulcan waterjet is ideal for cutting industrial parts with intricate patterns and creating unique custom designs. Advantages of the Vulcan waterjet include prototype to production with no tooling, full CNC capability, single pass cutting, no thermal deformation, multidirectional cutting, environmentally sound kerf and water recovery and reduced dust emission. To demonstrate its unsurpassed performance, Vulcan Waterjet provides FREE sample cuts upon request. For more information about Vulcan Waterjet Cutting Services, call (414)645-2040 or (800)932-5323 or e-mail: vwaterjet@aol.com.

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Renato Lombardi

Systems Manager
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Canada

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1. R. Lombardi, "Ultra-High Pressure Non-Abrasive Polymer Jetting: A Production Environment Implementation," *Proceedings of the 9th American Waterjet Conference* (Dearborn, Michigan, August 23-26, 1997), Paper 17, pp. 251-266.
2. R. Lombardi, "Cutting Fiberglass Acoustical Panels," *Jet News*, December 1995, p. 7. Also see ¹.
3. R. Lombardi, letter to the Editor, "...the longevity of our consumable jet components due to the lubricity of Super-Water®," *Jet News*, November 1996, pp. 2 and 11.
4. W.G. Howells, "Polymerblasting with Super-Water® from 1974-1989: a Review," *International Journal of Water Jet Technology*, Volume 1, Number 1, (March 1990), pp 1-16.
5. W.G. Howells, "Additive Improves Abrasive Jet Cutting," *Jet News*, December 1995, pp. 5 and 10.
6. D. Weber, letter to the Editor, *Jet News*, February 1997, p. 12.

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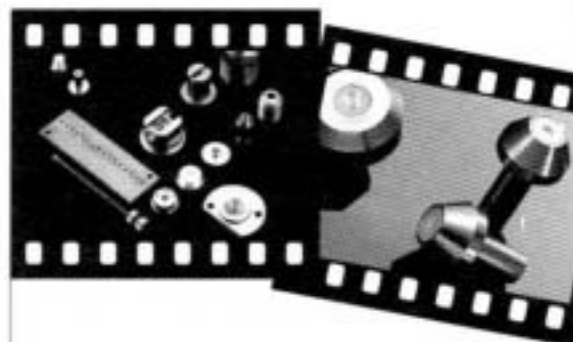
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9th American Waterjet Conference Photographs

August 23-26, 1997 • Dearborn, Michigan

Conference participants examine the latest in equipment and supplies in WJTA's exhibit hall



Forrest Shook, Conference Chairman, and George Savanick, WJTA President, cut the ribbon to open the WJTA Exhibit Hall.



photographs continued on pg. 15

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CORRECTION

The editor regrets that the incorrect city name was listed for Reinke Manufacturing Company in the October 1997 *Jet News* article, "Waterjets On Irrigation Systems." The correct address is:

Reinke Manufacturing Co., Inc.
101 Reinke Road
P.O. Box 566
Deshler, NE 68340

The 4th Annual Pumper & Cleaner Environmental Expo West

The largest annual convention and trade show for Western liquid waste management and sewer/drain cleaning professionals was recently held in Long Beach, California (USA) October 16-17-18, 1997.

The fourth annual Pumper & Cleaner Environmental Expo West drew 742 different companies and 1500 total attendees, a 24% increase in attendance over 1996. It featured two educational seminars, five exhibit hall workshops, and six hands-on outdoor demonstrations. 114 exhibitors displayed their wares in 130,000 square feet of exhibit space.



Aqua-Dyne's exhibit.

Products and services of interest to collection system operators and contractors included: pipeline rehabilitation equipment/services (including new robotic trenchless technologies); video inspection equipment; combination jetting/vacuum machines; wet/dry vacuum loaders; catch basin cleaners; high pressure waterblasting equipment; cable and bucket machines; sewer jetters and rodding machines; and much more.

Items on display of interest to liquid waste management companies included: septic and industrial vacuum trucks and tankers; vacuum/pressure pumps; hose and couplings; portable toilets, trailers, sinks, chemicals, and service trucks; sludge dewatering



Spartan's outdoor demonstration.

equipment; grease separation equipment; safety equipment; and much more.

For 1998 the entire event will once again be located at the Long Beach Convention Center in Long Beach, California, September 24-26. The pre-registration rate is \$10 (US) per person until August 14, 1998 (\$15 on site) and permits admission to the exhibits on all three days and attendance at any of the seminars, workshops and demonstrations.

To receive an informational brochure and registration information, write the sponsors of the convention: Cole Inc., PO Box 61, Three Lakes, WI 54562 USA; or phone toll-free in US and Canada (800)257-7222; elsewhere (715)546-3346; fax: (715)546-3786. E-mail: cole@cleaner.com or cole@pumper.com. See us on the Internet, www.cleaner.com or www.pumper.com.



U.S. Jetting's outdoor demonstration

Photographs of the 1997 Pumper & Cleaner Environmental Expo West courtesy of Cole, Inc.

Boride Introduces Longer Life Abrasive Waterjet Nozzle

Boride Products has announced a new, longer-wearing abrasive waterjet (AWJ) nozzles that can increase service life approximately 30% over all previous nozzle options. The new ROCTEC® 500 nozzles join ROCTEC 100 nozzles to provide another price/performance option for AWJ system users. While ROCTEC 100 nozzles typically provide from 80 to 140 hours of cutting performance, new ROCTEC 500 nozzles can provide from 100 to 180 hours of service, depending on the application and abrasive used.

The ROCTEC 500 AWJ nozzles are made from patented ROCTEC composite carbides which are tungsten carbide based materials formed using the patented Rapid Omnidirectional Compaction (ROC) process for which Boride Products holds an exclusive license.

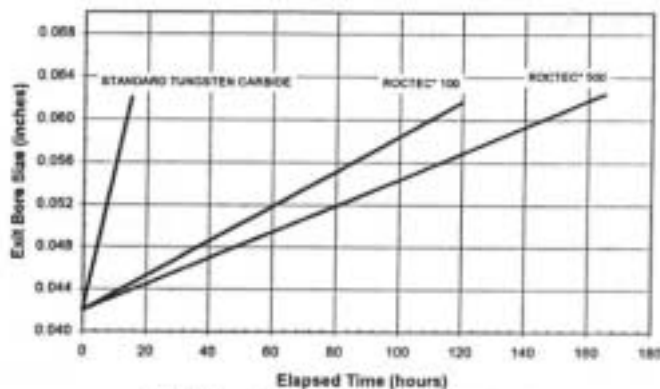
According to Jeff Gardner, marketing manager, by providing superior wear resistance, the new ROCTEC 500 nozzles will deliver the lowest total cutting costs per inch by increasing average cutting speed, reducing system downtime for nozzle changeouts and maintaining cutting precision, predictability and consistency.

ROCTEC 500 AWJ nozzles are available exclusively through abrasive waterjet equipment manufacturers.

For more information, contact Boride Products, a division of Greenfield Industries, by phone (800)662-2131 or (616)946-2100 or by fax (800)662-2132 or (616)946-3025.

*Trademark of Greenfield Industries, Inc., or its affiliates.

Abrasive Waterjet Nozzle Performance Comparison



80,000 psi, 80 mesh Boron Carbide, 1 Barmin flow rate, 3/4" initial bore size

Comparative testing documents extended service life provided by ROCTEC nozzles versus tungsten carbide. ROCTEC nozzles also were observed to wear concentrically, providing greater cutting precision right up until replacement.

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Add To Final Rinse Water
or Waterjet Spray

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Non-Combustible & Non-Corrosive

Heat Solution to speed Drying Time

No Odor, Even When Heated

New Oscillating Soliton Gun (Patent Pending) Developed For 60,000 psi By Aqua-Dyne

Aqua-Dyne, Inc., a leading manufacturer of high pressure Water Energy™ Systems for the waterjetting industry, has announced the introduction of an innovative, new Water Energy™ gun engineered to minimize maintenance cost, maximize waterjet cleaning power and enhance productivity rates.

The Soliton Gun (patent pending) features a unique oscillating arm which provides greater cleaning efficiency than any conventional rotary or manually operated nozzle. Designed for tough cleaning jobs requiring up to 60,000 psi working pressure, the Soliton Gun is adaptable to use one or more Aqua-Dyne Shape Jet nozzles or any standard waterjetting nozzle. The up and down oscillating motion of the Soliton Gun's nozzle arm is powered by a small one-half horsepower air motor which produces 500, 950 and 2100 revolutions per minute to operate the cleaning nozzle. A high pressure water hose is connected from the gun to an air dump valve which allows the high pressure water to be conveniently dumped at a remote location rather than at the blasting site, thus eliminating clean up and hazard.

The Soliton Gun's new oscillating design improves performance and productivity by always directing the nozzle to a fresh surface as compared to the uneven overlapping directional control problems characteristic of rotary nozzles. The Soliton Gun is lightweight (approximately 6 pounds) and available in a selection of lengths and body styles. The unique engineering design of the Soliton Gun with its compact nozzle end provides an especially effective technique for removing thick deposits, cleaning in tight or cramped locations and allowing the operator to keep a more consistent cleaning angle with the work surface.

Another important feature of the Soliton Gun is its ability to eliminate rotary sealing and waste of energy due to its concentrated overlapping cleaning coverage.

Aqua-Dyne's new Soliton Gun offers the following features not found in standard waterjetting guns.

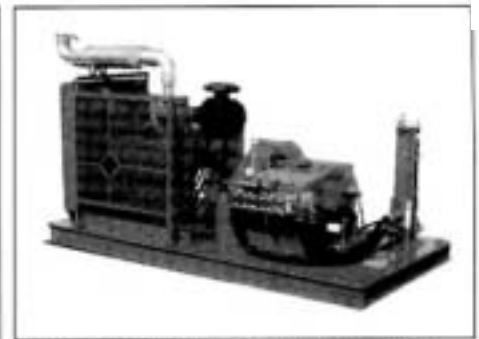
- Maximum working pressure - 60,000 psi
- Concentrated overlapping coverage
- Lightweight and compact design
- No dynamic seals to replace
- Air dump valve control
- Single or multiple jet energy delivery
- High flow with minimal pressure loss
- Maximum flow to 30 gallons per minute (113 liters per minute)

New Aqua-Dyne Pumps

Aqua-Dyne, Inc. has available two new brochures describing its new C and GA Pump lines rated to 35,000 psi.

The C Pump Series is available with working pressures rated from 5,000 to 35,000 psi, up to 500 horsepower and flows ranging from 9.8 gallons per minute to 171.4 gallons per minute. The GA Pump offers performance with up to 200 horsepower, working pressures from 5,000 to 35,000 psi and flow ranges from 3.7 gallons per minute to 68.6 gallons per minute.

The new C and GA Pump brochures include graphs highlighting the pumps' pressure and flow ranges, horsepower ratings, pump speeds and plunger sizes available. The brochures also contain pump performance charts for low,



C Pump Water Energy™ System

medium, high and very high pressure pump models and dimensional drawings of the different fluid ends available in each line. Descriptions of the C and GA Pump fluid end and power end components are included along with detailed illustrations of Aqua-Dyne's Water Energy™ generators, tools and Accessories.

The C and GA Pumps are the hearts of Aqua-Dyne's high pressure Water Energy™ generators which can be powered by diesel or gas engines, electric motors or hydraulic systems and may be mounted on a skid, tandem four wheel trailer or in-plant steerable trailer. Both pump lines feature Aqua-Dyne's original Valve-in-Line sectionalized, stainless steel fluid ends which are field tested and designed for dependability.

Fluid ends for both the C and GA Pumps have non-scoring alumina ceramic plungers (optional colmonoy or tungsten carbide coated steel available), heat treated stainless steel valves and seats and proprietarily treated stainless fluid cylinders. New dripless, self-adjusting V-ring packing made of advanced polymer material is standard for each pump along with a closed loop pressure lubrication system for the plungers and packing with water supplied by the suction manifold.

(continued on page 20)

Flow Names Brad Lawrence Chief Operating Officer

Flow International Corporation (NASDAQ:FLOW) has promoted Executive Vice President R.B. (Brad) Lawrence to the position of Chief Operating Officer. Lawrence will have operational responsibility for all of Flow's businesses in the U.S. and Canada.

Lawrence came to Flow in August 1996 to head its automation and services businesses, and in April of this year was named executive vice president, Ultrahigh-Pressure Systems. "In his relatively short time at Flow Brad has successfully integrated our automation businesses, and he is an ideal choice to lead the operations and productivity improvements we expect to see from our refocus on core UHP technology," said Ronald W. Tarrant, Flow's chairman, president and CEO. "One of Brad's first assignments will be to spearhead our ISO 9000 certification program. I'm confident that his leadership, combined with his previous ISO experience at PACCAR and Rockwell International, will keep that program on track."

Prior to joining Flow, Lawrence was president and chief executive officer at Conductive Rubber Technology (CRT), a leading supplier of silicone rubber keypads, customer keyboards, and keypad assemblies. Earlier in his career Lawrence held senior management positions with PACCAR and Rockwell International. His background includes assignments in general management, marketing, and plant management in the U.S., South America and the Far East.

Flow's primary markets include automotive, aerospace, job shop, food processing, paper, and surface preparation.

December 1997

Waterjet Cutting Techniques Course, January 18-21, 1998, Florence, SC

Richel, Inc., a waterjet consulting firm, is offering a three day, with an optional fourth day, hands-on waterjet cutting course, targeted at anyone exploring opportunities in this, an exploding business. Mornings are devoted to theory and afternoons to hands-on work, giving attendees the opportunity to operate a system. Attendees are encouraged to bring samples of materials they want tested. Specific attention to starting up and operating a waterjet business, including marketing, administration, how to price work, and typical selling rates is always popular with entrepreneurs who attend. A full and complete understanding of the industry, how it relates to your business and your opportunities is assured. For more information call (330)633-7698.

If you have any further questions, please contact:

Richard Ward

(President of Richel, Inc.)

Phone: (330)633-7698 • Fax: (330)633-7670

E-mail: richel@ix.netcom.com

WJTA Conference Exhibit Hall Photographs, from pg. 11



Jet News

Page 15

WJTA COMMITTEES

The following are committees in effect in WJTA and the present member(s) of these committees. WJTA members are urged to contact WJTA President George Savanick if they wish to serve on any of these committees.

Awards Committee: Recommends recipients of WJTA awards.

David Summers, Ph.D., Chairman

Bylaws Committee: Recommends changes to WJTA bylaws.

David Summers, Ph.D., Chairman
John Wolgamott
Bruce Wood

Contractors Committee: Is responsive to needs of waterjetting contractors and users of mobile waterjetting equipment.

Bruce Wood, Chairman
Dan Bernard
Andrew Conn, Ph.D.
Pat DeBusk
John Wolgamott

Manufacturers Committee: Responsive to interests of in-plant waterjetting applications.

Mohamed Hashish, Ph.D.,
Chairman
Thomas Kim, Ph.D.
Tom Labus
Forrest Shook

Membership and Public Relations Committee: Recommends policies to increase membership in WJTA.

Andrew Conn, Ph.D., Chairman
Lydia Frenzel, Ph.D.
Mike Gracey
Thomas Kim, Ph.D.

Nominations and Elections Committee: This committee oversees election of board members.

Andrew Conn, Ph.D., Chairman
Paul Bowser
Lydia Frenzel, Ph.D.

Safety Committee: Recommends changes to safety manual.

George Savanick, Ph.D., Chairman
Craig Anderson
Tony Bessette
Pat DeBusk
Ron Hyziewicz
Arthur Miller
Forrest Shook
David Summers, Ph.D.
Bruce Wood

Safety Video Committee: Plans and oversees the production of a video tape version of *Recommended Practices for The Use Of Manually Operated High Pressure Waterjetting Equipment*.

George Savanick, Ph.D., Chairman
Pat DeBusk
Forrest Shook
David Summers, Ph.D.
Bruce Wood

Short Course Committee: Plans and oversees the course *Fluid Jet Technology - Fundamentals and Applications*.

Tom Labus, Chairman
Andrew Conn, Ph.D.
Lydia Frenzel, Ph.D.
Mohamed Hashish, Ph.D.
David Summers, Ph.D.
Bruce Wood

Technical Research Committee: Responsive to the needs of waterjet researchers.

Thomas Kim, Ph.D., Chairman
Mohamed Hashish, Ph.D.
Tom Labus

10th American Waterjet Conference Committee:

Pat DeBusk, Chairman
Mohamed Hashish, Ph.D.
Thomas Kim, Ph.D.
Forrest Shook
Bruce Wood

11th American Waterjet Conference Site Selection Committee:

John Wolgamott, Chairman
Paul Bowser
Thomas Kim, Ph.D.
George Savanick, Ph.D.
Mohan Vijay, Ph.D.

Five-Year Planning Committee:

Paul Bowser
Thomas Labus
Bruce Wood

To volunteer for any of these WJTA committees, contact:

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E Manutencao Industrial

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Aquastenger The Power Of Water Co.

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(continued on page 18)

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9th American Waterjet Conference Photographs

Demonstrations of equipment and applications during the technical tour of Detroit waterjetting sites.



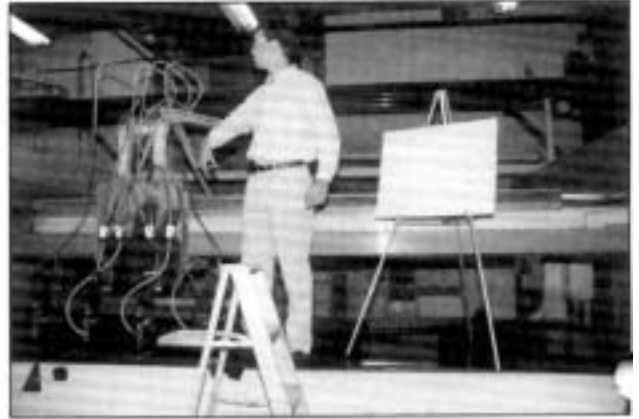
George Rankin (above left) and Jerry DeSantis (above right) man the microphones as tours begin.



The Flow International robot used to clean paint booths in automobile plants.



NLB tank cleaning equipment.



A Jet Edge representative explaining the operation of the equipment.

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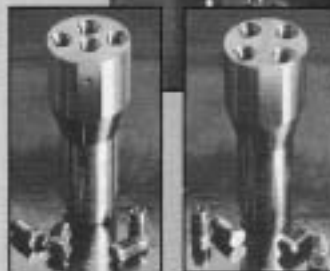
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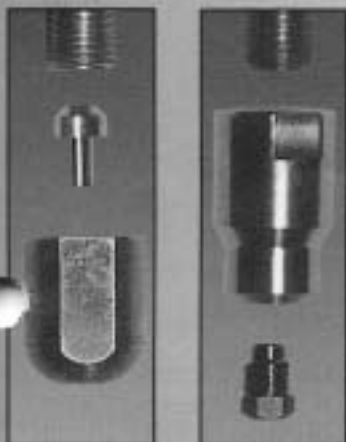
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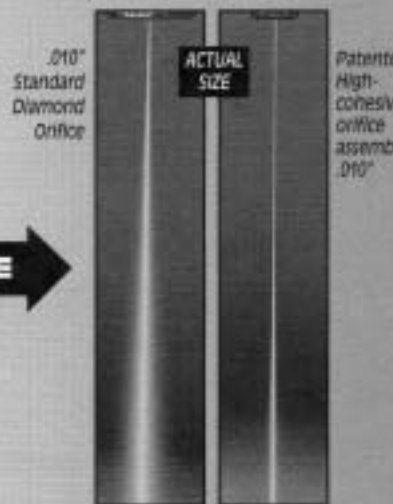
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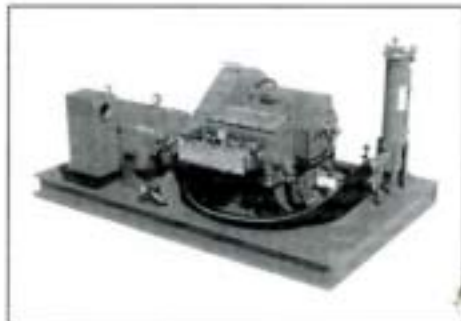
*Happy Holidays and
Best Wishes for a Healthy
and Prosperous New Year
from the WJTA Officers,
Board of Directors, and Staff*

New Aqua-Dyne Pumps,

from pg. 14

No external lubrication is necessary. Individual lightweight suction and discharge manifolds are easily removed for simple maintenance and packing changes in the field.


Power ends for both C and GA Pumps are iron alloy casting with heavy duty taper roller bearings and have either high strength ductile iron or alloy steel crankshafts. Lubrication for the C Pump is a forced feed, cooled and filtered oil circulation system while the GA Pump uses a splash oil lubrication system.



C Pump Water Energy™ System

Aqua-Dyne has a full line of optional Water Energy™ accessories including hand and foot Dyna-Guns, Zero Thrust Dyna-Guns, Multi-Gun Flow Splitters, Shapejet Nozzles, Rotary Unions, abrasive Dyna-Saws, Dyne-a-Mo floor and grate cleaners, Dyna Valves and other accessories. Aqua-Dyne also manufactures Water Energy™ Systems like the CNC Cutting System, Pipe Cutting System, Shell Side Bundle Cleaner, RHD (Rotating Hose Device), Hydrostatic Tester, Multi-Lancing Machine, Roto-Jet Blaster, Tank and Vessel Cleaning Machine and Sewer Cleaner.

For additional information or new product literature, call: (800)324-5151 or (713)864-6929, fax: (713)864-0313, e-mail us at info@aqua-dyne.com or see our web page at <http://www.aqua-dyne.com>.



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