

WJTA

WaterJet Technology
Association



Jet News

APRIL 1999

*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

The Clarence Buckingham Fountain



Photograph courtesy of Chicago Park District.

See article on page 2

The Clarence Buckingham Fountain

The covers shows a view of the Clarence Buckingham Fountain in Grant Park at the foot of Congress Parkway in downtown Chicago, Illinois. The fountain consists of three circular basins, one above the other, made of Georgia pink marble. The fountain sits in a pool. The diameter of the pool and basins are as follows: the bottom pool — 280 feet; the bottom basin — 103 feet; the middle basin — 60 feet; and the upper basin — 24 feet.

The water capacity, with all the basins filled, is 1,500,000 gallons. Depending on wind conditions, major displays use approximately 14,000 gallons of water per minute jetted through 133 jets. Water is re-circulated and not replenished except to replace losses from wind and evaporation. The water display can be controlled

manually, but it is normally computer-controlled.

The underground pump room is 35 feet long, 25 feet wide, and 25 feet high. It consists of three motor driven pumps: a 250 horsepower motor powering a pump rated at 7,000 gallons per minute; a 190 horsepower motor driving a pump rated at 5,500 gallons per minute; and a 75 horsepower motor driving a pump rated at 1,600 gallons per minute. The 250 and 150 horsepower pumps produce an output head of 100 feet. The 75 horsepower pump increases the head of the center jet to 200 feet and raises this jet to a height of 135 feet above the lower basin.

Article adapted from a brochure published by the Chicago Park District.

Gardner Denver Announces Acquisition Of Butterworth Jetting Systems, Inc.

Gardner Denver, Inc. reported the acquisition of Butterworth Jetting Systems, Inc. in a cash for stock transaction. Butterworth, located in Houston, Texas, is a manufacturer of water jet pumps and systems used for a variety of industrial applications. For the year ended March 31, 1999, Butterworth's revenues were approximately \$12 million.

Ross Centanni, Chairman, President and Chief Executive Officer of Gardner Denver said, "Butterworth competes in the rapidly growing water

(continued on page 12)

All New For '99!

**CRS Power
Flow Introduces
its New Line of
Control Guns!**

CRS' New Dry Shut Control Gun

Light, powerful and built to take punishment! Perfect for applications where remote dumping is required to keep discharge water in the blasting area to a minimum. Featuring 60 second cartridge overhaul.

2 models to choose from:

HGDS-15K and HGDS-20K

Weighs only 12 lbs. (5.44 KG)

Pressure up to 20,000 psi (1380 Bar)



New, Lighter HGLT™ Control Gun

Now lighter and ergonomically redesigned for operator comfort and safety. Power to handle the toughest jobs swiftly and effectively! Features 60 second cartridge overhaul.

Weighs only 12 lbs. (5.44 KG)

10-40 Kpsi (800-2750 Bar)



New Dry Shut Unloader Valves!

Run multiple guns from the same pump. Eliminates dump water from hand gun or foot gun! Fast cartridge overhaul. Set up is fast and easy. Dial in pressure required and lock in place!

New FG & DSFG Footguns!

Dry Shut Foot Guns available in 10/15K and 20K models. Dump Style Foot guns available in 10/15K, 20K & 40K models!

Flow Dividers: Multi Gun Valves!

3 models to choose from: • 10/15K
• 20K • 10K Hi-Flow Model (90 gpm)

Call for new product catalogs!

CRS POWER FLOW

**QUALITY ENGINEERED FOR
THE NEW MILLENNIUM!**

8807 Emmott Road, #100

Houston, Texas 77040

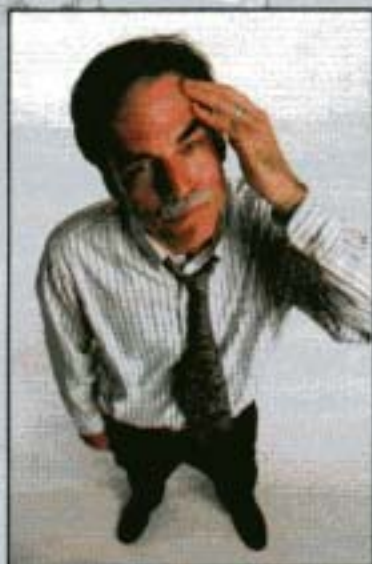
1-800-580-FLOW

(713) 466-6269 • Fax: (713) 466-8155

www.crspowerflow.com • crsinfo@texas.net

Under Pressure Lately?

Make Autoclave your solution!



Typical Supplier ...

- Technical Support – Slow to No Response
- Delivery in Weeks
- Quality – Inconsistent
- Product Innovations – Never!

Spending weekend trying to solve his own problem!



Autoclave Customer...

- Technical Support in **Hours**
- Delivery in **Days**
- Quality – **Repetitive & Consistent**
- Product Innovations – **Continuously!**

Spending weekend fishing – Autoclave solved his problem!

High Pressure Ball Valves

- Working Pressures to 20,000 psi
- Quarter Turn Single Piece Ball/Stem
- 2-way, 3-way & 4-way Designs from 3/16 to 1/2" Bore

Product Innovations

Autoclave Engineers 

Fluid Components
Division of Snap-tite, Inc.

2930 West 22nd Street
Erie, Pennsylvania 16506-2302 USA
PH: 814-838-5700 FAX: 814-838-5811
e-mail: ae_sales@snap-tite.com
www.autoclaveengineers.com

Value Goes Beyond the Product... Autoclave Engineers... The High Pressure Experts.

ISO-9001 Certified

WJTA Board Meeting
February 6, 1999

Summary of Board Actions

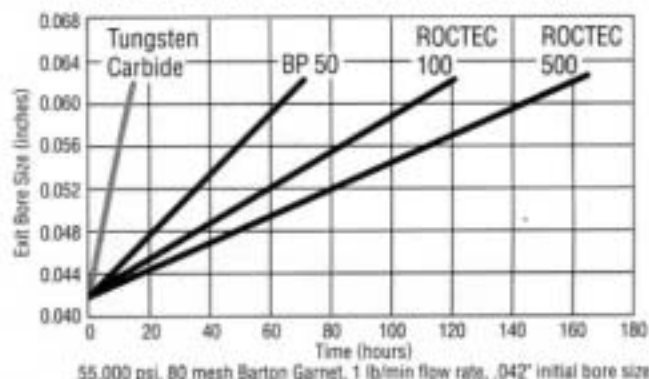
The Board of Directors of the WaterJet Technology Association (WJTA) met on February 6, 1999, at the JW Marriott Hotel in Houston, Texas. The following decisions were made at this meeting:

1. Three (3) workshops will be held in conjunction with the 10th American Waterjet Conference. These are a surface preparation seminar, a short course on the fundamentals and applications of waterjet technology, and a safety seminar based on the WJTA's *Recommended Practices for the Use of Manually Operated High Pressure Waterjet Equipment*.
2. A concurrent session for contractors will held on Monday, August 16, 1999, during the 10th American Waterjet Conference.
3. Exhibitors at the 10th American Waterjet Conference will be permitted space at one of the stops on the August 17 technical tour at no charge. Non-exhibiting companies participating in the tour will be charged \$700.
4. The WJTA will sponsor an award for the best paper presented at the 10th American Waterjet Conference.
5. Accept the proposal of Andreas Momber, Ph.D., to prepare a monograph on concrete demolition rates using waterjets.
6. Advertisers in the *WJTA Membership Directory* will be limited to one tab in the *Directory* until all advertisers have had an opportunity to purchase tab advertising space.
7. The advertising space on the outside covers, inside covers, and tabs in the *Membership Directory* must be four-color and will be selected by a lottery system.
8. A Spanish translation of the WJTA's *Recommended Practices* has been completed and is being reviewed. A safety seminar based on the *Recommended Practices* will be held on May 1, 1999, at the Hyatt Regency O'Hare in Chicago, Illinois.
10. WJTA logos were approved for distribution.
11. Establish a standing committee to review and update the *WJTA Policy Procedures Manual*.
12. Future WJTA board meetings will be held on Fridays.

— George A. Savanick, Ph.D.

Now there are 3 "best" choices for AWJ nozzles.

Abrasive Waterjet Nozzle Performance Comparison



Not all AWJ projects demand the very longest wearing nozzle, but all require one that wears slowly and concentrically for predictable cutting precision. Of course, longer life is always better.

That's why we've added the BP 50 nozzle to our family. The BP 50 AWJ nozzles were developed in response to industry requests for a lower cost nozzle for short runs, prototyping, and multiple daily setups. They are also ideal for operator training or when new system setups make breakage a concern.

As with longer life ROCTEC® 100 and longest life ROCTEC 500 nozzles, the BP 50 wears concentrically and with great predictability...while providing several times longer service than tungsten carbide.

The result? Now you have more ways to achieve lowest total operating costs. Because all three Boride nozzles increase cutting speed, reduce system downtime for nozzle changeouts, and maintain cutting precision, predictability, and consistency longer.

As always, the BP 50 and ROCTEC AWJ nozzles are available exclusively from your AWJ equipment manufacturer. For technical assistance, call us at 800-662-2131 or 616-946-2100 or fax 800-662-2132 or 616-946-3025. www.boride.com



BORIDE PRODUCTS
2879 Aero Park Dr.
Traverse City, MI 49686-9170

Trademark of Greenfield Industries, Inc. or its affiliates



A division of the Kennametal Engineered Products Group

FOR QUALITY, PERFORMANCE & DELIVERY YOU CAN COUNT ON

Orifice Assemblies

We offer many different types of mountings. Assemblies have the size clearly marked, for easy identification.



Adaptors

Change your current orifice to our patented, high-cohesive assembly using a simple adaptor.

Change from this...to this!



77 YEARS OF
EXCELLENCE

A.M. GATTI
INC.

1922 - 1999

FOR THE BEST ORIFICE ASSEMBLIES AND NOZZLE BODIES

← INCREASE PERFORMANCE →

A.M. GATTI INC.
524 TINDALL AVE.,
TRENTON, NJ 08610
1-800-882-0105

609-396-1577 • FAX: 609-695-4339

Multi-Orifice Nozzle Bodies

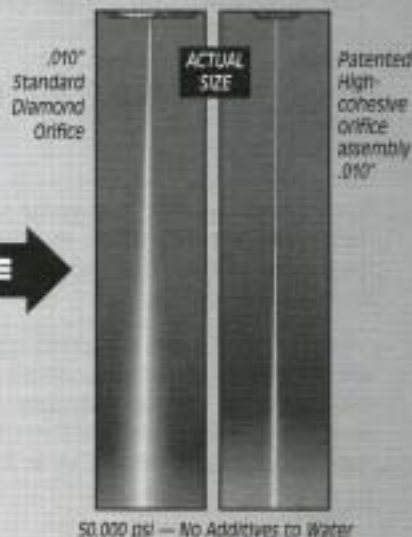
State-of-the-art nozzle bodies designed for even energy distribution.



High-Cohesive

Use our high-cohesive assembly for better and faster cutting and coating removal.

Compare the streams...



50,000 psi — No Additives to Water

A Self-Contained Paint Removal System

J. L. Manta, Inc. had several challenges to contend with when it received a contract to perform lead abatement and apply coatings to two nitrogen storage tanks in Terre Haute, Indiana. Each tank measured 130 feet in diameter and 60 feet high.

Project specifications required SSPC-SP-6 Commercial Blast. One of J.L. Manta, Inc.'s most significant obstacles to overcome at the initial stage of the project was developing a lead plan that included a containment system sufficient enough to contain spent abrasive, while still contending with variable wind conditions and the facility's requirements to have periodic access to the tank.

Project managers at J.L. Manta, Inc. knew that performing lead abatement with conventional grit blasting techniques on a 40,000 square foot tank — 15,000 square feet on the domed top and 25,000 square feet on the sides — meant extensive labor to erect and maintain the containment system. This was in addition to costs associated with spent abrasive clean up and disposal.

After reviewing alternatives to conventional abrasive blasting, J.L. Manta, Inc. elected to utilize the HydroCat, an automated waterjet surface preparation system designed by Flow International Corporation, Kent, Washington.

"By utilizing the HydroCat, containment was reduced to simple ground cover. Disposal costs were minimal since the HydroCat is a self-contained system that collects all of the water, coatings and rust generated in the removal process," said Ernie Dunbar, project manager for J.L. Manta, Inc. "We also enjoyed a labor savings using the HydroCat, since the number of employees required to operate the unit for surface preparation was less than the number required for conventional grit blasting."

FLOW's HydroCat automated surface prep vehicle attaches itself, using a vacuum, to any vertical or horizontal surface, enabling a single operator to remove coatings at rates of up to 500

square feet per hour, depending on the type of coating. The HydroCat is powered by FLOW's HUSKY™ 40,000 psi pump and is equipped with a 60 horsepower FlowVac™ that performs two functions. First, FlowVac provides a powerful vacuum for secure attachment of the HydroCat to the work surface. The unit is also independently suspended by a dual cable system to ensure safety should the HydroCat lose suction. Additionally, the FlowVac transports all of the water and removed coating from the HydroCat robot to a filtration bag. Paint particles are filtered out of the bag and contained in the fabric filtration bag, which is designed for easy removal and disposal.

Following proper onsite training by a FLOW technician, J.L. Manta, Inc. found that journeymen painters were capable of operating the HydroCat system.

Using the HydroCat, concerns about complying with environmental air standards and ground contamination are minimized, since the unit is a 100 percent self-contained system. Waste water from the removal process can usually be disposed of into a treated sewer system.

Since the HydroCat provided 100 percent containment of materials, J.L. Manta, Inc. staff could apply the new coating system adjacent to the removal operation. Production rates on the Terre Haute project averaged 250 square feet per hour on the domed portion of the tank and 400 square feet per hour on the straight sidewalls. An entire tank was completed in just under 250 jetting hours.

"The HydroCat provides a white metal surface and concerns about soluble salt contamination on the steel are a non-issue," said Dunbar. "Our third-party inspector on the project realized the HydroCat provides a constant level of surface cleanliness, eliminating hold points and allowing us to coat directly behind the cleaning process."

Disposal of the removed coatings during the project was streamlined. The



lead-based paint chips were filtered into 10 haul-away bags, which were placed into a 20-yard dumpster and hauled to a landfill for disposal. Since no water treatment system was available on the project site, water was pumped directly into a 21,000-gallon holding tank and then pumped off into 3,000 gallon tanker trucks. It was then hauled to a municipal waste water treatment plant for disposal.

In addition to the HydroCat, J.L. Manta, Inc. also used FLOW's A-3000 hand tool. This air-powered tool, which weighs 11 pounds and operates at 3,000 revolutions per minute, was used in conjunction with the HUSKY pump for surface preparation on the stairways, valves, walkways and handrails on the second tank.

"Project specifications called for a commercial blast on these areas as well. Achieving that cleanliness with coal slag abrasive was slow and created significant labor costs for clean up," said Dunbar. "We designed a dike around the base of the tank to collect the water that ran down the sidewalls, then pumped that water through a dual stage, one micro filtration system and into the holding tank."

"Instead of a potential for 10-15 twenty-yard dumpsters filled with hazardous waste, each tank required just one dumpster to transport the filtration bags. Overall, our customer appreciated the major benefits of reduced labor and elimination of any hazardous airborne particles at its facility."

For more information: contact Lisa Brandli, Flow International — (425)271-2078.

Waterjet Cutting

By: Richard Ward, Richel

There is a good chance something you used today was cut with water. The soles of your shoes, the dashboard in your car, possibly the food ate at lunch was cut or processed with water. Also for those of you with babies even the disposable diaper was trimmed to shape with water.

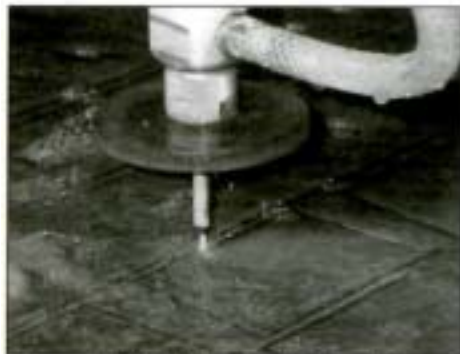


Figure 1. Single head waterjet cutting steel.

But the real inroads being made by waterjet are in the aerospace, automotive, medical, defense and machining industries where waterjet cutting is being used to shape mild steel parts up to 12 inches thick, stainless steel parts of 10 inches and "carve" intricate parts for implants in titanium (Figure 1).

As pressure on manufacturers is maintained to produce faster, better, lighter and stronger products, new materials are constantly being developed. Many of these are considered composites, being made from a series of different materials laminated together. For example, a layer of titanium and aluminum separated with a honeycomb layer made from a phenolic, an epoxy looking type of material with fibers weaving their way through the structure, are now common.

The issue that quickly comes to mind is how to cut the laminated materials.

Waterjet cutting in many cases does not see the difference between the materials in the various layers, enabling the materials to be cut quickly, efficiently and with precision.

Waterjet cutting can best be described as an accelerated erosion process under control. Water is pressurized to 60,000 psi, forced through a small orifice normally 0.003 inch to 0.016 inch in diameter, after which abrasive is added to the stream and accelerated to 2,000 miles per hour. It is this fast traveling abrasive that does the cutting on hard materials. In soft materials, only water is used.

There is no heat generated with waterjet cutting, hence the lack of any localized damage to the part as is associated with laser, plasma and oxy-fuel cutting.

Tolerances as close as 0.005 inch can often be held comfortably, eliminating the need for any secondary machining or finishing. This often allows manufacturers to use waterjet cutting to complete a project in fewer steps, saving costs and reducing turnaround time.

Waterjet cutting is unique in that the stream does not know what it is about to cut through. It simply erodes its way through whatever is in its path. For this reason, waterjet cutting has become an extremely versatile process. Businesses operating waterjet systems are able to offer a diverse range of services, cutting virtually every material known on earth. A job shop that was limited to cutting steel with an oxy-fuel torch, with the addition of a waterjet could now offer services to businesses manufacturing wooden toys, signs,



Figure 2. Dual head waterjet cutting steel.

marble inlay floors for hotel and residential lobbies, custom glass designs, gaskets and complex parts in almost every steel, alloy and composite. From works of art, to intricate engineering parts in stainless, inconel and titanium, waterjet cutting is carving its way into the future (Figure 2).

Richel Offers Waterjet Cutting Seminars

Richel, a waterjet consulting group, is hosting several one-day waterjet cutting seminars, including:

- May 17 - Orlando, Florida
- May 19 - Atlanta, Georgia
- May 21 - Chicago, Illinois
- June 25 - San Francisco, California
- June 28 - Los Angeles, California
- June 30 - Houston, Texas

Each course will cover all aspects of waterjet cutting, including comparison of waterjet with laser, plasma and oxy-fuel. The presentation is supported with impressive video, computer generated interactive displays and CAD/CAM and controller demonstrations. Richel has trained over 200 companies on all makes and models of waterjet machines. This is a unique opportunity to have all waterjet questions answered. Seating is limited. For more information and reservations, please call (330)633-7698, fax: (330)633-7670 or visit the website: www.richel.com

Welcome WJTA New Members

Corporate

Alba Industries USA, Inc.

Ronald Hackler

P.O. Box 22599
Honolulu, HI 96823
Phone: (808)955-4082
Fax: (808)955-4082

M. J. Yeomans

Shevock Farm, Inch
Aberdeenshire, Scotland AB52 6XO
United Kingdom
Phone: [44](146)4821483
Fax: [44](146)4821484

H.H. Alba

Alba Industries GmbH
Hinter den Kirschkaaten 32
D-23560 Lubeck
Germany
Phone: [49](451)5820454
Fax: [49](451)5820459

Cadcraft AB

Inge Helgesson

Bo Johansson

Nils-Göran Bergman

Verkstadsgatan 12
Borås 504 62
Sweden
Phone: [46](33)128810
Fax: [46](33)120910

Jetstream Of Houston

Sophia Anderson

1300 West Bartlett Road
Elgin, IL 60120
Phone: (847)741-5370
Fax: (847)742-3035

David Williams

Ron Schmidt

4930 Cranwick
Houston, TX 77041
Phone: (800)231-8192
Fax: (713)462-5387

Northwood Consultants, LLC

James A. Smith

Donna M. Smith

James J. Smith

19 Northwood Drive
Malta, NY 12020-3832
Phone: (518)885-8079
Fax: (518)885-8079

Individual

Bill Black

Bosk Corporation
P.O. Box 461
Escanaba, MI 49829
Phone: (906)786-1883
Fax: (906)786-1885

William Buon

Sterling Marble & Granite Ltd.
144 Bruckner Boulevard
Bronx, NY 10454
Phone: (718)585-4200
Fax: (718)585-2939

Bob Detzel

Premier Manufacturing Support Service L.P.
2828 Highland Avenue
Cincinnati, OH 45212
Phone: (800)771-0540 x-5135
Fax: (513)731-3659

Steven Hughell

NASA Lewis Research Center
21000 Brookpark Road
Cleveland, OH 44135
Phone: (216)433-2216
Fax: (216)433-3362

Jacek Kaminski

Chalmers University of Technology
Hörsalsvägen 7, Produktionsteknik
Göteborg S-41296
Sweden
Phone: [46](31)7721284
Fax: [46](31)7723819

Brad Lehman

Captain Clean Ltd.
3845 F Avenue NW
Cedar Rapids, IA 52405
Phone: (319)396-1107
Fax: (319)362-9442

Rick Napier

Kenny Industrial Services
5233 Hohman Avenue
Hammond, IN 46320
Phone: (219)937-8139

Jurga Piotr

Aqua-Dynamic
Ul. Dragonow 4/98
Warszawa 00-467
Poland
Phone: [48](22)8401707
Fax: [48](22)8401707

Jack Prescott

Alcon Labs
15800 Alton Parkway
Irvine, CA 92618
Phone: (949)753-6742
Fax: (949)753-6336

Alex Roksaz

5510 Cherry Creek Bend Court
Houston, TX 77041

Student

Patrik Dahlman

Chalmers University of Technology
Hörsalsvägen 7, Produktionsteknik
Göteborg S-41296
Sweden
Phone: [46](31)7723823
Fax: [46](31)7723819

10th American Waterjet Conference - Preliminary Contractor's Program Monday, August 16, 1999

Lowering Your Operating Costs, *Dennis Chisum*

A Comprehensive Waterblast Health & Safety Program, *Mike Zustra*

Factors Influencing the Leakage Characteristics of NPT and NPTF Connections, *William A. Lees*

Fluid Jet Ignition Hazards Safety Analysis, *Paul L. Miller*

Nozzle Performance in Rotary Applications, *Doug Wright*

Why Are Shipyards and Contractors Using Waterjets for Surface Preparation, *Richard Schmid*

Your Source for Ultra High Pressure Hose



*Spir Star...
Outstanding Quality
Outstanding Service*

Servicing the **Waterblast** Industry with hose and accessories for:

- Heat Exchanger Tube Cleaning
- Line Moleing
- Surface Cleaning & Preparation
- Storage Tank & Vessel Cleaning
- Hydro Demolition
- Waterjet Cutting
- Automated Cleaning Systems



Offshore Technology Conference
ASTRODOME U.S.A. • HOUSTON, TEXAS
3-6 MAY 1999

See us at OTC Booth #6271!

SPiR STAR®

11983 FM 529 • Houston, Tx 77041 • 713 856-8989
Fax 713 856-8999 • 800 890-STAR (7827)
www.spirstar.com

WJTA Seeks Suggestions For Revisions To WJTA Short Course Content And Format

In order to continue to help meet the ever-changing educational needs of professionals involved in waterjet technology, the WaterJet Technology Association (WJTA) Board of Directors is considering a change in the content and format of the WJTA short course, *Fluid Jet Technology - Fundamentals and Applications*.

WJTA members are encouraged to submit suggestions for possible changes to the short course content and format.

The short course traditionally covers the fundamentals of waterjet technology, including a historical perspective, fluid mechanics of jets, influence of basic jet parameters and physics of abrasive waterjet cutting, hydraulic mining, abrasive jets, high pressure equipment and systems, cleaning applications, industrial applications, comparison of laser and abrasive waterjet technology, high pressure safety, and construction and civil engineering applications.

In order to allow adequate time for review of suggested revisions, please submit your comments to the WJTA office no later than **June 18, 1999**, to: WJTA Short Course Revisions, 917 Locust Street, Ste. 1100, St. Louis, MO 63101-1413, e-mail: wjta@primary.net, fax: (314)241-1449.

The WaterJet Technology Association's 10th American Waterjet Conference

August 14-17, 1999

JW Marriott Hotel • Houston, Texas

Preliminary Schedule of Events

Friday, August 13

5:00 p.m.-9:00 p.m. Registration

Saturday, August 14

7:00 a.m.-9:00 p.m. Registration

8:30 a.m.-Noon

WJTA Concurrent Seminars

- Short Course on the Fundamentals and Applications of Waterjet Technology
- A Safety Practices Seminar
Speaker: Larry Meers
Resource Management Strategies, Inc.
- Advanced Topics in Surface Preparation
Speaker: Dr. Lydia M. Frenzel
Advisory Council
San Marcos, TX

Noon-1:30 p.m.

Luncheon for course participants

1:30 p.m.-4:30 p.m.

Concurrent Seminars (cont.)

6:30 p.m.-9:30 p.m.

Welcoming Reception in The Exhibit Hall — Exhibit Opens

Sunday, August 15

7:00 a.m.-5:00 p.m. Registration

8:30 a.m.-11:30 a.m.

Concurrent Sessions

- Research & Development Sessions I
- Research & Development Sessions II

9:30 a.m.-5:00 p.m.

Exhibits

11:30 a.m.-2:00 p.m.

Exhibit Hall Viewing
(Lunch served Noon-1:30 p.m.)

2:00 p.m.-5:00 p.m.

Concurrent Sessions (cont.)

5:30 p.m.-6:30 p.m.

WJTA Biennial Business Meeting

Monday, August 16

7:00 a.m.-5:00 p.m. Registration

8:30 a.m.-11:30 a.m.

Concurrent Sessions

- Contractor's Program
- Research & Development Sessions I
- Research & Development Sessions II

9:30 a.m.-2:30 p.m.

Exhibits

11:30 a.m.-2:00 p.m.

Exhibit Hall Viewing
(Lunch served Noon-1:30 p.m.)

2:00 p.m.-5:00 p.m.

Concurrent Sessions (cont.)

6:30 p.m. - 11:00 p.m.

Awards Presentation/Party

Tuesday, August 17

7:00 a.m.-8:30 a.m. Registration

8:00 a.m.-3:00 p.m.

Technical Tour and Field Demonstrations

Abrasive Recycling System

Abrasive is the single largest consumable cost borne by all abrasive waterjet cutting customers. In fact, it is not unusual to find abrasive costs in excess of \$100 per hour for those operating a 150 horsepower system.

The WARD 24 is a Waterjet Abrasive Recycling dispenser that serves not only as an abrasive removal system, but also as an abrasive recycling system. The sludge is removed from the tank (Figure 1) with a patented abrasive removal nozzle, which has no moving parts. The sludge is then pumped through a series of screens where it is washed and separated into waste product, and good product consisting of abrasive over 100 mesh in size, ready to be used again (Figure 2).

The good abrasive is then dried and passed over a final screen where it is possible to add new abrasive at any desired ratio, bringing the new and used abrasive into equilibrium.

The savings generated in field tests have indicated recovery rates from a general job shop environment of up to 70%. In fact, savings have been so great, it could be possible to save over \$800 per day in recycled abrasive alone at larger operations. When the recycled abrasive is recycled for a second and third time, the savings become even greater.

As the abrasive is recycled, all associated costs are reduced, from sludge removal, to hauling away the waste sludge.

(continued on page 11)



Figure 1. The Ward 24 abrasive recycling system in operation.

**The Toughest Jobs
Just Got
Easier!**

**New & Rebuilt
HI-PERFORMANCE
WATER BLASTERS**



Series M-1200

5,000 - 40,000 PSI
Skid or Trailer Mounted
New or Rebuilt
Priced Competitively

FINANCING AVAILABLE
LEASE PURCHASE
RENTAL

Also Available

- Shell Side Bundle Cleaners
- Water Jet Cutters
- Water Jet Lances
- All Stainless Steel Fluid Ends
- World Renowned FMC Power Ends

**Industrial
Pressure
Inc.**

800-826-8379

www.indpress.com

"WATERJET ORIFICES"

Sapphire — Ruby — Diamond

*Micro-Rolled Edge Produces
Superb Stream Quality*

Mechanically drilled to insure optimum material integrity, eliminating possible fatigue due to laser drilling.

Orifices manufactured in the USA to fit your design requirements.

I.D. Sizes: .002" through .100"

O.D. Sizes: Your choice

Thickness: Your choice

Rework capabilities eliminate scrapping of poor stream quality orifices. Give your used orifices a second life for a fraction of the cost of replacement.

Liberal order policy allows you to place a blanket order without committing to orifice size until released.

Assemblies available, sapphire or diamond, to fit most any system, tested and ready for installation.

Microlap Technologies/Langer Plant

213 1st Street N.W.

Rolla, ND 58367

Telephone: (701)477-3193 Fax: (701)477-6579

Abrasive Recycling System, from page 10

Typically, most abrasive removal systems need to keep the abrasive in suspension to operate efficiently. Settling of the abrasive can cause clogging and stoppages. The WARD 24 works best when the sludge and slime are stacked up over the removal heads. This eliminates the problem of having to keep everything in suspension. In fact, it is not even necessary to remove the abrasive prior to operation of the WARD 24. The nozzles can simply be dropped under the grates, and recycling can begin.

The WARD 24 is the size of the average desk, is compact and can be placed up against a wall (Figure 3).

EasiJet, the sole distributor of the WARD 24, predicts a potential surge in waterjet systems sales as the WARD 24 proves its worth to



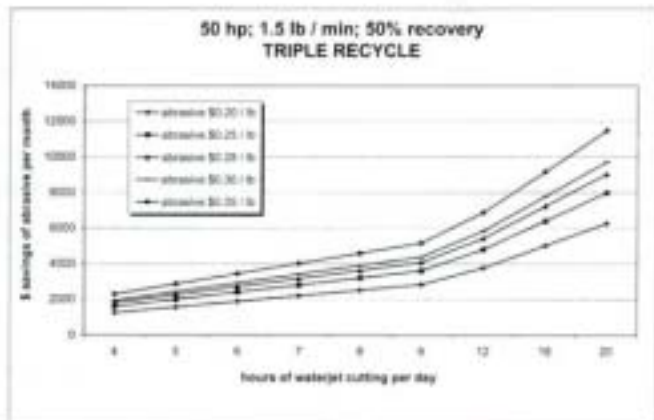
Figure 2. Recycled abrasive.

operators. Firstly, existing operators using a WARD 24 should be able to increase profits immediately, and secondly, as operating costs plummet, contract cutters will become more competitive with laser and plasma. Many companies will need to re-evaluate the viability of waterjet cutting, taking into account the savings of recycling abrasive.

Indeed, several companies have already quoted large jobs contingent upon the installation of a WARD 24.

EasiJet is offering live testing of clients abrasive sludge at EasiJet's facility, conditional on a company representative being present to witness the results. The sludge is weighed, then processed. A quick calculation will reveal the actual percentage of recovered abrasive from the clients waste sludge, either justifying or discarding the viability of the WARD 24.

If a company's production is too small to warrant the use of WARD 24, the company could begin to store the sludge for recycling at a later stage, ultimately being able to justify a purchase purely based on processing the stored abrasive.



When cutting steel and harder materials, one could save over \$4000 per month running a 50HP pump with 50% recovery, triple recycle, 8 hours per day.


The WARD 24 has been described as the most revolutionary advancement in reducing operating costs since the inception of waterjet technology.

For more details, including samples of recycled abrasive, video and interactive CD presentations, contact EasiJet at (330)633-7698; fax 330-633-7670, email: ward24@easijet.com website: www.easijet.com




Figure 3. The Ward 24 is compact self contained and easy to run.

Photograph courtesy of EasiJet, Tallmadge, Ohio.



SLASHING ABRASIVE WATERJET OPERATING COSTS!



To date, all abrasive has been thrown away, but with the WARD 24 it is possible to recycle and reuse this abrasive. As a result, the drastically lower prices of waterjet cutting allow waterjet to be a more competitive player in the cutting industry.

REVOLUTIONIZE YOUR WATERJET OPERATIONS WITH THE WARD 24

EasiJet
200 Northeast Ave., Tallmadge, OH 44278
phone: 330 633-7698 fax: 330 633-7670 email: ward24@easijet.com
www.easijet.com

Member News

ABB I-R Waterjet Systems Certified

ABB I-R Waterjet Systems L.L.C., a joint venture between ABB Flexible Automation and Ingersoll-Rand Waterjet, has achieved certification as ISO 9001/ANSI/ASQC Q9001. ABB I-R is a global designer and builder of waterjet and abrasive waterjet cutting systems. The certification service that conducted the audit was SGS International Certification Services, Inc. located in Rutherford, New Jersey.

The ISO 9001 standard, specifically detailed for companies that design, develop and manufacture, is part of the ISO 9000 Series of standards and consists of 20 clauses or areas by which an industrial company can measure its quality performance to objective criteria. These areas of measurement encompass all levels of the organization, from management methods to production processes plus documentation and continuous monitoring of quality.

The International Organization for Standardization (ISO) is a Geneva-based group which first published the ISO 9000 Series certification in 1987 and has now been adopted as the quality standard by more than 40 industrial countries. Obtaining an official ISO 9000 Series certification demonstrates to customers and potential customers that a firm has implemented a documented quality system to control internal processes that affect product or service quality.

ABB I-R Waterjet Systems L.L.C., located in Wixom, Michigan, combines Ingersoll-Rand's high-pressure intensifier and two-dimensional waterjet-cutting technology with ABB's expertise in robotics and motion equipment. For more information, contact ABB I-R Waterjet Systems by phone: (248) 449-1900 or by fax: (248) 449-6707.

Aquajet Systems Certified

Aquajet Systems AB of Sweden, an international manufacturer and supplier of hydrodemolition equipment has achieved quality approval from Lloyd's Register Quality Assurance (LRQA) for the international standard ISO 9001.

Stefan Hilmersson, managing director of Aquajet Systems AB says, "This approval is an important milestone for us — putting our customers first was the motivating factor behind achieving ISO 9001. It is a quality security awarded for teamwork and communications."

Aquajet Systems AB adopted ISO 9001 as a means of inspiring and maintaining the confidence of the hydrodemolition markets. "Approval by a prominent independent body such as LRQA proves that Aquajet Systems AB takes quality matters very seriously — it's a voluntary commitment to become even better at

what we do," adds Stefan Hilmersson.

For more information about Aquajet Systems' hydrodemolition equipment, contact Aquajet Systems by phone at 46 383 50801 or fax at 46 383 50730.

Flow Unit Changes Name

Flow International Corporation has announced that its robotic simulation unit has changed its name to Flow Software Technologies. The Windsor, Ontario-based division, formerly operating as Robotic Simulations, Ltd. (RSL), integrates its Workspace™ 3-D robotic simulation software with FLOW's ultrahigh-pressure waterjet operating systems.

"By changing RSL's name to Flow Software Technologies we further reinforce our commitment to maximize the strengths of our worldwide divisions as we continue to offer total

(continued on page 13)

Gardner Denver Announces Acquisition Of Butterworth Jetting Systems, Inc., from page 2

jet market, serving the industrial cleaning and maintenance market. Applications in this market include runway and ship-hull cleaning, concrete demolition and metal surface preparation. The high rate of growth in this industry is driven by several factors, including environmental advantages of water blasting compared to sandblasting, ease of clean up and effectiveness of water jets."

"This acquisition enables Gardner Denver to expand our position in a rapidly growing segment of the industrial market, thereby reducing

the company's dependence on the petroleum business," Mr. Centanni stated.

Gardner Denver, with 1998 revenues of \$385 million, is a leading manufacturer of reciprocating, rotary and vane compressors and blowers for various industrial applications and pumps used in the petroleum and industrial markets. Gardner Denver's news releases are available by fax by calling (800) 758-5804, extension 303875, or by visiting the company's home page on the Internet (www.gardnerdenver.com).

system solutions to our core markets," said Ron Tarrant, FLOW's CEO, chairman and president. FLOW develops and manufactures ultrahigh-pressure waterjet systems for advanced commercial applications, and is a leading provider of robotics and factory automation equipment to the automotive, aerospace, job shop, food, paper and surface prep markets.

"FLOW is a highly progressive and technologically advanced international company. We wanted the marketplace to make the connection that our expertise in 3-D software is an ideal compliment to FLOW's current software control systems," said Mark Bevins, president, Flow Software Technologies.

FLOW has developed a proprietary PC-based software, FlowMaster®, that fully and automatically optimizes cutting speeds, cutting path and

machining parameters for all materials. FlowMaster eliminates the need for extensive operator training because it does not require any previous CNC programming or computer language knowledge.

Workspace, developed in 1989 by RSL, helps companies meet the exacting needs of high volume production environments. Workspace gives the designer and robot programmer a highly versatile and cost-effective package that allows rapid assessment and implementation of ideas and programs.

For more information, contact Mark Bevins, Flow Software Technologies, phone: 519-948-6840.

Soheil Mosun Names Renato Lombardi To Abrasive Waterjet Cutting Division

Soheil Mosun Limited has announced the addition of Renato Lombardi to their Abrasive Waterjet Cutting division. Renato will be acting as Waterjet Department Manager and will be the primary contact for all waterjet cutting requirements.

Renato brings with him over ten years of waterjet cutting and IT management experience in a custom-manufacturing environment. He is also the author of several publications on the use of polymer additives in ultra-high pressure waterjet cutting systems. Whether your cutting needs are straightforward or complex, his hands-on experience and technical research capabilities are at your disposal.

For more information, contact Soheil Mosun: phone: (416)243-1600, fax: (416)243-7132.

Introducing a new generation of protective apparel: WaterArmor™



Nothing protects operators from the impact of water jets like new WaterArmor™. Available exclusively from NLB Corporation, this advanced apparel makes an ordinary wet suit extraordinary.

Key features include:

- Tough, flexible TurtleSkin®, a patented technology from Warwick Mills featuring ballistic-grade KEVLAR®
- Increased protection up to 10,000 psi (700 bar)
 - In tests, WaterArmor was not penetrated by water jets at 10,000 psi and 16 gpm (velocity 8.2 fps, nozzle stand-off 1-1/4")
- Lightweight (2.5 lbs. or 1.1 kg), comfortable and cool
- Adjustable panel system allows one-size-fits-all outfitting
- Fits comfortably under any standard wet suit

WaterArmor™: the new standard in water jet protection. Don't let your operators wear anything less.



29830 Beck Road, Wixom, MI 48393: (248) 624-5555
Texas: (281) 471-7761, New Jersey: (609) 423-2211
<http://www.nlbcorp.com>

A Climbing Robot

Bartlett Services, Inc. is pleased to announce the successful field demonstrations of its technology, The Robotic Climber™. These demonstrations were held at the Hemispheric Center for Environmental Technology (HCET) at Florida International University.

HCET evaluates innovative and emerging technologies that may have utilization in the area of surface decontamination, coating removal and concrete decontamination.

Aside from performing various activities faster than conventional



methods, The Robotic Climber is the first technology to remove coatings from a ceiling, i.e., in an inverted position. This "first ever" achievement was bolstered by the fact that The Robotic Climber also performed coating removal at a rate of 80 square feet per hour in this inverted position on a concrete ceiling.

The Robotic Climber is a unique, lightweight, free-climbing device. It is remote controlled and is adhered to the surface using vacuum. The robot is "armed" with eight nozzles located on a spinner assembly. These nozzles shoot up to 40,000 PSI of water pressure. This water pressure can remove coatings, decontaminate surfaces, even "shave" into concrete to decontaminate the concrete. And, of significant importance, is the fact that the vacuum holding the robot to

the surface also captures all the water and waste right at the robot. Hence, there is no discharge of waste or contaminants into the environment.

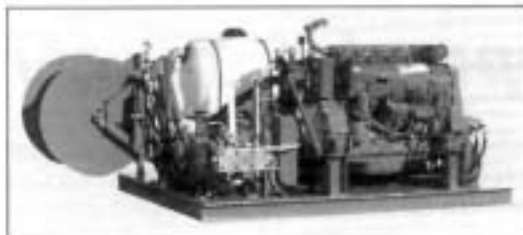
The Robotic Climber looks like a small tank with approx. dimensions of 2 feet by 2 feet. The robot only weighs 78 pounds.

Coating removal from concrete walls was approx. 165 sq. ft. per hour. Coating removal from concrete floor was approx. 235 sq. ft. per hour. Cleaning rust from steel plates was accomplished at a rate of about 172 sq. ft. per hour.

The Robotic Climber is ideal for removing coatings from metal tanks and other large structures such as ship hulls. For more information, please contact Sam Maggio at BARTLETT in Plymouth, MA, USA. (508)746-6464 Ext:140 or e-mail: samm@bartlettinc.com.

Aqua-Dyne's New Sewer Cleaner

Houston-based Aqua-Dyne, Inc., has introduced a 1,500 psi - 6,000 psi sewer cleaner.



Photograph courtesy of Aqua-Dyne, Inc., Houston, Texas

Aqua-Dyne's sewer cleaner unit uses a horizontal triplex positive displacement pump rated to 100 horsepower. Fuel and hydraulic storage tanks are standard built-in features with options including a swivel hose reel, separate water storage tanks and sheet metal shrouding. The sewer cleaner is available with diesel or gas power drivers for mounting on skid, trailer or pick-up truck.

Performance ratings are: 1,500 psi (103 bar) at 68.56 gpm (259.52 l/m) through 6,000 psi (413 bar) at 17.14

gallons per minute (64.88 l/m).

For additional information about Aqua-Dyne's full line of Water Energy™ equipment, call toll free: 800-324-5151 or 713-864-6929, fax: 713-864-0313 or visit Aqua-Dyne's web site at www.aqua-dyne.com



Pressures to 40,000 psi
Horsepower to 500 HP

**INDUSTRY'S MOST POPULAR 40,000 psi
WATER ENERGY™ SYSTEM!**



GA 100 DT - Skid or Trailer mounted

Removes grease, chemicals, dirt, rust, mill scale, paint, cement, marine growth and other substances from any surface including tanks, masonry, tube bundles, ships, machinery, concrete and others.

Aqua-Dyne's systems provide high pressure cleaning power with rugged equipment engineered to perform far longer than anything else in the field with comparable pressure and flow rates.

AQUA-DYNE, INC. 3620 West 11th St. Houston, TX 77008-6004
713 864-6929 Fax 713 864-0313 800 324-5151
<http://www.aqua-dyne.com> info@aqua-dyne.com

Aquajet AB Hydrodemolition Robots

The Aquajet Systems AB line of robots consists of four new models, offering a wide range of new features not seen on previous units. New to the Aquajet line is a diesel engine driven option available on two of the new model robots, a feature currently not being offered by any of Aquajet's major competitors.

Additionally, the new line of robots features improvements to the oscillating high-pressure lance which result in a major increase in the power of the system. After many years' research and operational testing, the new patented high efficient removal head called EDS is being released to the market. This new revolutionary head is able to consistently maintain the standoff distance between the jet nozzle and surface regardless of the waterjet's preset attach angle to the surface. The company claims a dramatic increase in efficiency which translates into a 25% higher removal rate, compared with previous model systems.

The onboard computer system controls and monitors all aspects of the operation with a very simple, user friendly program.

Another new feature on the Aquajet robots, the width of the tracks can be adjusted hydraulically allowing for increased maneuverability and improved stability. Additionally, the power head which is also hydraulically driven, can rotate through 360° tilt 90° and traverse in all directions, which provides improved flexibility and reach in situations where access is limited. The ease with which the mast systems assemble also means that vertical and overhead work is effortless carried out.

The HVD and HVE robots which are used for horizontal, vertical and overhead work are equipped with a tower assembly kit providing a working height to 6 meters (19.67 feet) as

standard equipment. If required this height is easily increased to customer requirements. Vertical working heights in excess of 10 meters (32.8 feet) have already been achieved with great success.

Narrow spaces are also very accessible with the new line of Aquajet robots. The compact design allows for operation in tunnels and similar spaces with working heights of as low as 1.3 meters (4.25 feet) and widths as small as 1.1 meters (3.6 feet).

The new line of Aquajet robots also feature a large range of optional accessories, including Circular Power Head (CPH) for use on circular surfaces such as pillars or columns. This can easily be put into service by simply replacing the standard power head with a CPH. For light concrete removal or scarification and surface preparation, the Rotolance is available and Parapet & Underbridge Beams allow access to both the sides and the underside of a bridge deck as the robot operates from above.

The new Aquajet self-propelled diesel robots can be delivered as complete packages, including one of the powerful high pressure Aquajet pump units housed in a specially constructed container. The container offers the combined purpose of protecting and securing the pumping unit, providing storage space for the robot while not in use and also serves as an operator's workshop at the job



Rehabilitation on the Lisnave Dry-Dock in Portugal commenced in January 1999 and is expected to be completed by year-end. The task is to remove and replace the deteriorated concrete from the walls, floors and galleries of the dry-dock as well as from the surrounding facilities, quay and wharves. The walls in the dock are from 42.7 to 49.2 feet (13 to 15 meters) high, and the concrete has to be selectively removed to expose the rebar on the total area. Approximately 106,000 cubic feet (3,000 cubic meters) of deteriorated concrete will be taken out and replaced. The general contractor is a local company — Belbetoes, which is a subsidiary of Teixeira Duarte S.A. The demolition work is partially performed by Belbetoes, but also by the local specialized company TECOR, using the versatile hydrodemolition robot Aqua Cutter HVD-6000 powered by the high pressure unit PP-480 capable of delivering 51 gallons per minute at 14,500 psi. The machine rapidly removes the deteriorated concrete from the high vertical walls and the floors. Almost all concrete will be replaced using formwork.

site. The complete set up, which all fits into this single container, can be easily delivered to the job site, ready for action, requiring only fuel and water to begin work.

Another product on the Aquajet line is the Aqua Frame X-Y system. The

(continued on page 16)

Aquajet AB Hydrodemolition Robots, from page 15

Aqua Frame is a complete assembly, which can be extended in all directions depending on the requirements of the contractor. One of the largest Aqua Frame systems has a cutting area of 5 x 40 meters (16.4 x 65.6 feet) or 200 square meters (2,153 square feet), in a single assembly. This system is normally used when access to the surface is very limited and there is insufficient access space to deploy a self-contained robot. The Aqua Frame system can be monitored and operated either by one of the robots or can be delivered complete with its own independent computerized control and power system.

Aquajet equipment is used for the selective removal of weakened or damaged sections of steel-reinforced or non-reinforced concrete. Aquajet equipment is in use worldwide delivering the highest quality rehabilitation of concrete surfaces available, affected by salt, frost, acid pollution and normal wear and tear. Aquajet equipment is used on a large range of structures including bridges, pillars, columns, walls, ceilings, tunnels, dams and piers.

The robots have their ability to remove from 0.5 cubic meters per hour to 1.5 cubic meters per hour (17.7 to 53 cubic feet per hour) of concrete, dependent on concrete quality and model system used.

Systems from Aquajet Systems AB are frequently used on large projects around the world. Two major construction projects in Scandinavia have recently been completed using

Many older water channels leading small rivers and streams under roads are in need of rehabilitation. To replace the channels would require closing roads, resulting in traffic interruptions and high costs. Rehabilitation by the hydrodemolition method is the preferred method because it secures high quality rehabilitation and causes only minor traffic interruptions. A major problem in this kind of rehabilitation is the small working space in the tunnels. The bottom can also be very rough and uneven. The tunnel pictured here is only 4.6 feet (1.4 meters) high and 6.6 feet (2 meters) wide. The remote controlled Aqua Cutter robot is used for this task. Approved track chassis and compact size allow the robot to easily crawl into the tunnel while the operator controls the operation from the outside. The robot can enter small tunnels down to 4.2 feet (1.3 meters), and it can turn and tilt the power head in all directions to reach the surface. The concrete is replaced by shotcrete. Aquajet Systems AB launched a comprehensive new line of hydrodemolition robots approximately two years ago. This series has been successful for the company, offering contractors the most versatile hydrodemolition units available.



Aquajet equipment. The Limfjordstunnel in North Denmark, undertaken by Christiansen & Essenbaeck and in south Sweden the contractor Stabilator using Aquajet equipment on applications in Malmoe and Helsingborg.

The Limfjordstunnel was the largest concrete rehabilitation project in Europe. The task was to remove and replace a total of approximately 2,000 cubic meters of heavily reinforced concrete from the walls and ceilings in the two lane, twin tunnels. In the joints between the tunnel elements the concrete was removed to within an accuracy of 150 millimeters to 250 millimeters to a total width of approximately 2 meters on either side of the joints on the walls and ceilings, and to a height of 6 meters.

In addition, the walls between the joints had to be repaired from ground level to a height of approximately 4 meters, accurate to between 50 millimeters-80 millimeters, due to the chloride corrosion that has taken place.

All three hydrodemolition contractors involved in this substantial project were utilizing Aquajet equipment, up to 6 robots being used at any one time. This large job, as well as numerous others, was successfully completed on

time frame and the contractors could easily move on to other scheduled projects.

On the Swedish project several thousand square meters of reinforced concrete were in need of replacement at parking garages in Malmoe and Helsingborg, mainly on floors but also on the walls, pillars and ceilings. Stabilator operated Aquajet equipment on a 24 hour basis for the duration of the project in order to minimize the time in the garage would stay closed to patrons.

A few other major worldwide concrete rehabilitation projects are:

- Westgate Bridge, Melbourne, Australia
- Great Straight Bridge, Taipei R.O.C.
- Niagara Power Project, Canada
- Thelwall Bridge, Manchester, Great Britain
- Samill High Bridge, Seoul, Korea
- Hadeed Steelplant, Jubail, Saudi Arabia
- Almaraz Nuclear Power Plant, Spain
- Chixoy Hydroelectric Dam, Guatemala

For more information, contact Aquajet Systems by phone at [46](383)50801 or by fax at [46](383) 50730.

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. Market size for waterblast equipment or services.
4. An index of papers in WJTA publications, cross-referenced by subject and author.
5. 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.

"Concrete Demolition Rates" Proposal Accepted

The WJTA Monograph Committee has accepted a proposal to create a database of "Concrete Demolition Rates Using Waterjets" as submitted by Dr. Ing. Andreas W. Momber.

WJTA members are encouraged to submit information that may be helpful to Dr. Ing. Andreas W. Momber in care of the WaterJet Technology Association.

BARRACUDA®



**New Power
for Shotgun
Cleaning**

Patent
Pending

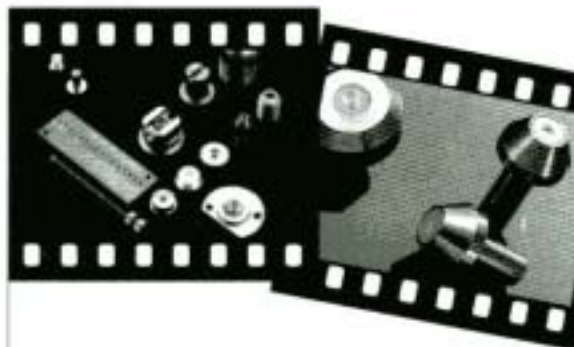
MEMBER
WJTA

Waterjet Technology
Association

**One tool for all your needs
5 - 20 Kpsi and 6 - 14 gpm
No-leak seal that's easy to change
Use all your pump power**

Phone 970-259-2869 FAX 970-259-2868

STONEAGE®
WATERJET TOOLS



**Cutting, spraying, cleaning ...
with sapphire nozzles you are out
in front!**

Nozzles for injecting, cutting, cleaning. Spraying nozzles for industrial and commercial uses. Sapphire technology finds more and more applications wherever nozzles need to resist severe pressure, corrosion and heat. We can help you in any development project, and advise you on product design.

For North America please contact:

ALC+

American Lechlore Corporation
ALC Building, 40 First Court
Parsippany, NJ 07054-1007
Tel: (973) 944-5900 Fax: (973) 261-0933
Email: sales@alcpres.com
Website: www.alcpres.com

comadur sa
A Company of **BOSS**

Comadur SA
Boswil, CH
CH-8600 Thun (Switzerland)
Tel: +41 051 221 8811
Fax: +41 051 222 8431

10th American Waterjet Conference - Accepted Abstracts

Houston, Texas

August 14-17, 1999

- A Comparison of Surface Preparation for Coatings by Water Jetting and Abrasive Blasting, *Lydia Frenzel*.
- A Finite Element Model for Abrasive Waterjet Machining (AWJM), *Ashraf Ibrahim Hassan and Jan Kosmol*.
- A High Efficiency Jet Nozzle with Flow Deflector, *Chen Yufan, Gong Weili and Fang Mei*.
- A New High Efficient Pulsating Nozzle Used for Jet Drilling, *Baoqiang Sun*.
- A New Type of High Pressure Water Jet Mill, *Fang Mei and Gong Weili*.
- A Study of Near Well-Bore Formation Processing with High Pressure Rotating Water Jets, *Li Gensheng, Ma Jiaji, Huang Zhongwei and Zhang Debin*.
- A Study on Technology and Equipment for Cannon Bore Cleaning by Abrasive Suspending Waterjet, *Guo Jidong*.
- Abrasive Waterjet Drilling: Numerical Experiments and Simulations, *Z. Guo and M. Ramulu*.
- Abrasive Waterjet Part Quality Improves with Custom Waterjet Software, *Richard Ward*.
- Abrasives for High Energy Waterjet - Investigation of Properties, *L.M. Havlic and P. Martinek*.
- An Experimental Investigation of the Effect of Non-Newtonian Properties of Fluid on Jet Characteristics, *Li Zhonglin, Liu Chengwen and Sheng Zhongzhou*.
- An Experimental Research on a New Type of High Pressure Cavitating Waterjet Device, *Liu Jintao, Zhu Jintao and Lu Hongqi*.
- An Experimental Study of 3D Machining, *John Xu, Mark Harkess, Kevin Otterstatter, Chris Erickson and Jude Lagus*.
- An Experimental Study on Characteristics of Self-Oscillation Jet Under Ambient Pressure, *Gensheng Li and Debin Zhang*.
- Analytical Investigations of Hydraulic Breaking Coefficient of Coal Seams, *R.V. Radtka*.
- Application Examples of Waterjet Cutting Processing, *Shenglong Xue, Hongping Huang, Yuefang Li and Jingwei Song*.
- Application of Ice Particles for Precision Cleaning of Sensitive Surfaces, *E.S. Geskin, D. Shakhin and E. Babets*.
- Aspects on High Pressure Jet Assisted Turning, *Patrik Dahmen and Jacek Kaminski*.
- AWJ in the Real World, *Stewart Shaffer*.
- Calculation of the Efficiency Rate of High Pressure Pumps, *N. Herbig and F. Trieb*.
- Characterization of Low Pressure AWJ Cutting, *David G. Taggart, Madhu Nandurt and Thomas J. Kim*.
- Clean the Oil-Gas Tube of the Catalytic Unit with the High Pressure Water Jet Cleaning Technology, *Zhang Lanyao, Xiao Yang and Zhang Qizhuang*.
- Cutting and Drilling at 700 MPa Pressure, *Mohamed Heshish*.
- Cutting Efficiency of Abrasive Water Jet Nozzles, *Madhusavathi Nandurt, David G. Taggart and Thomas J. Kim*.
- Cutting to the Quick, *Stewart Shaffer*.
- Demilitarization of Chemical Weapons Using High Pressure Ammonia Fluid Jets, *Paul L. Miller and Felicia Miller*.
- Designing and Building a Waterblast Training Complex, *R. Bruce Wood*.
- Development of a Low-Budget Cutting System, *Asel Henning and Bernd Kempmann*.
- Development of High Erosivity Cavitating and Acoustically Enhanced Water Jets for Well Scale Removal, *K.M. Kalameck, G.L. Chahine, G.S. Frederick and P.D. Ney*.
- Dynamic Modeling of Core-Bit Flow in the Well-Bottom, *Li Xu and Shuhua Fang*.
- Effects of Additives on Behavior of Abrasive Suspension Jet, *Yonglin Yang, Rellie Wang, Zhonghou Shen and Weidong Zhou*.
- Enhancement of Ultrahigh Pressure Technology with LN_2 Cryogenic Jets, *H.-T. Liu and S. Fang*.
- Erosion of Steel Substrates When Exposed to Ultra-Pressure Waterjet Cleaning Systems, *R. Kirk Miller and Gary J. Swenson*.
- Experiments on Discretized Abrasive Waterjet Milling Using Electro-Hydraulic Pulsing, *G. Holmqvist and K.M.C. Qimertz*.
- Extended Technologies for Ultra High Pressure Waterjet Cutting System, *S.X. Xue, W.P. Huang, Z.W. Chen, Y.B. Fan, H.J. Peng, Y.H. Yang and D.J. Shi*.
- Finite Element Modeling of Coolant Flow at the Cutting Zone in High Pressure Water Jet Assisted Milling, *Ram S. Mohan, Radovan Kovacevic and V. Chiratanagandla*.
- Finite Element Modeling of Crack Propagation in PCC Slabs Slotted with Abrasive Water Jet, *Ram S. Mohan and Radovan Kovacevic*.
- High Volume-Low Pressure Nuclear Waste Removal - The Sluicing Concept, *Robert D. Fossey, D.A. Summers, G. Galecki, Mike Rinker and Erian Fadel*.
- High Pressure Water Dynamic Fracture of Rock, *Gangbo Li, Aron Shukla, Martin H. Sudd and Ran Hengplan*.
- Hydrokinetic Usage in the Cleaning of Exchanger Tubes and Pipes, *Brooks Bradford Sr.*
- Hyper Pressure Waterjet and Abrasive Waterjet Cutting, *John Xu, Kevin Otterstatter and Jude Lagus*.
- Influence of Waterjet Machining on the Fatigue Properties of Extra High-Strength Steels, *Christian Qimertz, Gustav Holmqvist, Yngve Bengtsson and Marco Franzaroli*.
- Laboratory Experiments for Cleaning and Polishing the Surface with Hydraulic Jets, *Sorin Radu, Nicolae Ilies, Andrei Magyari and Andrei A. Magyari*.
- Mathematical Modeling of Thick Wall Tubing, *Tom Thrash*.
- Measurements of Water-Droplet and Abrasive Speeds in Waterjets and Abrasive Waterjets, *H.-T. Liu, P. Miles, C. Hibbard and N. Cooksey*.
- Mica Particle Size Dimension Distribution After Waterjet Comminuting, *Fang Mei, Xu Shuhong and Xu Xiaodong*.
- Micro Abrasive Waterjets, *D.S. Miller*.
- Modeling and Simulation of Pressure Fluctuations in High Pressure Waterjets, *Martin Tremblay and M. Ramulu*.
- Modelling of Flow Modulation Following the Electric Discharge in a Nozzle, *M.M. Vijay, A.H. Makowski, A. Tieu and W. Yan*.
- Modelling of Turning Operation for Abrasive Waterjets, *Asel Henning*.
- Modeling the Waterjet Contact/Impact on Target Material, *Z. Guo, M. Ramulu and M.G. Jenkins*.
- Non-Linear Dynamics in Modelling of Cutting Edge Geometry, *Asel Henning and Günther Radons*.
- Numerical Modeling of Waterjet Depainting: Neural Network Approach, *K. Babets and E.S. Geskin*.
- Numerical Modeling of Waterjet Paint Stripping: Grapho-Analytical Fuzzy Inference, *K. Babets and E.S. Geskin*.
- Numerical Simulation of the Waterjet-Rock Interaction, *A. Bortolussi, R. Cicci and B. Grosse*.
- On the Development of an Intelligent Abrasive Waterjet Cutting System Software, *Pawan Singh, Greg Mort and Ihab Kain*.
- Optimization of the Hydro-Cannon Nozzle, *Gennady Atanov*.
- Processing with Thermodynamically Controlled Fluidjets, *Mohamed Heshish*.
- Profiling with 400 MPa Fine-Beam Abrasive Water Jet, *St. Brandt and H. Loul*.
- Purchasing and Running a Profitable Abrasive Waterjet, *Michael Ruppenthal*.
- Quick Method for Determination of the Velocity Profile of the Axial Symmetrical Supersonic Liquid Jet, *L.M. Havlic, I.M. Havlicova and V. Miel*.
- Recent Developments in Offshore Platform Decommissioning with UHP Abrasive Waterjets, *Chidambaram Raghavan, Jim Allen and James Alton LaLonde*.
- Removal of Hard Coatings from the Interior of Ships Using Pulsed Water Jets: Results of Field Trials, *M.M. Vijay, A. Tieu and W. Yan*.

**REDUCE YOUR COMPONENT COSTS
BY OVER 60%!**



*Barton - the world's leader in
waterjet abrasives introduces
HP Waterjet Components*

HP EXTENDED LIFE NOZZLES ... \$90

HP ORIFICE ASSEMBLIES ... \$19.50

**ENGINEERED FOR FLOW'S® PASER II
AND PASER III CUTTING HEADS**

BARTON

(800) 792-5462

Fax: (518) 798-5728 www.barton.com

Barton HP Waterjet Abrasives increase cutting speed by up to 27% over Paser Plus®.

*For more than a century Barton garnet has set the **world standard for performance** in the abrasives industry. Naturally the hardest, sharpest and most angular, Barton garnet is the abrasive of choice for such diverse applications as precision optical grinding and lapping, coated abrasives, and **abrasive waterjet cutting**.*

*The University of Rhode Island Department of Engineering compared the cutting speed of Barton HPX and Barton HPA vs. Paser Plus® using their Flow Abrasive Waterjet system. **Barton HPX and Barton HPA outperformed Paser Plus®** on each and every test, regardless of machine speed, application demand or material thickness.*



CUT SPEEDS ON 2" STEEL		
Barton HPX (Crystalline)	Barton HPA (Alluvial)	Paser Plus®
.35 ipm	.325 ipm	.275 ipm

BARTON

(800) 792-5462

Fax: (518) 798-5728

www.barton.com

Nominations Open For WJTA Board Of Directors

Nominations for the WaterJet Technology Association (WJTA) Board of Directors are now open," announced Dr. Andrew Conn, secretary of the WaterJet Technology Association.

"The WaterJet Technology Association is growing rapidly, and the Association needs dedicated directors to lead the members as the WJTA grows," says Dr. Conn who is also chairman of the Committee on Nomination. "The duties of the directors are truly challenging and rewarding."

The four-year terms of office of Paul Bowser, Pat DeBusk, Lydia Frenzel, Ph.D., Thomas J. Kim, Ph.D., Forrest Shook and John Wolgamott will expire on August 15, 1999. Therefore, nominations are sought for six (6) board members, each to serve a four-year term of office beginning August 15, 1999.

According to the WJTA bylaws, each of the above-named individuals are eligible for re-nomination and re-election to the WJTA Board of Directors.

With regard to all first-time nominees, the WJTA bylaws provide that no more than one of the elected board members may be from the same company or organization. Therefore, board members may not be nominated from facilities that are already represented on the board by individuals whose terms expire in 2001. These facilities include: Conn Consulting, Inc. (Andrew F. Conn, Ph.D.), Flow International Corp. (Mohamed Hashish, Ph.D.), MPW Industrial Services, Inc. (Bruce Wood), VLN Advanced Technologies, Inc. (Mohan Vijay, Ph.D.), and the University of Missouri-Rolla (David A. Summers, Ph.D.).

According to the WJTA bylaws, any WJTA member in good standing (1999 membership dues paid) may submit a nomination(s). Nominees must also be WJTA members in good standing. The deadline for making nominations is at least eleven (11) weeks prior to the biennial business meeting scheduled for Sunday, August 15. Your nomination(s) should reach the WJTA office no later than May 17, 1999. To submit a nomination(s), complete the form below and return to:

Chairman, Committee On Nomination
WaterJet Technology Association
917 Locust Street, Suite 1100
St. Louis, MO 63101-1413
Phone (314)241-1445
Fax (314)241-1449

Remember, nominations must be received no later than May 17, 1999.

Nominations/Elections Procedures

In accordance with the bylaws of the WaterJet Technology Association, revised in 1993, nominations and elections to the Board of Directors include the following procedures:

- At least two calls for nominations to the board of directors will be published in the *Jet News*. The first call for nominations appears in this issue. Nominations will be accepted through May 17, 1999.
- A list of the eligible nominees and a brief biographical sketch for each individual will be published in the June 1999 issue of *Jet News*.
- An official ballot listing the eligible nominees will then be forwarded by mail to all eligible voting members of the Association on July 2, 1999. Signed and executed, ballots must be mailed to the Association's office for tallying by August 11, 1999.
- The names of newly elected board members will be announced on Sunday, August 15, 1999, at the WJTA general membership meeting held in conjunction with the 10th American Waterjet Conference in Houston, Texas.

Only eligible members of the WaterJet Technology Association may submit a nomination and nominees must be eligible members of the WaterJet Technology Association.



Nomination Form

Name Of Nominee _____ Title _____

Address _____

City _____ State _____

Country _____ Postal Code _____

Telephone _____

In US/Can (_____) _____ Outside US/Can (_____) (_____) _____
(area code) (country code) (city code)

Fax _____

In US/Can (_____) _____ Outside US/Can (_____) (_____) _____
(area code) (country code) (city code)

Attach biographical information with a brief statement of your nominee's mission and vision for WJTA.

Name Of Nominator _____ Title _____

Address _____

City _____ State _____

Country _____ Postal Code _____

Telephone _____

In US/Can (_____) _____ Outside US/Can (_____) (_____) _____
(area code) (country code) (city code)

Fax _____

In US/Can (_____) _____ Outside US/Can (_____) (_____) _____
(area code) (country code) (city code)



Stop Paying Too Much For Garnet

Convert to FLOW's **high-performance PASER Plus Garnet** and reduce costs by 25%—or more—compared to the other high-performance brand. PASER Plus will save abrasivejet users thousands of dollars annually, while matching the performance and quality of HP Garnet.

PASER Plus Garnet is free of dust and debris and meets the same high quality standards of FLOW's other spare parts. Scientific testing proves PASER Plus cuts just as fast as HP Garnet, and **reduces your cost** per inch.

FLOW has lowered net shipping costs and **guaranteed availability** with its regional warehouses in Seattle, Los Angeles, Houston, Chicago, Jacksonville and New Jersey. Price per ton includes 2,204 lbs. of garnet, packaging and pallets. Prices are F.O.B. warehouse. Be sure to ask about our special contract pricing!

Price of Garnet by Mesh Size

Mesh Size	1-9 Ton Price	10-19 Ton Price	20 Ton Price
50 Mesh	\$.23 lb.	\$.21 lb.	\$.20 lb.
80 Mesh	\$.27 lb.	\$.24 lb.	\$.23 lb.
120 Mesh	\$.30 lb.	\$.27 lb.	\$.26 lb.

FLOW guarantees your **complete satisfaction** with PASER Plus. Try a ton of PASER Plus at FLOW's special first-time order price of 15% off list price. If you are not completely satisfied with the product, FLOW will refund your money.

Call **1-800-526-4810** to order your first ton of PASER Plus and **start saving** thousands of dollars annually.

Tell a Friend About PASER Plus

Call FLOW customer service with the name of an abrasivejet shop in your area that's not using PASER Plus Garnet and **receive 10% off** your next garnet order. Also, FLOW will reward you with a \$300 spare part credit if the user signs an annual contract for PASER Plus.





Start saving money with PASER[®] Plus

Not all garnets are created equal. Sandblasting garnets may cost a few pennies less per pound, but they cut up to 20% slower than PASER Plus Garnet. Slower cut speeds increase your total cost per inch when you factor in all costs associated with machine operation and overhead. The bottom line is lost profits to your company. Convert to FLOW's high-performance PASER Plus and **reduce cost per inch** up to 20% compared to sandblasting garnets. By spending a few pennies more a pound up front, PASER Plus will **save** abrasivejet users thousands of dollars annually by increasing production capabilities.

PASER Plus Garnet is **free of dust and debris** and meets the same high quality standards of FLOW's other spare parts. Scientific testing proves PASER Plus cuts up to 20% faster than the sandblasting garnets.

1 inch stainless steel, separation cut

Brand	Delivered Price	IPM	Cost Per Inch
PASER Plus	\$.27 lb.	5.0	\$.48
Sandblasting Brand 1	\$.20 lb.	3.9	\$.57
Sandblasting Brand 2	\$.20 lb.	3.8	\$.57

2 inch mild steel, separation cut

Brand	Delivered Price	IPM	Cost Per Inch
PASER Plus	\$.27 lb.	2.5	\$1.53
Sandblasting Brand 1	\$.20 lb.	2.0	\$1.62
Sandblasting Brand 2	\$.20 lb.	1.9	\$1.62

For complete details on pricing and regional warehouses, please see reverse side.

FLOW guarantees your **complete satisfaction** with PASER Plus. Try a ton of PASER Plus at FLOW's special first-time order price of 15% off list price. If you are not completely satisfied with the product, FLOW will refund your money.

Call **1-800-526-4810** to order your first ton of PASER Plus and **start saving** thousands of dollars annually.

Tell a Friend About PASER Plus

Call FLOW customer service with the name of an abrasivejet shop in your area that's not using PASER Plus Garnet and **receive 10% off** your next garnet order. Also, FLOW will reward you with a \$300 spare part credit if the user signs an annual contract for PASER Plus.

Accepted Abstracts, from pg. 18

- Rock Cutting with AWJ and Fractal Dimension of Cut Surface Profiles, Chung-In Lee, Wan-Mo Kim, Hyung-Mok Kim, and Byung-Sun Choi.
- Rock Disintegration Using Waterjet-Assisted Diamond Tools, A. Bortolussi, R. Cicci, B. Grosso and J. Vasek.
- Simulation of the Cleaning Process with an Optimal Control Approach, H. Louis and W. Milchers.
- Some Investigations on Abrasives in Abrasive Waterjet Machining, D. V. Krishniah Chetty and N. Ramesh Babu.
- Status and Potential of Waterjet Machining of Composites, Mohamed Heshish.
- Study on Dynamic Characteristic of Air Nuclei in Aerated Water Jet, Liu Jinzhi, Zhu Jinxu and Lu Hongqi.
- Study on the Cleaning Processing for Underground Buried Pipelines with Large Diameter Using High Pressure Water Jet, Zeng Yanli, Dayang Xianwu, Lu Wenzhu, Liu Guangheng and Ning Guoping.
- Study the Anti-Rust Problem for Machines and Tools of the High Pressure Water Jet Cleaning, Jiao Yang and Zhang Leyao.
- Surface Preparation of Concrete and Metal with High Pressure & Ultra High Pressure Water, Ted Kupschick.
- The Analysis of Magnetohydrodynamic Effects - New Approach to the Pulse Jet Generation, L.M. Havlicek and L.M. Havlic.
- The Carving of the Millennium Arch, Estelina Sandys, Scott Porter, David Summers, Grzegorz Galecki, Robert Fossey, James Blaine and John Tyler.

- The Development of a High-Power Pulsed Waterjet Process, Gene G. Yie.
- The Development of New Waterjet Pumps, Gene G. Yie.
- The Effects of Process Parameters and Their Interactions on AWJ Cutting, Jiyue Zeng.
- The Influence of the Rocks Parameters During the Cutting Process Using High Pressure Water Jets, Nicolae Nias, Andrei Magyari and Sorin Radu.
- The Mechanism of Particle Comminuting by Waterjet, Fang Mei, Jiang Shan and Xu Xiaodong.
- Theoretical and Experimental Investigation of a High Energy Waterjet Efficiency on Thermally Treated Rocks, L.M. Havlic.
- Using 40,000 PSI for Field Work, M.T. Gracey and M. Perry.
- Water-Jetting Productivity Study for the Marine Industry, Gordon Kuljian and Darren Melhuish.
- Waterjet Use Dealing with the Problem of Anti-Personnel Landmines, D.A. Summers, D.R. Mitchell, S.J. Thompson, R. Denier and E. Barnes.

CORRECTION

Jetech Inc. of Battle Creek, Michigan, can be reached by telephone at (619)965-6311. Jetech's telephone number is incorrectly listed in the company's 1999 WJTA Membership Directory advertisement (page 33). Jetech can also be reached by fax: (619)965-6554, email: info@jetech.com, and on the web: www.jetech.com

10th AMERICAN WATERJET CONFERENCE - August 14-17, 1999 Hotel Reservation Request Form

JW MARRIOTT HOTEL

150 Westheimer • Houston, Texas 77056 • (713)961-1500

Rates: \$99 Single/Double occupancy.

Reservations received after July 29, 1999, will be confirmed on an availability basis.

The JW Marriott is pleased you have chosen us for your upcoming visit. Our staff looks forward to serving you in the fine Marriott tradition.

To expedite your check-in process, and assure your room type preferences are honored as much as possible, we require the following important information: 1) Credit card name, number, and authorization (signature); 2) Bed type (King or two double beds) and smoking preference in order of priority; and 3) Estimated arrival time (Check-in 3:00 p.m., but efforts will be made to room you as soon as possible).

The JW Marriott regrets that it cannot hold your reservation after 6:00 p.m. on the day of arrival without a credit card, or first night's room deposit by check or money order (do not send cash).

Deposits will be refunded only if cancellation notification is given up to 24 hours prior to arrival. If more than one room is requested, please enclose list of names and addresses, indicating which guests share rooms.

Name _____ Company _____

Address ☐ Company ☐ Home _____

City _____ State _____ Country _____ Postal Code _____

Phone In US/Canada (_____) _____ Fax (_____) _____

Phone Outside US/Canada (_____) (_____) _____ Fax (_____) (_____) _____

Room type preference ☐ King ☐ Double/Double Smoking preference: ☐ Non-Smoking ☐ Smoking

Which preference is more important: ☐ Bed type ☐ Smoking preference

Please list names of guests sharing your room _____

For arrival on _____ day _____ date _____ time _____ Depart on _____ day _____ date _____ time _____

☐ Check or money order enclosed — Amount \$ _____

☐ American Express ☐ Carte Blanche ☐ MasterCard (Please include interbank # directly below card #) ☐ VISA ☐ Diners ☐ Discover

Credit Card Number _____ Expiration Date _____

I authorize the JW Marriott Hotel to charge my account for one night's room charge in the event I do not cancel my room by 6:00 p.m., the day of arrival.

Signature _____ Phone # _____

Check-out time is noon. Rooms may not be available for check-in until after 3:00 p.m. RESERVATIONS REQUESTED BEYOND THE CUT OFF DATE ARE SUBJECT TO AVAILABILITY. ROOMS MAY STILL BE AVAILABLE AFTER THE CUT OFF DATE, BUT NOT NECESSARILY AT THE ABOVE RATE. PLEASE APPLY 17% SALES AND LODGING TAX TO THE ABOVE RATES. (Tax rates subject to change.)

Candidates Sought For 1999 WJTA Awards

You are invited to submit candidates for these special awards that are presented biennially by the WaterJet Technology Association to honor a company, organization or individual who has made a significant contribution to the industry through accomplishments that directly enhance waterjet technology and the industry as a whole.

Candidates must be received no later than July 1, 1999. The award recipient, to be selected by the Awards Committee of the WaterJet Technology Association, will be honored at a presentation ceremony on Monday, August 16, 1999, in conjunction with the 10th American Waterjet Conference in Houston, Texas.

Following is an official form for candidate nominations. Complete one form for each nomination submitted. Please make additional copies of the form as needed. Nominations providing complete written information specified on the form may be faxed to (314)241-1449 or mailed to the WaterJet Technology Association, 917 Locust Street, Suite 1100, St. Louis, MO 63101-1413, USA.

1999 WJTA Awards Nomination Form

Instructions: Complete sections below and submit a narrative (300-word maximum) to support your nomination on a separate sheet of paper. Please print or type all information.

I nominate the following company, organization, or person as a candidate to receive a 1999 WJTA Award (CHECK ONE AWARD):

☐ **Distinguished Pioneer Award**

The nominee must:

- Have made contributions to the waterjet industry;
- Have made contributions to the achievement of the goals of WJTA;
- Have high moral character;
- Have strong personal and business ethics;
- Be dedicated to the future of the waterjet industry and to the growth of WJTA.

☐ **Service Award**

How has the nominated company, organization or individual contributed in time and talent toward improvement in the Waterjet Technology Association?

☐ **Safety Award**

What has the nominated company, organization or individual done to introduce new and innovative ideas in safety? This could include, but is not limited to new products, new concepts, new safety techniques . . . any unique activity which increases the overall safety of waterjet equipment.

☐ **Technology Award**

What has the nominated company, organization or individual done to introduce new and innovative ideas in engineering or manufacturing? This could include, but is not limited to, new products, new manufacturing techniques, patents . . . any unique activity that advanced the technology of the waterjet industry.

Candidate: _____ Company: _____

Address: _____ City: _____

State: _____ Country: _____ Postal Code: _____

Phone In US/Canada (_____) _____ Fax (_____) _____
area code area code

Phone Outside US/Canada [_____] (_____) _____ Fax [_____] (_____) _____
country code city code country code city code

Candidate Submitted By: _____ Company: _____

Address: _____ City: _____

State: _____ Country: _____ Postal Code: _____

Phone In US/Canada (_____) _____ Fax (_____) _____
area code area code

Phone Outside US/Canada [_____] (_____) _____ Fax [_____] (_____) _____
country code city code country code city code

Signed: _____ Date: _____

Nominations must be received no later than July 1, 1999. For a prompt response, fax completed form to (314)241-1449, or mail to the WJTA, 917 Locust Street, Suite 1100, St. Louis, MO 63101-1413, USA.

Eight Easy Ways To Attend The 1999 Waterjet Conference

1. FULL CONFERENCE

Includes admission to all technical, scientific and contractor sessions (except preconference workshops on Saturday, August 14), pass to Welcoming Reception in Exhibit Hall (Saturday, August 14), exhibits and sponsored luncheon on Sunday, August 15, and Monday, August 16, coffee breaks, WJTA Party on Monday, August 16, and technical tour and demonstration. **Each full registration also receives one copy of the Conference Proceedings, including CD-ROM.**

2. COMBO

Includes everything listed under Full Conference **PLUS** your choice of preconference workshops on Saturday, August 14.

3. SAVE \$ ON MULTIPLE EMPLOYEE FULL/COMBO REGISTRATIONS

Companies that purchase three or more full or combo registrations receive a special discount for each additional employee registered after the first two. To take advantage of the special discount, register the first two (2) employees from your company at the regular FULL/COMBO rates and receive the discounted rate for the third and subsequent employee registrations.

4. DAILY ATTENDANCE

Includes admission to all technical and scientific sessions, exhibit hall, coffee breaks, and sponsored luncheon on that day. Register for one day and receive a 50% off coupon for the 1999 Conference Proceedings, including CD-ROM. Register for two days and the Proceedings are included. **NOTE:** Admission to the WJTA Party on Monday is **NOT** included in the daily registration fee, and tickets for this event must be purchased separately.

5. PRECONFERENCE WORKSHOPS

- Waterjet Short Course
- WJTA Recommended Practices (Safety) Seminar
- Advanced Topics in Surface Preparation

Includes handout materials for workshop selected, coffee breaks, luncheon, and August 14 Welcoming Reception in Exhibit Hall.

6. EXHIBIT HALL PASS

See waterjet equipment, supplies, and services on display. Pass includes exhibit hall admission (9:30 a.m.-5:00 p.m.) and sponsored luncheon on Sunday and contractor's program, exhibit hall admission (9:30 a.m.-2:30 p.m.) and sponsored luncheon on Monday. Does **NOT** include Welcoming Reception in Exhibit Hall on Saturday, August 14.

7. TECHNICAL TOUR

Includes round-trip bus transportation, luncheon, and admission to several company sites where you'll see live waterjet demonstrations.

NOTE: Cameras are not permitted on technical tour.

8. STUDENTS

The registration fee for WJTA student members is \$20. Student registration includes admittance to technical programs and the technical tour, but does **NOT** include copies of books, Welcoming Reception in Exhibit Hall on Saturday, August 14, or admittance to any food/social functions. **NO** discount is available for students that are not members of the WJTA. WJTA student members must be enrolled full-time in a university graduate or undergraduate program.

CANCELLATION POLICY

Fees will be refunded in full for cancellations received at least four weeks prior to the Conference. Cancellations received more than 10 days and less than four weeks prior to the Conference will be subject to a \$50 charge. No refund will be made for cancellations received less than 10 days prior to the Conference. However, substitutions may be made at anytime.

Discounts for WJTA members and early-bird registrants!

WJTA members receive a special discount off the regular registration fees. You will also receive an additional discount if your registration is postmarked or received in the WJTA office by **August 2, 1999.**

WaterJet Technology Association

Telephone: (314)241-1445, Fax: (314)241-1449, Website: www.wjta.org

Hotel Reservations

Contact the JW Marriott for hotel reservations.

Make your hotel reservations early to take advantage of the special WJTA Conference rates. Use the convenient form on page 19, or call the Marriott at (713)961-1500. Be sure to request the special group rate for the 1999 WJTA Conference — \$99 single or double occupancy.

1999 WJTA Conference Registration Form

Name _____ Title _____
 Company _____ Mailing Address: ☐ Home ☐ Work
 Address _____
 City _____ State _____ Country _____ Postal Code _____
 Telephone # [] () _____ Fax # [] () _____
 E-mail Address: _____
 Information for name tag _____

Print name as you wish it to appear on your name tag

THREE EASY WAYS TO REGISTER

By Phone: Just call
(314) 241-1445 and
have your credit card
information ready. (MC/
VISA/Am. Exp. ONLY).

By Fax: Fill out the reg-
istration form with your
credit card information
and call our 24-hour fax
number at: (314)241-
1449.

By Mail: Fill out the
registration form and
mail with applicable
payment to: **WJTA,**
917 Locust Street,
Suite 1100, St. Louis,
MO 63101-1413.

Payment Method: ☐ Enclosed is my check, payable to **WaterJet Technology Association** (U.S. DOLLARS ONLY).
☐ Please charge my ☐ MasterCard ☐ VISA ☐ American Express

Credit Card # _____ Expiration Date _____

Print name as it appears on card

Cardholder's signature

**Join the WaterJet Technology Association
now and receive a substantial discount off
Conference registration fees.**

WJTA MEMBER		NONMEMBER*	
By 8/2/99	After 8/2/99	By 8/2/99	After 8/2/99

Eight Ways To Register

- ☐ **Full Conference ONLY** \$ 495 \$ 525 \$ 545 \$ 575 = \$ _____
- ☐ **Combo** (Full Conference PLUS Preconference Seminar) \$ 665 \$ 695 \$ 715 \$ 745 = \$ _____
- Specify preconference seminar:
☐ Short Course ☐ Safety ☐ Surface Prep
- ☐ **Daily**
- ☐ Saturday (includes lunch) \$ 295 \$ 310 \$ 345 \$ 360 = \$ _____
- Specify: ☐ Short Course ☐ Safety ☐ Surface Prep
- ☐ Sunday (includes Luncheon in Exhibit Hall) \$ 220 \$ 235 \$ 235 \$ 250 = \$ _____
- ☐ Monday (includes Luncheon in Exhibit Hall) \$ 220 \$ 235 \$ 235 \$ 250 = \$ _____
- ☐ Tuesday, **Technical Tour** (includes lunch) \$ 100 \$ 110 \$ 110 \$ 120 = \$ _____
- ☐ **Exhibit Hall Pass Sunday/Monday ONLY** \$ 20 \$ 20 \$ 20 \$ 20 = \$ _____
- Does not include Welcoming Reception on 8/14
- ☐ **Student** (WJTA members ONLY) \$ 20 \$ 20 N/A N/A = \$ _____

MULTIPLE CORPORATE REGISTRATIONS (Applies to third and subsequent registrants from same company)

- ☐ **Full Conference ONLY** \$ 420 \$ 450 \$ 470 \$ 500 = \$ _____
- ☐ **Combo** (Full Conference PLUS Preconference Seminar) \$ 590 \$ 620 \$ 640 \$ 670 = \$ _____
- Specify: ☐ Short Course ☐ Safety ☐ Surface Prep

WJTA MEMBERSHIP ☐ \$50 Individual membership ☐ \$20 Student membership ☐ \$350 Corporate membership = \$ _____

☐ **Conference Proceedings** Copies x \$99.00 = \$ _____

1999 WJTA Conference registrants may purchase extra copies of the Conference Proceedings (two-volume soft cover Proceedings and CD-ROM) for only \$99. Regularly priced at \$155, you will SAVE \$56. Offer valid through 8/31/99.

SPECIAL OFFER!

EXTRA TICKETS — The Full and Combo registrations include one ticket per registration for the Exhibit Hall Luncheons (Sunday and Monday) and Awards Presentation/Party (Monday evening). Each Daily registration includes a luncheon ticket for the day registered: Saturday, Sunday, Monday and/or Tuesday. Additional tickets may be purchased as follows:

- ☐ **Welcoming Reception** \$ 50 \$ 50 \$ 50 \$ 50 = \$ _____
- ☐ **WJTA Awards Presentation/Party** \$ 65 \$ 70 \$ 65 \$ 70 = \$ _____

*Non-WJTA members who are members of the International Society of Waterjet Technology are permitted a 5% discount off nonmember registration fees.

TOTAL ENCLOSED \$ _____

For the highest quality valves, fittings and tubing . . .



that will reduce your waterjet costs,
there's only **HiP**

When you "turn up the pressure" on your waterjet system, you need to know you're working with the highest quality, most dependable fluid products. And in today's competitive environment you need to save money wherever possible. To do both, you need High Pressure Equipment Company.

Our ISO 9001 certified design and manufacturing operations are part of a quality focus that has helped us gain the trust of many new customers. And our on-time delivery has made us an integral part of our customers inventory reduction efforts.

We stock an extensive line of valves, fittings and tubing in pressures ranging from 10,000 psi to 150,000 psi to satisfy your waterjet application. In addition, our technical staff is available to answer questions and custom design a solution to your problem.

There is a choice in high pressure valves, fittings and tubing . . . HiP. To find out more, give us a call at 800-289-7447.

ISO 9001
CERTIFIED

**High Pressure
Equipment
Company**

P.O. Box 8248, 1222 Linden Avenue
Erie, Pennsylvania 16505 U.S.A.
Phone: (814) 838-2028 • 800-289-7447
Fax: (814) 838-6075
E-Mail: sales@highpressure.com
Web Site: www.highpressure.com

