WJTA Jet News

WaterJet Technology Association

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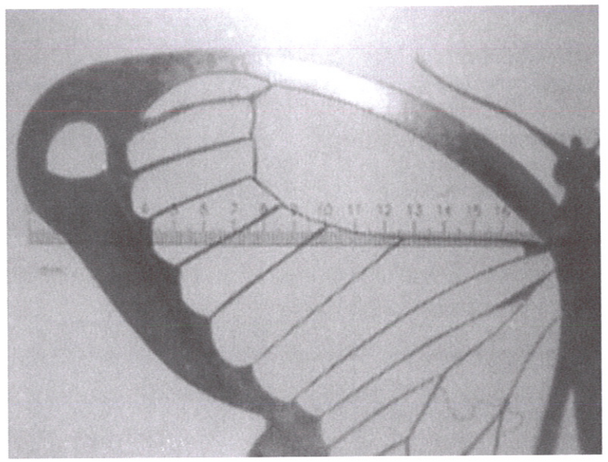
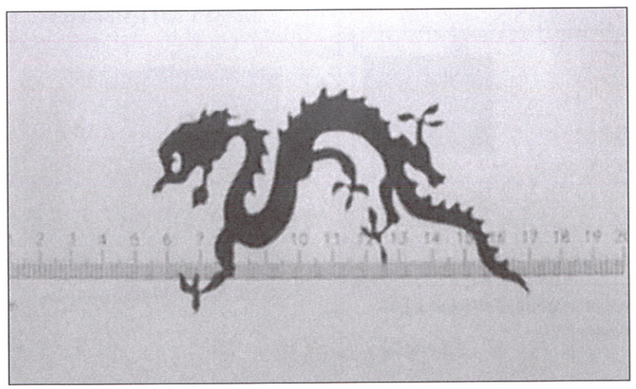
Papers To Be Presented At The 2003 WJTA Conference In Houston, Texas, August 17-19, 2003



Example of reproducing thin sections (scale 100 micron for smallest division).

Over 40 papers will be presented at the 2003 WJTA American Waterjet Conference at the Adam's Mark Hotel in Houston, Texas. Authors will present a variety of subjects ranging from firefighting to the cutting of sandwiches. The pictures shown here are from the paper entitled, "Developments in Abrasive Waterjets for Micromachining," by D.S. Miller. A brief summary of each paper presented appears in this newsletter.

Each paper appears on the CD-ROM, *Proceedings of the 2003 WJTA American Waterjet Conference*. To order your copy, see the enclosed publications order form.



Profile from 50 micron thick stainless steel, cut with 300 nanometre abrasive using a 40 micron diameter nozzle.

On the inside

Papers To Be Presented At The 2003 WJTA Conference in Houston, Texas, from pg. 1

Session A
Ultra High Pressure Cutting and Surface Preparation
Monday, August 18 • 1:00 p.m.-3:00 p.m.

1-A. Cutting Mechanism and Cutting Efficiency for Water Pressures Above 600 MPa, *H. Louis, M. Mohamed and F. Pude*

This paper discusses the equipment and the cutting process for pure waterjets and abrasive waterjets with pressures up to 900 MPa.

2-A. Feasibilities of Abrasive Water Jet Multipass Cutting Technique, *B. Jurisevic, K.C. Heiniger, A. Schuetz and M. Junkar*

A study of abrasive waterjet machining with the aim of improving cut quality and energy efficiency and reducing machining time and costs.

3-A. Modeling of Wear Mechanisms at the Abrasive Waterjet Cutting Front, *Axel Henning and Engelbert Westkämper*

New applications to modeling the abrasive waterjet cutting process are elaborated with emphasis on cut quality.

4-A. Physical Basis of High-Pressure Hybrid Water-Abrasive-Ice Jet Application for Surface Treatment, *P. Borkowski*

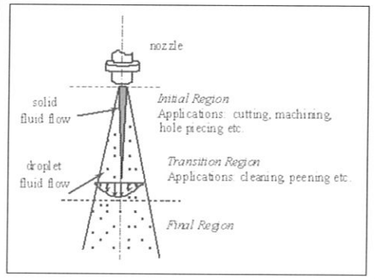
The subject technology is based on a high pressure abrasive waterjet with the addition of dry ice pellets. The theory is discussed along with an experimental plant.

5-A. An Analytical Model for Prediction of Residual Stresses in Water Jet Peening, *N. Ramesh Babu and G. Vikram*

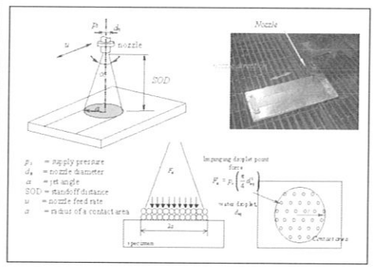
An analytical model is proposed to estimate the residual stresses induced in a surface of a material treated by waterjets.

6-A. Mathematical Modeling of Ultra High Pressure Waterjet Peening, *S. Kunaporn, M. Ramulu and M. Hashish*

Mathematical modeling of high pressure waterjet peening was developed to describe a relationship between the waterjet peening parameters and the resultant material modification in the target.



Schematic of changes in jet structure with distance from the nozzle.



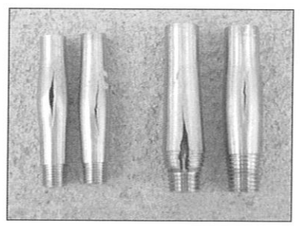
Graphic representation of the waterjet peening process.

6-A

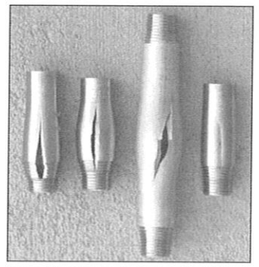
Session B
Putting A System Together
Monday, August 18 • 3:20 p.m.-5:00 p.m.

1-B. Pipe Threads – What is the Limit?, *D. Wright, J. Wolgamott and G. Zink*

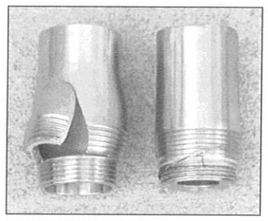
This paper presents the results of tests to determine the failure point of tapered pipe threads (1/8 to 1-1/4 NPT) when internally pressurized.



1/8 and 1/4 NPT 304 test samples



1/2 NPT 304 test samples



1-1/4 NPT 304 test samples

1-B

(continued on page 6)

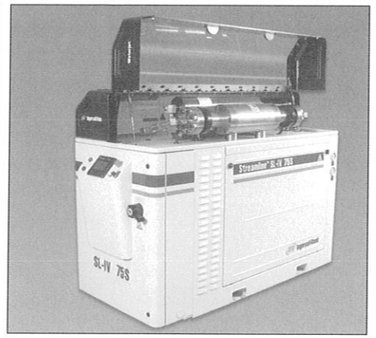
Ingersoll-Rand Launches SL-IV 75 S & R Intensifer

Ingersoll-Rand (IR) Waterjet Systems, with over four decades of ultra high pressure design expertise, pioneered the Waterjet Industry in 1971 when it introduced the very first cutting intensifier pump – the Streamline™ SL-I. Continuing its tradition of manufacturing the highly reliable, world-renowned Streamline™ series, IR Waterjet Systems is launching another high-performance intensifier – the SL-IV 75 S&R.

The SL-IV 75 S & R has a 75 hp, single intensifier and allows for a redundancy option.

The SL-IV 75 outputs 1.34 gpm when operating continuously at 60,000 psi and using the maximum rated .016 orifice size. Its intensification ratio is 23:1. In line with the newly introduced Plus intensifier series, the SL 75 S&R features the patent-pending Hyperlife™ seal technology, which extends plunger seal life to unprecedented levels, and the new innovative metal-to-metal end cap design, which eliminates the need for check valve seals.

A programmable logic controller (PLC) provides basic intensifier shift control while monitoring out-of-limits conditions. The operator communicates with the PLC by use of the touch screen display/control panel. The touch screen display panel is a 5.5" monochrome display panel using ten screens to switch and monitor the different machine functions. These screens are selected from a Main Menu Screen. They control start/stop and recirculation functions, pressure control, set-up, stroke rate, stroke count, run time, alarms and alarm history, maintenance, configuration, language select and many functions to aid in normal machine operation.



SL 75 S & R

- Remote monitoring of the PLC is available as an option. An optional modem is interfaced with the PLC, allowing IRWJ service technicians to perform real-time diagnostics, remote troubleshooting, and data analysis software updates. The pump CANNOT be started remotely via the modem.
- An optional digital pressure transducer can be incorporated into the PLC interface/ display screen.
- An optional proportional pressure control is available whereby the operator can select or vary HP water pressure from the touch screen or from a remote location.
- Remote control (hard- wired) terminals for START/ STOP/ E-STOP/ RUN indicator light/ MALFUNCTION indicator light functions is available to allow basic pump control/ monitoring at the cutting box/ cutting table control console.

The SL-IV 75 S&R has features that provide a highly productive work climate:

- Integrally-packaged electrical control and motor starter panel
- Louvered doors and frame legs for ease of cooling air flow to the electric motor
- Leg-mounted low pressure water gages for ready analysis of potential cutting water supply problems
- Smoked plastic top cover for at-a-glance visual checks for water leaks
- Top cover design allows ready access to HP intensifier and associated water piping.
- Top pan design provides convenient work platform for intensifier routine maintenance, while providing a catch pan for liquid leakage.
- Side panels are easily removed and re-installed, provide a significant improvement in noise reduction.
- Integral bottom drip pan with fork tubes for ease of maneuvering pump into location.
- Bulkhead fittings arranged in a single, centralized location at one corner of the IRWJ pump frame for connecting water/ shop air services.

Visit www.irwj.com for more information or contact IR Waterjet Systems by email: wjet_sales@irco.com, phone: 1-800-826-9274 or mail: 635 West 12th Street, PO Box 151, Baxter Springs, KS 66713-0231.

The ***Jet News*** is published by the WaterJet Technology Association (WJTA) and is a benefit of membership in the Association.

Waterjet Cutting Courses Offered

RICHEL, Inc. is offering Waterjet Cutting Techniques Courses, Sunday through Tuesday, September 14-16 and November 9-11. These courses are designed to provide rigorous hands-on training in waterjet cutting as well as a foundation in the basic principles of waterjet technology, operation, and practice including comparison of waterjet with laser, plasma and oxy-fuel.

The presentation is supported with video, computer generated interactive displays, CAD/CAM and controller demonstrations and will provide information on abrasive recycling. This is an opportunity to scan, program and cut parts, rebuild cutting heads and intensifier pumps and run a waterjet.

The instructor, Richard Ward, CEO of RICHEL, Inc., has written numerous articles on waterjet applications and given presentations nationally and internationally. Training will be held at RICHEL, Inc., 4485 Crystal Parkway, Suite 100, Kent, Ohio (south of Cleveland). To enroll and obtain more information, call: 1-330-677-9100, fax: 1-330-677-9121, email: richel@richel.com or visit www.richel.com.

WJTA Conference Sponsors

BuTech Pressure Systems

General Pump, Inc.

High Pressure Equipment Company

International Waterjet Parts (IWP)

Jet Edge

NLB Corp.

Parker Polyflex

TurtleSkin WaterArmor by Warwick Mills

Universal Minerals

VLN Advanced Technologies Inc.

WOMA Corporation

Onsite Live Demonstrations Will Be Held At The Conference

Onsite Live Demonstrations will be held at the 2003 WJTA American Waterjet Conference on Monday, August 18, and Tuesday, August 19, in the rear parking lot of the Adam's Mark Hotel in Houston, Texas. Demonstrations will include both live and static displays. A list of participating companies and their display descriptions available at press time appear below:

AQUA-DYNE, Inc.

AQUA-DYNE, Inc. will demonstrate 40,000 PSI surface preparation blasting to bare metal using the latest GA 200 DS Vacuum System, Aqua-Spider, Aqua-Scrubber and Robotic Cleaner for vertical and horizontal walls, ship hulls/bottoms and vessels. AQUA-DYNE's rotary gun, mini scrubber and Dyna Mo (grate and floor cleaner) are also being demonstrated.

Gardner Denver Water Jetting Systems, Inc.

Demonstration of Gardner Denver Water Jetting Systems' new 50K X-Stream waterjetting unit showing significant improvement realized by utilizing 50,000 PSI high pressure water for cutting and coatings removal.

Hydro-Engineering, Inc.

Introducing the revolutionary Hydrojet-40, the all new, self-rotating, UHP surface preparation nozzle, with "interspin" technology, rated for up to 40,000 psi. Come see why air rotary guns are soon to be a thing of the past. For single gun operations, simply use a standard 40,000 psi dump gun and the Hydrojet-40. For multi-gun applications, use standard 40,000 psi shut-off guns with a pressure regulator.

Features: no air or air lines required; no expensive tumble boxes required; cartridge overhaul in 30 seconds; no external rotating parts; lightweight and durable; and simple design for field maintenance.

Jetstream of Houston, LLP

Jetstream of Houston, LLP will demonstrate its 4200 D series waterblaster. Customers will be shown how advanced engineering can take the basic concept of pressurizing water and simplify it for ease of maintenance and user-friendly operations. The demonstration will highlight how easy it is to accomplish conversion of pressures, preventative maintenance and field repair. They will show how univalve and cartridge design can limit downtime, decrease operating cost and improve productivity.

NLB Corporation

NLB is a worldwide manufacturer and marketer of high and ultra high pressure waterjetting equipment and will be demonstrating its 40201D UHP pumping unit removing coatings from steel and concrete surfaces utilizing a vacuum recovery hand lance and SpinJet®.

Peinemann Equipment

We will be operating several of the Peinemann inside tube cleaning machines, including the IBC-5, our 5-lance rigid lance machine. Also two of the Peinemann flex lance units will be demonstrated: the 3-lance TLE and the portable 1-lance LTC.

Reliable Pump, Inc.

Reliable Pumps, Inc. will be demonstrating the 40,000 PSI waterblaster with the new Segmented In-Line Fluid Cylinder and integral manifold. This design has made the 40K simple, user friendly, and low maintenance cost. The simple and easy seal replacement gives the operator confidence that any maintenance can be addressed quickly to minimize downtime and reduce cost significantly compared to other pumps. It's that simple!

StoneAge, Inc.

Our newest concept in design for self-rotary tools is a product called the "Badger," which allows contractors the ability to clean 4" to 12" ID pipeline at 15,000 psi.

TurtleSkin WaterArmor by Warwick Mills

Patented TurtleSkin WaterArmor protects operators from accidental swipes as high as 40,000 psi. How can this lightweight, flexible material be capable of preventing an injury at such high pressures? Seeing is believing. Our demonstration replicates an accidental swipe traveling at a rate of 8 feet per second with an NLB pump running at 40,000 psi at a flow rate of 5 gpm at a distance of 3 inches using a single orifice 0.035" sapphire nozzle of 0 degrees with a 22 efficiency factor.

Universal Minerals

Universal Minerals will be demonstrating it's RIPP 3000 rotating abrasive nozzle. Our RIPP nozzle may be used with any 20K to 40K system and fits on most gyro guns. We will be removing 10 to 14 mil of both standard and cold tar epoxies. We will also be removing mill scale and heavy corrosions.

VLN Advanced Technologies Inc.

VLN Advanced Technologies, Inc. will exhibit and demonstrate its new and unique product, "The Forced Pulsed Waterjet Generator," called the RFM (Retrofit Module) that can be integrated to the end-user's existing pumps to produce highly effective pulses of water.

Welcome WJTA New Members

Corporate

J - T Rentals LLC
Jerald Templeton
David Maxwell
Tom Walker
402 South 16th Street
LaPorte, TX 77571
Phone: (281)867-9700
Fax: (281)867-9777

New Corporate Alternate

John F. Burke
J.J. White
5500 Bingham Street
Philadelphia, PA 19120
Phone: (215)722-1000
Fax: (215)745-6229

Wendy Coggins
Cleaner Times Magazine
1000 Nix Road
Little Rock, AR 72211
Phone: (501)280-0007
Fax: (501)280-9233

Todd Hageman
Taplin Environmental Contracting
5700 West Michigan Avenue
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Phone: (269)375-9595
Fax: (269)375-2830

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Fax: (941)729-7511

Michael Pardoen
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Jamaica
Fax: (876)986-7711

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Seocho-Dong, Seocho-Gu
Seoul, Republic of Korea
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Fax: (520)621-8330

Waterjets Cut Artistic Floor Designs, from pg. 15

owner Mark Cuban hired Waterjet Works! to create the glass and stainless steel logo sign in the team's corporate office. The Dallas Stars locker room doors were also designed and created by Waterjet Works!

Floor icons are a Waterjet Works! specialty. More than 300 Albertson's grocery stores have been produced, nearly 100 Babys R Us floor logos, JoAnn store logo and Wacky Bear floors. Whimsical designs have been fashioned for, Vanderbilt Children's Hospital in Nashville, Children's Medical Center of Dallas, Texas Scottish Rite Hospital and the pediatric wings of numerous other hospitals, including Lakeland Memorial Hospital in Florida and Valley Baptist Hospital in South Texas. The highly lauded Dallas Police Memorial features the waterjet artistry as well as the City Hall of Lewisville.

Einsohn attributes his exceptional track record to 23 years of servicing customers in the furnishings field of the hospitality industry. "I understand the process from conception of the idea to implementation and completion, so I approach the architect or designer as a consultant," Einsohn says. "Not only can I offer suggestions, I can help them better understand the technology so we can design according to their vision. It is a formula that has worked well. We are pleased with the number of referrals we have received from other waterjet companies who know enough not to get involved in projects that are beyond their market segment. I surely wouldn't know what to do in the waterjet cleaning business nor the job-shop part of the industry."

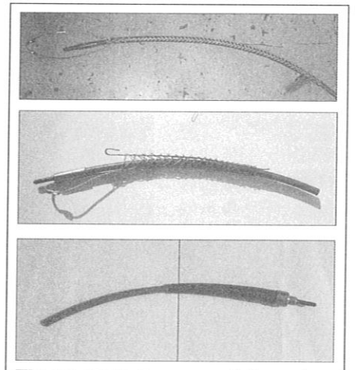
WJTA Conference Exhibitors

AccuSTREAM
Aimm Technologies, Inc.
Ameri-Force Labor Services, Inc.
AQUA-DYNE, Inc.
Autoclave Engineers, Fluid Components Division of Snaptite, Inc.
BEI *PECAL*
Barton Mines Company, LLC
Bingham Manufacturing, Inc.
Boatman Industries Inc.
Boride Products
Business & Industry Connection (BIC) Magazine
BuTech Pressure Systems
CADCRAFT AB
CAT PUMPS
Chemac, Inc.
Cleaner Times Magazine
EBBCO, Inc.
Euro Navy/GTS Group
Flow International Corporation
Flow-Tech Products GmbH
Freemyer
Gardner Denver Water Jetting Systems, Inc.
General Pump, Inc.
Great Lakes - Eglinton
Hammelmann Corporation
Heintzmann Corporation
High Pressure Equipment Company
Hydro-Engineering, Inc.
Idrojet S.a.s.
International Waterjet Parts (IWP)
JGB Enterprises, Inc.
Jet Edge
JETECH, Inc.
Jetstream of Houston, LLP
LaPlace Equipment Company, Inc.
Millennium Enterprises, Inc.
NLB Corp.
Oxilink Group, Inc.
Parker Polyflex
Peinemann Equipment
PowerTrack International, Inc.
Pratt & Whitney Advanced System Technologies, Inc.
Reliable Pumps Inc.
Sharp Performance Products
South Houston Hose
SPIR STAR, Inc.
Sprague Products
StoneAge, Inc.
TurtleSkin WaterArmor by Warwick Mills
Universal Minerals
VLN Advanced Technologies Inc.
WGI Heavy Minerals Inc.
Wilco Supply L.P.
WOMA Corporation

Papers To Be Presented At The 2003 WJTA Conference in Houston, Texas, from pg. 2

2-B. Recommended Practices for the Use of High Pressure Hose, *Paul Webster and Stephen Johns*

This paper presents field practice to assist the user in maximizing ultra high pressure hose life, determining when a hose should be replaced and manufacturing techniques and accessories used to build a safe and reliable product.



The top photo shows a containment grip, the middle shows a support grip and the bottom photo shows at bend restrictor. All accessories shown are design for UHP hose.

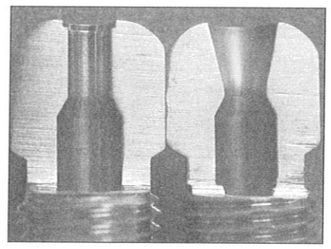
2-B

3-B. Acoustic Emission of Plain Water Jets, *A. Bortolussi, R. Ciccu, W. Cuccu, A. Marcus, G. Massacci, and S. Usala*

The sound contributions of each 10 cm length of free exposed waterjet is measured and the maximum waterjet free exposed length beyond which the sound power doesn't significantly increase is determined.

4-B. Waterjet Nozzle Material Types, *D. Wright, J. Wolgamott and G. Zink*

This paper presents the results of laboratory testing and field analysis to determine the wear rates and failure modes of steel, carbide, and sapphire nozzles. Recommendations are given for nozzle material depending upon operating conditions.



Steel nozzle on the right showing abrasive erosion from very dirty water.

Steel nozzle with cavitation erosion.

Steel nozzles, effect of inlet shape to orifice on cavitation erosion.

4-B

Session C

Cutting Stone and Other Uses

Monday, August 18 • 1:00 p.m.-2:20 p.m.

2-C. Erosion of Natural Stone by Abrasive Grains, *M. Monno, W. Polini, C. Ravasio and S. Turchetta*

This is a study of the impact of abrasive particles on a marble surface with emphasis on abrasive speed and impact angle.

3-C. Modeling Jet Cutting of Oil Sands, *J.T. Bartley and B. Singh*

This paper presents a theoretical model for waterjet cutting of oil sands.

5-C. Comparative Performance Study of Polyacrylamide and Xanthum Polymer in Abrasive Slurry Jet, *S.V. Chacko, A. Gupta and D.A. Summers*

This experimental study uses jet penetration distance in concrete blocks as a measure of effectiveness of different polymers and concentrations.

6-C. Investigation of the High-Speed Water Slugs, *O. Petrenko, V. Samardzic, E.S. Geskin, G.A. Atanov, B. Goldenberg and A. Semko*

A laboratory scale prototype of a device forming super high speed water slugs (water cannon) was constructed and tested. The tests included investigation of the external ballistics of the slugs as well as materials piercing and breakage.

(continued on page 7)

Waterjets Cut Artistic Floor Designs

It is not every day that a company's work becomes part of a major art exhibition that debuted at the Smithsonian and has toured several top American museums. Yet the Dallas-based firm Waterjet Works! is doing just that through involvement with an exhibition showcasing the works of the late contemporary sculptor Juan Muñoz. The retrospective, which enjoyed a three-month stint at the Smithsonian's Hirschhorn Museum and Sculpture Garden in 2001, traveled to the Art Institute of Chicago and the Contemporary Arts Museum in Houston, and was on view at the Museum of Contemporary Arts (MOCA) at The Geffen Contemporary in Los Angeles through Sunday July 27, 2003.

Artist Juan Muñoz, led the worldwide movement in the 1980s to revive figurative sculpture. He developed works that used architectural elements and clusters of figures to situate the viewer within compelling room-size environments.

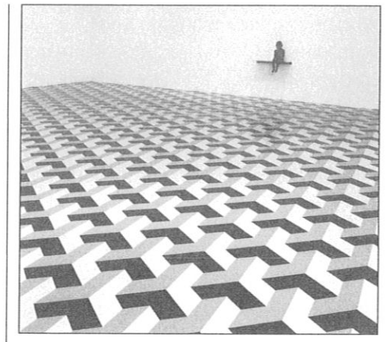
Waterjet Works! President Philip Einsohn noted that his company was asked to create the geometric, three-dimensional floor design for the Muñoz exhibit; The Wasteland and The Prompter. While the large surfaces appear to be painted, they actually encompass thousands of linoleum pieces that have been flawlessly cut with waterjet technology. The pieces are then meticulously hand-placed like a puzzle to create the floors.

Flooring giant Armstrong World Industries, collaborated with Waterjet Works! on the project. Together, the companies donated the materials, services and labor to mount this exhibition at all four museums. Armstrong chose Waterjet Works! over other companies because the Dallas firm has a stellar reputation with demanding architects, contractors and interior designers.

Waterjet Works! spent hundreds of hours on the Muñoz project. To begin with, each museum space required a custom installation. The payoff has been worth it, Einsohn says. "It's been great fun … and our hope is that the Muñoz project will be a springboard for more 'out-of-the-box' collaborations with museums and cultural institutions and artists."

According to Einsohn, waterjet technology traditionally has been used to efficiently cut massive quantities of materials for industrial applications. His company is one of a handful of American firms to move beyond the industrial market. "Very few waterjet companies understand the idiosyncrasies of flooring materials. They shy away from this type of project. There are so many variables beyond the actual cutting of the material that can affect the final outcome. You really need to understand all aspects of the job…from concept to completion. We pride ourselves on making sure that everyone is pleased…from the architect/designer to the end user. It takes a great deal of time to satisfy the customer beyond the actual cutting of the material."

"Waterjet cutting has been used for decades; but we're using the technology in an innovative manner," Einsohn says. "Architects, interior designers and other creative industries are beginning to take advantage of this cutting method because it is cost effective and adds ingenuity to their projects. So far, any design produced on a computer can be cut with waterjet technology. Waterjet Works!



The floor of *The Wasteland* is inspired by centuries-old trompe l'oeil designs and features a three-dimensional-like custom-designed pattern. Six thousand pieces of Armstrong UNI WALTON™ linoleum were required to create the floor. *The Wasteland*, Juan Muñoz, 1986. From the collection of Marvin and Elayne Mordes, Baltimore, MD.

Dallas Mavericks' Logo

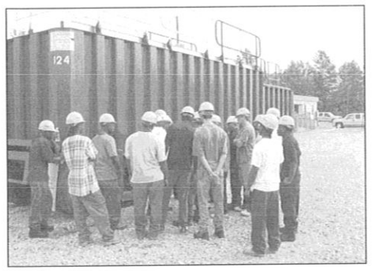
uses the computer-generated technology to design and create floor medallions, signage, outdoor sculptures, monoliths and art and much, much more.

While Waterjet Works! is less than five years old, it already has attracted an elite group of national clients. You can find their work in hospitals, educational institutions, retail stores, commercial buildings, airports, custom homes and now museums." Perhaps the firm's highest profile project is in the state-of-the-art American Airlines Center in Dallas. Dallas Mavericks

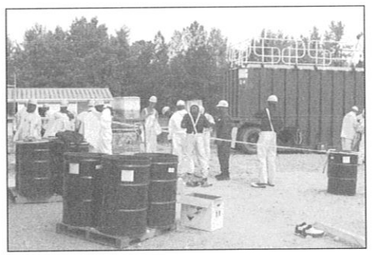
(continued on page 16)

Papers To Be Presented, from pg. 12

and allowing hands-on training in waterjet applications. The module also supports both safety and vacuum training.



Training class at mobile waterjet training module.



5-H

6-H. Formation and Application of Fine Ice Abrasives, *K. Kluz, E.S. Geskin, D.V. Shishkin, B. Goldenberg and O. Petrenko*

A device for the formation of fine (5 microns or less) ice particles was designed and constructed. The feasibility of damage free, pollution free processing of sensitive surfaces was demonstrated.

Safety Committee Solicits Comments On Improvements To Recommended Practices

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

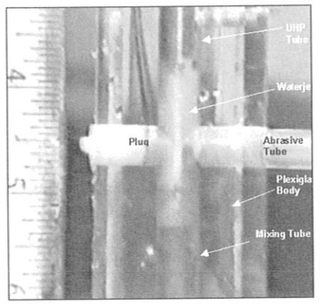
Please address your comments and suggestions to: Safety Committee, c/o WJTA, 917 Locust Street, Suite 1100, St. Louis, MO 63101-1419, fax: (314)241-1449, e-mail: wjta@wjta.org, web site: www.wjta.org.

Papers To Be Presented At The 2003 WJTA Conference in Houston, Texas, from pg. 6

Session D
Advances In Industrial Cutting
Monday, August 18 • 3:20 p.m.-5:00 p.m.

1-D. Inside Abrasive-Waterjet Nozzles, *Mohamed Hashish*

This paper addresses issues of water-air and abrasive interaction inside abrasive-waterjet (AWJ)) nozzles. The following factors were found to affect AWJ performance: Reynolds number, the AWJ suction characteristics and the abrasive hose characteristics, abrasive swirl and jet alignment.



Plexiglas AWJ Nozzle for Visualization

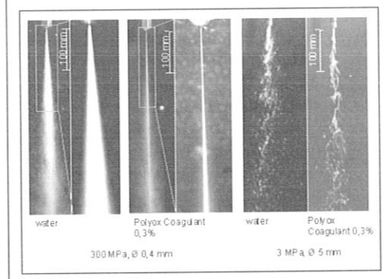
1-D

2-D. Quantitative Study of Abrasive Contamination in a Ductile Material During Abrasive Aqua Jet Machining (AAJM), *K. Patel and F. Chen*

An experimental study with aluminum showed that grit contamination increases as the depth of cut increases. Oscillating cuts are ten times less contaminated than straight cuts.

3-D. Potential of Polymeric Additives for the Cutting Efficiency of Abrasive Waterjets, *H. Louis, F. Prude and Ch. von Rad*

The influence of polymeric additives in increasing the efficiency of water jets is discussed.



Jet stability of waterjets and polymer supported waterjets.

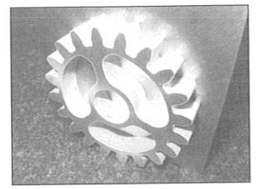
3-D

4-D. Bending Radius Dependence in AWJ Machining of Stone Free-Form Profiles, *L. Carrino, M. Monno, W. Polini and S. Turchetta*

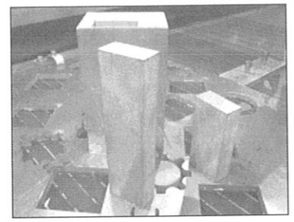
This is an experimental study on the ability of AWJ technology to cut profiles of different bending radii in marble for applications in artistic works.

5-D. Advanced Error Correction Methodology Applied to Abrasive Waterjet Cutting, *J. Olsen, J. Zeng, C. Olsen and B. Guglielmetti*

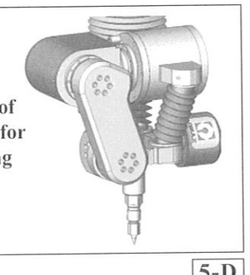
This paper provides insight into the development of error correction wherein the nozzle automatically tilts along the arc cutting and around corners to compensate for taper errors and lag errors.



Gears cut with tool tip tilting mechanism.



A 20 cm (eight inch) thick aluminum rectangle machined using corner passing to improve the quality of the outside corner, while simultaneously speeding up part cutting significantly.



Solid model of final design for tool tip tilting mechanism.

5-D

Session E
Cleaning Surfaces
Tuesday, August 19 • 1:30 p.m.-3:10 p.m.

1-E. WJ Decoating, *M. Annoni and M. Monno*

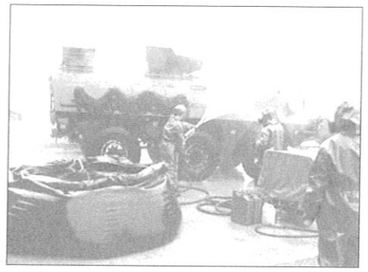
This paper describes waterjet decoating of a thermal barrier and abradable coatings in aeronautical engines.

(continued on page 8)

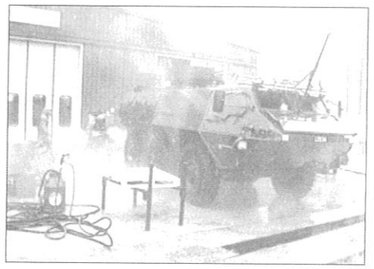
Papers To Be Presented At The 2003 WJTA Conference in Houston, Texas, from pg. 7

2-E. Radiological Decontamination of Armored Personnel Carriers with Continuous and Pulsed Waterjets at Umea, Sweden, *M. Vijay, W. Yan, A. Tieu, T. Cousins and B. Sandstrom*

Decontamination experiments were performed comparing a forced, pulsed waterjet and a conventional high pressure hot water spray.



General view showing decontamination on the sides (& front) of the vehicle.

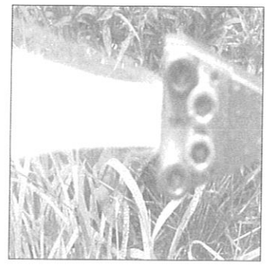


General view showing decontamination on the backside of the vehicle.

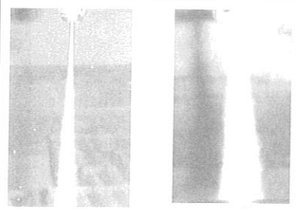
2-E

3-E. Formation and Application of a Rectangular Jet, *E.S. Geskin and B. Goldenberg*

This paper demonstrates that rectangular waterjets can be effective machining and cutting tools.



A rectangular jet generated by NJIT nozzle at a pressure of 140 MPa and a flow rate of 17.01/min., scale 1:1.



Water stream generated by a commercial and a NJIT nozzles.
a) Commercial round nozzle, ID=0.7 mm, pressure P=86 MPa, flow rate=11/min.
b) NJIT nozzle, pressure P=93 MPa, flow rate=2.91/min, scale 1:2

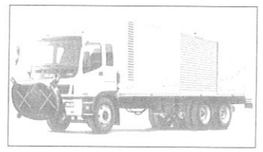
3-E

4-E. Manufacturing Case Study Involving Major Oil Company, *Michael T. Gracey and R.O. Berry Jr.*

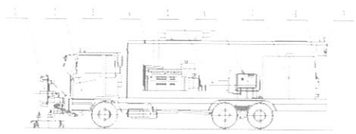
A high pressure hot water washdown unit for an offshore platform was manufactured to specifications written by an international engineering group. The documents, drawings, electronic submittals, approval cycle, inspection and final acceptance testing required for the project doubled the scope of work for the equipment when compared with historical methods of procuring this type of equipment. This paper illustrates a new way of doing business in waterjet equipment procurement.

5-E. Development of Airport Runway Rubber Glue Removing Vehicle in China, *Shengxiong Xue, Zhengwen Chen, Haojun Peng, Yibin Fan, Yongqiang Wang, and Xu Zuo*

This paper describes the design and application of an airport runway coating removal vehicle.



Multi-Function Airport Runway Glue Removing Unit.



Overall Assembly Arrangement of Multi-Function Airport Runway Surface Glue Removing Vehicle. 1. Surface Cleaner 2. Chassis 3. Diesel Engine 4. Cuboid Compartment 5. Speed Regulation Mechanism 6. High Pressure Pump 7. Water Tank 8. Fire Extinguisher 9. Camera Head

5-E

Session F
Industrial Cutting Considerations
Tuesday, August 19 • 10:00 a.m.-11:20 a.m.

1-F. Development of a Production Line for Packaging with Waterjets, *Axel Henning, Bernd Besieger, Peter Williams and Wolfgang Rah*

The use of water jets in cardboard packaging is discussed with emphasis on small series production.

(continued on page 10)

Papers To Be Presented At The 2003 WJTA Conference in Houston, Texas, from pg. 11

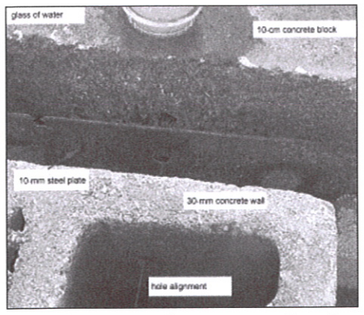
Session H
New Uses for Equipment
Tuesday, August 19 • 3:30 p.m.-5:30 p.m.

1-H. An Abrasive Suspension Waterjet for Drilling Small-Diameter Holes, *P.W. Johnson, A.J. Graettinger and C.H. Sewell*

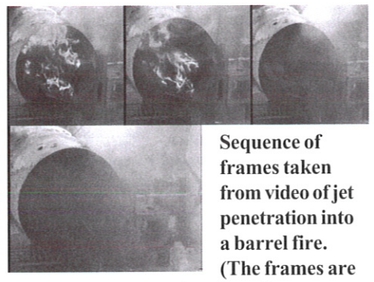
An abrasive suspension waterjet tool was developed for drilling small-diameter, long-reach holes to allow non-destructive inspection of foundation piles. A laboratory test unit produced straight holes as small as 3/8-inch in diameter to depths of up to three feet in concrete pilings and reinforced concrete.

2-H. A Method for Suppression of Building Fires, While Providing Access for Interrogative Equipment, *Samir Dorle, D.A. Summers, and A. Gupta*

This paper describes a portable tool composed of a small slurry abrasive waterjet that can drill through all of the components of a collapsed building to fight the fire and to introduce instruments to detect survivors in the rubble.



Hole drilled through concrete and steel, note the glass of water.

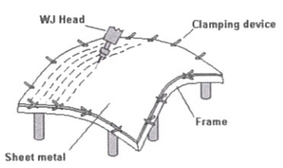


Sequence of frames taken from video of jet penetration into a barrel fire. (The frames are from a sequence so that there is one second between the first and last frames. The jet drill has gone through a concrete construction block and the wall of the barrel.)

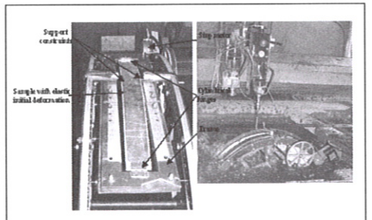
2-H

3-H. WJ Forming: A New Opportunity, *E. Grossi, M. Monno and A. Vergari*

This paper deals with waterjet forming, a new application of waterjet technology. The waterjet is used to generate sufficient plastic strain so that the metal keeps a defined shape after removal of clamps.



Waterjet Forming



Fixturing system allowing to keep constant stand off and cutting head inclination angle.

3-H

4-H. Improvements in a Multi-Use Waterjet Tool for Humanitarian Demining, *R.D. Fossey, D.A. Summers, J.G. Blaine, G. Galecki and S. Dorle*

A waterjet tool is described that identifies and neutralizes landmines. A jet pump (soil sucker) removes the cover of the landmine so that its presence can be confirmed. An abrasive jet is used for insitu neutralization of the landmine.

Neutralization tool slicing mine after identification.

In-situ cutting of anti-tank mine.

Uncovered anti-personnel mine.

4-H

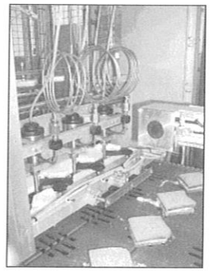
5-H. A Mobile Waterjet Training Module, *Gary W. Toothe*

This paper describes a mobile training module that includes equipment found at customer sites

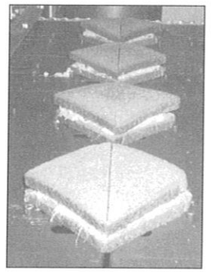
(continued on page 14)

2-F. Pure Waterjet for Sandwiches – The Second Step, *Franz H. Trieb*

This paper gives an overview of the application of waterjet to cut sandwiches. It presents a comparison between the conventional blade cutting method and the new application with pure waterjet.



Cut unit in operation

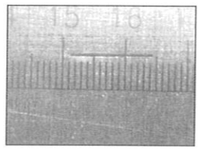


Cut sandwiches

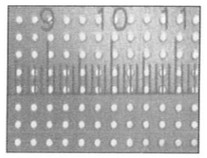
2-F

5-F. Developments in Abrasive Waterjets for Micromachining, *D.S. Miller*

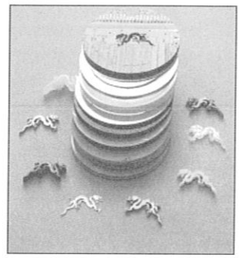
This paper describes the state-of-the-art of micromachining with abrasive waterjets and predicts future trends in this technology.



Outlet of slot cut in 50 micro thick stainless steel with a 40 micron diameter jet moving at 400mm/min.



Holes to larger scale, 50 micron thick stainless steel.



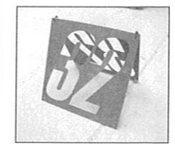
Examples of materials profiled with MASJs.

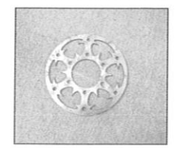
5-F

(continued on page 11)

6-F. Application of Abrasive Waterjet Machining in Undergraduate Engineering Courses, *D.G. Taggart, D. Chelidze, W.J. Palm, B.E. Stucker and T.J. Kim*

Abrasive jet technology has been implemented in undergraduate courses at the University of Rhode Island. Student designs are manufactured using abrasive waterjets.





AWJ machined components for URI's entry into the Mini-Baja competition sponsored by the Society of Automotive Engineers: Carbon-epoxy composite vehicle number (top left), drivetrain component (top right), full vehicle (bottom).

6-F

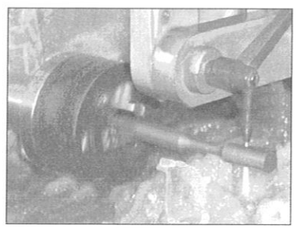
Session F

Industrial Cutting Considerations

Tuesday, August 19 • 3:30 p.m.-4:30 p.m.

3-F. Abrasive Waterjet Used as a Tool for Producing Materials Test Specimens, *U. Andersson, G. Holmqvist, and K.M.C. Öjmertz*

This paper points out the advantages of waterjet machining for producing test specimens.



AWJ turning of fatigue test specimen.

3-F

4-F. A Study of Abrasive Waterjet Machining of Kevlar Composite, *Rahmah Bte Abdullah, Ahsan Ali Khan and M. Ramulu*

An experimental study using abrasive waterjet (AWJ) in cutting Kevlar reinforced phenolic composites. The influences of the cutting parameters on surface roughness and kerf type were demonstrated.

8-F. Cutting Comparisons of Different Waterjet Abrasive Grades and Their Respective Recyclability, *Alan Bennett and Allen Green*

This presentation analyzes cutting data of all primary grades of available garnet abrasive.

Session G

Research Into Cutting

Tuesday, August 19 • 1:30 p.m.-3:10 p.m.

5-G. Modulation of Cutting Operation With Abrasive Waterjets, *Axel Henning and Engelbert Westkämper*

This paper outlines a method for improving the quality of abrasive waterjet cut surfaces by avoiding the formation of striations.

1-G. Abrasive Waterjet Machining of Aerospace Structural Sheet and Thin Plate Materials, *I. Connor, M. Ramulu and M. Hashish*

This paper presents the results of work on machining of aerospace sheets and thin plate materials by AWJ, investigating surface quality, kerf features, and the effects of varying certain process parameters.

2-G. Measurement of Particle Velocities in High Speed Waterjet Technology, *Anuja Dorle, L. John Tyler and David A. Summers*

This research is an investigation into abrasive particle behavior based on the experimental determination of particle velocity.

3-G. Monitoring of the AWJ Cutting in the Submerged Conditions, *Andrej Lebar, Bostjan Jurisevic and Mihael Junkar*

The AWJ cutting process can be monitored online using a pressure sensor that measures the water backflow force generated during kerf cutting.

4-G. Study of Ice Particle Production Using Experimental and Computational Fluid Dynamic Methods, *D.K. Shanmugam and Y. Morsi*

A study was conducted to examine ice particle production and to characterize the ice particles produced by convection heat transfer between water droplets and a heat sink.

(continued on page 12)