



Water Jetting At The Wild Horse Saloon



Two Wildhorse Saloon logos greet customers, one inside each door. The horse fairly bolts from the floor!

The creators of Nashville's new Wild Horse Saloon found an innovative way to buck the high cost of custom-designed floors when they laid out the vast restaurant/entertainment complex in the city's historic riverfront district downtown.

They roped in David Wright, veteran tile craftsman and Crossville Ceramics' artistic advisor who helps orchestrate the new water jet precision-cutting system.

Wright's Wild Horse challenge was a big one. At nearly 1,000 sq. ft., it is, in fact, the **largest** installation to use water jet design since the program was introduced. It's also the most colorful: a giant's bandanna, replete with swirling paisley and framed in solid tiles, now

(continued on page 2)

In this Issue

<i>Scanning Enhances Water Jet Cutting</i>	pg. 3
<i>Snap-tite Announces Purchase Of Assets Of Autoclave</i>	pg. 3
<i>Additive Improves Abrasive Jet Cutting</i>	pg. 5
<i>Three Dimensional Machining With Abrasive Water Jets</i>	pg. 6

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— Advertisement —

Water Jetting At The Wild Horse Saloon, from page 1

undulates across the Wild Horse's floor, embraces the 30-foot bar, then blends into the hardwood dance floor. Seven colors of unpolished porcelain tile have been worked into the design, a masterpiece of planning, precision cutting, and assembly.

For Celeste Oxford, IIDA (International Interior Design Association), a member of the design team at Earl Swensson Associates, Nashville, that bandanna is a vision come true. "Everybody was sitting around, brainstorming about design," recalls Jesse Bowling, architectural marketing representative at Louisville Tile.

"Everybody" includes David Minnigan, AIA (American Institute of Architecture), IIDA; Michael Marziale, AIA, and Velda Fox, IIDA. (American Constructors, Inc., Nashville, was general contractor, John Madole in charge.)

"We knew the client wanted the atmosphere of a country western saloon, a place where you could go for a hamburger and a beer," Bowling says. The client — Gaylord Entertainment Company, owner of Opryland Hotel, the Grand Ole Opry, and the newly refurbished Ryman Auditorium — also wanted to keep a lid on the budget.

So when Celeste threw the country bandanna idea into the design discussion everybody got excited, says Bowling. The rub lay in creating a design vast enough for the enormous site, used to off-load freight wagons from river boats in Nashville's earlier life.

"We were thinking mosaics at first," Celeste says. "But the cost would have made it impossible. I know we would have ended up just painting the design on the floor if Jesse hadn't suggested an entirely new idea: using the water jet."

But could it be done? Within the budget? How would it look?

"The idea was so new there was nothing anywhere comparable that the design and architecture teams could even go look at. I mean, Crossville is really leading the way in water jet design!" says Bowling.

Both he and Celeste went home and ransacked their own closets, looking for the bandanna they ultimately photocopied and faxed to David Wright's studio in Murfreesboro, Tennessee. Wright's evaluation of the design for a tile floor: "Complex...but do-able."



Crossville Ceramics artistic advisor David Wright oversees the installation of the water jet cut pieces of porcelain tile that form the Wildhorse logo. Each piece was numbered and covered front and back with clear contact plastic. The installer peels the back plastic, and sets the piece with the front plastic still in place.

(continued on page 11)

Scanning Enhances Water Jet Cutting

Vulcan Waterjet Cutting Services recently announced the addition of scanning capabilities to its menu of services. The ability to scan hand drawings and even actual parts has opened the way for artists and other creative people without their own computer design facilities to utilize the water jet advantage.

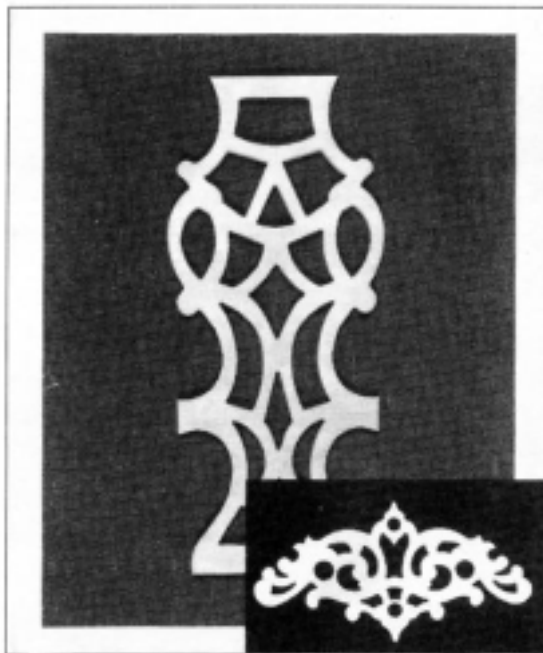
Traditional use of the water jet cutting process begins with actual blueprints or CAD files provided by the customer.

Now, Vulcan Waterjet Cutting Services has in place a flatbed scanner and sophisticated software that enables the creation of machine code from even the roughest paper drawing. One customer recently presented a hand drawing on an 8-1/2" x 11" plain piece of paper. The design was for 1-inch thick steel table legs of extreme intricacy, with a finished overall height of 16 inches. The scanning technique input the drawing to the computer, scaled it, and the water jet machine code was completed in a matter of minutes.

Computer scanning also lends itself well to the production of fine details, dovetailing with the water jet's narrow kerf and multidirectional cutting paths. In order to produce an exact reproduction of an antique trunk latch for a customer, Vulcan Waterjet scanned the actual latch, produced the machine code, and cut the part — all in less than one hour!

Prototyping benefits from both the water jet's scanning facets and its CNC capabilities. Engineering changes can be quickly and cost effectively incorporated into the programming as needed. The low kerf erosion process minimizes waste, further decreasing prototype costs.

Vulcan Waterjet Cutting Services provides customers with the advanced technology of high-speed, abrasive cutting on virtually any material up to 10 inches thick. The Vulcan water jet is ideal for creating signage, flooring, sculpture and unique custom designs. Advantages of the water jet include prototype to production with no tooling, full CNC capability, single pass cutting, no thermal deformation, multidirectional cutting, environmentally sound kerf and water recovery and reduced dust emission.



Composite photograph of steel table legs and an antique trunk latch cut by Vulcan. Photograph courtesy of Vulcan Waterjet Cutting Services.

Snap-tite Announces Purchase Of Assets Of Autoclave Engineers Group

On September 22, 1995, Snap-tite, Inc. purchased the assets of Autoclave Engineers Group, a unit of Autoclave Engineers, Inc.

With this acquisition, Snap-tite has now grown to employ over 700 people world-wide. They maintain five manufacturing facilities and their corporate headquarters in Erie, Pennsylvania. Snap-tite also operates a manufacturing facility in Wexford, Republic of Ireland, and has distribution facilities in Houston, Texas; Burlington, Ontario, Canada, and Nugent, France.

Snap-tite is an ISO-9001 certified manufacturer, established in 1935. They manufacture and sell quick disconnect couplings, hydraulic and solenoid valves, high pressure valves, tubing, fittings and pressure vessel systems, industrial hose, fire hose, and related hardware. With the acquisition, Snap-tite's annual sales are now in excess of \$75 million.

George A. Clark, Snap-tite CEO, stated, "The purchase of Autoclave Engineers Group is part of Snap-tite's commitment to profitable growth and quality. With the strengths of these two fine organizations, we look forward to an exciting and prosperous future."



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

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Additive Improves Abrasive Jet Cutting

By: Glenn Howells, Ph.D.
Berkeley Chemical Research, Inc.
Berkeley, California, United States

For the so-called "abrasive suspension jet technique," the improvement in abrasive water jet cutting that is achieved by using the water blasting additive, Super-Water® is well documented, e.g. Hollinger, Perry and Swanson, USWJTA 1989 — Toronto, Canada; Hollinger and Mannheimer, WJTA 1991 — Houston, Texas, USA; Hashish, 12th International Symposium on Jet Cutting 1994 — Rouen, France; and WJTA 1995 — Houston, Texas, USA.

However, the abrasive suspension jet requires specifically designed high pressure equipment such as that described in U.S. Patent 5,184,434 (Hollinger). Some of the advantages of using Super-Water® and abrasives are readily achieved without a need for specific equipment.

For example, in 1985 Summers and Howells discussed the simultaneous use of Super-Water® and abrasives in a disclosure of invention, following a preliminary and limited study in 1984 by Yie and Howells who used a "standard" Venturi abrasive injector.

This brief note is to report on actual production results of using Super-Water® with a "standard" abrasive injector.

1. Ultra-high pressure cutting.

Peter Tirion, President, Aqua Jet, Inc., Austin, Texas, phone: 512-252-2440, fax: 512-252-2423, using intensifier equipment manufactured by Waterjet Service, Inc. of Joplin, Missouri, phone: 417-781-7778, fax: 417-781-7982, reports the following:

For the past two years Super-Water® has been used on a production basis, in conjunction with 100 grit copper slag as an abrasive, for cutting laminated glass (13/16-inch thick) and aluminum (1/4-inch thick). A 0.1% solution of Super-Water® educes (Venturi process) the abrasive through either a central or side feed. Conditions are: fluid pressure- 40,000 psi, fluid flow- 0.5 gpm, nozzle- 6/1000 inch, standoff- 1/4 inch, abrasive flow- 30 lb/hour.

The cutting rates of the glass and aluminum are 20% higher than with plain water at a cost of 90 cents per hour for the Super-Water®.

More recently similar results have been obtained on stainless steel.

(Parenthetically, Mr. Tirion reports increased efficiency of a Super-Water® solution — without abrasive — for cutting gaskets, 10-inch thick polyurethane foam and 1/2-inch thick silicone rubber.)

2. General comments.

The improvement of "standard abrasive cutting by Super-Water®, compared to that with water, probably results in part from the following factors:

(a) More effective momentum exchange between the viscous Super-Water® solution and the abrasive particles.

(continued on page 10)

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WJTA Seeks Safety Videos

The WJTA is studying the possibility of creating a videotape that demonstrates good safety practices for employers and employees who are working near or with high pressure water jetting equipment.

In order to have as much information as possible to work with, WJTA members are asked to submit suggestions for the video tape as well as footage from safety videos already in use.

If you have specific suggestions and/or a video that you think might be helpful, please forward your written suggestions and a written description of your video to the WJTA office by mail or fax.

If you have any questions, contact Rhonda Stevens at the WJTA office.

Three Dimensional Machining With Abrasive Water Jets

By: Mohamed Hashish, Ph.D.
Quest Integrated
Kent, Washington, United States

The paperweight at right was machined out of a granite block in a single setup using an automated abrasive water jet machining system. This system consists basically of a high pressure pump, 5-axis manipulator, an abrasive water jet lathe, and an automated quick change nozzle system.

An Adept I manipulator was used to traverse the abrasive water jet nozzle over the work piece. The work piece was mounted in a lathe chuck whose angular position and rotational speed are controlled with same manipulator controller. An automated quick change nozzle system consisting of a nozzle body, cartridges, and cartridge load/unload station was also used. The nozzle body is permanently mounted on the manipulator and is connected to all service lines such as abrasives, water, and air. The cartridges (containing the water jet orifice and mixing tube) are mounted on the load/unload station for automated quick change similar to turrets on CNC machine tools.



Abrasive water jet used to machine granite. Photograph courtesy of Quest Integrated, Inc., Kent, Washington

To machine the piece, a cartridge (A) to produce a powerful abrasive water jet, was loaded. The abrasive water jet was used to shape the block of granite by turning the outside diameter and by cutting segments to produce a flat area for internal shape cutting. When this process was completed, a drilling-type cartridge (B) was loaded and used to drill all the starting holes for internal shape cutting. This drilling cartridge is less powerful than the cutting cartridge, i.e., a smaller water jet and less abrasive flow rate were used. During drilling, the water jet pressure was ramped using a PC-controlled intensifier pump. Pressure ramping was found to be critical for consistent and chip-free drilling. The drilling cartridge was unloaded after drilling all the starting holes and another cartridge (C) was loaded for cutting the letters, "Congress of the United States of America," and to cut the "eagle." The cutting jet starts at the drilled starting holes and is traversed to cut the desired shapes. These shapes were programmed into the manipulator controller starting from a CAD drawing. After shape cutting, a milling cartridge (D) was loaded to mill grooves (not clearly shown) in the middle part of the "eagle" representing the stripes in the US flag.

Cartridge (A) was used to cut off part of the base. This completed the machining operation. The total time was less than 90 minutes. Several tons of these pieces were machined and distributed to Members of Congress and it is believed that former President George Bush may have one of these unique abrasive water jet machined paper weights. This work was sponsored by the National Center for Manufacturing Sciences.



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Polyvinyl chloride tubing connects the automatic float switch (Model #1P 504,

0620], to the six intensifiers. The automatic float switch actuates both the peristaltic pump and the main inlet water flow upon demand ensuring that there is a steady supply of homogeneous SUPER-WATER [R] solution and no possibility of losing suction. Use of this method results in a dramatic improvement in cut quality, a 15% higher production rate and a pressure of 50,000 psi in contrast to the required 55,000 psi with plain water. Additionally because of the lubricity imparted by the SUPER-WATER [R] the intensifiers and nozzles experience less wear with a resulting savings in operating and maintenance costs.

Mr. Bill Howell of the U.S. Shoe Company reported in February 1993 that the diamond nozzles being used have had their lifetime extended from the manufacturers value of 720 hours to 2,040, 2,424, and 4,392 hours, i.e. by a factor of 2.83, 3.37, and 6.03 respectively.

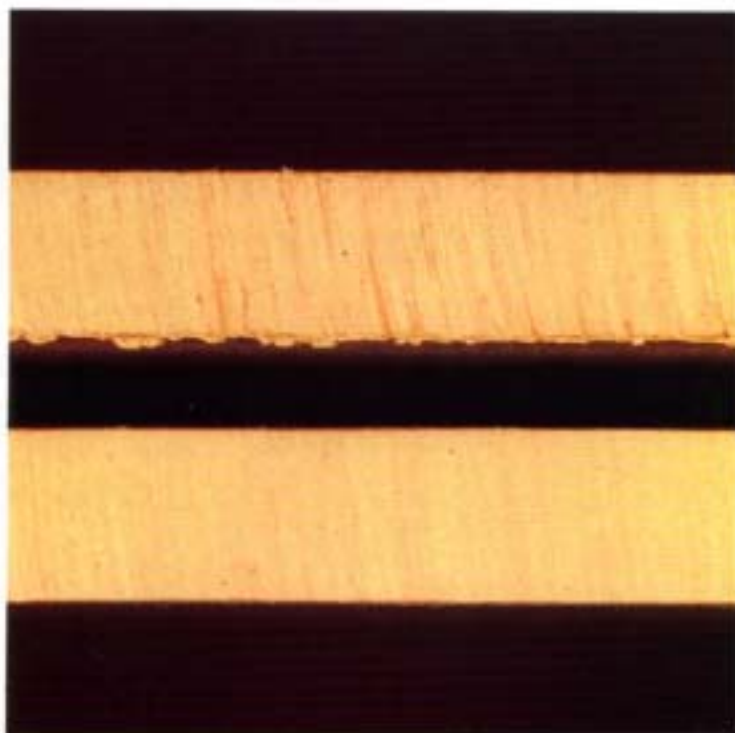
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peristaltic or tube pump, Model 7533-Model 7518-00 and a static mixer, all Company of Barrington, Illinois. [Please 1 (800) 637-3739 for details of equipments]. The peristaltic pump injects the into the main water stream which then to an 80-gallon neoprene holding tank, (800) 362-1000], where complete hy- (Because the intensifiers are operating residence time of 42 minutes, i.e. 80

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Cutting Fiberglass Acoustical Panels

By: Renato Lombardi
Decoustics Ltd.
Etobicoke, Ontario, Canada

Decoustics Limited is a leading designer/manufacturer of custom fabric, vinyl and spray coated architectural acoustical wall and ceiling panels, hanging baffles, screens and banners. Decoustics has, since 1988, employed a fully-automated robotic ultra-high pressure panel cutting and marking system to ensure accuracy in panel identification and size. The robotic cutting system, designed by Spar Aerospace Limited, consists of a Flow Systems Model 6X intensifier pump and 5-foot by 12-foot cutting bed with variable cutting speeds of 1 inch per second to 20 inches per second. The acoustical panels are pre-nested and cut out of standard fiberglass sheet* stock. The system is capable of cutting 10-15 patterns an hour more or less with a weekly panel output of approximately 1200+ units. Water usage by the system is 10-18 gallons per shift.

Over the years we have found that jet cohesion and the quality of the cut on our panels has been a major issue. Our fiberglass sheet* stocks range in thicknesses of 1/8 inch to 2 inches and can be up to 4 inches thick if sheets are laminated. We knew that something had to be done to improve the edge condition of the panels that were coming off the production system. Over the years the accurately cut panels were, when needed, gently edge sanded manually to remove the water jet striations.

Acting on advice from Dynovation Machine Systems Inc. in Burlington, Ontario, we decided that the first change to improve the focusing of the jet was to move from a sapphire-tipped nozzle to a diamond-tipped nozzle. This change made a significant difference in the quality of our panel edges and reduced the need for sanding.

The next change came when RCI Waterjet Cutting Services in Mississauga, Ontario, suggested that we investigate the use of Super-Water® as an additive to our plain water jet to enhance jet focusing, a product that they had earlier inquired about. We contacted Dr. W. Glenn Howells at Berkeley Chemical Research Inc. in Berkeley, California and asked for information on this product.

After reviewing all of the information we decided that it was worth investing some time and money into researching this product. It has since become an integral part of our Flow Systems cutting environment. It became immediately apparent that the Super-Water® additive did in fact increase the focusing of the jet. We are also expecting that the lubricity of this additive will lead to an increase in the longevity of our consumable jet components.

A 0.1% Super-Water® solution has been used in our cutting environment for the past several months. Since its introduction the need for sanding the panel edges has been further reduced, almost to the point of not requiring sanding at all on most thicknesses. Average cutting speed increases of 30% to 200% have been obtained with acceptable striations at a cost of 45 cents per hour for Super-Water®.

* Industrial insulation made up of inorganic glass fibers, formed with a thermosetting resin into flexible rigid rectangular boards 6-7 lbs/cf density.

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Meet The WJTA Officers, Board of Directors

George A. Savanick, Ph.D., of Minneapolis, Minnesota, is the president of the Water Jet Technology Association. Dr. Savanick, a WJTA founding member, is the editor of the *Jet News* and a contributor to the WJTA short course manual, *Fluid Jet Technology — Fundamentals and Applications*. Dr. Savanick is a group supervisor at the U.S. Department of the Interior's Bureau of Mines in Minneapolis and his primary areas of expertise are research in water jet technology, hydraulic mining and borehole mining.

Thomas J. Labus of Fontana, Wisconsin, is the chairman of the WJTA Board of Directors. Mr. Labus is an engineering consultant for Scire Corporation of Fontana, Wisconsin, and a professor at the Milwaukee School of Engineering. Mr. Labus has coordinated the preparation of the WJTA Short Course and accompanying manual, *Fluid Jet Technology — Fundamentals and Applications*, for the last three presentations and served as the editor of the WJTA Conference *Proceedings* for 1991 and 1995.

Vice President John Wolgamott is the president of StoneAge, Inc., Durango, Colorado. StoneAge is a charter corporate member of the Water Jet Technology Association. Mr. Wolgamott has served on the Board of Directors since the association was founded in 1983. He served as secretary in 1987 and treasurer from 1988 to 1995 when he was elected to the office of vice president.

Secretary Andrew F. Conn, Ph.D., of Baltimore, Maryland, is the president of Conn Consulting. Dr. Conn is a technical expert witness for water jet injuries, accidents and contract disputes and offers consulting services for water jet systems and components. Dr. Conn has served on the WJTA board of directors and in the office of secretary.

Treasurer Bruce Wood is the director of engineering and technology at MPW Industrial Services, a contract cleaning services company in Hebron, Ohio. Mr. Wood was first elected to the WJTA board of directors in 1993.

Newly elected board members:

Paul T. Bowser of Foxburg, Pennsylvania, joined Autoclave Engineers, Erie, Pennsylvania, in 1957 as a draftsman. Since then he has served as application engineer, assistant sales manager, field sales coordinator, domestic sales manager, vice president of sales, and senior vice president of operations with responsibilities that included budgeting/forecasting, business planning, advertising and promotion. Throughout his career he has been extensively involved in international sales world-wide.

Pat DeBusk is the executive vice president of HydroChem Industrial Services, Missouri City, Texas. Pat is a charter member of the Water Jet Technology Association and former member of the board of directors. He has been with Hydro-Services (now HydroChem) for more than 30 years.

Lydia M. Frenzel, Ph.D., of the Lydia Frenzel Conference Series, Sutter Creek, California, is an expert in paint failures, environmental compliance and

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(continued on page 11)

Member News

Dr. Andreas W. Momber is a 1995 recipient of the "Feodor Lynen" Award of the Alexander von Humboldt Foundation in Germany. This marks the third consecutive time Dr. Momber has received the award. Established by Feodor Lynen, a former Nobel laureate and biochemist, the award is presented to outstanding young German scientists and allows them to work on projects together with leading international researchers in their field. Dr. Momber is also a member of the New York Academy of Sciences. He is currently working on several projects involving erosion, fracture, and process control at the Center for Robotics and Manufacturing Systems, University of Kentucky, Lexington.

SPIR STAR has opened a new high pressure hose manufacturing facility in Houston, Texas, stocking a complete line of hose and fittings with operating pressures from 5,000 to 60,000 psi. Every hose assembly is pressure tested to 1.5 times the recommended working pressure, under the strictest conditions with computer assisted quality control and inspection procedures. The facility provides 24-hour emergency service with a fully-trained staff for technical support. Headquartered in Morlenbach, Germany, SPIR STAR has more than 15 years of combined experience in design, research and manufacture of high pressure hose. For more information or to obtain a product catalog, call 1-800-890-7827 or fax 1-713-681-4770.

Deborah A. Schulze has joined the staff of **Vulcan Waterjet Cutting Services** as a computer aided drafting (CAD) operator/programmer. Ms. Schulze's primary responsibility is to produce machine code for the water jet. As part of the process, Ms. Schulze downloads customer drawings on CAD equipment, edits the machine code program, and produces nesting diagrams for the project. Ms. Schulze also prepares some projects for cutting by using a flatbed scanner to input information to the CAD system. In addition to her programming duties, Ms. Schulze is involved in job scheduling, materials inventory and ensuring timely completion of projects. Ms. Schulze holds an associate of applied science degree in computer aided drafting technology from ITT Technical Institute in Milwaukee, Wisconsin.



Deborah A. Schulze

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Additive Improves Abrasive Jet Cutting, from page 5

(b)Focusing of the Super-Water® solution while it traverses the mixing chamber should be advantageous in the cutting process and extended nozzle lifetime should also result. (It is well known that air in the three-phase system of air, water and solid particles in the mixing chamber is not conducive to performance. If however the abrasive were to be introduced as a suspension in Super-Water® the consequent decrease in air intake should result in increased performance.)

(c)During the transient contact between abrasive and fluid in the usual abrasive mixing chamber it is unlikely that the abrasive particles are substantially wetted by the stream of water. Super-Water® as sold contains surfactants for emulsification of the active ingredient — partially hydrolyzed polyacrylamide. It may be that these water-soluble surfactants promote water wetting of the abrasive particles. Such wetting should also increase efficiency by improving momentum exchange described under (a) above.

Super-Water® concentrated industrial water blasting additive is produced and marketed by Berkeley Chemical Research, Inc., P.O. Box 9264, Berkeley, California 94709. Phone: 510-526-6272; Fax: 510-KAL-BERK (525-2375).

Letter To The Editor

RE: Section 4.0 of the WJTA's *Recommended Practices for the Use of Manually Operated High Pressure Water Jetting Equipment*

Dear Jet News:

The above listed section of the water jet safety practices instructs water jet operators to carry a water proof card that is easily accessible and that outlines the possible injury.

In an effort to procure a card I found that there is not a card available and also that the phone number that is listed is not the National Poison Control Center, but the State of Pennsylvania. [A representative from the State of Pennsylvania] also stated that they would not help anyone other than residents of that state.

Carolina Equipment and Supply Company is a distributor for both Binks and Graco Spray Painting Equipment. Both of these companies provide a laminated card that is provided to them by the National Spray Equipment Manufacturers Association. I have enclosed a copy of this card (see below) for your inspection.

The information needs to be current and up-to-date.

I would think that this would be the type of information that a national organization would want to provide.

If there is any way I can assist, please give me a call.

— Larry Fulmer, President

Carolina Equipment Company, 7251 Cross Country Road, North Charleston, SC 29418

Mr. Fulmer's letter points out a serious safety deficiency in the water jetting industry. Although some companies, like Carolina Equipment Company, require workers to carry a medical alert card, others do not. In any case a standard medical alert card has not been produced which is specific to water blasting. We at the Water Jet Technology Association (WJTA) will try to remedy this situation.

The lack of a central contact to advise on the medical treatment of water jet penetration injuries is a problem for our industry. The WJTA would like to remedy this problem but has been unable to locate a suitable provider. The association would welcome advice from members on this matter.

— George A. Savanick, Ph.D.

The text of the following card appears courtesy of the National Spray Equipment Manufacturers Association. Note that French, Spanish and Greek translations that appear on the original card are omitted here due to space limitations. These translations are available from the WJTA office.

MEDICAL ALERT AIRLESS SPRAY WOUNDS

NOTE TO PHYSICIAN

Injection in the skin is a serious traumatic injury. IT IS IMPORTANT TO TREAT THE INJURY SURGICALLY AS SOON AS POSSIBLE. Do not delay treatment to research toxicity. Toxicity is a concern with some exotic coatings injected directly into the bloodstream.

Consultation with a plastic surgeon or a reconstructive hand surgeon may be advisable.

The seriousness of the wound depends on where the injury is on the body, whether the substance hit something on its way in and deflected causing more damage, and many other variables including skin microflora residing in the paint or gun which are blasted into the wound. If the injected paint contains acrylic latex and titanium dioxide that damage the tissue's resistance to infection, bacterial growth will flourish. The treatment that doctors recommend for an injection injury to the hand includes immediate decompression of the closed vascular compartments of the hand to release the underlying tissue distended by the injected paint, judicious wound debridement, and immediate antibiotic treatment.

WARNING

Any injury caused by high pressure liquid can be serious. If you are injured or even suspect an injury:

- Go to an emergency room now.
- Tell the doctor you suspect an injection injury.
- Show him this card.
- Tell him what kind of material you were spraying.

Water Jetting At The Wild Horse Saloon, from page 2

The following months became "a huge collaborative effort, as Bowling describes the year-long project that was to unfold.

"Sure, we had to respect the budget," Bowling says. "But the clients got so excited when they saw the original Wild Horse logo we cut in tile, they ordered two more, budget or not!"



Wood flooring is incorporated into the giant bandanna tile design that embraces the 30-foot bar on both sides.

The actual installation — usually done under David Wright's watchful eye — was handled by Southern Ceramics, Inc. of Nashville. Counting field tiles, the job covers more than 4,000 sq. ft. Clear-face mountings and a simple numbering system on cut pieces helped ensure a first-rate installation.

Celeste remembers the project as "so much fun," a word that pretty well describes the Wild Horse Saloon itself. The once derelict Historic Place has become a mecca for tourists, revelers and dancers — more than 800 can line dance at a time; some 1,200 fans can fit in for a concert.

Even before the saloon was finished and opened for fun (and, yes, hamburgers and beer) the Wild Horse's floors made coast-to-coast news. "Good Morning America" sent in a camera crew who televised the floor-in-progress at the newest energy source in the old city's historic section.



Sized to suit a giant, the bandanna covers nearly 1,000 sq. ft. of floor space, making it one of the largest tile installations to use a water jet design since Crossville introduced the program.

"There's life in downtown Nashville now," Bowling observes. "And it's largely due to the Wild Horse!"

Not to mention, its wild, water jet floor!

Photographs appear courtesy of Crossville Ceramics.

Meet The WJTA Officers, Board of Directors, from page 8

technical training. Dr. Frenzel is a popular speaker and educator and her water jetting and water blasting seminars are well-known.

Thomas J. Kim, Ph.D., is a professor and dean of engineering at the University of Rhode Island, Kingston, Rhode Island. Dr. Kim is a fellow of the American Society of Mechanical Engineers and senior member of the Society of Manufacturing Engineers. He serves on the Board of Directors of the International Society of Water Jet Technology and is the chief editor for the *International Journal of Water Jet Technology*.

Forrest Shook is the president and founder of National Liquid Blasting (NLB) Corporation, Wixom, Michigan. Named Michigan's entrepreneur of the year in manufacturing in 1991, Mr. Shook built NLB from its infancy in 1971 to the headquarters and manufacturing complex it is today.

Board members, third year of four-year term:

Mohamed Hashish, Ph.D., senior research scientist and manager of jet cutting technology at Quest Integrated, Kent, Washington, and David A. Summers, Ph.D., curators' professor of mining engineering at the University of Missouri-Rolla Rock Mechanics and Explosives Research Center/High Pressure Water Jet Laboratory, continue to serve terms on the Board of Directors.

Honorary board members are Mohan Vijay, Ph.D. of the National Research Council of Canada, and Fun-Den Wang, Ph.D. of the Colorado School of Mining.

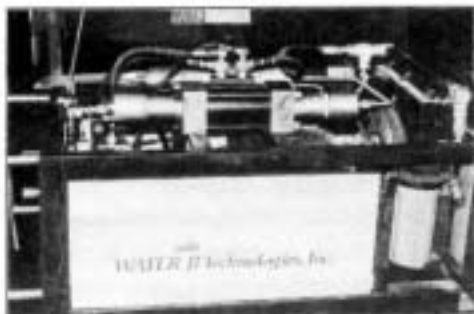
For your information, a complete list of the officers and board members, including telephone numbers, appears on page 2.

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