

5629 Minnehaha Ave. South • Minneapolis, MN 55417, USA • 612/ 725-4543

Water Jets Help Protect Liberty Bell

Last fall, a vandal used a paving brick to punch a large hole in one of the two 2,100-pound panels that form the north wall of the structure that contains the Liberty Bell in Philadelphia. The panels are being replaced by a special safety glass that will provide improved security for the bell.

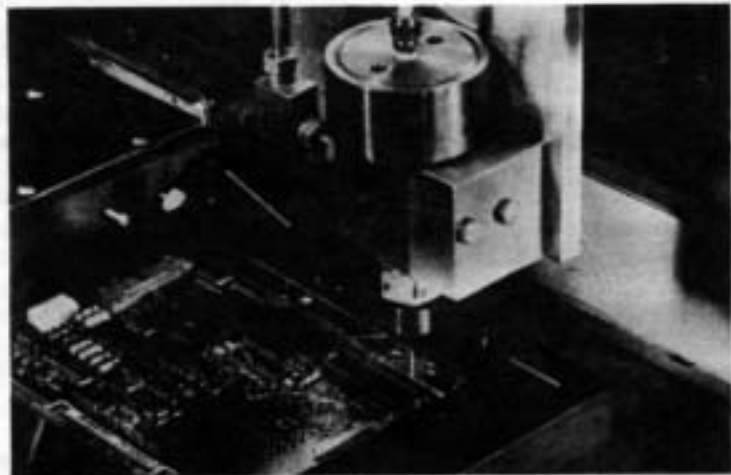
The project is being undertaken by the Du Pont Company, Ingersoll-Rand of Woodcliff Lake, New Jersey, and Dlubak Studios, Inc., of Pittsburgh as a public service.

The Liberty Bell project will involve the replacement of the present two panels with six panels of 1-inch-thick safety glass, each measuring 6 by 10 feet.

The replacement glass is resistant to penetration and shattering, and will provide additional security against virtually any kind of physical attack, Du Pont said. The safety glass, Du Pont's "Butacite" polyvinyl butyral resin sheeting, is widely used in car and truck windshields and in architectural applications.

The safety glass panels were fabricated and laminated by Dlubak Studios. Glass artist and expert Frank Dlubak said Ingersoll-Rand's high-powered waterjet "allows me to cut the glass more perfectly. Then we seal the panels with structural silicone to make seams that are not distracting to visitors."

"The advanced waterjet technology uses pressurized water to cut such extremely durable materials as glass, steel, and concrete," said Michael E. Gaillard, vice president and general manager of Ingersoll-Rand's Waterjet Cutting Systems in Baxter Springs, Kansas. "Laminated glass up to 2 inches thick can be cut by waterjet without cracking or delaminating."



Ingersoll-Rand Circuit Board Cutting System

Waterjet Cutting

Giving ordinary tap water the power of a laser beam means cost savings in cutting and trimming everything from candy bars to concrete. Today every house, car, and airplane has something in it that was cut with a waterjet.

Waterjet, or hydrodynamic machining, uses a needle-thick stream of water exiting at over twice the speed of sound (Mach 2.8) to slice through materials like a knife through butter. Squirted through a specially-designed nozzle, the waterjet cuts neatly and with microscopic precision through all conceivable types of material, from glass and metals to the latest composites.

The world's first application of waterjet cutting was installed in 1971 by the McCartney Division of Ingersoll-Rand at the Alton Boxboard Co. cutting 3/8 inch pressed board for furniture forms. Since that date, almost 1,500 units have been installed by various manufacturers worldwide.

A waterjet cutting system can slit a mile of newsprint in a minute using only a cup of water. With the addition of an abrasive to the water stream, the abrasive waterjet can cut an alloy steel plate 2 inches thick at the rate of 6 inches per minute. It can also cut difficult composites like bullet-proof laminated glass and perform microfine cuts like those in a jigsaw puzzle.

Waterjets are an integral part of the CIM/FMS (Computer Integrated Manufacturing/Flexible Manufacturing Systems) revolution in manufacturing, particularly in the rapidly growing number of industries using composites. Waterjets are already widely used in composite cutting for the automotive industry, with some 100 installations in place. At its Hardware Trim plant, for example, General Motors Corporation uses Ingersoll-Rand's waterjets to produce three-dimensional trim resin-bonded wooden door panels. The previous method of steel rule die cutting only produced a two-dimensional trim and required another operation for the third-dimension trim. At LOF Plastics, robotic waterjets trim fiberglass composite parts that were formerly trimmed by routers. Improved work environment and part repeatability are the results.

The new technology has helped Cessna Aircraft boost revenues by manufacturing key graphite and engineered composite components for other aircraft manufacturers.

Continued on page 2

Administration

Chairman of the Board

Dr. David Summers..... 314/341-4311

President

Dr. George Savanick.... 612/725-4543

Vice-President

Dr. Michael Hood..... 415/642-5639

Treasurer

Dr. James Evers..... 618/536-2368

Secretary

John Wolgamot..... 303/259-2869

1986-1988 Directors

Pat Debusk 713/499-8611

Dr. Tom Labus..... 414/275-5572

Dr. James Reichman.... 206/828-5189

Forrest Shook..... 313/624-5555

Evette Steele..... 513/421-6827

Dr. Fun-Den Wang..... 303/278-3253

Mike Woodward..... 713/896-0002

Association Office..... 612/725-4543

U.S. Water Jet Technology Ass'n

ATTN: Dr. George Savanick

5629 Minnehaha Avenue South

Minneapolis, MN 55417, USA

From the President's Desk

One of my goals is to increase industry interest and participation in the U.S. Water Jet Technology Association (USWJTA); so I was pleased to receive a phone call from George Reinbold, of Ingersoll-Rand (IR) Waterjet Systems in Baxter Springs, Kansas. George asked how IR could help USWJTA.

I told George that IR could help by giving input from the perspective of an equipment manufacturer. This input is very valuable in our rapidly emerging technology. Equipment manufacturers are often in on the inception of new applications as they work with customers to widen the applicability of water jetting. They are aware of new applications before most of us, and thus are in an advantageous position to educate fellow water jetters.

George volunteered to send material for the newsletter, some of which is included in this issue. He will also arrange for IR people to attend our meetings and short courses.

I encourage other members to become more active in their association. Give us the benefit of your unique perspective on water jetting. Share your problems and your triumphs. Send us some items for the newsletter.

Waterjet Cutting

Continued from page 1

The firm supplies Teledyne with parts of fairing assemblies made of the composite Kevlar, for its Apache helicopters. Kevlar typically frays when cut with a bandsaw or router, requiring tedious handwork to clean the edges. Cessna also employs the waterjet to make graphite-based control surfaces used in its Citation S/II and Citation III jets.

Waterjets are similar to lasers in many ways. However, while lasers cut by vaporizing or burning the material, waterjets cut with no heat, and in most cases, less expense. Waterjets are also more easily adapted to robots, resulting in lower first cost. Waterjets can also cut a myriad of materials with the same equipment and setups, thus greatly reducing setup time and fixture costs. With virtually no dust or toxic fumes, waterjet cutting is uniquely suited to metallic (aluminum-boron) and non-metallic (Kevlar, graphite) composites. An added bonus, therefore, is that its unique properties make for a healthier work environment.

Waterjet cutting systems typically operate at approximately 50,000 psi. Their nozzles have orifice diameters ranging from .004 to .020 inches. This concentrates force on a tiny area, thereby greatly enhancing cutting.

For cutting a variety of materials used in high tech operations, waterjet offers several advantages over other cutting methods. The cut is omni-directional and requires no starting holes or tooling changes between operations. No matter how difficult or how contoured the cut, waterjet performs effectively, and because operating pressure is predetermined, its performance is unaffected by the machinist's "touch."

Moreover, waterjet cutting produces less waste and deformation of materials than other methods, a very important factor when cutting expensive composites which must be scrapped if they delaminate. With waterjet, there is little or no fraying or clogging.

Robotic Waterjet System

The new Ingersoll-Rand Robotic Waterjet System (RWS) is a 5-axis waterjet workcell providing omni-directional, three-dimensional precision cutting. The RWS is furnished with a powerful controller with the capability to program off line as well as on line.

Applications include:

- trimming of plastic, rubber and foam materials for the automotive market
- trimming of composite materials, such as Kevlar and epoxy graphite for the aerospace market
- trimming pressure-formed and vacuum-formed plastic compounds for such diverse products as kitchen appliances and recreational vehicles.

Hydroabrasive Waterjet System

The Ingersoll-Rand Hydroabrasive Waterjet System (HWS) is a 2-1/2 axis, CNC X-Y machine designed specifically for high accuracy hydroabrasive waterjet cutting. Unlike most other X-Y tables where the part is stationary and the cutting nozzle moves, the Ingersoll-Rand HWS employs a split axis where the part moves in one direction and the jet moves in the other. This key design feature permits better material handling, simplifies the design of the catcher (a device that dissipates the energy of the waterjet) and eliminates the need for a large tank to collect the spent water abrasive and kerf material.

The HWS is particularly suited to cutting harder materials such as titanium, high alloy stainless steels, thicker composites, ceramics, and glass and similar materials where the requirements for higher cutting speeds, greater accuracy, and superior edge quality are important.

Waterjet Circuit Board Cutting System

Designed specifically for the rapidly changing circuit board industry, the new Ingersoll-Rand Waterjet Circuit Board Cutting System (CBC) more effectively separates individual circuit boards from the "mother" board. With the trend toward surface mount technology and smaller, higher density boards in circuit design, the CBC will provide the more complex cuts required.

The complete system includes and intensifier, split-axis X-Y table and PC driven controller. This unique design provides many of the outstanding features found in the Hydroabrasive Waterjet System.

When you need quality High Pressure Valves, Fittings and Tubing delivered on time . . . specify Autoclave Engineering

In the water jet industry, it's mandatory you have reliable high pressure components capable of operating at pressures to 60,000 psi. Autoclave Engineers has more than 40 years experience in high pressure technology. We build our valves and fittings by the book . . . our Quality Control Manual, because we have high regard for high pressure and for our water jet customers. This manual is your assurance you are getting the highest quality product available . . . at any cost.

Autoclave has a wide range of high pressure components for the water jet industry in addition to our valves, fittings and tubing. Autoclave also is a source of supply for manifold blocks and valves, accumulators/attenuators and custom articulation coils. Eleven coned and threaded tubing sizes are available as well as all types of specialty and custom designed high pressure products. Autoclave is your one-stop source for quality high pressure components. And we ship from stock to arrive just-in-time to meet your schedule.

Remember, the Autoclave difference is in the book — and in the valve. For additional information, contact:



Autoclave Engineers



Autoclave Engineers, Inc. 2930 W. 22nd St.
Box 4007 Erie, PA 16512 USA (814) 838-2071

Automated Waterjet Cutting Processes Clinic

The Society of Manufacturing Engineers is pleased to announce an important 2-day educational clinic specifically addressing "Automated Waterjet Cutting Processes." List this interesting clinic on your calendar of events.

Automated Waterjet Cutting Processes
May 10-11, 1988
Holiday Inn Fairlane
Detroit, Michigan

The clinic is specifically designed to present the latest advances in abrasive and non-abrasive waterjet cutting technologies. Experts from industry and academia will be presenting topics combining theory with practical cutting applications for manufacturing operations.

Robotic and waterjet suppliers, as well as industry users, will discuss effective applications and capabilities of waterjets, abrasive jets, robotic and computer integration, plus flexible waterjet workcells for manufacturing.

For more information, contact Kristen Dudash:

Society of Manufacturing Engineers,
313/271-1500, extension 399.

"The best way to predict the future is to create it."

Peter Drucker

This Space for Sale

You can advertise in *JET NEWS* at these low rates:

Full Page	\$ 150
1/2 Page	\$ 90
1/4 Page	\$ 60
Business Card	\$ 5
B/W Photos (each)	\$ 5

Ad Deadline	Issue Date
May 10	June 1
July 10	August 1
September 10	October 1
November 10	December 1

Send your advertisement to:

U.S. Water Jet Technology Ass'n
ATTN: Dr. George Savanick
5629 Minnehaha Avenue South
Minneapolis, MN 55417, USA
with your payment.

Is someone you know not on our mailing list? If you know of an interested person, who should be on our *JET NEWS* mailing list, please send his/her name to the return address below.

The 1988 UMR Short Course on Waterjet Technology August 8-9, 1988

In joint sponsorship between the University of Missouri-Rolla, the U.S. Water Jet Technology Association, and the Mining and Excavation Research of ASME.

Course Objective:

This 2-day course will review the current state of the art in water jet cutting and cleaning. By discussing the development of this technology, it will draw lessons for the most effective use of this new tool.

Text Material:

Course notes and references will be provided. The final afternoon of the course will be spent at the High Pressure Water Jet Laboratory observing demonstrations of equipment and technology.

Fee and Registration:

The fee of \$299 covers program materials, coffee breaks, and one evening meal. Advance registration is encouraged. The University reserves the right to cancel the course and return all fees if insufficient registration is received. Deadline July 30, 1988. For further information, contact:

High Pressure Waterjet Laboratory
Rock Mechanics Facility
University of Missouri-Rolla
Rolla, MO 65401, 314/341-4311

Postmaster: Please send Form 3579 to:
U.S. WATER JET TECHNOLOGY ASS'N
5629 Minnehaha Avenue South
Minneapolis, MN 55417, USA
612/725-4543

MOVING? Please cut off the bottom of this page including your old address at the right and mail to the above address after filling in the NEW address shown below.

New Address _____

City _____

State _____ Zip Code _____