WJTA Jet News

Water Jet Technology Association

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United States Navy Memorial. *Continent outlines on amphitheater floor cut by water-jetting robot. (Photograph courtesy of U.S. Navy Memorial.)*

Navy Memorial's Giant Map Of The World Adopts Water-Jet Technology For Cutting Granite

by Tom Coldwell, Captain, U.S. Navy (Retired)

New England Stone Industries (NESI), Smithfield, Rhode Island, is using an advanced technology employing a thin stream of liquid under extremely high pressure to carve a 100-foot-diameter granite map of the world to be installed at the U.S. Navy Memorial in Washington, D.C. The cutting method represents a breakthrough in stone cutting which may have a widespread and lasting impact on architecture, sculpture, and construction techniques, according to William J. Conklin, FAIA, partner in the New York firm of Conklin Rossant, architects of the Navy Memorial.

Computer controlled and robot operated, highly sophisticated machines are already being used in other industries to cut multiple layers of fabric, aircraft engine parts, disposable diapers and a wide range of other materials, particularly where other cutting techniques would change the materials being cut. Manufacturers can cut steel and other metals without tempering the materials with heat. Even bakeries use the liquid jet to cut cake, leaving behind neither crumbs nor soggy cake slices.

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Conference Proceedings Available

The official Proceedings of the 5th American Water Jet Conference, held August 27-31, 1989, in Toronto, Ontario, Canada, are available in a single, hard cover volume. A variety of presentations relating to the following general topics are included: Rock Cutting, Basic Studies, Concrete, Construction and Industrial Uses, Coal and Soil Cutting, Medical Applications and Safety Considerations.

The Proceedings are available for $75.00 each, plus $5.00 for shipping and handling (in continental U.S). **Additional shipping charges apply for destinations outside the U.S.** To order, contact:

Water Jet Technology Association
818 Olive Street - Suite 918
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Administration

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Jet News is published by the Water Jet Technology Association and is a benefit of membership in the Association.

The belief that one's own view of reality is the only reality is the most dangerous of all delusions.

– Paul Watziawick

Accident Case Study – UK Job Shop

by Paddy Swan, S.P.D. Swan Consultants, Derbyshire, U.K.

An operator with 15 years of experience was testing the pressure at which casting refractory material was removed from a stainless-steel casting. The operator was operating comfortably as the jetting gun was mounted on a gimbal and the jet was retained within a jetting cabinet. The pump was rated to operate at approximately 500 bar (7,250 psi) and 102 liters per minute (22 imp gals/min).

The operator was finding the rate of removal of the ceramic material quite slow so he decided to change the nozzle from 2.8 mm diameter to one with a diameter of 2.4 mm. He switched off the pump, which was driven by a 90 kW (120 hp) prime mover and asked a colleague to hold the gun, which was of the dry shut-off type, in the open position while he attempted to achieve a higher pressure at the unloader which was fixed to the pump head. He then switched on the pump and attempted to screw down the unloader which was on the side of the pump furthest away from him and which necessitated the operator leaning across the pump. He read the pressure from the gauge at 700 bar (10,000 psi) and called out that the pressure was okay to his colleague on the gun. The operator on the gun released the trigger to shut off the gun and heard a bang.

On investigating, he found the operator who had been adjusting the pressure lying on the floor in a pool of blood and a stream of water was spraying up from the top of the pump head where a stud had blown completely away and had passed directly through the asbestos roof of the factory. The studding had hit the operator on the side of the jaw, breaking it and causing a wound requiring 30 stitches.

Upon investigation, the following facts were found: a) The safety valve/blow-off valve was set at 550 bar (8,000 psi). The pump and ancillaries had been tested to 1.5 times maximum working pressure within the last 6 months. b) The surface underfoot was dry and uncluttered. c) The studding from this accident was not recovered, but subsequently several studs which blew off on two later occasions when the pump was performing at 500 bar and 102 litres/min or less, were recovered and on investigation were shown to have been stretched beyond their yield point.

CONSIDER THE FOLLOWING:

1. What do you think were the major causes of this accident? How might it have been avoided?
2. Could such an accident happen on your site?
3. What were the causes of this accident?
4. How might it have been avoided?

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From The President's Desk...

Please mark your calendars to reserve Saturday, August 24 through Tuesday, August 27, **1991**, for the Sixth American Water Jet Technology Conference to be held at the Westin Galleria Hotel in Houston, Texas. The organizing committee would be pleased to receive suggestions regarding the format and content of the conference. We would also need volunteers who wish to work on planning the conference or to participate in panel discussions at the conference.

We are presently compiling the 1990-1991 Membership Directory. Members will receive a copy by mail in July.

A copy of the premier issue of the International Journal of Water Jet Technology is sent gratis with this issue of *Jet News*. Please consider subscribing to this new journal.

This issue of *Jet News* contains an article on an architectural application of water jet technology. The Navy Memorial in Washington, D.C., contains a plaza made of the largest map of the earth in existence. It is constructed of a 2-inch-thick layer of granite and is 100 feet in diameter. The map has an area of 7,854 ft^2 and contains 100 tons of granite. The irregular coast lines depicted in this map were cut with a computer-controlled jet. I am convinced that architects and artists of the future will discover many such fascinating applications for water jet technology.

– George A. Savanick, Ph.D.

LETTERS TO THE EDITOR

Dear *JET NEWS*:

Dr. Glenn Howells, of Berkeley Chemical Research, recently provided me with a reprint of his paper submitted for publication in the forthcoming International Journal of Waterjet Technology. In this paper, mention is made that I use hot water when carrying out waterblasting with SUPER-WATER (polymerblasting) and also of my success in removing 20,000ft^2 of adhesive-attached cork from a concrete ceiling by polymerblasting where plain waterblasting was ineffectual because the cork merely absorbed the water.

A point that was not included in Glenn's paper, and one that will be of interest to your readers, is that I am having success in polymerblasting when using 0.1 pct SUPER-WATER as well as the 0.3 pct concentration which is usually recommended for maximum productivity. Some situations do not require 0.3 pct concentrations of SUPER-WATER because production can be enhanced by a smaller percent of polymer. Plain water is at the bottom of the productivity scale and the addition of SUPER-WATER increases that factor as concentration increases to higher levels. These ideal concentration levels must be experimentally determined for each application to reach a point where increased productivity balances the cost of the polymer. Different cutting situations dictate different maximum concentrations of SUPER-WATER to arrive at the point of greatest efficiency. Thus, use of 0.1 pct concentration reduces the cost of polymerblasting to approximately 3 cents/gallon as opposed to the 9 cents/gallon indicated in Glenn's paper.

I am now writing to let you know of other applications of polymerblasting with which I have had success. (In every case, use of plain water was either too slow or ineffective.) They include the following:

1. We were asked to clean 10-inch sewer lines that were almost totally plugged with phenolic resin at a plastics plant. With plain water, we were only able to break off chunks of the resin and cut a 2-inch hole along the bottom of the pipe. With SUPER-WATER, however, we were able to virtually pulverize the hardened resin and clean out the pipe in its entirety.
2. We were required to remove polyester resin that had built up to a depth of 4 feet in a reactor. Waterjets bounced off the resin and were incapable of cutting it, although the waterjet sometimes broke the bond between the resin and the outside wall. With SUPER-WATER we were able to cut the resin like a knife and totally clean the vessel.
3. Slag and refractory material had accumulated in a coal-fired powerplant boiler and plain-water blasting had proved incapable of removing it. The water was able to cut the slag, but it had no effect upon the harder refractories which were embedded in and around steel studs welded to the boiler tubes. With SUPER-WATER, we were able to cut the refractory 5 times faster than with the only other alternative method which involved blasting with abrasives and which was very slow and quite costly.
4. We found in installing vents and pipes, that we could cut through a 10-inch concrete wall at 10,000 psi with precision and accuracy. The SUPER-WATER decreased the cutting time over water by at least a factor of 3 and perhaps more. This technique appears to work best when dealing with concrete that contains smaller aggregate stones in the mix. The water stream can cut the sand and cement mix, but cannot cut through larger aggregate stones. The stream must cut around the larger stones until they become dislodged and are blown away. The addition of a very hard aggregate into the water stream would readily solve this problem, however, and these injectioned devices are available in the market place.
5. We were able to obtain 100 pct removal of paint from a block building where, with water alone, only 25 pct was removable. Additionally, the SUPER-WATER increased the production rate by 3 to 4 times over plain water. In fact, the SUPER-WATER is so effective that we tend to remove too much coating that is still bonded properly. We would tend to lose money on the blasting part of the operation prior to painting until we began using SUPER-WATER on a regular basis. For this application, SUPER-WATER is absolutely cost-effective.

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Subject: Weep Holes

Dear *Jet News*:

I would like to say that I think people using fittings on high-pressure water equipment should be advised that weep holes should have some sort of a baffle around or over them. I was involved in an incident where an operator was using a hand-held lance and while the gun was under pressure, he turned, causing the hose to loosen at the fitting which in turn allowed the water to travel through the weep hole at excessive force, hitting him in the hand between the thumb and index finger, resulting in a lost-time accident. The manufacturer has been notified and has since corrected the problem, but there are still a lot of manufacturer's who don't realize that the possibility for an accident due to this is very real and should be warned.

I have also designed a gun with operating pressure up to 20,000 psi and would like to know if you could advise me of any manufacturers who would be interested in testing it. I would appreciate it if I could get on *Jet News*' mailing list.

Thank you.

Kevin Campbell
CEDA-REACTOR, LTD.
P.O. Box 3009
Edmonton, Alberta T8A 2A6l
Canada

(continued on page 6)

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

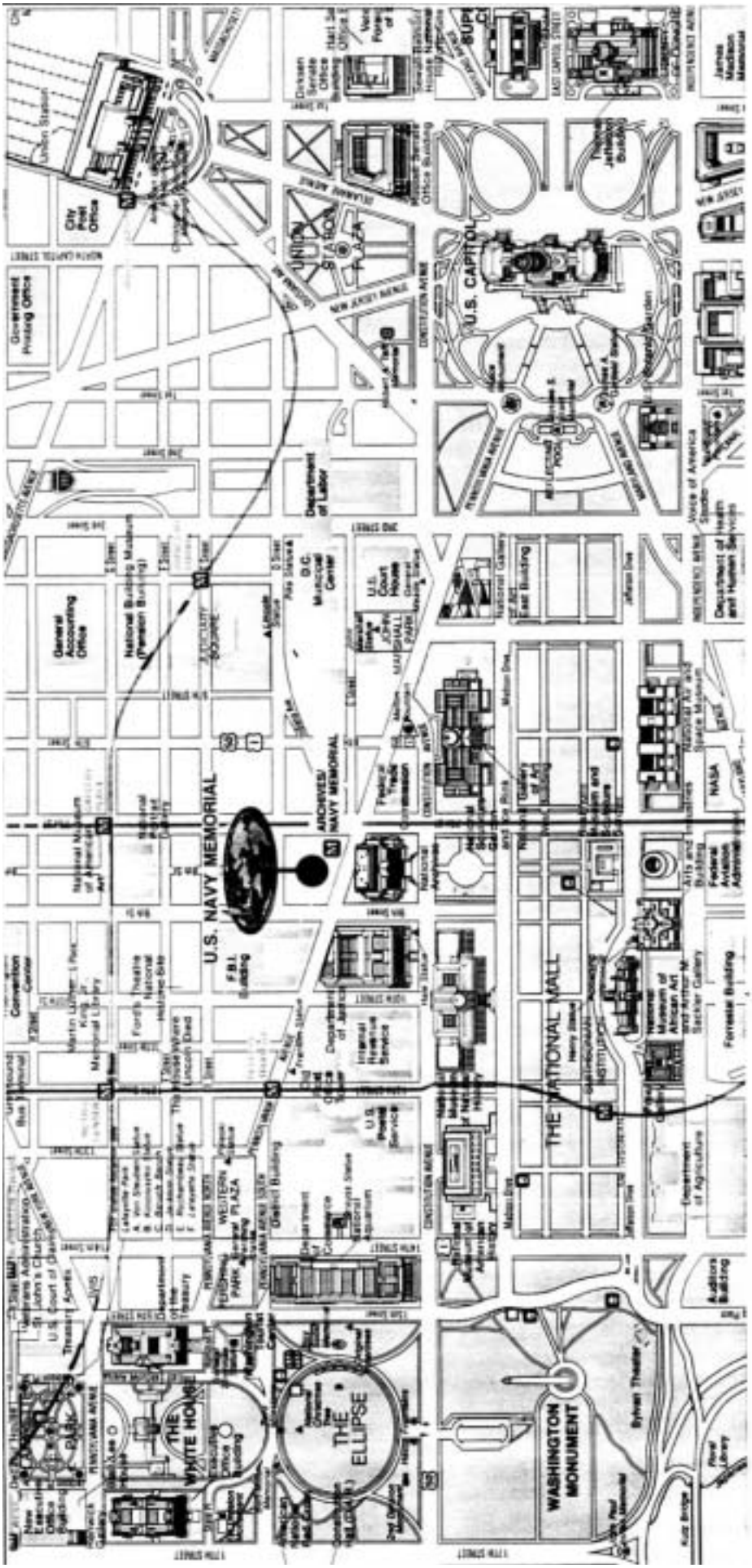
In the water jet industry, it's mandatory you have reliable high pressure components capable of operating at pressures to 60,000 psi. Autoclave Engineers has more than 40 years experience in high pressure technology. We build our valves and fittings by the book . . . our Quality Control Manual, because 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



Getting To The Navy Memorial: The Navy Memorial is located at 8th Street and Pennsylvania Avenue, NW, immediately north of the National Archives and midway between the White House and the Capitol. The most convenient transportation to and from the Memorial is via Metro, the city's underground rapid transit system. The Memorial stop is Archives/Navy Memorial on Metro's Yellow Line.

Navy Memorial's Giant Map Of The World Adopts Water-Jet Technology For Cutting Granite,

from page 1

Designed to use water or a mixture of water and an abrasive slurry as the cutting medium, the liquid jet machines are manufactured by Flow Systems of Kent, Washington.

Liquid jet cutting methods did not reach the stone cutting field until the Navy Memorial design posed this challenge: create a very detailed map of the world, in two shades of granite – one for land, another for oceans.

The old fashioned solution – cut out the puzzle pieces by hand – would have sacrificed considerable detail and cash, donated by patrons of the Memorial. "We would never make our delivery date," says Michael Messore, project manager at New England Stone Industries. "We are the first stone fabricator in the nation to use this new technology, which is going to revolutionize stone cutting."

The liquid jet is a stream approximately 1/32nd of an inch, under 60,000 lbs. of pressure. "The cut is very smooth and clean," says Messore. "We can move through the 2-inch granite up to 2 inches a minute on straight cuts, slowing down to one-half inch a minute for detailed curve cuts."

Two types of granite are being used on the map – Laurentide from Canada for ocean areas, and Deer Isle from Maine for land areas. The water and slurry cutting will be used only for coastal outlines. Conventional techniques will be used to cut latitude and longitude lines which will cross-hatch the ocean areas forming the largest expanse of the globe.

"Every liquid jet cut will be made twice," says Messore, "once on the 'ocean' granite and once on the 'land' granite. With the smoothness of the cuts, the adjoining pieces should fit tightly together."

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LETTERS TO THE EDITOR, from page 3

Dear *JET NEWS*:

6. We were asked to clean a 12-inch-diameter pipe about 1,200 foot long that carried a slurry made of pulverized coal slag and water. Following the accidental closing of a valve in very cold weather, the contents of the pipe (which is above ground) froze solid. We cleaned this pipe using SUPER-WATER and self-propelled moles in about 12 hours. We found with the SUPER-WATER that we could reach double the length of pipe obtainable with plain water and that there was much more pulling power on the self-propelled sewer-cleaning lance than with water alone. This is because the pressure drop is much less through a long line using SUPER-WATER and, therefore, allows for better cleaning power at much greater distances from the pump in all types of cleaning applications.

7. We normally draw on our experience in using SUPER-WATER – when to use it and at what concentration at which we obtain its greatest efficiency (i.e., reduction in cleaning time versus cost of SUPER-WATER). Probably 80 percent of the time we start out with SUPER-WATER in lower concentrations and work up to higher concentrations, if needed, until the most cost-effective concentration is achieved. Sometimes where cost is not a factor, but time is critical, we will immediately use SUPER-WATER because we know that is the fastest way to get any job completed. Most of our real challenges are in power plants and paper mills where there are various and many types of cleaning situations to deal with and which are almost always under a very tight time schedule. Clearly, excessive downtime costs money. Such things as coal slag, fly ash, lime scale and other mineral deposits, by-products from production of green and brown wood liquor, slat cake, magnesium slag, recovery boiler ash, etc., are all amenable to remove with SUPER-WATER.

Sincerely yours,

Bob Goldsmith
Goldsmith Painting & Cleaning, Inc.
425 Forest Avenue
Sheboygan Falls, Wisconsin 53085

The Editor's Reply:

This letter is a testimonial to the effectiveness of a particular polymeric additive. It is printed here because it contains a number of interesting applications. However, the reader is reminded that reference to specific products does not imply endorsement by the Water Jet Technology Association.

Subject: Weep Holes, from page 3

The Editor's Reply:

There are good engineering reasons for the presence of weep holes. They protect against a buildup of pressure inside the fitting which might cause a fitting failure. However, Mr. Campbell's letter teaches us that a sudden eruption through a weep hole can cause injury. Operators of hand-held lances should be taught to avoid putting their hands near these holes. In addition, it is not a bad idea to have a guard to dissipate the direct stream from the weep holes. Equipment manufacturers should investigate the feasibility of increasing the diameter of the weep holes. This would reduce the velocity of the escaping stream.

Mr. Campbell's letter also emphasizes the danger of loosening the fittings during the jetting operation. Operators should be aware of the danger engendered by the unscrewing of fittings during jetting operations.

I thank Mr. Campbell for his letter. Perhaps it will prevent the occurrence of a similar accident.

The Cutting Edge

by George A. Savanick, Ph.D.

Explosions have recently occurred as fuel storage tanks were being dismantled with flame torches. These accidents have accelerated interest in the use of abrasive water jets for this application.

Asbestos removal with water jets appears to be well established. There is some disagreement concerning the mode of application of the jets. Some feel that water jets should be used for bulk removal of the asbestos. Others feel that the bulk of the asbestos should be removed mechanically and water jetting should only be used in the finishing of the job.

Reinforced concrete can be drilled with an abrasive jet drill. This drill can penetrate the steel reinforcing bars as well as the aggregate and cement in reinforced concrete.

Water jet drills without abrasives can also be used in combination with mechanical drilling of reinforced concrete. Drilling reinforced concrete with mechanical drills is risky because of the inability to penetrate reinforcing bars. If a mechanical drill encounters a steel reinforcing bar, the hole must be abandoned. However, a water-jet drill can drill a hole overlapping the pre-existing hole and, thereby, get around the reinforcing bar.

Toro, Inc. has introduced a water-jetting device for aerating golf courses. It is composed of 11 nozzles which can aerate and fertilize 25,000 ft^3/hour by firing jets 6 inches deep into the earth. It recently treated the Augusta golf course in Georgia.

A utility has instituted a policy to cover fluid jet injuries after a worker lost part of his hand from a fluid jet injection injury. Gangrene developed a day after the injection with an oil jet. The wound was treated immediately after the accident, but emergency room personnel were not familiar with fluid jet injuries and did not treat the wound as a surgical emergency. Members are reminded that fluid jet injuries should be considered as a surgical emergency (see April newsletter).

Recently a worker was cut with a waterjet while using a flexible lance to clean the end of a vertical heat exchanger tube. This is a very dangerous practice. Workers should be required to take the time to change to rigid lances for such jobs.

Navy Memorial's Giant Map Of The World Adopts Water-Jet Technology For Cutting Granite, from page 5

The map will be based on a computerized enlargement of a one-tenth-scale azimuthal projection purchased from the Defense Mapping Agency. The map centers on Washington, D.C., which will serve at the point of the North-South alignment at the Memorial site on Pennsylvania Avenue, across the street from the National Archives.

"The map may be one of the world's largest complete projections of the world," said Mr. Conklin. "One inch on the map will equal less than 12 miles on the earth."

The map forms the central plain of the Memorial and will serve as an amphitheater for concerts by the U.S. Navy Band and other military performing units. The Memorial was authorized by Congress through legislation, in 1980, which granted public land for the project in the District of Columbia but stipulated that all funding to build the Memorial come from private donations. The Memorial has already raised half the $10 million required to complete the facility, which will be turned over to the National Park Service. The Memorial is dedicated to the men and women of the U.S. Navy – past, present, and future. The huge grid map will be surrounded by fountains and waterfalls, a ring of bronze bas relief panels depicting events in U.S. Navy history or honoring various groups within the Navy.

Standing prominently on the grid map floor will be the Stanley Bleifeld sculpture of The Lone Sailor, which will represent all who have served or will serve in the Navy. The Memorial will also have a visitor's center, leased in one of two commercial buildings to be built around the northern perimeter of the Memorial. The center will house a motion picture theater, reception room, ships store, offices and the Long Room which will contain a computerized permanent record of present and former Navy members on whose behalf contributions have been made.

Architect Conklin says that a walk across the grid map might give one the feel for one of the Navy's newest frontiers – outer space. "A person whose eye level is between 5 and 6 feet off the grid map is at a scale height of 700 to 800 miles above the earth depicted on the grid."

Conklin Rossant architects wondered whether scaling of the map should incorporate some bumps on the land surfaces to represent mountain ranges. "Even at 29,000 feet, Mount Everest at this scale works out to a bump of 3/8 of an inch, so we thought it was not worth the trouble," said Conklin. "The bumps would not be noticed in the thermal surface we plan for the whole map – a fire-hardened rough and tough finish chosen for durability and traction for pedestrians."

New England Stone Industries (NESI) began cutting stone early this year, permitting spring and early summer deliveries to the Memorial site for installation by Pagliaro Brothers Stone Co., Inc. of Marlboro, Maryland.

William Conklin is pleased about the adaption of liquid jet technology to stone cutting, especially that it has come about through his firm's Navy Memorial project. He says the application is a forerunner in architecture – permitting closer tolerances resulting in tighter bonds of stone against stone.

The result of the Navy Memorial's "necessary meeting invention" was unveiled when the Memorial was dedicated on October 13, 1987.

Contributions to the Memorial's building fund are tax deductible and may be mailed to: **U.S. Navy Memorial Foundation, P.O. Box 12728, Arlington, Virginia 22209. Donors may obtain more information by calling 800-821-8892; in Virginia, 703-524-0830.**

Reprinted with permission from Building Stone Magazine, July/Aug. 1987.

Accident Case Study – UK Job Shop, from page 2

What do you think were the major causes of this accident? How might it have been avoided?

Could such an accident happen on your site?

What were the causes of this accident?

How might it have been avoided?

A sticking valve caused the internal pressure fluctuations in the head. The pump had "bridge pieces" to allow easy access to valves. The stud bolts held the bridge pieces to the head. These stud bolts failed either because they were faulty or they were overtorqued.

The injury would have been avoided if a guard were in place over the bridge pieces or if the operator had not exposed himself by leaning across the pump.

Jetting Conference Confirmed In Holland

BHRA, The Fluid Engineering Centre, has now released the final details of its Tenth International Symposium on jet cutting technology.

The organizers have selected the Sonesta Hotel in Amsterdam, Holland, as a suitable venue for this meeting. The symposium will be held in the Sonesta from October 30 to November 2, 1990, for a fortnight earlier than originally scheduled.

Jetting techniques are now extensively employed for a wide range of tasks, from cutting difficult materials in hazardous environments, to dismantling reactor vessels, as well as solving many cleaning and descaling problems. The jetting industry is working to improve the profitability and efficiency of its systems in order to further extend the variety of applications of this valuable cold-cutting technique. This meeting will enable researchers, manufacturers, contractors and end users to discuss current practice as well as explore opportunities for the future.

Further details can be obtained from the Tenth Jet Cutting Symposium, BHRA, The Fluid Engineering Centre, Cranfield, Bedford, MK43 0AJ; telephone (0234) 750422; telex 825059; fax (0234) 750074.

Call For Papers

6th American Water Jet Technology Conference

Oral and Poster Sessions will be featured at the 6th American Water Jet Technology Conference. Authors wishing to present papers are invited to submit abstracts for consideration. An Abstract Review Committee consisting of six referees, chosen from the Organizing Committee and the body of International Advisors, will review the abstracts and decide their suitability for inclusion in the Conference.

To submit an abstract(s), please complete the enclosed Abstract Submission Form and forward to the attention of the Conference Coordinator at the Water Jet Technology Association. Abstracts are to be submitted NO LATER THAN DECEMBER 1, 1990, to ensure consideration. Authors will be advised by January 15, 1991, regarding the decision of the abstract Review Committee.

Mark Your Calendars!

WJTA
Water Jet Technology Association

6th American Water Jet Technology Conference

August 24-27, 1991
Westin Galleria
Houston, Texas

The Preliminary Conference Program Includes:

- **Scientific Papers**
- **Short Course On Water Jet Technology**
- **Jet Application Symposia**
- **Field Demonstration And Technical Tour**
- **Technical Exhibits**
- **Spouse Program**
- **Awards Banquet**
- **Texas Hospitality**

For additional information regarding the 6th American Water Jet Technology Conference, contact the :

Water Jet Technology Association
818 Olive Street – Suite 918
St. Louis, MO 63101, USA
(314)241-1445; FAX: (314)241-1449

Upcoming Events

October 1990 - Waterjet Short Course - Milwaukee, Wisconsin. Please contact Roger Hirons, University of Wisconsin Extension (414) 227-3105.

October 31 - November 2, 1990 – Tenth International Symposium on Jet Cutting Technology, Amsterdam, Holland. Please contact BHRA, Cranfield, Bedford, England.

May 9-10, 1991 – First Asian Conference on Recent Advances in Jetting Technology, Singapore.

August 24-27, 1991 – Sixth American Water Jet Technology Conference, Houston, Texas. Please contact the Water Jet Technology Association (314) 241-1445.

September 24-26, 1991 – Geomechanics '91, Hrodec, Czechoslovakia. Please contact Z. Rakowski, Mining Institute of Czechoslovak Academy of Science, A. Rimana 176B, 70800 Ostrava Poruba, Czechoslovakia.