WJTA Jet News
Water Jet Technology Association
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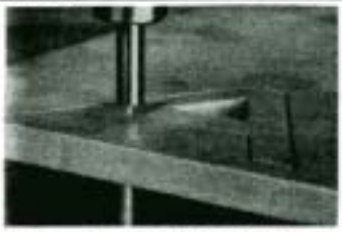
From The President's Desk...

The Board of Directors will meet at the Westin Galleria in Houston, TX, on Saturday, November 17. The main purpose of this meeting will be to discuss Association business and to review the accommodations and the plans for the Sixth American Water Jet Technology Conference scheduled for August 24-27, 1991, in Houston. Members are urged to contact the President if they wish to have an item placed on the meeting agenda.

The August issue of *Jet News* contained an article introducing Toro's new Water Jet Turf Aerator. This issue contains a followup article by Dana Lonn of Toro explaining the design and operation of the aerator. My first thought when I became aware of the Turf Aerator was "I wish I had thought of this." The Turf Aerator appears to be a good idea whose time has arrived. Toro will begin selling the aerator in 1991.

Paddy Swan's safety article reminds us of the danger of hydrogen sulfide gas dissolved in water. It is important to keep this in mind when working in areas with slow moving or stagnant water.

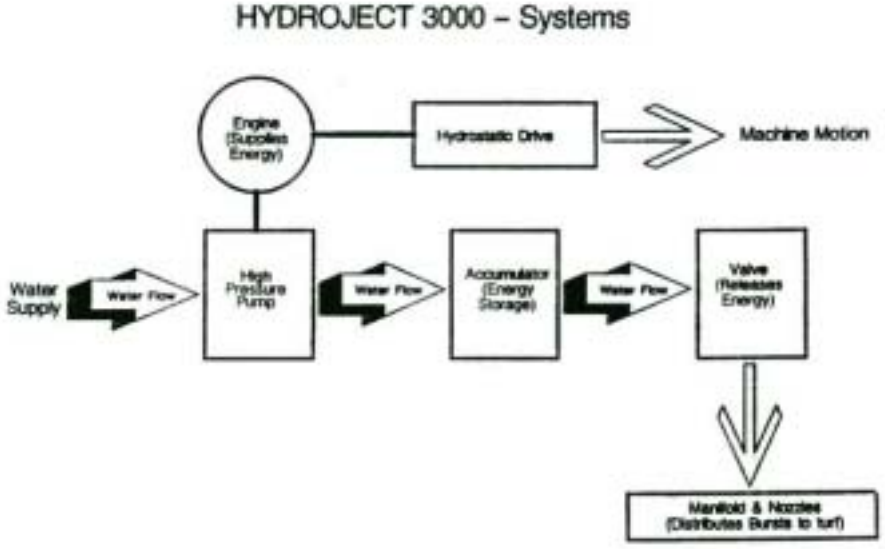
All members should have received a copy of the 1990-91 membership directory. Comparison of this directory with that of 1989 will show that the Association membership has increased significantly. A listing of services provided by members is included with the hope of increasing communication and business activity between members. Members are urged to apprise the President of any suggestions for making the directory more useful.



Abrasive water jet cutting the letter A from a piece of 1/2" thick aluminum
Photo courtesy of Ingersoll-Rand Waterjet Cutting Systems, Baxter Springs, Kansas

Water Jet Turf Aerator

by Dana R. Lonn, P.E. (Manager of Advance Engineering, The Toro Company)



In last month's WJTA *Jet News*, we introduced the Toro Hydroject™ 3000 turf aerator which uses high pressure water jets to aerate the turf. In this month's article we would like to explain a little more about the state-of-the-art technology which is embodied in the product.

The heart of the product is really very simple. It consists of an engine driven pump, accumulator, valve and cam, water distribution system and nozzles.

The inlet water is supplied to the system by a hose which is attached to the turf irrigation system. The 4 gallon/minute inlet water flow is screened and filtered to assure cleanliness. (Irrigation water supplies tend to be quite dirty with silt and sand.) A pressure switch assures that the inlet pressure is a minimum of 20 psi. Normal irrigation pressures are in the 80 to 150 psi range. The water enters a rod displacement pump which raises the pressure to a nominal 5000 psi. This pump is Toro designed and uses a custom-sealing system to provide extended life.

The accumulator sits above the valve assembly. It's purpose is to store the energy produced by the pump between injection cycles. The valve is a custom-designed valve which releases a pulse of the 5000-psi water into the distribution manifold at a rate of 5.3 times per second. The manifold distributes the water to 11 nozzles which releases the water to the ground.

This system produces (11) 4-inch- to 8-inch-deep holes in a golf course green which is built to the construction standards which are published by the United States Golf Association. A hole is placed every 3 inches which results in 16 holes per square foot. With the energy which is available on the machine, 210,000 holes are pierced per hour over an area of 13,000 ft^2.

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"You must do the things you think you cannot do."

– Eleanor Roosevelt

PPG Uses Abrasivejet Cutting System To Increase Productivity, Reduce Overhead

PASER II™ cutting fiberglass

Computerized controller for PASER II™ abrasive jet cutting system

PPG Industries' Huntsville, Alabama, plant is using an advanced abrasivejet cutting system to better meet production schedules, improve product quality and eliminate the need for overtime.

Built in 1969, the Huntsville plant is one of the world's most modern facilities for manufacturing aircraft transparencies such as windshields and side windows. Occupying 350,000 sq. ft. and employing 600 people, the plant is the nation's largest fabricator of these aircraft glass/plastic products. The plant also manufactures specialty products such as bullet-resistant windows and railroad glazing.

More than 800 different aircraft transparencies are manufactured at the plant, with about 250 parts in production at any one time. Formed of laminated glass/plastic, the transparencies are completely encased around their circumferences by edge attachments that are used to mount them in aircraft fuselages. Cut out of fiberglass, aluminum, and stainless steel flat stock, the edge attachments measure up to 96 inches long and 36 inches high, 1 to 6 inches wide, and 0.020 to 0.030 inch thick.

Formerly, the external and internal dimensions of the edge attachments were cut using traditional methods such as NC machining and saws. However, these methods created heat that caused the attachments to warp. This resulted in extensive scrap, time-consuming rework, and a loss of productivity. In addition, saw-cutting of flat stock created airborne dust.

To solve these problems, the plant installed a PASER™ abrasivejet cutting system from Flow International Corporation in Kent Washington. This system uses an ultrahigh-pressure intensifier pump to pressurize water up to 55,000 psi and force it through a nozzle as small as 0.004 inch in diameter, generating a high-velocity waterjet at speeds up to 3000 feet per second. An abrasive delivery system entrains abrasives such as garnet into this waterjet, enabling it to cut metals and other hard materials.

"The PASER abrasivejet system cuts cool," says Robert L. (Butch) Hughes, PPG. "As a result, it provides a better quality edge appearance with reduced deburring requirements and fewer product rejects."

"The abrasivejet system also cuts clean," he points out. "Airborne dust problems therefore were eliminated."

"Overall, the system provided a productivity gain of 150 percent because we were able to run faster feed rates than with NC machining or saw-cutting."

Integrated with a Westinghouse S6000 robot equipped with a Producer II controller and a 48- by 80-inch table, the system also provided computerized control of cutting operations. This eliminated the need for manual tape punching and hard tooling, and significantly reduced the time required to produce finished parts from CAD drawings.

(continued on page 5)

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:

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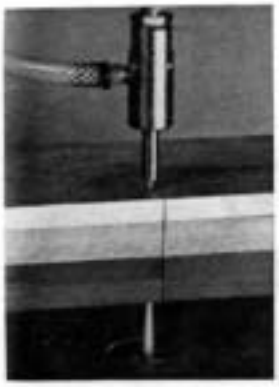
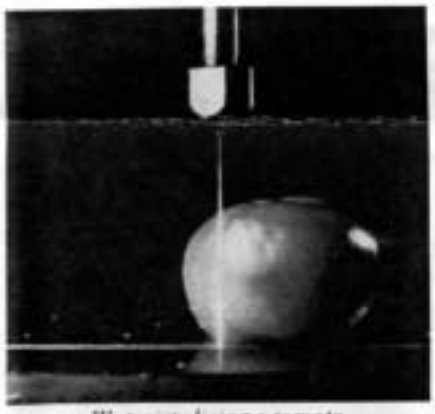


Abrasive jet simultaneously cutting: 1/2" aluminum, 5/8" kelvar, 1/2" glass and 1/2" phenolic



Waterjet slicing a tomato

Photos courtesy of Ingersoll-Rand Waterjet Cutting Systems, Baxter Springs, Kansas

Water Jet Turf Aerator, from page 1

Many questions have been raised by our customers on the merits of using the water jet technology as an aerator. We had similar questions when the technology was demonstrated by our research and development people. As a result of discussions with Dr. Jim Watson, Chief Agronomist at the Toro Company, and Dr. Paul Rieke, of the Hancock Turfgrass Research Center at Michigan State University, we decided to fund a long-term research program on the agronomic benefits. This study began in 1985 and was completed the summer of 1990 with the doctoral dissertation of Dr. Jim Murphy.

HydroJet™ 3000
Photo Courtesy of the Toro Company, Bloomington, MN

The research conducted by Dr. Murphy compared water jet aeration technology, conventional hollow tine aeration, and no aeration treatments. Water-jet aeration was proved to have many benefits over conventional technology including: improved infiltration, reduced bulk density of the soil, increased root mass, less short-term damage, increased clipping yields, and more playable putting surface. Conventional hollow-tine aeration was found to provide more thatch reduction potential and provides an opportunity for the turf manager to change the soil profile.

The product is in the final stages of development. It will be produced this winter and will be available through authorized Toro distributors throughout the world after the first of the year. The suggested retail price will be in the $20,000 to $24,000 range.

PPG Uses Abrasivejet Cutting System, from page 2

Although the abrasivejet system was producing good results, there were several problems that needed to be addressed in order for it to become more cost-effective, according to Hughes. One was that system nozzles had to be shut down for 15 minutes every four hours to change nozzles, resulting in downtime of 2.5 hours a week. Another was a sporadic problem caused by the inconsistent flow of garnet. This resulted in uneven cutting and a reject rate of up to 1.5 percent.

The plant eliminated these problems earlier this year by upgrading to new PASER II abrasivejet cutting system recently introduced by Flow International. The PASER II system is equipped with longer-lasting nozzles that provide 80 instead of only four hours of life. In addition, the system incorporates design improvements that provide much more consistent abrasive delivery.

"The PASER II system provides a 20 times greater nozzle life of 80 versus only four hours," Hughes says. "This results in a 2.5 hour reduction in downtime every week."

"The system's nozzles cost substantially more than the previous ones," he explains. "But, even so, there is a savings of about $5,000 per year as a result of less downtime."

"PASER II also provides more consistent, even abrasive flow," he continues. "This is making it possible to reduce the number of rejects by 15 a month to less than 0.5 percent, resulting in a saving of $7,000 per year."

"More consistent abrasive delivery also permits abrasive usage to be cut by 50 percent," he notes. "This results in another savings of $3,000 per year."

"Based on these savings, PASER II is reducing costs by a total of $15,000 a year," he relates. "The upgrade to the system costs $8,000, so the system will pay for itself in about six months."

An added benefit of more consistent abrasive delivery is an increase in cutting speeds of 50 to 100 percent, according to Hughes. Cutting speeds for aluminum and steel, for example, increased from 30 to 45 inches per minute, and cutting speeds for fiberglass rose from 30 to 60 inches per minute.

"These increased cutting speeds are enabling us to eliminate the need for overtime," Hughes says. "We are also better able to meet production schedules. In addition, we now have the capacity to handle additional production on one shift in the future."

The PASER II system is used to cut 95 percent of all fiberglass, aluminum, and steel edge attachments. An average of 15 different attachments is run on one shift a day, five days a week, with quantities varying from 10 to as many as 150. Very simple to use, the system is operated by any one of three persons.

The system cuts up to 30 attachments at a time, depending on material and thickness. For instance, 0.030-inch-thick fiberglass attachments are cut in stacks of 30, which measure close to one inch in total thickness. Aluminum and steel attachments are cut in multiple plies at thicknesses totaling up to 0.75 inch.

Attachments are cut based on designs created on CAD equipment. CAD operators generate tool paths that are downloaded from their workstations to a PC located next to the room in which the abrasivejet cutting system is operated. The PC then downloads the tool path data to the system's controller. Multiple plies of attachments are set up on the system's table in a minute or two, following which cutting operations are begun under programmed control with the push of a button.

"The improved capabilities of the PASER II system are enabling us to expand the number of attachments which we can economically and efficiently cut," sums up Hughes. "So we will be cutting more and more attachments as times permits to perform analyses in the future."

Overall, the upgraded abrasivejet cutting system is helping the PPG Huntsville plant to achieve its continuing goal, which is to "provide products and services to our customers that fully meet their requirements, on time, every time. We are dedicated to constant improvements in every area of our business and to doing our job right the first time, so as to achieve total customer satisfaction."

The Cutting Edge
by George A. Savanick

The Occupational Safety and Health Administration (OSHA) published a proposed rule on occupational exposure to the asbestos minerals in the July 20, 1990, issue of the *Federal Register*. WJTA members involved in asbestos removal might be interested in reading this proposed rule. A hearing on this rule will take place in Washington, DC, on October 23, 1990. For further information, contact: **James F. Foster, Director of Information and Consumer Affairs, Occupational Safety and Health Administration, U.S. Department of Labor, Room N 3649, 200 Constitution Avenue NW, Washington DC 20210.**

Manufacturers and industrial users of high (50,000 psi) pressure water jet and abrasive jets are interested in developing a body of medical knowledge to aid in the treatment of jetting injuries. Such injuries are rare, but may become more frequent as the technology develops. Readers are urged to write to *Jet News* if they have any ideas on this matter.

Abrasive jet cutting has many uses in offshore construction. Recently a need has arisen for abrasive jet cutting equipment for removing concrete pilings offshore.

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, St. Louis, MO 63101, (314)241-1445, FAX: (314)241-1449**.

Accident Case Study – UK Job Shop

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

A jetting team working for a water supply municipality was set the task of cleaning out a sludge pit. This job was carried out once every 3 months, usually on a Friday. Prior to entry into the pit, which was approximately 50,000-gal capacity, a gas check was carried out.

The team leader entered the pit and used a 1-meter extension lance, a flow of approximately 15 gpm at 2,500 psi with a fan jet to flush the sludge and generally clean the walls of the pit.

After working on this operation for some three-quarter job cycles, the team leader, who was a member of an experienced three-man jetting team, complained to management that on every occasion he had tackled this job, he had displayed the following systems:

1. After completing the job, he felt fine until 2 or 3 o'clock the following morning (Saturday).
2. At 2 or 3 o'clock in the morning, he had woke and had experienced nausea. This nausea was followed by sickness with a foaming pink vomit.
3. After being sick, he was capable of returning to work on Monday.

On investigation by a medical examiner, the systems were diagnosed as a toxic reaction to low-level hydrogen sulphide. The hydrogen sulphide was retained in pockets within the sludge and was not detected during the gas test operation. The water jetting activity naturally disturbed the gas and because it was in fairly high concentration, but small amounts, it was unlikely to have been smelled by the team leader, but was in sufficient quantities to cause the sickness experienced.

MORAL

Beware of any sludge or deposit which has the capacity to contain pockets of gas, even after checking, since the water jetting will certainly release such gases.

NOTE: A sudden high concentration of hydrogen sulphide can paralyze the smell receptors. Thus, the team leader did **NOT** experience the typical "rotten egg" smell of this invisible gas.

Upcoming Events

October 30 - November 2, 1990: Tenth International Symposium on Jet Cutting Technology, Amsterdam, Holland. Further details can be obtained from the Symposium Organizer, BHRA, The Fluid Engineering Center, Cranfield, Bedford, MK43 0AJ; England, telephone (0234) 750422; telex 825059; fax (0234) 750074.

May 7-8, 1991: First Asian Conference on Recent Advances in Jetting Technology, Singapore. Please contact Cl-Premier PTe Ltd., 150 Orchard Road, #07-14, Orchard Plaza, Singapore - Tel: 733 2922; Fax: 235-3530.

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.