

# WJTA Jet News

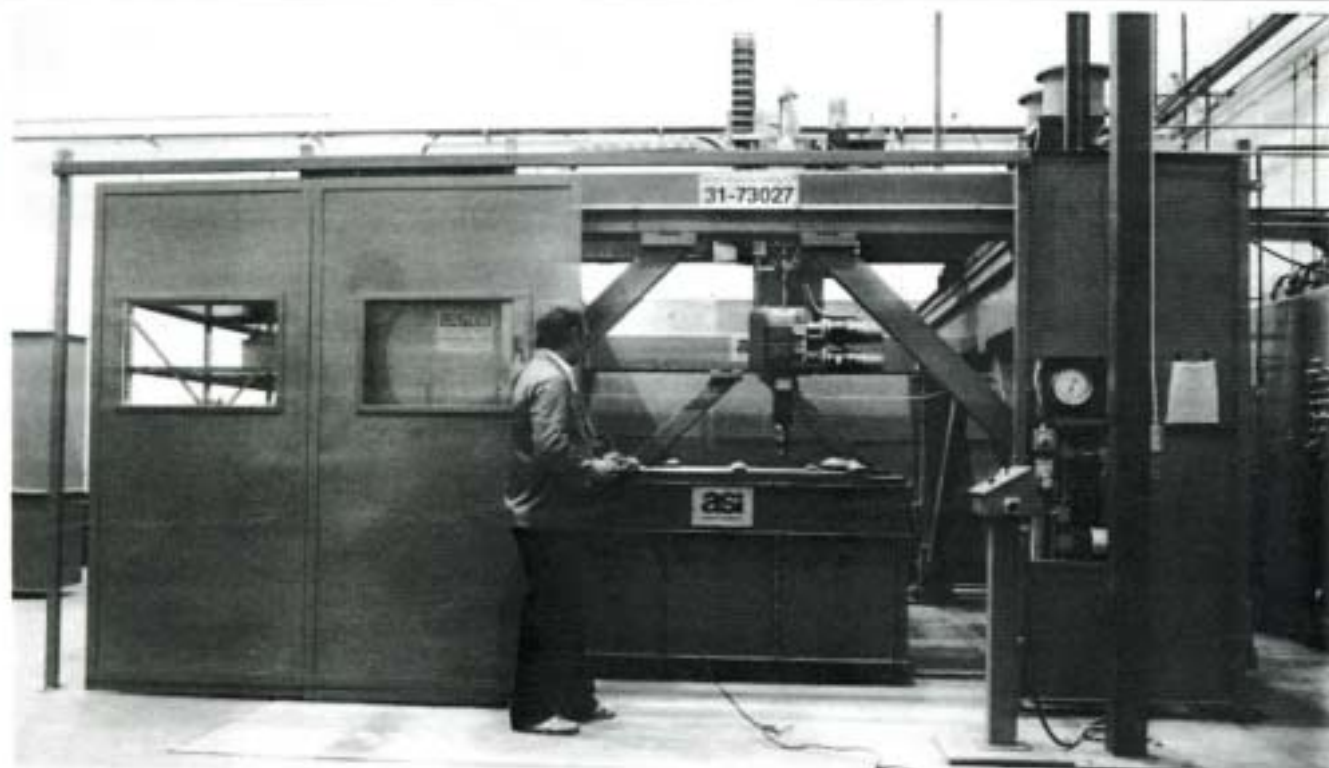
Water Jet Technology  
Association



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Boeing's PASER™ II abrasive jet system operates in a 5'x 10' work envelope. A key component is Flow International model 9X intensifier pump that achieves 55,000 psi water pressure. Also part of the work cell are an ASI Robotics high-gantry robot and an Allen-Bradley 8400 controller that is completely operator programmable. Photo courtesy of Flow International Corp.

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## Abrasive jet cutting at Boeing

As the next generation of military aircraft takes to the skies, the U.S. is increasingly relying on advanced materials to help provide a technological edge over potential adversaries.

Mission requirements calling for new warplanes to be virtually undetectable by enemy radar or to be faster and more agile, while being more reliable and easier to maintain than the military aircraft flying today, have led designers to greater use of advanced composite, or non-metal, materials.

At the Military Airplanes Division of Boeing's Defense & Space Group in Seattle advanced composite components for aircraft, such as the Air Force's new B-2 advanced technology bomber and the Lockheed/Boeing/General Dynamics F-22 Advanced Tactical Fighter, are produced in a state-of-the-art composites factory facility.

Located within the company's Development Center, the factory represents a \$400 million company commitment to the process of building tomorrow's military airplanes. The facility houses a variety of both standard and sophisticated machine tools and automated systems, many of them pioneered for the facility.

(continued on page 9)

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## Water jets clean airport runways



*Airport runway cleaner stripping a film off a bridge. Photo courtesy of Jet Edge.*

Jet Edge, Inc., Minneapolis, MN, and Blasters, Inc., Tampa, FL, have pioneered and announced a joint venture airport runway cleaner. The ARC-I removes rubber and coatings with 36,000-psi, ultra-high water-pressure. Blasters, Inc. has integrated a Jet Edge 36-250D, ultra-high water pressure pump into a large truck robotic cleaner.

The truck includes a water tank to supply the needs of the Jet Edge unit. Water consumption is 6 gpm. A 26-inch-diameter cleaning path is provided by a high-speed, rotating bar with water-jet nozzles. By adjusting the rotation speed of the nozzles, nozzle configuration, and attack distance from the pavement, rubber removal is precisely controlled and is nondestructive to the cleaned surface. Vehicle speed can also be precisely controlled by the ARC-I operator from 0-350 feet per minute.

Other features of the package include: cab-operated control of the ultra-high water-pressure pump towed behind the truck; rotating nozzles; and energy-efficient diesel power on the Jet Edge pump. Applications for the ARC-I include: runway cleaning, coatings removal, surface preparation, paint stripe removal, etc. The ultra-high pressure water-blasting method is an environmentally safe alternative to chemical removal or sand-blasting methods.

For more information on this unit contact: Jet Edge, Inc., 825 Rhode Island Ave. S., Minneapolis, MN, 55426 or call (612) 545-1477.

## In Memoriam

We are saddened to report the deaths of WJTA members, **Professor C. Bruce Baker** and **Dr. Thomas E. Sample Jr.**

**C. Bruce Baker** of the University of Pittsburgh at Johnstown, PA, passed away on May 7, 1991. Professor Baker was a member of the Water Jet Technology Association since 1989.

**Dr. Thomas Sample**, who passed away early this spring, was the technical director of Serv-Tech, Inc., Houston, TX. Dr. Sample was a member of the WJTA for three years.

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## Water jet excavates WWII airplane from Greenland glacier

In July 1942, a squadron of eight WWII U.S. war planes on their way to England made a forced landing on the ice cap in Greenland. The fliers were rescued, but the two B-17 bombers and six P-38 fighters were abandoned on the ice. In the 50 years since then, the airplanes have become encased in the ice to a depth of 250 feet.

The Greenland Exploration Society has been organized in Atlanta, Georgia, for the purpose of recovering these airplanes. The Society, including members of the crew of the planes in the ice, retained Hamilton Engineering, Seattle, Washington, to retrieve the planes.

The ice in the glacier has flowed and carried the planes from their original location. In 1990, Hamilton Engineering located the planes with ground penetrating radar and brought out the first plane, a B-17.

The B-17 was dismantled and brought out, piecemeal, through a 4-foot-diameter shaft melted 250 feet into the ice with a heated bit. A cave was excavated around the B-17 at the base of the shaft. Hand-held water jets were used to create the cave using the water from melted snow held in a pond on the surface.

## Tarrant, Andrews assume leadership of Flow International

Ronald W. Tarrant, 54, is the new president and chief executive officer of Flow International Corp., Kent, WA. Lloyd Andrews, 71, has been named the chairman of the board. Tarrant and Andrews succeed Dr. Y.H. Michael Pao, 56, who resigned from Flow to pursue other interests.

Fill us in on the latest news breaking at your company – new officials, promotions, equipment, plant openings. Add *Jet News* to your press release list!

## Software for abrasive jet cutting systems

Flow International Corp., manufacturer of industrial waterjet and abrasive waterjet (AWJ) cutting tools, has introduced a new data base software package known as FLOWpro™.

Developed to maximize operating efficiency of the company's PASER™ abrasive-jet shape-cutting systems, FLOWpro is a customer support data base which incorporates four main functions:

- Recommended cutting parameters for common materials. In the past, AWJ cutting was a complex process, involving up to 20 parameters, such as speed, orifice size, and abrasive flow rate. Selecting parameters incorrectly resulted in lower operating efficiency and higher costs. With FLOWpro, the user now has access to highly accurate cutting parameters and corresponding results for a variety of commonly cut materials – steel, composites, titanium, Inconel™, glass, ceramics, and others.
- Customized data. Users can also add their own cutting data and integrate it easily with Flow-supplied information.
- Cost analysis. A unique and powerful attribute of the data base, the cost-analysis function allows users to determine operating cost for every inch of material cut. The cost-per-inch numbers include intensifier pump wear average based on operating pressure, plus other elements, such as consumable parts, water, power, abrasive use and labor. This critical data helps the user select which process parameter setting is best for any cutting operation and makes job quoting accurate.
- Job tracking and client management. This function incorporates information for accounting and account management purposes, streamlining the task of re quoting or running a repeat job. All relevant information on customers and work performed for them is available at the touch of a key.

Developed totally in-house, FLOWpro features full-color graphics and pull-down menus. It was designed to run on an IBM-compatible computer using a DOS 3.0 or greater operating system. The software costs \$900 and buyers receive free software upgrades for 1 year after purchase.

"This is another step," said Chip Burnham, Flow shape-cutting product manager, "toward the development of complete on-line customer support and fully automated AWJ work cells."

Three years in development, the FLOWpro system was beta-tested 6 months at major aerospace manufacturers and job shops cutting all types of advanced composites and metals. The testing proved that AWJ operating efficiency could be improved dramatically if mistakes in choosing cutting parameters were eliminated.

Headquartered in Kent, WA, Flow International Corp. is the world's leading manufacturer of ultra-high-pressure water-jet and abrasive-jet tools for industrial cutting and cleaning.

For more information, contact Flow International Corp. at (206) 872-4900.



Flowpro™ Software Package. Photo courtesy of Flow International Corp.

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## From the president's desk...

The water jetting community is small, but close-knit. I was reminded just how close-knit we are last week. During the last full weekend of May, I worked on a water jetting job with American Water Jetting in Richmond, CA. I drilled reinforced concrete with an abrasive jet drill in conjunction with Frank Zeier and Stan Frost.

The next week I was speaking with John Walgomott, of Stone Age, Durango, CO, who informed me that Stan Frost was lost in a boating accident the previous week. Both John and I knew Stan Frost.

Stan was an enthusiastic water jetter who attended the Fifth American Water Jetting Conference in Toronto, Canada, in 1989. All of us who knew him are saddened by his loss.

Each waterjetter is all the more precious because we are a relatively small group. The untimely loss of one of our fellows is most keenly felt.

- George A. Savanick, Ph.D.

## Ingersoll-Rand waterjet makes strategic move to the Detroit area

To accommodate anticipated growth in its key automation markets, Ingersoll-Rand announced the company will move its Waterjet Division's managerial, sales, marketing, and research headquarters to Farmington Hills, MI, later this summer. The manufacturing facilities for Waterjet's ultra-high pressure pumps, components, and accessories will remain in Baxter Springs, KS, to build upon 40 years of high-pressure manufacturing experience.

"This move signals Ingersoll-Rand's commitment to the commercialization and growth of waterjet technology," said Chuck Havill, General Manager and Vice-President, Waterjet Cutting Systems Division. "The automotive industry makes up the largest concentration of waterjet installations and we feel it is imperative to be located closer to our users. Because Waterjet's continued growth is directly related to the successful integration of automation systems, the considerable resources of Ingersoll-Rand's Automated Production System Division, also located in Farmington Hills, will be an invaluable asset."

The new headquarters will include facilities for advanced development and demonstration of waterjet cutting systems. "Our new facility will increase our customer interaction in our product development efforts," added Havill.

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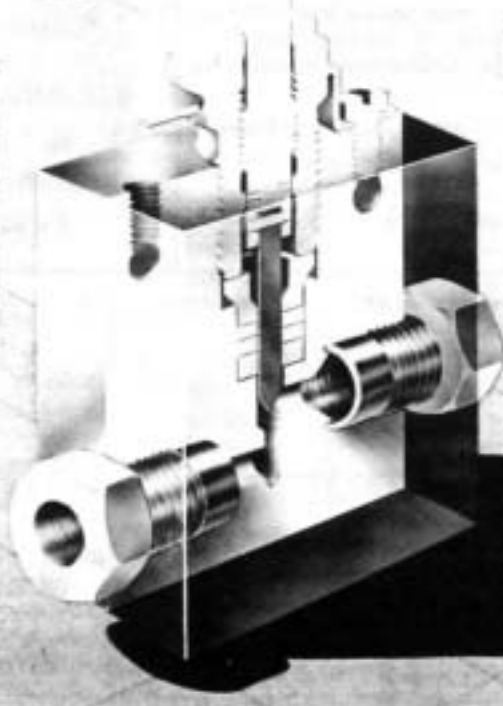
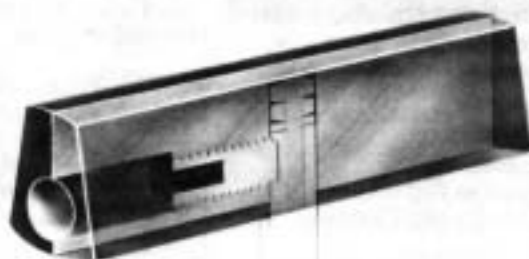
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## New cartridge advances abrasive-jet cutting technology

Flow International Corp. has developed a new pre-aligned cutting head for use on its advanced PASER™ II abrasive-jet cutting system.

Known as the PASER Cartridge, the new head is extremely accurate and easy to install and use. Because of its precise tool center point (TCP), the Cartridge is particularly useful in fabricating three-dimensional parts and for tight-tolerance 2-D cutting (less than  $\pm .010$ ). Most applications are in the aerospace industry for cutting composite materials.

Designed for use exclusively on Flow's PASER II abrasive-jet system, the Cartridge can be changed out in seconds while maintaining an established TCP. The TCP remains constant because the Cartridge is prealigned at the Flow factory and inspection tested at full operating pressure of up to 55,000 psi. Average operating life for the Cartridge is 80+ hours.

Three years in development, the Cartridge was beta-tested 9 months at several sites including two McDonnell-Douglas facilities and two large aerospace-oriented job shops, Hydro-Abrasive Machining and HydroSabre Technologies.

"The Cartridge eliminates the headaches of 3-D machining," said one customer cutting advanced composite materials. "With no alignment required, we just put it on the machine and go."

For more information, contact Flow International Corp. at (206) 872-4900.



PASER™ Cartridge. Photo courtesy of Flow International.

## Conference proceedings available

A limited supply of 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:

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## Abrasive jet cutting at Boeing, from page 1

The factory's engineers began seriously investigating new means of fabricating composites, especially those made of graphite epoxy, in the mid-1980's. After reviewing many advanced machining technologies, Boeing chose to add a fully integrated abrasive waterjet (AWJ) cutting system featuring an ASI Robotics high-gantry robot and an ultra high-pressure intensifier pump and PASER™ abrasive-jet system from Flow International Corp. The system included an Allen-Bradley 8400 controller that is completely operator-programmable.

Initially, flexibility was what appealed to Boeing most about abrasive jets. While the system was installed to cut all types of composites without fear of delamination, Boeing personnel soon discovered it worked extremely well on titanium, aluminum, and stainless steel.

The system operates in a 5 by 10-ft work envelope. A key component is a Flow International model 9X single intensifier pump, driven by a 40-hp motor, that achieves 55,000-psi water pressure. Boeing customized its package with a water filtration unit and booster module, a de-ionized water system, an extra abrasive hopper, and robotic motion system to cut in three dimensions. For most jobs, operators use one of two grades of garnet abrasive - 100 grit for use on fine materials and 80 grit for thicker parts.

Roy Mosely, special projects mechanic, is the chief operator of the PASER system. He said the equipment typically runs two shifts per day, cutting everything from one-eighth-inch aluminum to nine-tenths-inch graphite composite. He estimated 30-40 percent of his work involves composites.

Originally, composite parts were only used in secondary structures. However, the new B-2 bomber makes extensive use of composites for primary structure. Boeing's new 777 jetliner, now in design, will have composite vertical and horizontal tail sections.

"Before the PASER came, we usually used tools with carbide and diamond blades on composites," said Mosely. "They created a lot of dust and couldn't produce a good, finished edge. Abrasive jets immediately solved those problems."

Cutting titanium poses another challenge, explained Mosely. "Lasers are great for many things, but they leave heat-affected zones in titanium that can destroy the integrity of a part. Abrasive jets cut with absolutely no heat, so the physical characteristics of the part never change."

Mosely added that while AWJs usually cut slower than lasers - average speed on one-eighth-inch material is 20-30 inches per minute - they reduce the need for secondary finishing so total part production time is often shorter.

Several other capabilities impressed Boeing personnel about the PASER AWJ system. "The equipment is easy to operate," said Bill Huber, an equipment engineer. "It requires operator skill in knowing abrasive feed and jet flow rates, but the technology is very straightforward." ASI Robotics did all the initial operator training.

In addition to cutting many different materials, Boeing's robotic abrasive jets can make a wide range of shapes and contours with minimum set-up time. "They can cut to extremely tight tolerances," Huber added, "so we really reduce material waste."

In 1990, Boeing chose to add five-axis robotic capability and upgrade its abrasive jet cutting operation with the new PASER II™ technology from Flow International. Several years in development, the advanced PASER II has predictable erosion of the abrasive mixing tube which resulted in the ability to fabricate net-cut parts.

How does Boeing plan to use abrasive jets in the future? "This system has worked well for us so far and every week we get requests from inside the company to cut something else with it," said Mosely. "Abrasive jet technology has definitely found a home at Boeing."

For more information, contact Flow International Corp., 21440 - 68th South, Kent, WA, 98032. Telephone: (206) 872-4900.

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A tour of firms specializing in water jet systems will be held on Tuesday, August 27. Live demonstrations of various systems and equipment will be held at each site.

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- 1. FULL CONFERENCE:** Includes admission to all technical and scientific sessions (except Short Course), exhibition, coffee breaks, luncheons, receptions, banquet, and technical tour and demonstration. **Each full registrant also receives one hardbound copy of the official Conference Proceedings.**
- 2. COMBO:** Includes everything listed under Full Conference **PLUS** admission to the Water Jet Short Course.
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**NOTE:** The official Conference Proceedings and admission to receptions and/or the banquet are **NOT** included in the daily registration fee. The Proceedings or optional function tickets must be purchased separately.

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### CANCELLATION POLICY

Fees will be refunded in full for cancellations received at least six weeks prior to the Conference. Cancellations received more than 21 days and less than six weeks prior to the Conference will be subject to a \$50 charge. No refund will be made for cancellations received less than 21 days prior to the Conference. However, substitutions may be made at any time.

### Discounts for WJTA members and early-bird registrants!

WJTA members receive a special discount off the regular registration fees. You will also receive a special additional discount if your registration is postmarked or received in the WJTA office by **August 15, 1991.**

## Register Now!

## Seating is limited!

See page 13 for registration information.

### Water pollution controls coming from EPA

*by Ernst P. Hall (Chief, Metals Branch, U.S. Environmental Protection Agency)*

The Environmental Protection Agency (EPA) is currently collecting data and studying the processes used to shape metals and make metal parts and machines. This project, under the somewhat misleading name of Machinery Manufacturing and Rebuilding (MM&R), is one of EPA's most ambitious regulatory efforts.

The project is now collecting detailed information on some 50 categories of metals processes, one of which is abrasive jet machining (including waterjet cutting). During the next several months, EPA will be making engineering visits to manufacturing facilities in many parts of the country. They would welcome the opportunity to visit and examine waterjet cutting operations in conjunction with these visits. [To volunteer, please call Ernst P. Hall at (202) 382-7126].

EPA is scheduled to propose a wastewater pollutant discharge regulation for this area in late 1993. Typically, EPA metals regulations have included limits that require the conservation or reuse of water and removal of pollutants to the level of the best available technology (BAT). At the time of proposal, public comments will be sought on the proposed regulation.

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<input type="checkbox"/> Sunday <input type="checkbox"/> Monday <input type="checkbox"/> Tuesday	_____ days × \$ _____				= \$ _____

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**TOTAL ENCLOSED \$**  

\*Non-WJTA members who are members of the International Society of Water Jet  
Technology are permitted a 5% discount off nonmember registration fees.

\*Full-time students may register at a 50% discount off nonmember registration fees.

## Nominees sought for Board of Directors

The Nominating Committee hereby solicits nominees to serve on the Board of Directors. The Board will be elected at the meeting of the WJTA members held during the Sixth American Water Jet Conference in August in Houston. Send nominations to:

**Evette Steele, Secretary**  
**Water Jet Technology**  
**Association Office**  
**818 Olive - Suite 918**  
**St. Louis, MO 63101**

*Impatience gets things done.*

-Erma Bombeck

# GARNET

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**FAX: (206)682-8829**  
**TLX: 759030**

## Mark Your Calendars!

# WJTA

**Water Jet Technology  
Association**



**6th American  
Water Jet  
Technology  
Conference**

**August 24-27, 1991**  
**Westin Galleria**  
**Houston, Texas**

### PRELIMINARY SCHEDULE OF EVENTS

#### Saturday, August 24, 1991

8:00 a.m. - 4:30 p.m.	Water Jetting Short Course
6:30 p.m. - 8:00 p.m.	Welcoming Reception

#### Sunday, August 25, 1991

8:30 a.m. - 4:30 p.m.	General Session
Noon - 5:00 p.m.	Exhibits Open
8:30 a.m. - 4:30 p.m.	Concurrent Session on Applications for Water Jetting Contractors
4:30 p.m. - 6:00 p.m.	WJTA Biennial Business Meeting

#### Monday, August 26, 1991

7:30 a.m. - 5:00 p.m.	Exhibits Open
8:30 a.m. - 5:00 p.m.	General Session
7:00 p.m. - 11:00 p.m.	Reception and Dinner Banquet

#### Tuesday, August 27, 1991

7:30 a.m. - 10:30 a.m.	Exhibit Hall Open
8:30 a.m. - Noon	General Session
Noon - 7:00 p.m.	Technical Tour and Demonstration

**See registration form on page 13 or contact:**

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