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An Introduction To Air-Mover Vacuum Trucks



Figure 1. Anatomy of an air-mover

S ince an air-mover can vacuum liquids, dry materials, a mixture of wet and dry materials, and sludge, it is a very flexible piece of equipment. As long as the material can flow through a six or eight inch hose or tube and has a flash point higher than 150 degrees, an airmover can handle the job.

As more and more contractors, municipalities and utilities learn about the performance advantages and cost benefits of air-movers, they are eager to evaluate this method of vacuum excavation, but they find delving into the technical information a daunting task.

This article is designed to provide a comprehensive look at the equipment, available options and practical guidelines for air-mover operation and maintenance. This is an overview and not a substitute for the more detailed and specific instructions provided by the manufacturer. To assure optimal and safe air-mover operation, all operators should be required to read the equipment manual and to be trained on the safe operation and maintenance of the equipment.

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Safety Committee Solicits Comments On Improvements To *Recommended Practices*

The WJTA Safety Committee hereby solicits comments regarding improvements to the publication, *Recommended Practices* for the Use of Manually Operated High Pressure Waterjetting Equipment. While Recommended Practices is reviewed periodically at the biennial conferences of the WaterJet Technology Association, your comments and suggestions for improving the publication are invited and welcome anytime.

Please address your comments and suggestions to: Safety Committee, c/o WJTA, 906 Olive Street, Suite 1200, St. Louis, MO 63101-1434, phone: (314)241-1445, fax: (314)241-1449, e-mail: wjta@wjta.org, web site: www.wjta.org.

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An Introduction To Air-Mover Vacuum Trucks, from page 1

Anatomy of An Air-Mover

An air-mover is referred to by a number of names such as a wet/dry vacuum truck or even by the names of major air-mover manufacturers such as Supersucker® manufactured by Super Products LLC or Federal Signal's Guzzler[™]. A typical airmover in today's market has a high vacuum 27-28 inch dual lobe or trilobe high air flow (5000-6000 cfm) vacuum pump. It also has a 16-18 cubic yard tank, cyclone separator and baghouse with filter bags.

An air-mover uses a combination of vacuum and air flow to convey material. It uses just enough vacuum to lift the material into the air flow then let the air flow carry the material. To understand how to operate and maintain an air-mover, it is essential to learn about the air flow and filtration of the equipment. Most air movers have four (4) stages of filtration to remove material from the air flow. Figure 1 (below and on page 1) shows the air flow of a typical modern designed air-mover.



Note the air flow going through the hose or tube into the debris tank where the air flow slows down allowing most of the material to drop into the tank. (stage 1) From the tank, the air flows into a cyclone separator (stage 2) where the air flow spins allowing centrifugal force to separate material from the air as the air exits the center of the separator (see Figure 2).



The air flow leaves the cyclone separator and goes to the third stage of filtration, the baghouse. The baghouse normally contains acrylic coated bags to handle wet or dry material. The bags filter out material greater than one micron as air flows through the bags. From the baghouse, the air flows through a final filter screen (stage 4) then through the vacuum pump and out the exhaust silencer.

Performance Enhancing Options

To enhance air-mover performance, there are a number of options available to meet application-specific needs.

Hydraulic Boom

This is an ideal tool for vacuuming material out of a trench or sewer, or when it is necessary to reach over a wall or fence. It allows the user to

(continued on page 7)

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Fan Jet Characteristics

S himizu* recently published a paper on the subject of structure and erosive characteristics of fan jets. Here are the highlights.



Fan jets were produced with nozzles like the one shown in the picture. This nozzle has a conical convergent inlet section with a 84° convergent angle. The outlet face of the nozzle has a 52° triangular notch. In the center is an elliptic hole with major/minor diameters of 0.43 mm/ 0.33mm (for a nominal diameter of 0.33 mm nozzle).

Instantaneous photographs of the fan jets, with pressure varying from 70 to 300 MPa, were taken from two directions with an exposure time of 1.5 microseconds. The jet shown in the picture was at pressure 300 MPa. It has a spreading angle of approximately 24°. Below a region of transparent liquid sheet is a region with streak structures of water droplets, where practical coating removal takes place.

A stationary fan jet produces a line segment type of damage on the target

material. The erosive intensity is fairly even when the jet operates immediately downstream of the liquid sheet and then gradually becomes uneven as the distance increases. The erosive power of a moving fan jet is also the highest immediately downstream of the liquid sheet. Shown in the picture is the topography of a damaged mild steel specimen by a moving fan jet at 300 MPa and 400 mm/min, with a standoff of 20 mm.







Article reprinted with permission from the *Quality Waterjet Newsletter*, December 5, 2006, published by QualJet LLC, www.qualjet.com.

Jet Edge Releases New Precision Waterjet Cutting Product Brochure

Jet Edge, Inc., a leading manufacturer of ultra-high pressure waterjet and abrasivejet systems for precision cutting, coating removal and surface preparation, recently released a new brochure highlighting its precision waterjet cutting products.

The new brochure features Jet Edge's ultra-high pressure intensifier pumps which are rated for 60,000 psi (4,100 bar), as well as its precision cutting systems, which include an expandable high-rail gantry, a mid-rail gantry and an abrasive machining center. The brochure also highlights Jet Edge's AquaVision Di motion controller and precision cutting accessories that include cutting heads, abrasive delivery, removal and recycling systems, and a closed loop polisher.

To request a brochure, call 1-800-JET-EDGE (538-3343) or e-mail sales@jetedge.com.

The *Jet News* is published by the WaterJet Technology Association (WJTA) and is a benefit of membership in the Association.

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KMT Reorganizes

Due to the recent acquisitions of RPT and H2O Jet, as well as the new joint-venture KMT Spindle Technology, KMT introduces a new organization based on four business areas. In connection with the new organization, KMT also presents a new management structure. The new structure was effective January 1, 2007.

KMT will be organized in four Business Areas as follows:

KMT Waterjet, includes:

- KMT Waterjet Systems, Baxter Springs, USA
- KMT Aqua-Dyne, Houston, USA
- KMT McCartney, Baxter Springs, USA
- KMT H2O, Olympia, USA

KMT Precision Grinding, includes:

- KMT UVA, Bromma, Sweden
- KMT Lidköping, Lidköping, Sweden
- KMT NanoGrinder, Lidköping, Sweden
- KMT LMV, Lidköping, Sweden
- KMT Spindle Technology, Wafangdian, China

KMT Robotic Systems, includes:

- KMT RPT, Auburn Hills, USA
- KMT Cutting Systems, Ronneby, Sweden

KMT Sheet Metal Working, includes:

- KMT Ursviken, Ursviken, Sweden
- KMT Herber, Värnamo, Sweden

In connection with this change, KMT introduces a new Group Management consisting of:

Lars Bergström, Chief Executive Officer Joakim Roslund, Chief Financial Officer Per-Olof Jungqvist, Technical Director

Duane Johnson, President Business Area KMT

Duane Johnson, President Business Area KMT Waterjet

Kevin McManus, President Business Area KMT Robotic Systems

Johan Westberg, President Business Area KMT Precision Grinding

Lars Bergström (CEO), President Business Area KMT Sheet Metal Working

For more information, please contact Lars Bergström, CEO, Karolin Machine Tool AB, Telephone: +46 8 594 211 50 or e-mail: lars.bergstrom@kmtgroup.com

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Nominations Open For WJTA Board Of Directors

N ominations for the WaterJet Technology Association (WJTA) Board of Directors are now open. The duties of the directors are truly challenging and rewarding.

The terms of office of Craig Anderson, Pat DeBusk, Lydia Frenzel, Ph.D., Larry Loper, Forrest Shook, and John Wolgamott will expire in August 2007. In addition, the recent resignation of Dr. David Summers from the board has resulted in a seventh open position. Therefore, nominations are sought for seven (7) board members. Six (6) board members will be elected to serve a four-year term of office beginning August 17, 2007. The candidate receiving the seventh highest number of votes will be elected to complete Dr. David Summers' unexpired term of office and will serve the remaining two years of the four-year term ending August 2009.

The WJTA bylaws provide that no more than one of the elected board members may be from the same company or organization. Therefore, board members may not be nominated from the same company or organization already represented on the board by individuals whose terms expire in 2009, including the Colorado School of Mines (Hugh B. Miller, Ph.D.), Flow International Corporation (Mohamed Hashish, Ph.D.), OMAX Corporation (Carl Olsen), and Veolia Environmental Services (Bill McClister).

According to the WJTA bylaws, any WJTA member in good standing (2006 membership dues paid) may submit a nomination(s). A nominee who has not paid his/her dues by March 31, 2007, shall be declared ineligible to run for office in the 2007 election. The deadline for making nominations is **March 31, 2007.** Your nomination(s) should reach the WJTA office **no later than March 31, 2007.**

To submit a nomination(s), complete the Nomination Form and return, <u>along with biographical</u> <u>information and a brief statement of</u> <u>your nominee's mission and vision</u> <u>for WJTA</u>, to:

> WJTA Administrative Office 906 Olive Street, Suite 1200 St. Louis, MO 63101-1434 phone: (314) 241-1445 fax: (314) 241-1449.

Remember, nominations must be received **no later than March 31**, **2007.**

Nominations/Elections Procedures

In accordance with the bylaws of the WaterJet Technology Association, revised in 2002, nominations and elections to the Board of Directors include the following procedures:

- At least two calls for nominations to the board of directors will be published in the *Jet News*. The first call for nominations appears in this issue. Nominations will be accepted through March 31, 2007.
- An official ballot listing the eligible nominees and a brief biographical sketch for each individual will then be forwarded by mail to all eligible voting members of the Association on May 28, 2007. Signed and executed ballots must be mailed to the Association's office for tallying by June 25, 2007.
- The names of newly elected board members will be announced in the *Jet News* and on the WJTA web site.

Only WJTA members in good standing (2006 membership dues paid) may submit a nomination(s). A nominee who has not paid his/her dues by March 31, 2007, shall be declared ineligible to run for office in the 2007 election.

| Nomination Form |
|--|
| Title |
| |
| State |
| Postal Code |
| |
| _ Outside US/Can [] () |
| |
| _ Outside US/Can [] () |
| l information with a brief statement of 's mission and vision for WJTA. |
| Title |
| |
| State |
| Postal Code |
| |
| _ Outside US/Can [] () |
| [country code] (city code) |
| _ Outside US/Can [] () |
| |

An Introduction To Air-Mover Vacuum Trucks, from page 2



Hydraulic Boom

add tubes and lower the tubes directly into the material while the operator stands at a safer distance and cleaner area rather than using a vacuum hose by hand.

Sludge Pump

By adding a sludge pump, users can pump sludge and liquid from the tank.

Body Pressurization/ Auxiliary Vane Pump

When an application requires liquids to be blown out of the body, a vane pump can be added to pressurize the body. Typically this is set at a maximum of 13 psi. The vane pump can also be used as an auxiliary vacuum pump so it can operate as a liquid vacuum.



Body Pressurization/Auxiliary Vane Pump

Pneumatic Unloading

An air-mover can be equipped with a pneumatic unloading option to discharge virtually any dry material from the body into a silo, storage hopper, truck or storage containers. By feeding material from the debris



Pneumatic Unloading (continued on page 8)



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An Introduction To Air-Mover Vacuum Trucks, from page 7

tank into an air stream (normally using the exhaust from the vacuum pump), the material is blown into the desired receptacle.

High Dump

The high dump option is designed to give the air-mover the capability of unloading material into roll off containers. It raises the debris tank so material can be dumped into an open top container without the need for ramps.

Detachable Separator

When an application requires material to be unloaded into barrels, bags, open top containers or railroad cars before it enters the debris tank, a detachable separator can be added. It is effective for handling hazardous material since it separates the material before it enters the debris tank and allows for continuous vacuuming and unloading of material.

High Rail System

Air-movers can be equipped with rail wheels that can operate on railroad tracks. The rail wheel package includes rail wheels mounted on the front and rear. Users can also add: a rear operator seat and platform so the unit can be operated while on rail tracks; a creeper system to propel the unit forward and backward while it is on the tracks; and a hydraulically operated telescopic boom.

Sound Suppression

A sound suppression package is an option that enables airmovers to achieve low sound levels at all operating ranges.

Air-Mover Setup: The Basics

An air-mover is an exceptional tool that can provide users with an efficient, cost-effective vacuum extraction solution. However, like any tool its implementation demands careful consideration of the equipment as well as a critical eye to safety measures.

Although the following material covers most aspects of air-mover setup and operation, it serves as a guideline and is not a substitute for a manufacturer's operation and safety manual.

• The proper **location** of the vehicle is essential to its safe operation. Choose a location that has level solid ground. Select a site that is free from overhead obstructions and power lines, and where all sides of the vehicle will be easily accessible. These same



High Dump



Detachable Separator



High Rail System

considerations apply to locations where the unit will be dumped.

• After positioning the vehicle at the site, **layout all vacuum hose/tubing** material. Then, **install the**

(continued on page 11)



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WJTA Welcomes New Members

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David Cronk Bill Caton 105 South Albany Road Selkirk, NY 12158 Phone: (518)767-0285 Fax: (518)767-0289

Pettit Environmental

Ralph Pettit, Jr. Earl Hellinger Chuck Druin 340 Byrne Avenue Louisville, KY, 40209 Phone: (502)673-5100 Fax: (502)637-3322 Precision Industrial Supply, LLC Melanie Delfakis Alex Delfakis Lindsay Gorrill P.O. Box 2834 Hayden, ID 83835 Phone: (208)762-3536 Fax: (208)762-7635

Prince George Hydro Mechanical LTD. Greg Pocock Ken Blair

Scott Thomson P.O. Box 2369 2011 PG Pulpmill Road Prince George, BC V2N 2S6 Canada Phone: (250)561-0342 Fax: (250)561-2026

Veit & Company, Inc. Dan Gotz 14000 Veit Place Rogers, MN 55374 Phone: (763)428-9590 Fax: (763)428-9583

Mark Sonaglia 14000 Veit Place Rogers, MN 55374 Phone: (763)428-6763 Fax: (763)428-8348

Rikky Fredrickson 15429 Comet Road Bemidji, MN 56601 Phone: (218)243-2440 Fax: (218)243-3049

Corporate Alternate

Joe Cisar

Bystronic Inc. 185 Commerce Drive Hauppauge, NY 11788 Phone: (631)231-1212 Fax: (631)231-1040

Warren Christopherson

Chukar Waterjet, Inc. 12070 43rd Street, N.E. St. Michael, MN 55376-8427 Phone: (763)497-8749 Fax: (763)497-8701

(new members continued on page 16)



IMPORTANT NOTICE REGARDING SPAM

Email addresses and other member contact information published in the WJTA Membership Directory is meant to encourage helpful, informative communication between members. The information is not provided to circulate spam or junk mail.

The WJTA leadership requests that members respect the contact information of fellow members and not use that information for the dissemination of spam or junk email. Membership information is not meant to be circulated beyond the WJTA membership.

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inline vacuum relief valve,

which should be used for all vacuuming jobs. The valve should be located near the end of the work hose within easy reach of the hose operator. The work hose operator should be tethered to the valve so that he/she can activate the vacuum relief valve when needed.

- Before starting to vacuum, **check the unit's functions**. Confirm that all throttle controls, lights, alarms, gauges, vacuum relief devices and hydraulic controls are functioning correctly. In addition, performing these checks at the end of a shift is a good practice.
- After all items are set up and checked for operation, start the unit. Once the unit is vacuuming, adjust the throttle to reach the vacuum pump's desired speed. The vacuum pump doesn't necessarily need to be running at maximum rpm for all types of material. Often an operator will run the vacuum pump too fast for a given job or type of material, which wastes fuel and decreases the efficiency of the unit. Vacuuming light-weight material at an excessive speed creates more carryover into the separator and baghouse by not allowing gravity to pull material out of the air flow into the collector body. This carryover material will then need to be cleaned out of areas that normally should not have material buildup.

Maintenance: Extending Unit Life

By following simple maintenance procedures consistently, users can extend the life of the air-mover equipment, optimize its performance, and reduce repair and downtime expenses. Before starting the unit, walk around it and look for any obvious items that need repair or attention such as missing bolts, loose bolts, broken items, torn gaskets, leaking oil, damaged safety decals, etc. Then, check oil levels, make sure safety equipment is functioning correctly and check for overhead or dumping obstructions. Next, confirm that the filter bags are seated correctly and in good condition. Verify that the filter cleaning system is functioning correctly. Extremely dirty bags reduce the efficiency of the unit along with demanding additional fuel consumption. Look for any dirt on the

(continued on page 17)



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Safety Of Waterjets For Demilitarization

I aterjets have been used in demilitarization since early 1950s. However, impact initialization of high explosive materials is always a safety concern. Miller's article* on this subject provides a good source of information. Here is a review of his article.

There are two types of explosives: primary and secondary. Primary explosives (e.g. PETN) are used in small quantities to initiate an explosion. Secondary explosives (e.g. TNT) are used in much larger quantities and are more stable. Primary explosives are extremely sensitive to impact shock. For example, PETN can be ignited by a 2 kg weight dropping from a height of only 0.0125 meter. Explosives are also sensitive to projectile impact. The projectile velocity required to initiate 50% of the explosives is 310 m/s for PETN and 780 m/s for TNT. Two other factors of projectile impacts are projectile diameter and shock pressure.

At 50,000 psi water pressure, the velocity of waterjet is estimated to be 830 m/s, which is higher than the above initiation velocity for most explosives. However, the shock pressure from a slug of water is much less than that of metals impacting at the same velocity. A study by Mader in 1981 determined that the initiation of explosives by a liquid jet depends on the product of $\tilde{n}V^2d$ (\tilde{n} = density of liquid, V = jet velocity, d = impactdiameter).

For an abrasive waterjet with 0.014" orifice, 0.043" mixing tube, 50,000 psi water pressure, and 0.57 kg/min of 80 mesh garnet abrasive, the product of nV^2 d is calculated to be 7.524x10⁵ kg/ s^2 . To be on the safe side, the density and velocity of the three phase mixture (air, water, abrasive) are assumed to be equal to those of water, knowing they are much less. This value is way

below the published value of 1.50x10⁸ kg/s² for PBX-9404, a very sensitive high explosive. It is also below the value of $8.6 \times 10^7 \text{ kg/s}^2$ – the "one chance in a million" accident criterion.

To verify the safety of waterjet demilitarization operations, 50 waterjet impact tests at 1,000 MPa (145,000 psi) were done on TNT and PETN explosives. No denotation occurred. About 500,000 high explosive projectiles were also successfully cut with abrasive waterjets. An independent study by US National Research Council, on behalf of the US Army, reached the following conclusion:

"The use of high pressure water or ammonia to cut explosive-loaded ordnance and/or to wash out energetic materials from ordnance casings is a proven technology."

* Miller, Paul L. (2001) Impact initialization mechanisms of high explosive materials during waterjet demilitarization, in Mohamed Hashish (Ed.), Proceedings of the 2001 WJTA American Waterjet Conference, Minneapolis, Minnesota, USA, August 18-21.

Article reprinted with permission from the Quality Waterjet Newsletter, January 9, 2007, published by QualJet LLC, www.qualjet.com.

See related graphics on the following page 13.

2007 American WJTA Conference And Expo

Preliminary Schedule Of Events

Sunday, August 19, 2007

| ····, | |
|--------------------|---|
| 8:00 a.m Noon | Pre-Conference Workshop* |
| Noon - 1:30 p.m. | Luncheon For Workshop |
| | Participants* |
| 1:30 p.m 5:00 p.m. | Workshop (continued) |
| 7:00 p.m 9:00 p.m. | Welcoming Reception In The Exhibit Hall |
| | Exhibit Officially Opens* |

Monday, August 20, 2007

| | · · · , · · · · · · · · · · · · · · · · · · · | |
|---|--|--|
| | 8:00 a.m 10:00 a.m. | Live Demonstrations |
| | 10:00 a.m 11:30 a.m. | Poster Session in Exhibit Hall |
| | 10:00 a.m 5:00 p.m. | Exhibits Open |
| | 10:30 a.m 12 Noon | Waterjet Boot Camp |
| | 11:30 a.m 1:00 p.m. | Lunch In Exhibit Hall* |
| | 1:30 p.m 4:00 p.m. | Waterjet Boot Camp |
| | 1:30 p.m 5:00 p.m. | Research and Development Paper Presentations |
| | 5:00 p.m 6:00 p.m. | WJTA Membership Meeting |
| | 7:30 p.m 10:30 p.m. | Awards Presentation/Party* |
| 1 | Tuesday, August 21, | 2007 |
| | 8:00 a.m 10:00 a.m. | Live Demonstrations |
| | 10:00 a.m 11:30 a.m. | Poster Session in Exhibit Hall |
| | 10:00 a.m 1:30 p.m. | Exhibits Open |

| n | - 1:30 p.m. | Exhibits Open | |
|---|-------------|----------------|--|
| | 4 0 0 | M/ / 1 / D / O | |

10:30 a.m. - 1:30 p.m. Waterjet Boot Camp

11:30 a.m. - 1:30 p.m. Luncheon In Exhibit Hall*

1:30 p.m. - 5:30 p.m. Research and Development Paper Presentations

*Ticket will be required.

Safety Of Waterjets For Demilitarization, from page 12

| | Explosive | Relative Sensitivity |
|-------------------|-----------|-------------------------|
| \wedge | PETN | 37 |
| / | RDX | 54 |
| ٦٢ | Tetryl | 67 |
| | PBX 9404 | 68 |
| | OCTOL | 94 |
| | PBXN-105 | 97 |
| | CYCLOTOL | 101 |
| | COMP B | 105 |
| wore Sensitive | TNT | 174 |
| | | |

Explosive Sensitivities (Petersen, 1982)



TNT Samples Shot at 1,000 MPa

Candidates Sought For 2007 WJTA Awards

You are invited to submit candidates for the special awards that are presented biennially by the WaterJet Technology Association to honor a company, organization or individual who has made a significant contribution to the industry through accomplishments that directly enhance waterjet technology and the industry as a whole. A list of previous WJTA award recipients appears below.

Candidate nominations must be received no later than July 2, 2007. The award recipient(s), to be selected by the Awards Committee of the WaterJet Technology Association, will be honored at a presentation ceremony on Monday, August 20, 2007, in conjunction with the 2007 American WJTA Conference and Expo in Houston, Texas.

An official form for candidate nominations appears on page 18. Complete one form for each nomination submitted. Please make additional copies of the form as needed. Completed nomination forms may be faxed to (314)241-1449 or mailed to the WaterJet Technology Association, 906 Olive Street, Suite 1200, St. Louis, MO 63101-1434, USA.

Previous Award Recipients

| 1981 | Pioneer Award | Jacob Frank (deceased) |
|------|------------------|--|
| 1983 | Pioneer Award | H.D Stephens, Bedford, England |
| 1985 | Pioneer Award | William Cooley (deceased) |
| 1987 | Pioneer Award | Norman Franz, Ph.D., Vancouver, BC, Canada |
| 1989 | Pioneer Award | Richard Paseman, Houston, TX |
| 1991 | Pioneer Award | John H. Olsen, Ph.D., Kent, WA |
| 1993 | Pioneer Award | Fun-Den Wang, Ph.D., Golden, CO |
| | Safety Award | David Summers, Ph.D., Rolla, MO |
| | | NLB Corporation, Wixom, MI |
| | Service Award | George A. Savanick, Ph.D., Apple Valley, MN |
| | | Mohan Vijay, Ph.D., Gloucester, ON, Canada |
| | Technology Award | Mohamed Hashish, Ph.D., Kent, WA |
| | | Autoclave Engineers, Erie, PA |
| | | Hammelmann Corporation, Dayton, OH |
| 1995 | Pioneer Award | George Rankin, Houston, TX |
| | Safety Award | Autoclave Engineers, Erie, PA |
| | Service Award | Thomas J. Labus, Lake Geneva, WI |
| | Technology Award | Thomas J. Kim, Ph.D., Kingston, RI |
| 1997 | Pioneer Award | David A. Summers, Ph.D., Rolla, MO |
| | Service Award | Andrew F. Conn, Ph.D., Baltimore, MD |
| | Technology Award | Prof. Dr-Ing. Hartmut Louis, Hannover, Germany |
| 1999 | Pioneer Award | Mohamed Hashish, Ph.D., Kent, WA |
| | Safety Award | Bruce Wood (deceased) |
| | Service Award | John Wolgamott, Durango, CO |
| | Technology Award | Ryoji Kobayashi, Ph.D., Ishinomake, Japan |
| 2001 | Pioneer Award | George A. Savanick, Ph.D., Apple Valley, MN |
| | Technology Award | Richard Ward, Kent, OH |
| 2003 | Pioneer Award | Pat DeBusk, LaPorte, TX |
| | Service Award | Mohamed Hashish, Ph.D., Kent, WA |
| | Technology Award | Ernest S. Geskin, Ph.D., Newark, NJ |
| 2005 | Pioneer Award | Hartmut Louis, DrIng., Germany |
| | Safety Award | TurtleSkin WaterArmor, New Ispwich, NH |
| | Service Award | NLB Corporation, Wixom, MI |
| | Technology Award | Jay Zeng, Ph.D., Kent, WA |

February 2007

Upgrade Available To FlowMaster 6.0 And Higher Users

F low International Corporation (NASDAQ: FLOW), a worldleader in the development and manufacture of ultrahigh-pressure (UHP) waterjet technology, has announced the availability of FlowMaster 6.31, an upgrade to FlowMaster 6.30, Flow's innovative Windows®-based waterjet control system.

FlowMaster 6.31 provides for performance improvements in FlowPath and FlowCut, two software products within FlowMaster's software suite. FlowMaster is Flow's intelligent easy-to-use waterjet control system that includes an integrated database of cutting parameters for virtually any material and thickness. FlowMaster gives users unparalleled flexibility to automatically program and path a part or select easy-to-use tools to quickly customize advanced designs and tolerances. Additional features include innovative cutting models for the highest waterjet pressure available - 87,000 psi - available only from Flow.

"Flow's software is one of the most innovative, feature-rich software packages found in manufacturing today," said Chris Maier, Product Manager, Flow International. "Our strategy of continually improving our software to keep pace with waterjet innovations such as speed improvements, the ability to customize taper on arcs, 87,000 psi cutting and semi-auto pathing help customers stay competitive by improving their productivity." The FlowMaster 6.31 upgrade is available at no additional cost to all FlowMaster 6.0 and higher users.

To download, log onto www.flowparts.com.

2007 American WJTA Conference and Expo August 19-21, 2007

Marriott Houston Westchase, Houston, Texas

- Live, Onsite Demonstrations of a variety of waterjet applications, including cleaning, paint/coating removal, concrete preparation, and testing the durability of safety equipment, and industrial vacuum/air moving operations.
- Waterjet Expo featuring displays of waterjetting equipment, systems and supplies and industrial vacuum/air moving vehicles.
- Waterjet Boot Camp—Industry experts offer information and suggestions on ways to help contractors buy smart, improve efficiency and generate profitable new business. Sessions are presented in the exhibit hall so participants can alternate between viewing exhibits and catching sessions of interest.
- Waterjet Technology: Basics and Beyond Pre-Conference Workshop—Start with the basics and follow up with an in depth look at waterjet applications: Surface Preparation, Cleaning Applications, and Cutting Applications.
- Emerging Technology, New Applications—Hear some of the world's foremost engineers and researchers share new developments in applications, mechanics, equipment, and procedures.

Hotel Reservations at the Marriott Houston Westchase. The Marriott Houston Westchase, 2900 Briarpark Drive, Houston, Texas 77042, is the central location for the WJTA Conference and Expo activities. The Marriott is a **smoke-free** facility. For reservations, call toll-free **1-800-452-5110** or contact the Marriott directly at **1-713-978-7400**. Be sure to identify yourself as attending the WaterJet Technology Association Conference to receive the special group rates of **\$109 single/\$119 double occupancy**. August 10, **2007**, is the deadline for guaranteed room availability. Reservations received after August 10, 2007, will be confirmed on a space available basis. Rooms may still be available after August 10, but not necessarily at the rates listed above.

The Hilton Houston Westchase, an alternate hotel, is located two blocks from the Marriott at 9999 Westheimer, Houston, Texas 77042. Smoking and non-smoking rooms are available. For reservations, call 1-713-974-1000. Be sure to identify yourself as attending the WJTA Conference to receive the special group rate of \$114 single or double occupancy. August 6, 2007, is the deadline for guaranteed room availability. Reservations received after August 6, 2007, will be confirmed on a space available basis. Rooms may still be available after August 6, but not necessarily at the rates listed above.

Visit WJTA's website, www.wjta.org, for updated Conference information or contact: WJTA, 906 Olive Street, Suite 1200, St. Louis, MO 63101-1434, phone: 314-241-1445, fax: 314-241-1449, email: wjta@wjta.org

StoneAge Product Developments

The new **Raptor Self-Rotary Nozzle** will be replacing the RJV Self-Rotary Nozzle. Similar to the RJV, the new Raptor self-rotary nozzle is designed to clean pipes ranging in sizes from 3 inch to 12 inch. The Raptor will be offered for either 15K psi or 20K psi and have a maximum flow capacity of 60 gpm, nearly twice the flow of the RJV. The same accessories for centering the tool in different pipe sizes will be available, as well as different head options. The RJV will not appear in the next catalog, but maintenance parts will be available.

The new **OC8 holders and OC8 carbide inserts** are recommended for use when filtration is poor, abrasive solids are present or for very high flow applications. These nozzle tips are offered for both 15K psi and 20K psi connections. The replaceable carbide inserts are available in large orifice diameters to handle high flows and offer a long taper to provide excellent jet quality and distance. **OC8 Flow Straighteners** reduce turbulence in the water, which helps provide better jet quality and increased production. Additional straighteners are available by request.

Descaling jets can improve productivity in pipes that have hard scale build-up. StoneAge now stocks **descaling heads** that offer two additional ports at more aggressive angles for the WG, WH, and WS models of **Warthog tools**.

StoneAge engineers have developed an improvement that can extend the life of the**WT-3/8 Warthog**. Four carbide inserts are epoxied into pockets flush with the outside diameter of the tool. The carbides act as a protective barrier when the WT-3/8 Warthog rotates against the wall of a pipe.

Visit www.stoneagetools.com to view clips of waterblast tools being used in a variety of applications, as well as custom projects by application type. For more information, email customerservice@stoneagetools.com or call (970) 259-2869.

J.D. Frye Joins StoneAge

S toneAge is pleased to announce the addition of Mr. J.D. Frye as the company's "Manufacturer's Representative" for the Gulf Coast Region. Mr. Frye has over 35 years of engineering experience in the waterblast industry. Most importantly, he has worked and understands both worlds, that of being a cleaning contractor and an equipment manufacturer.

Mr. Frye will not be involved in sales, instead his experience and knowledge of StoneAge products will be available as a resource for our distributors and customers.

To contact Mr. Frye, call 281-222-9076, or email him at stoneage_tech_rep@msn.com.



Jetstream Introduces New Catalog

Jetstream of Houston, manufacturer of high-quality waterblasters, parts and accessories, has just introduced a new detailed catalog that features more than 15,000 waterblasting products and parts for pressures up to 15,000 psi.

"This new catalog provides far more than just a part number and a snapshot," said Mike Bullard, parts marketing specialist, Jetstream. "It helps customers select the right product for the job at hand by giving them the same data and specifications our experts see."

Bullard explained that selecting certain waterblaster accessories and parts, such as nozzles, can be complex. "This catalog features hundreds of flow charts, replacement part diagrams, and technical specifications that can help customers easily find the replacement part needed or decide on the best product for a particular application."

"Of course, our Jetstream solutions providers are still available to assist customers in product selection," Bullard said. "We see the catalog as just one more value-added service one more way for our customers to get exactly what they need to work productively and safely.

The new Jetstream catalog is the third and final in a series that previously featured units, parts and accessories for 40,000 psi and 20,000 psi product lines. The 15,000 psi catalog features everything from the latest Jetstream C Series Compact Diesel Waterblast Units to a vast selection of fittings and adapters, including ³/₄-inch and 1-inch pipe threaded fittings specially engineered for reliable operation at 15,000 psi.

Also included is a comprehensive offering of fluid ends for converting a

worn or inefficient pump to the acclaimed Jetstream UNx design. Conversions are available for many of the industry's leading manufacturers, including NLB, Gardner-Denver and Woma.

Products in the catalog are divided into categories that include units, pumps and fluid ends, guns and valves, nozzles, hoses and lances, fittings, and safety and surface cleaning tools.

Customers can request a copy of the catalog from the literature section

of the Jetstream Web site (www.waterblast.com) by calling 1-800/231-8192 or by e-mailing Lisa Astrello at lastrello@waterblast.com. A PDF of the catalog is also available for downloading from the Jetstream Web site.

Jetstream of Houston, LLP is a division of Federal Signal Corporation's (NYSE:FSS) Environmental Products Group, which includes Elgin Sweeper, Guzzler Manufacturing and Vactor Manufacturing.

WJTA Welcomes New Members, from page 10

Corporate Individual

Wayne Harris

KMT Aqua - Dyne, L.P. 3620 West 11th Street Houston, TX 77008-6004 Phone: (713)864-6929 Fax: (713)864-0313

Bradley Lawrence

KMT Waterjet Systems 438 South River Birch Drive Springfield, MO 65809 Phone: (417)866-4822 Fax: (417)866-6022

Haisar Shehadeh

Hydrajet Technologies 2477 Lakeland Road Dalton, GA 30720 Phone: (954)805-4246 Fax: (706)428-0049

Tom Ulery

Parker Hannifin Corporation 520 Ternes Avenue Elyria, OH 44035 Phone: (440)366-1201 Fax: (440)365-6948 Individual

Jane Cooper Cooper Hong, Inc. 4N701 School Road, Suite A St. Charles, IL 60175 Phone: (630)377-2555 Fax: (630)377-2554

T.J. Maloy Waterjet Cutting, Inc. 2711 Karsten Ct. S.E. Albuquerque, NM 87102 Phone: (505)842-9500 Fax: (505)842-9502

Jeff Wallace

Maxpro South 10801 Hammerly #202 Houston, TX 77043 Phone: (713)365-9778 Fax: (713)365-9809

Hyan Soo Yoo

Ire Remodeling & Construction Gum Gang City Home # 601 Chang Dong 698-12 DoBong Gu, Seoul 132923 Korea, Republic of Phone: [82](2)904-2038 Fax: [82](2)904-2036

An Introduction To Air-Mover Vacuum Trucks, from page 11

top side of the filter bags, since this generally indicates that there is a hole in the bag. Filter bags are normally the most abused and overlooked part of a unit and they are one of the most critical components.

Grease the unit according to intervals recommended in the maintenance manual. Since most units have no more then ten (10) grease fittings excluding the chassis components, greasing is not a time-consuming task.

Check the oil levels on the vacuum pump, transfer case and the hydraulic system. This can usually be done by looking at a sight glass or sight tube.

Keeping the unit clean will not only make it easier to perform routine maintenance, but will also add to the equipment's life.

All gasket surfaces should be kept clean. Both the gasket contact surface

and the surface it seals against should be wiped off as needed. Tailgate gaskets are regularly overlooked and abused. Simply wiping off the surfaces and keeping sharp edged material off of them prolongs their life.

Listening to the unit while it is operating can provide valuable information to maintenance personnel. Potential problems can frequently be heard before they become mechanically visible. It is helpful to keep a small notebook in the cab to document when an operational symptom is noticed rather than try to recall it at a future date. Recording the time a problem was detected, the job or operation being performed, the type of material being vacuumed, the length of running time before noticing the problem and if it reoccurred under the same or different conditions will enable malfunctions to

be diagnosed quickly and speed corrective action.

A Sound Investment

By understanding an air-mover's operation and capabilities as well as its operational requirements, users are well prepared to optimize their investment. With the host of equipment options available, they can customize the unit to meet specific needs and enhance their productivity and profitability.

Readers who would like a complimentary <u>Air-Mover Operator</u> <u>Daily Checklist</u> are invited to request one by Emailing sales@superproductscorp.com

Additional information will be available in *Recommended Safety Practices for Vacuum Trucks*, which is now being developed by the WJTA in conjunction with the industrial vacuum industry.

Engineering Your Competitive Edge IN ABRASIVE WATERJET CUTTING



AWJ Nozzle Performance Comparison



ROCTEC° AWJ Nozzles

ROCTEC° 100 and 500 nozzles set the industry standard for long life and unsurpassed performance! Engineered to provide:

- Consistent wear and
- performance every time
- Less downtime
 Greater dimensional accuracy
- Faster cutting speeds
- · Superior overall value and performance
- Cost-effective performance under extreme conditions



Abrasive Flow Products

2879 Aero Park Drive, Traverse City, MI 49686 USA Phone: 800-662-2131 or 231-946-2100 Fax: 800-662-2132 or 231-946-3025 E-mail: traversecity.service@kennametal.com



February 2007

2007 WJTA Awards Nomination Form

Instructions: Complete sections below and submit a narrative (300-word maximum) to support your nomination on a separate sheet of paper. Please print or type all information.

I nominate the following company, organization, or person as a candidate to receive a 2007 WJTA Award (please print or type full individual, company or organization name):

company, organization, or person

Distinguished Pioneer Award

The nominee must:

- Have made contributions to the waterjet industry;
- Have made contributions to the achievement of the goals of WJTA;
- Have high moral character;
- Have strong personal and business ethics;
- Be dedicated to the future of the waterjet industry and to the growth of WJTA.

□ Service Award

How has the nominated company, organization or individual contributed in time and talent toward improvement in the WaterJet Technology Association?

□ Technology Award

What has the nominated company, organization or individual done to introduce new and innovative ideas in engineering or manufacturing? This could include, but is not limited to, new products, new manufacturing techniques, patents . . . any unique activity that advanced the technology of the waterjet industry.

□ Safety Award

What has the nominated company, organization or individual done to introduce new and innovative ideas in safety? This could include, but is not limited to new products, new concepts, new safety techniques . . . any unique activity which increases the overall safety of waterjet equipment.

| CANDIDATE: | | Company: | |
|--|--|---|---|
| Address: | | | |
| City: | State: | Country: | Postal Code: |
| Phone In US/Canada () | | Fax() | |
| area code Phone Outside US/Canada [] () country code city code | | area code Fax [] (country code city cod |)de |
| CANDIDATE SUBMITTED BY: | | Company: | |
| Address: | 0 | Quarter | DestalOester |
| Phone In US/Canada ()area code | State: | Country: Fax () area code | Postal Code: |
| Phone Outside US/Canada [] () | | Fax[](| _)de |
| Nomina For a prompt response, fax completed form | ations must be r to (314)241-1449, or | received no later than July mail to the WJTA, 906 Olive Street | 2, 2007. t, Suite 1200, St. Louis, MO 63101-1434, USA. |

Seven Easy Ways To Attend The 2007 American WJTA Conference And Expo

FULL CONFERENCE

Includes admission to all research and applications sessions (except Pre-Conference Workshop on Sunday, August 19), onsite live demonstrations, pass to Welcoming Reception in Exhibit Hall (Sunday, August 19), exhibits, luncheon on Monday, August 20, and Tuesday, August 21, coffee breaks, and WJTA Party on Monday, August 20. Each full registration also receives one copy of the Conference *Proceedings* on CD-ROM.

2. сомво

Includes everything listed under Full Conference **PLUS** a Pre-Conference Workshop on Sunday, August 19.

3. SAVE \$ ON MULTIPLE EMPLOYEE FULL/COMBO REGISTRATIONS

Companies that purchase three or more full or combo registrations receive a special discount for each additional employee registered after the first two. To take advantage of the special discount, register the first two (2) employees from your company at the regular FULL/ COMBO rates and receive the discounted rate for the third and subsequent employee registrations.

DAILY ATTENDANCE

Includes admission to all research and applications sessions, onsite live demonstrations, exhibit hall, coffee breaks, and luncheon on that day. Register for one day and receive a "50% off" coupon for the 2007 Conference Proceedings on CD-ROM. Register for two days and the Proceedings are included. **NOTE:** Admission to the WJTA

CANCELLATION POLICY

Party on Monday is **NOT** included in the daily registration fee, and tickets for this event must be purchased separately.

5. PRE-CONFERENCE WORKSHOP

Waterjet Technology -Basics and Beyond

Includes handout materials for workshop, coffee breaks, luncheon, and August 19 Welcoming Reception in Exhibit Hall.

6. EXHIBIT HALL and/or LIVE DEMO PASS

A \$25 exhibit hall and/or live demonstration pass for one day includes admission to the WJTA Exhibit Hall where you'll see waterjet equipment, supplies, and services, onsite live demonstrations between the hours of 8:00 a.m.-10:00 a.m., and designated contractor programs. Passes do **NOT** include luncheon in the exhibit hall. Tickets for lunch can be purchased separately.

You must purchase a ticket to attend the Welcoming Reception in the Exhibit Hall on Sunday, August 19, if you are not registered as a Full or Combo, or you are not registered for the Pre-Conference Workshop.

7. STUDENTS

The registration fee for WJTA student members is \$20. Student registration includes admittance to technical programs, onsite live demonstrations, and the exhibit hall on Monday and Tuesday, but does **NOT** include copies of the *Proceedings*, Welcoming Reception in Exhibit Hall on Sunday, August 19, or admittance to any food/social functions. **NO** discount is available for students that are not members of the WJTA. WJTA student members must be enrolled **full-time** in a university graduate or undergraduate program.

Fees will be refunded in full for cancellations received at least four weeks prior to the Conference. Cancellations received more than 10 days and less than four weeks prior to the Conference will be subject to a \$50 charge. No refund will be made for cancellations received less than 10 days prior to the Conference. However, substitutions may be made at anytime. Refunds will not be processed until after the Conference.

WJTA members and early-bird registrants SAVE up to \$120!

WJTA members receive a special discount off the regular registration fees. You will also receive a discount if your registration is postmarked or received in the WJTA office by **August 1, 2007**. Total Savings: Up to \$120!

OPTIONAL TRIP - NASA'S JOHNSON SPACE CENTER

An optional trip to NASA's Johnson Space Center is scheduled for Saturday, August 18, from 9:30 a.m.-



4:30 p.m. Buses will begin boarding a half-hour prior to departure times listed. Trip includes bus transportation, entrance to the space center and 1-1/2 hour tram tour. Lunch is not included and will be on your own.

2007 AMERICAN WJTA CONFERENCE PROCEEDINGS

The *Conference Proceedings* for 2007 will be on CD-ROM only. The two-volume books that were available in past years will not be produced.

Hotel Reservations

It's not too early to make hotel reservations for the 2007 American WJTA Conference and Expo to be held August 19-21, 2007, at the Marriott Houston Westchase Hotel, Houston, Texas, USA. For room reservations call the Marriott toll free at (800)452-5110 or direct at (713)978-7400. Be sure to identify yourself as a participant in the WJTA Conference.

> WaterJet Technology Association Telephone: (314)241-1445 Fax: (314)241-1449 Web Site: www.wjta.org

2007 American WJTA Conference And Expo Registration Form

| Name | | Member# | | THREE EASY WAYS TO REGISTER |
|---|--|---|--|--|
| Company | Title |) | | By Phone: Just call |
| Address | | Mailing Address | : 🗆 Home 🗅 Work | (314)241-1445 and have |
| CityStateCount | try | Postal Cod | е | tion ready. (MC/VISA/ |
| Telephone # []() | Fax # [](|) | | AMEX/Discover ONLY). |
| E-mail Address: | | | | By Fax: Fill out the |
| Information for name tag | | | | credit card information |
| Print name as you | u wish it to appear on | your name tag | | and call our 24-hour fax number at: (314)241- |
| | | | | 1449. |
| Payment Method: Enclosed is my check, payable to WaterJee | | | RS ONLY). | By Mail: Fill out the |
| | | | | with applicable payment |
| | LĄ | | | to: WJTA, 906 Olive Street Suite 1200 St |
| Print name as it appears on card | | Cardholder's signature | | Louis, MO 63101-1434. |
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| Join the WaterJet Technology Association now and | | IBER | NONMEMBER | 2 |
| registration fees. | By | After | By A | After |
| | 8/1/07 | 8/1/07 | 8/1/07 8 | /1/07 |
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| Seven Ways To Register | | | | |
| | \$ 495 | \$ 555 | \$ 555 \$ | 615 = \$ |
| | \$ 665 | ¢ 725 | ¢ 725 ¢ | 785 – ¢ |
| | ψ 000 | ψ 720 | ψ 120ψ | 700 ψ |
| Sunday - Pre-Conference Workshop (includes lunch) | \$ 280 | \$ 340 | \$ 340\$ | 400 = \$ |
| Monday (includes Luncheon in Exhibit Hall) | \$ 265 | \$ 295 | \$ 295\$ | 325 = \$ |
| Tuesday (includes Luncheon in Exhibit Hall) | \$ 265 | \$ 295 | \$ 295\$ | 325 = \$ |
| Exhibit Hall/Live Demo Pass | | | | |
| Monday (does NOT include Luncheon in Exhibit Hall) | \$ 25 | \$ 25 | \$ 25\$ | 25 = \$ |
| Tuesday (does NOT include Luncheon in Exhibit Hall) | \$ 25 | \$ 25 | \$ 25\$ | 25 = \$ |
| Student (WJTA members ONLY) | \$ 20 | \$ 20 | N/A | N/A = \$ |
| MULTIPLE CORPORATE REGISTRATIONS (Applies to third and subset | equent registrants from s | same company) | | |
| Full Conference ONLY | \$ 445 | \$ 505 | \$ 505\$ | 565 = \$ |
| Combo (Full Conference PLUS Preconference Seminar) | \$ 615 | \$ 675 | \$ 675\$ | 735 = \$ |
| WJTA MEMBERSHIP (US, Mexico, Canada) | 60 Individual | 3 \$20 Student □ | \$400 Corporate | = \$ |
| WJTA MEMBERSHIP - International (all other countries) | 80 Individual | 3 \$40 Student □ | \$460 Corporate | = \$ |
| Conference Proceedings Copies x \$89.00 | | | | = \$ |
| 2007 American WJTA Conference registrants may purchase extra copies of t CD-ROM for only \$89. Regularly priced at \$109 you will SAVE \$20. Offer | he Conference Proceed | ings on | ECIAL OFF | ER! |
| | | 361 | | |
| EXTRA TICKETS — The Full and Combo registrations include one ticket evening) and Awards Presentation/Party (Monday e Sunday daily includes Welcoming Reception in Exh | per registration for the E vening). Each Daily reg nibit Hall. Additional tick | xhibit Hall Luncheons (Mon istration includes a luncheor ets may be purchased as fo | day and Tuesday), Welco n ticket for the day register Ilows: | ming Reception in Exhibit Hall (Sunday ed: Sunday, Monday and/or Tuesday. |
| Welcoming Reception in Exhibit Hall - Sunday | \$ 60 | \$ 60 | \$ 60\$ | 60 = \$ |
| Luncheon in Exhibit Hall - Monday or Tuesday or both (\$40) | \$ 20 | \$ 20 | \$ 20\$ | 20 = \$ |
| WJIA Awards Presentation/Party - Monday | \$ /5 | \$ /5 | \$ /5\$ | /5 = \$ |
| | | | TOTAL ENC | LOSED § |
| | | | | |

Tom Johnson, Jeffrey L. Hohman Join Flow International Corporation

F low International Corporation, a leading developer and supplier of ultrahigh-pressure waterjet products, has appointed Tom Johnson as executive vice president and general manager of the Flow Waterjet Asia. Johnson will be responsible for all of Flow's waterjet operations in Asia, which includes Taiwan, China, Japan and Korea.

As head of Flow Waterjet Asia, Johnson provides leadership and focus to Flow International's ongoing efforts in Asia to accelerate growth through new application development, new product introduction for existing markets, and new service offerings.

Johnson, the senior VP of operations for Flow Waterjet America's for the last ten years, came to Flow International Corporation from PACCAR, Inc. where he was plant manager for Kenworth Truck Company's truck manufacturing operations in Washington State. At Flow, Johnson will oversee all of Waterjet Asia's business including standard and custom waterjet cutting systems, water management systems, aftermarket products, and special applications development and equipment.

Flow International has also appointed Jeffrey L. Hohman as executive vice president and general manager of the newly created Waterjet Americas Division. Hohman is responsible for all of Flow's waterjet operations in North and South America.

Hohman provides leadership and focus to Flow's ongoing efforts in the Americas to accelerate growth through new application development, new product introduction for existing markets, and new service offerings.

Hohman comes to Flow with a strong background in pump development and manufacturing at IDEX, a leading company in the fluid power industry. At Flow, Hohman will oversee all of Waterjet Americas' standard waterjet cutting systems, custom aerospace systems, ultra high pressure water pumps and water management systems, aftermarket products, and special applications development and equipment.



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WaterJet Technology Association's Order Form for Publications/Products

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| City State | your credit card information your credit card information ready. (MC/VISA/Am. Exc |
| Country Bostal Code | Discover ONLY). |
| Country Postal Code Phase # []() Fau # []() | American Express Discover By Fax: Fill out the order |
| Phone # []() Fax # []() | Credit form with your credit card information and call our 2/ |
| Email(to receive shineing confirmation) | _ Card # hour fax number at: |
| (to receive simpling commitmation) | Exp. Date |
| Billing Address (if different from above): | By Mail: Fill out the order form and mail with |
| Address | Print name as it appears on card applicable payment to: |
| City State | |
| Country Postal Code | Cardholder's signature 63101-1434. |
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| | Mon Member Shipping & Member Price Price Handling |
| Proceedings CD-ROM of The 2005 W.ITA American Wateriet Conference (2005) | $\varpi $ \$ 109.00 \$ 129.00 \$ 8.00 = \$ |
| Proceedings CD-ROM of The 2003 WJTA American Wateriet Conference (2003) | @ \$ 35.00 \$ 55.00 \$ 8.00 = \$ |
| Proceedings CD-ROM of The 2001 WJTA American Wateriet Conference (2001) | @ \$ 10.00 \$ 30.00 \$ 8.00 = \$ |
| Proceedings Book & CD-ROM of The 10th American Wateriet Conference (1999) | \emptyset \$ 10.00 \$ 30.00 \$ 8.00 = \$ |
| Proceedings Of The 9th American Wateriet Conference (1997) | ∞ \$ 10.00 \$ 25.00 \$ 8.00 = \$ |
| Proceedings Of The 8th American Wateriet Conference (1995) | @ \$ 0.00 \$ 0.00 \$ 8.00 = \$ |
| Proceedings Of The 7th American Wateriet Conference (1993) | @ \$ 0.00 \$ 0.00 \$ 8.00 = \$ |
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