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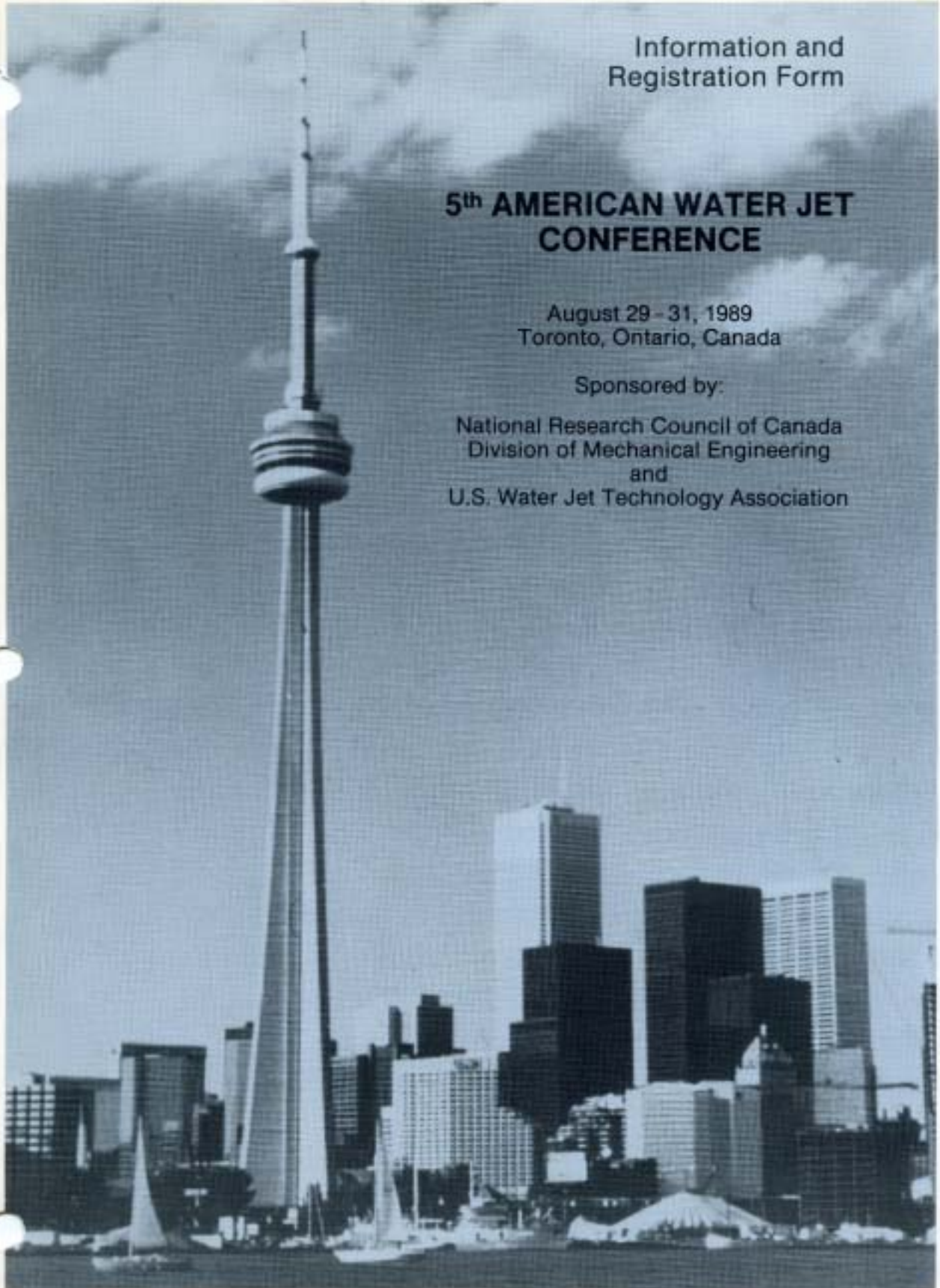
Information and
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**5th AMERICAN WATER JET
CONFERENCE**

August 29 - 31, 1989
Toronto, Ontario, Canada

Sponsored by:

National Research Council of Canada
Division of Mechanical Engineering
and
U.S. Water Jet Technology Association



818 Olive Street, Suite 918 • St. Louis, MO 63101, USA • 314/241-1445

Fifth American Water Jet Conference To Be Held In August

The U.S. Water Jet Technology Association will hold its fifth biennial conference August 29-31, 1989, at the Inn on the Park in Toronto, Ontario, Canada. This hotel is located in a park and is very beautiful, especially in the summer. All functions, including a banquet, will take place in the hotel. Entertainment will be provided during the banquet. The papers accepted for presentation will be published in a hard-bound volume and will be distributed to the delegates at the conference.

International Journal of Waterjet Technology

Although individual subscriptions are welcome, we need corporate donations and institutional subscriptions to accomplish the publication of this journal. The National Research Council of Canada, as a patron, has assisted in several ways in launching this journal. Congratulations to AUTOCLAVE ENGINEERS, Erie, PA, who became a PATRON by donating \$1,000. We look forward to having more patrons to support this worthy cause. Make your checks payable to "International Journal of Water Jet Technology" and mail to the Editor, Dr. Mohan Vijay.

Dr. M. M. Vijay, Editor
Gas Dynamics Laboratory
National Research Council of
Canada
Ottawa, Ontario, Canada, K1A 0R6

Jet Cutting At Cleveland State University

by: E. Earl Graham, Associate Professor, Department of Chemical Engineering

A fluid jet cutter, supplied by Belcan Corp., has been installed at the Advanced Manufacturing Center at Cleveland State University for applied testing and research. A brief summary of this work is presented here.

Studies of the water jet have been made using both still photography and high-speed motion pictures. The still photographs were obtained using two separate flash units at a speed of 1/20,000 of a second. These photographs have excellent resolution and clearly show the important sections of a jet including the coherent core region where the jet is strongest and the spreading of the jet. Photographs were obtained as a function of nozzle diameter and pressure. These photographs were used to develop a correlation of nozzle velocity, and coherent core length. A typical photograph is shown at right. High-speed motion pictures (1,000 frames/second) were also taken. They are most useful in obtaining information on how the jet interacts with the work material. Very valuable studies were made of the jet cutting multiple layers of leather showing clearly the cause of the splash back resulting when the two layers are separated.

A model based on the fundamental equations of Hashish and du Plessis was developed and tested. The work was extended to include the study of non-Newtonian fluids obtained by addition of polymeric additives to water. Extensive experimental data for the cutting of woods, plastics, and metals have been applied to the equations of Hashish and de Plessis resulting in correlations for two key parameters: the coherent core length and the damping coefficient. This has led to a general method for predicting the depth of a water-jet cut that requires no prior experimental data. Using only basic physical properties of a solid material, the depth of cut can be "predicted" for a given set of operating conditions including feed rate, nozzle diameter, stand-off distance and pressure. A paper on this work has been submitted to the ASME *Journal of Engineering for Industry*.

Further work is in progress to extend the results to a wider range of materials including metals and a more in-depth analysis of the jet stability and effect of nozzle diameter on jet stability will be made using the high-speed motion camera.



0.01" Nozzle - 32,000 psi

From The President's Desk

Recently I had the illuminating experience of responding to an editorial critique of a piece of my writing. This exercise taught me that I need to be aware that scientific jargon can sometimes hinder attempts to create comprehension in the mind of the reader.

My report was titled "An Abrasive Jet Drill for Hard Rocks." The editor was confused by the term abrasive jet and suggested that a more descriptive title would be abrasive-enhanced-waterjet drill. We who closely follow developments in water-jet cutting know that these terms are synonymous but the editor was correct in suggesting that people who are interested in becoming informed about jet cutting would get the correct idea faster if the title were changed.

This drill uses Schedule-160 steel pipe. The editor asked: Whose schedule is this? In all my years of using pipe, I had never thought of the origin of pipe-thickness schedules. I gather from reading handbooks and talking to pipe suppliers that these are ANSI (American National Standards Institute) pipe schedules. It is surprising how much can be learned by explaining the basics of a technology to the uninitiated.

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Jet Additive For Underwater Cleaning

by: W. Glenn Howells, Ph.D., Berkeley Chemical Research, Inc.,
P.O. Box 9264, Berkeley, California 94709, Phone: (415) 526-6272

In 1966, G.E. Gadd, of the Ship Division, National Physical Laboratory, of the United Kingdom, published a paper in the prestigious scientific journal *Nature* on the "Reduction of Turbulent Friction in Liquids by Dissolved Additives." At the same time, another English scientist was conducting studies for a Ph.D. degree in the Department of Applied Mineral Sciences at the University of Leeds. In the studies at Leeds, Dr. David A. Summers, now Curators' Professor and Director of the High-Pressure Waterjet Laboratory at the University of Missouri-Rolla, was examining the effects of dissolved polymeric additives in high-pressure waterblasting.

The results of these apparently unrelated studies formed the basis for a preliminary experiment conducted by Berkeley Chemical Research in conjunction with Chevron U.S.A. Encrusted submerged oilwell liners were cleaned in above-ground-level tanks with high-pressure waterjets or with a polymeric additive SUPER-WATER® concentrated industrial water-blasting additive. The results were better than were hoped for. A 3,000 ppm (0.3 pct) solution of SUPER-WATER® brought about a 15- to 30-fold increase in effective standoff distance (i.e., the distance between the water-jet nozzle and the target).

These preliminary results were of sufficient interest to prompt a more detailed study by Casper Zublin, now of Zublin & Co., Bakersfield, California. Zublin reported his findings at the Second U.S. Water Jet Conference held at the University of Missouri-Rolla in 1983.

Zublin confirmed the increase in effective standoff distance that could be achieved using SUPER-WATER® and examined it from a mathematical point of view. From data he had previously obtained over a decade of study, including consideration of surface bonding, internal bonding, material strength, hardness, lamination susceptibility, and impact failure, Zublin was able to develop a set of required values, expressed as cleaning energy flux, necessary for removing a wide range of deposits that occur in oil wells. Thus, barium sulfate was determined to be the most intractable deposit and had the highest value of cleaning energy flux (7,000) for successful removal with descending values associated with deposits such as silicates, calcium carbonate, calcium sulfate, carbonate sulfate, silica complexes and so on to non-thixotropic materials (500). The marked improvement that could be obtained with SUPER-WATER® was evident and was graphically presented. Unfortunately, because of particular mathematical assumption, later to be found in error, the true extent of the improvement with SUPER-WATER® was underestimated by a factor of 100.

Then, however, Zublin published an additional paper on downhole cleaning in *Petroleum Engineer International*. He pointed out and presented in graphical form the interrelationship between standoff distance and power of a submerged water jet and how SUPER-WATER® greatly enhances power efficiency.

Quite clearly, although this discussion has centered on internal cleaning of oilwell liners, in a general sense, the findings have equal applicability to removal of deposits under many submerged conditions and other operations. There would appear to be some potentially important applications for SUPER-WATER® in our industry and if any *Jet News* readers would like to pursue a particular application, Berkeley Chemical Research would be pleased to cooperate.

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Short Course On Water-Jet Technology

A one-day course on the fundamentals of fluid jet technology will be held on Monday, August 28, 1989, at the Four Seasons, Inn on the Park, 100 Eglinton Ave. E, Toronto, Ontario, in conjunction with the Fifth American Water Jet Conference. This course is aimed at users and researchers and covers the basics and the applications. Subject areas of the course include a historical perspective, fluid mechanics of various types of jets, parameters which influence basic jet performance and abrasive jets. High-pressure equipment including intensifiers, plunger pumps, fittings, and hoses will also be included. Applications will include cutting, cleaning, deburring in industrial, construction, and mining environments. Water-only abrasive and water jet-assisted mechanical applications will be addressed. Integration of water jets with various forms of automation equipment, including robots will be included. Instructors for this course are composed of researchers and experienced users covering all aspects of the technology. Questions concerning the course should be directed to Prof. T. Labus, University of Wisconsin-Parkside, telephone (414)553-2114.

For additional information regarding the Fifth American Water Jet Conference see page 8.

INTERNATIONAL JOURNAL OF WATER JET TECHNOLOGY

CALL FOR PAPERS

The Premier issue of the *Journal* will go to the press in November 1989. Authors who wish to publish their papers in the Premier issue, should send three copies of their manuscripts to the editor in **English** as soon as possible, but no later than **August 31, 1989**.

The publication of the first issue has been made possible by the generous contributions, as **DONORS & PATRONS**, by:

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In order to ensure the continuation of the *Journal*, we need a lot more personal and corporate support. Please send your contributions to:

Dr. M. M. Vijay, Editor
International Journal of Water Jet Technology
Gas Dynamics Laboratory
National Research Council of Canada
Ottawa, Ontario, Canada K1A 0R6Q

Please make your checks payable to: "International Journal of Water Jet Technology."

Confined Space Entry Program Offered

The University of Findlay, Ohio, the nation's only four-year college offering a B.S.-degree program in Hazardous Materials Management is offering a three-day seminar presented in conjunction with M-Tech Co. of Cleveland, OH, on confined-space-entry procedures. The material covered includes hands-on training in the use of respiratory protection, protective clothing, hazard evaluation, and use of gas detection instrumentation relating directly to manhole, tank, and mobile car entry. This program meets the requirements of OSHA's proposed Entry Permit Confined Space as outlined in 29 CFR 1910.146. All attendees will receive a formal certificate from the university and 2.5 C.E.U.'s.

The three-day program will address the following topics: Legislation, training requirements, confined space hazards, including oxygen deficiency/enrichment, explosion, toxicity, electrical, lockouts, and others; respiratory, protection, protective clothing, and equipment, hazard evaluation, ventilative techniques, use of instruments, procedures prior to and during entry, procedures for inspection, cold and hot work, rescue procedures and permit procedures.

The program will be presented by leaders in the field of confined-space entry, monitoring and rescue. Dan Hehr is Associate Prof. of Hazardous Waste Studies at Findlay College. He has 15 years of experience in the fields of environmental training and industrial consulting. Dan has been involved with OSHA standards, voluntary compliance and worksite monitoring since 1973.

Ed Fitzgerald is Confined Space Equipment Product Manager for M-Tech Services. He has 11 years of experience with industry servicing, selling, and training on all aspects of confined-space entry.

The program will be offered June 9-11, July 18-20, Aug. 22-24, Sept. 29 - Oct. 1, and Nov. 14-16, 1989.

The fee for these sessions will be \$395, payable in advance. To register, contact:

The University of Findlay
1000 N. Main Street
Findlay, OH 45840
(419) 424-4647 (in Ohio)
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Abrasive Jet Cutting In Manufacturing



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The U.S. Army has published a report reviewing the state of the art of abrasive jet cutting in factory manufacturing applications. It explains how the equipment works, identifies the important operating parameters, and establishes the advantages and limitations of abrasive jet technology. Examples are given of current and potential applications in aircraft and spacecraft, shipbuilding, robotics, foundries, the glass industry, and the automotive industry.

Copies are available at the following address:

Rolf Anderson AMXIB-PG
U.S. Army Industrial Engineering Activity
Rock Island, IL 61299-7260

Recommended Practices for the Use of Manually Operated High Pressure Water Jetting Equipment

Copies of the U.S. Water Jet Technology Association publication, "Recommended Practices" developed by industry, government, and university representatives to the Standards Committee of the U.S. Water Jet Technology Association are available for purchase. The publication includes personnel requirements, operator training, operating procedures, equipment care and maintenance, protective clothing, personnel protection, freeze precautions, and accident precautions for manually operated high pressure water jetting equipment commonly used by industries involved with construction, maintenance, repair, cleaning and demolition work. Attention is drawn to the relevant or proposed OSHA, ASTM, and ANSI standards.

Copies are available at the following prices (excluding shipping and handling): 1-10, \$5.00 each; 11-99, \$4.00 each; 100 or more, \$3.00 each. To order, please complete the form on this page.

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818 Olive Street - Suite 918
St. Louis, MO 63101, USA
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Adversity introduces a man to himself.

- Anonymous

Fifth American Waterjet Conference set for August 29-31, 1989

The Fifth American (formerly U.S.) Water Jet Conference will be held August 29-31, 1989, at the Inn on the Park in Toronto, Ontario, Canada. A short course on water jet cutting will be held on August 28 at the Inn on the Park.

The conference is being sponsored by the U.S. Water Jet Technology Association and the National Research Council of Canada. The conference will be designed as a forum in which researchers and practitioners can make contacts, exchange ideas, and review advances in this rapidly developing technology.

There will be an exhibition hall at the Inn on the Park. Exhibitors are reminded that there is room for 25 booths and to date, five have been reserved. Firms or organizations wishing to exhibit their products or literature at the Conference, should reserve a booth now by paying the fee of \$375.00 (Canadian) per booth immediately. Please contact:

Mrs. H. Lacoste, Conference Coordinator
Conference Services
National Research Council of Canada
Ottawa, Ontario, Canada K1A 0R6A

In addition to the table top exhibition at the Inn on the Park, a technical tour will be held on the afternoon of August 30. This tour will include stops at firms in the Toronto area which specialize in water jetting and at the grounds of the Atomic Energy of Canada at Mississauga, Ontario, for a demonstration of equipment. Firms wishing to demonstrate the operation of their equipment should contact Mr. A. D. (Doug) Hink at the following address to inform him of their requirements:

Mr. A. D. (Doug) Hink, General Manager
Advanced Systems Applications
Atomic Energy of Canada, Ltd.
2251 Speakman Drive
Mississauga, Ontario, Canada L5K 1B2
Telephone: (416) 823-9040
Fax: (416) 823-6120
Telex: 06-982372

The fee for participating in the equipment demonstration is \$500.00 (Canadian) payable immediately after requesting a place. The checks should be made payable to:

"NRC - Fifth American Water Jet Conference" and mailed to Mrs. H. Lacoste, the Conference Coordinator.

A business meeting of the members of the U.S. Water Jet Technology Association will be held after the close of the afternoon session on Tuesday, August 29. The purpose of this meeting will be to elect directors and officers for the 1989-1991 biennium, to discuss changes to the publication *Recommended Practices for the Use of Manually Operated High-Pressure Water Jetting Equipment*, and other business of the Association.

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