Sunday Republican
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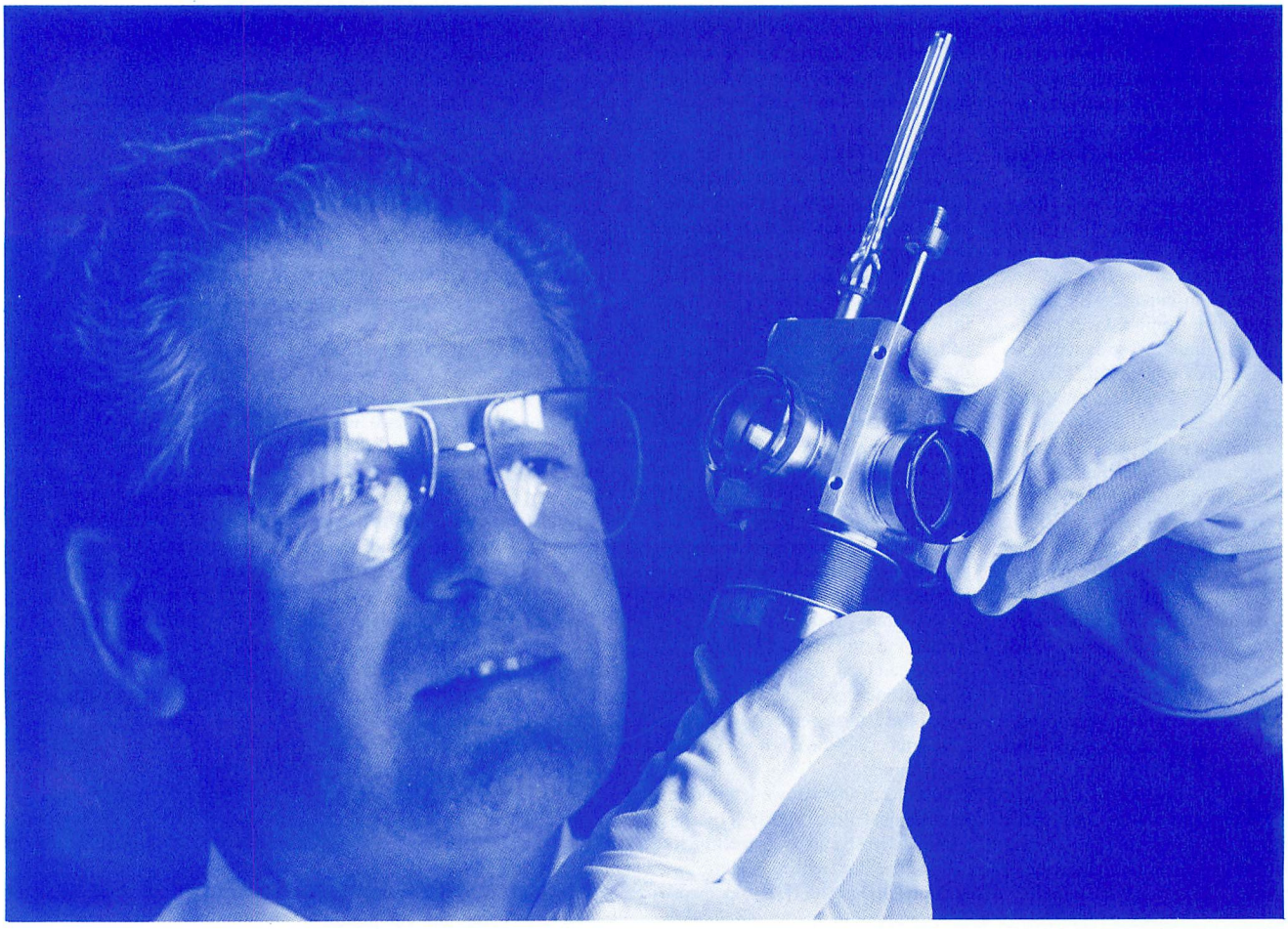
Business

Lending a hand in space



FINAL EXAM – William Howe, president of International Beam Welding, examines one of the crystal growth chambers his company has welded together for scientists at Rensselaer Polytechnic Institute.

West Side firm aids NASA research

By BARRY SCHATZ

WEST SPRINGFIELD – Space, January 1994.

Far above a welding plant at Doty Circle in West Springfield, a NASA vehicle circles the Earth.

Aboard the space shuttle are 10 vacuum-sealed, grapefruit-sized, crystal growth chambers, each containing a substance that may help unlock the secrets of what makes solid materials hard or soft, brittle or pliable.

The substance, a transparent organic material called succinonitrile, will be slowly cooled and photographed, cooled and photographed.

Twenty times the procedure will be repeated, Each time, the chamber temperature will be altered, perhaps by as little as one one-thousandth of a degree.

The photos will be examined and re-examined back on Earth as researchers seek to uncover the mystery of crystal growth—the phenomenon by which liquids change to solids and acquire traits along the way. For it is only in a world without gravity—or at the most microgravity—that scientists feel data won't be skewed, and the secrets of why one substance is strong, another weak, can be revealed.

And back on Earth, far away from theory and darkness of space, a West Springfield company will be waiting to see how its modest contribution to science will have performed.

Newton needed only the tree and an apple, Galileo just some spheres and a tower. But it is almost the 21st century now, and the Newtons of today need companies like International Beam Welding Corporation of West Springfield to help them advance their theories through the application of their unique and sophisticated skills.

"We do a lot of things that have never been done before," said William Howe, who founded International Beam Welding in 1967. "We like to say we do the impossible every day."

International Beam's most recent challenge began about 2 ½ years ago when it was given the task of welding the crystal-growing chambers designed by scientists at Rensselaer Polytechnic Institute and built by Northern Industrial Services of Albany, N.Y.

The job, which others had already failed at, required a process by which the chambers could be assembled by a means that would not contaminate them through the introduction of any foreign substances.

Lasers, which employ a light source, wouldn't work because that process is restricted to shallow welds. Braising, which involves melting an alloy at high temperatures, would contaminate the crystallizing process.

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West Side firm contributes to NASA research

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Electron beam welding was the answer since no welding material is used in the procedure. With electron beam welding, parts are joined together when a stream of electrons, accelerated to 60 percent of the speed of light, are focused on a fine spot. The bombardment of such small matter at such a high rate of speed creates localized heat, thereby welding together whatever it hits.

"It is very intricate," said Howe, while picking up a chamber in a gloved hand recently so as to minimize the level of contamination. The chambers never come in contact with human skin and will be sanitized with chemicals several times before experiments are performed on them. "It is fragile. The welding is delicate—welding heavy sections into thin sections."

Some of the welds on the chambers involved attaching material that was as fine as a human hair to material that was one-half-inch thick.

International Beam, one of about a half dozen electron beam welding operations in the Hartford-Springfield area, was recommended for the project by Northern Industrial Services, which has worked with Howe's company before.

"The work has been very good," said Richard Hahn of RPI, the project engineer for the $11 million Isothermal Dendritic Growth Experiment that will take place aboard the space shuttle. "The workmanship has been excellent. It's a unique application of science."

Howe's company has performed many delicate and remarkable functions with the electron beam welding machine, the technology for which was developed by Carl Zeiss Co. in Germany more than three decades ago.

Even Howe still seems somewhat amazed by what he saw when he was first introduced to the electron beam welder.

It was 1963 and Howe, then a recent graduate of Western New England College with a degree in mechanical engineering, had heard about this new technology while working for Corporate Systems, which was housed in the same building as Hamilton Standard in Windsor Locks, Conn. Hamilton had only recently begun to explore the possibilities of electron beam welding in the aerospace field.

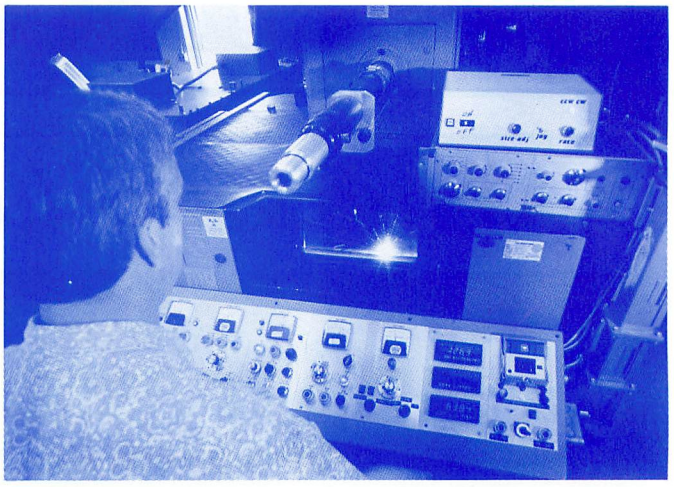
"I had no interest in it," said Howe. "I didn't know anything about it."

Soon, however, he realized one thing: "The electron beam was like nothing that came before."

So, he an three partners scraped together enough money to buy an electron beam welder, which cost $78,000 at the time—$600,000 now—and formed Fusion Labs in Chicopee.

"We had bank support, mortgages, financial backers," recalls Howe. "But none of us had any expertise. We had never run a machine, but we knew it had potential."

Four years later, Howe left to form International Beam. Early jobs consisted of aerospace subcontracting for companies like General Electric and McDonnell Douglas. He has done work for companies as far away as California and Canada.



SPARKS FLY – Evan Cromwell of International Beam Welding looks through the front window of electron beam welder as he performs a delicate weld.

Over the years, International Beam has built a rotor for TRW that was used by the U.S. Navy in its smart torpedoes of the 1970's and '80s.

"This part had been all over the country and no one could make it consistently," Howe said with rotor in hand.

More recently, Howe, along with his daughter Beverly MacFaddin, a mechanical engineer and the company's general manager, can take pride in having 600 weldments, or parts that have been welded, on a space shuttle. They manufactured a surgical stapler used in stomach operations, built more than half a million disposable probes employed in cataract operations and worked on valves used in brain probes.

Through all of this, the company has remained small. It does about $1 million worth of business a year, Howe said, and employs 10 people.

But the reach of its most recent work, the 10 crystal growth chambers that were shipped to RPI earlier this month, may in the future allow the company to say it contributed in a small way to a scientific breakthrough.

Martin E. Glicksman of RPI, the principle investigator for the crystal growth experiment, believes that understanding how crystals grow from their liquid to solid states is important since the growth patterns determine many of the properties of the substance. Researchers believe that the results of these experiments may one-day help scientists understand how to enhance a material's desirable properties as well as reduce its unwanted characteristics.

Information about crystal growth on earth has always been masked by the effects of convection, the major mode of heat transference on this planet. But when crystals are grown in microgravity, convection will not occur and some basic theories of crystal growth will either be confirmed or refuted.

Instead of metals or alloys, scientists on the space shuttle are using succinonitrile because if forms dendrites—structures that look like limbs of a pine tree—like metals do, but it does so at a much more workable temperature than most metals, 58 degrees centigrade.

"We aren't looking for crystals or diamonds," said Hahn, the project engineer. "We're looking for how crystals are formed.

"In order to improve on-ground processes, one has to have a good handle on the process. It's important to find out what happens without convection.

"It's good science," said Hahn. "The application comes later. You never know about these things."

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CHECKING FOR LEAKS – Beverly MacFaddin of International Beam Welding uses a helium leak detector to see if the crystal-growth chamber has been sealed vacuum tight before its use on a space shuttle experiment scheduled for January 1994.