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Paper Session III-B - Space Technology Benefits Life on Earth

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SPACE TECHNOLOGY BENEFITS LIFE ON EARTH -- TWO EXAMPLES

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For years the space community has visited schools and civic organizations to discuss the U.S. Space Program and the resulting benefits to life on earth. We spoke about weather and communications satellites, material and medical research and man's desire to explore. This all sounded great, but in our own minds, we knew that generally aerospace contractors were not spending their technology resources developing commercial products.

Well, things have changed. The defense budget is shrinking, NASA is struggling to keep current programs afloat, and technology funding is virtually non-existent. So what do we do with all of these very talented engineers and all this great technology? Should we venture into the unknown and search for earth bound applications for our unique and somewhat specialized technology or should we just accept the inevitable and downsize? Where do we l o o How do we market these products? Can we be cost competitive? Challenging technical problems came looking for us, now we have to go looking for them.

These are the questions we in the aerospace community have been asking ourselves over the last few years. Moog, Inc. decided to take the first step and look for new product opportunities. One broad-based technical individual with management experience was assigned to pursue these potential opportunities. Trade shows, with unrelated space technology, etc. were the first stop on the agenda.

Moog was pleasantly surprised to find new opportunities; and ironically, some opportunities came to Moog. Several new products are presently under development throughout the corporation. Following are two examples of Moog's adaptability from the space market to the commercial market.

From Spacecraft to Mass Transit

Several years ago, Moog developed a Helium II Orbital Resupply Coupling for NASA/JSC; however, satellite servicing is stalled in a "chicken and egg" syndrome. No one is going to build a satellite that is capable of resupply if the resupply infrastructure is not in place. Likewise, no one will fund a resupply infrastructure because there is no requirement for satellite resupply.

Helium II Orbital Resupply Coupling

However, the technology developed was used by Moog to benefit the Clean Air Act of

1990 which mandates conversion of fleet vehicles to alternate fuel sources by 1998. This Federal legislation along with more stringent State legislation has transformed alternate fuel technology from a good idea to law. Liquid Natural Gas (LNG) is the alternate fuel of choice for mass transit vehicles because it provides energy per gallon similar to diesel and is stored at low pressure. Moog, working with Houston Metro, utilized the lessons learned in developing the Helium II Orbital Resupply Coupling to manufacture a leak tight LNG refueling coupling for mass transit vehicles. The major technical challenge was icing. Existing couplings would freeze together preventing disconnect and, when separated, the self-sealing device would freeze open spewing LNG on the operator. Both the orbital resupply and LNG refueling projects required the development of a user-friendly, safe, reliable, cryogenic, self-sealing refueling coupling. A unique combination of materials, clearances, and sealing forces was utilized to produce a prototype LNG coupling in only six weeks.

Liquid Natural Gas Refueling Coupling

Moog's "Ice Breaker" technology is now the industry standard and LNG fueled vehicles are being produced at ever increasing rates.

Space technology, once again, benefits the environment on earth.

Kinetic Kill Vehicles to Interventional Cardiology

During the Reagan era, the nation spent billions of dollars developing space-based missile defense weapons. Moog, working with Lawrence Livermore National Laboratory, developed miniature propulsion control components for Kinetic Kill Vehicles. Throughout the eighties and into the nineties, quantum reductions were achieved in the size and weight of propulsion system components. Figure 1.0 illustrates the component weight savings. Space-based missile defense systems are no longer in vogue and much of the technology developed is essentially mothballed.

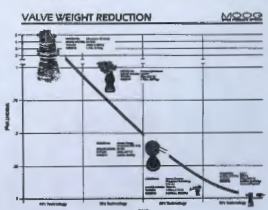

Figure 1.0
Component Weight Reduction

At the same time, a small company in Silicon Valley, SeamX, developed a process called Autonomous Selective Cutting (ASC) technology. The original application for this technology was cutting the honey-comb seal out of jet engine shrouds. The challenge was to remove the irregularly shaped honey-comb seal while not damaging the parent shroud.

A similar challenge exists in Interventional Cardiology; removal of plaque and fat deposits from coronary arteries with mechanical or laser cutters without damaging the artery wall.

Thanks to a referral from Lawrence Livermore National Laboratory, Moog and Seam-X joined forces to develop a control system to accurately guide a cathater inside an artery. Saline solution feeds through tubes in the annulus of a 1 mm catheter to four (4) minieture thrusters positioned just before the cutting head.

An ultrasonic sensor provides feedback to the control system regarding the position of the catheter inside the artery. The ASC control system accurately distinguishes between the blockage and the artery wall.

Moog valves, originally designed for a quad divert propulsion system on a Kinetic Kill Vehicle, are utilized to precisely control the flow of saline to the microthrusters located perpendicular to the catheter head. The fluid microthrusters (FMT) allow the accurate position control of catheter for precise and thorough blockage removal without damage to the artery wall.

Quad Divert Valve

Currently, in the USA alone, there are 250,000 coronery by-pass surgeries each year. This group of patients has total occlusions of plaque in their arteries. With existing technology, they are not candidates for catheterization. The ability to use self-guidance to treat total occlusions through catheterization offers the potential of reducing the procedure cost from the current $65,000 per procedure to $11,000. Other than cardiovascular, the benefits of adding steering capability to catheters in the Ob/Gyn, Urology, Oncology, Vascular, Internal, Neurosurgery & Radiology areas have been identified. The total potential impact in reducing health care cost would be significant.

SDIO technology improves the quality of life on earth.

Guided Catheter

Moog has several other technology conversion products in progress including natural gas vehicles, entertainment motion simulators, animatronics and earthquake vibration damping.

Opportunities to utilize space technology to benefit life on earth exist. These opportunities can provide excitement and growth for the depressed aerospace community.