monitoring ICP. The most promising solution is a sensor originally developed at Ames Research Center for measuring air pressure over an airfoil in wind tunnel tests of aircraft. It is an inductively powered capacitive transducer—that is, a sealed pressure-measuring cell that reports ICP by telemetry.

The ICP monitor has a number of advantages. It is "minimally invasive," meaning that, while penetrating the skull, it does not penetrate the dura, the tough membrane that forms a protective cover around the brain tissue. Once implanted, the scalp is closed over the transducer, reducing risk of infection and allowing the patient freedom of movement. Most important, the monitor can report continuously with a higher degree of accuracy than is currently obtainable.

A program to validate the ICP monitor is under way and the system then will be evaluated on neurosurgical patients. Konigsberg Instrument Co., Pasaddena, Cal. is producing pre-production ICP monitors for test and evaluation.

Liquid-Cooled Garment

Because there is no atmosphere to impede the sun's rays, it gets pretty hot on the moon—up to 250 degrees F. For that reason, astronauts working on the lunar surface wore a special suit consisting of a nylon outer layer supporting an inner network of tubing. Cool water flowing through the tubes kept the moonwalker comfortable. Researchers at NASA-Ames have made advancements in the Apollo suit design that offer highly efficient temperature control, and they have applied this technology to development of a water-cooled, brassiere-like garment used to aid the detection of breast cancer.

A liquid-cooled bra, offshoot of Apollo moon suit technology, aids the cancer-detection technique known as infrared thermography. Water flowing through tubes in the bra cools the skin surface to improve resolution of thermograph image.

Cancerous tissue gives off more heat than normal tissue and this forms the basis for a cancer-detection technique known as infrared thermography. However, it has been difficult to interpret thermograph results for detecting cancer in its earliest stages.

The liquid-cooled bra, being evaluated by the Breast Cancer Detection Demonstration Center in Oklahoma City, cools the breast to improve resolution of the thermograph image. Cancerous tissue recovers from cooling faster than normal tissue because of the increased blood flow characteristic of cancerous tumors. By increasing the temperature difference between normal and cancerous tissue through cooling, the differentiation becomes more apparent on the thermograph. The NASA-Ames bra contains tubes which carry the water to and from a pumping refrigeration unit.

Help for Crippled Children

Children with cerebral palsy have nervous system defects which lead to muscular spasticity and loss of coordination. Many of these children have great difficulty walking because certain muscles are in a constant state of contraction.

Surgical techniques can lengthen muscles or tendons to improve the child's walking pattern, but it is vital to diagnose accurately the particular spasticity problem of each patient; the individual muscles causing the handicap vary greatly from child to child. It is difficult by physical examination alone to determine precisely which muscle groups are most involved. Biotelemetry has provided a solution. For the past two years, the Children's Hospital at Standord, assisted by NASA and the Stanford Biomedical Application Team, has been applying biotelemetry to the cerebral palsy problem.

Auto-Lensmeter is an automated optician's aid which measures the corrective prescription ground into eyeglass and contact lenses in a fraction of normal time. The lens is positioned on a mount, the operator presses a button, and in two seconds the results appear in standard prescription form, on a digital display or on a printed record. Produced by Acuity Systems, Inc., Reston, Virginia, Auto-Lensmeter is a companion to the company's first product, the Auto-Refractor eye-testing instrument. The latter was developed by a Stanford Research Institute employee who worked on an infrared optometer for NASA's Ames Research Center.

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Space biotelemetry—physiological signals sent by radio waves—is being applied to diagnose accurately spasticity in children crippled by cerebral palsy. Miniature sensor/transmitters affixed on legs send wireless data on muscle activity helpful in determining corrective surgery and other remedial measures.

Used extensively throughout the space program to observe astronaut vital functions from the ground, biotelemetry is the monitoring of physiological signals sent by radio wave. In the cerebral palsy application, the signal is the "EMG"—for electromyogram—which indicates the activity of the leg muscles. Biotelemetry's advantage is that it needs no wires; other methods of monitoring EMG involve wires connecting a sensor on the patient to a recorder, thus interfering with the subject's normal walking pattern.

Freedom of movement is very important to the child with cerebral palsy, who frequently has an impaired sense of balance and lacks the muscle control necessary to protect himself when he falls. Telemetry offers a means for unencumbered recording of the child's true gait pattern, information extremely helpful to the physical therapist and the orthopedic surgeon in determining the need for corrective surgery, evaluating various types of braces, and deciding whether certain muscle-relaxing drugs might prove effective.

With the help of L&M Electronics Co., Daly City, Cal., NASA and Children's Hospital at Stanford introduced an improvement which eliminates the waist pack and the connecting cables previously used. Miniature transmitters, about the diameter of a half dollar, are affixed directly over the muscle group being studied. Each transmitter has its own battery and a pair of sensing electrodes. Because they are small and lightweight, several transmitters can be used to broadcast EMG signals from both legs simultaneously.

This important advance is now in active use by the Children's Hospital at Stanford for the cerebral palsy application. It appears to have broader potential, because it could be used for monitoring other types of physiological signals where biotelemetry offers clinical advantage.

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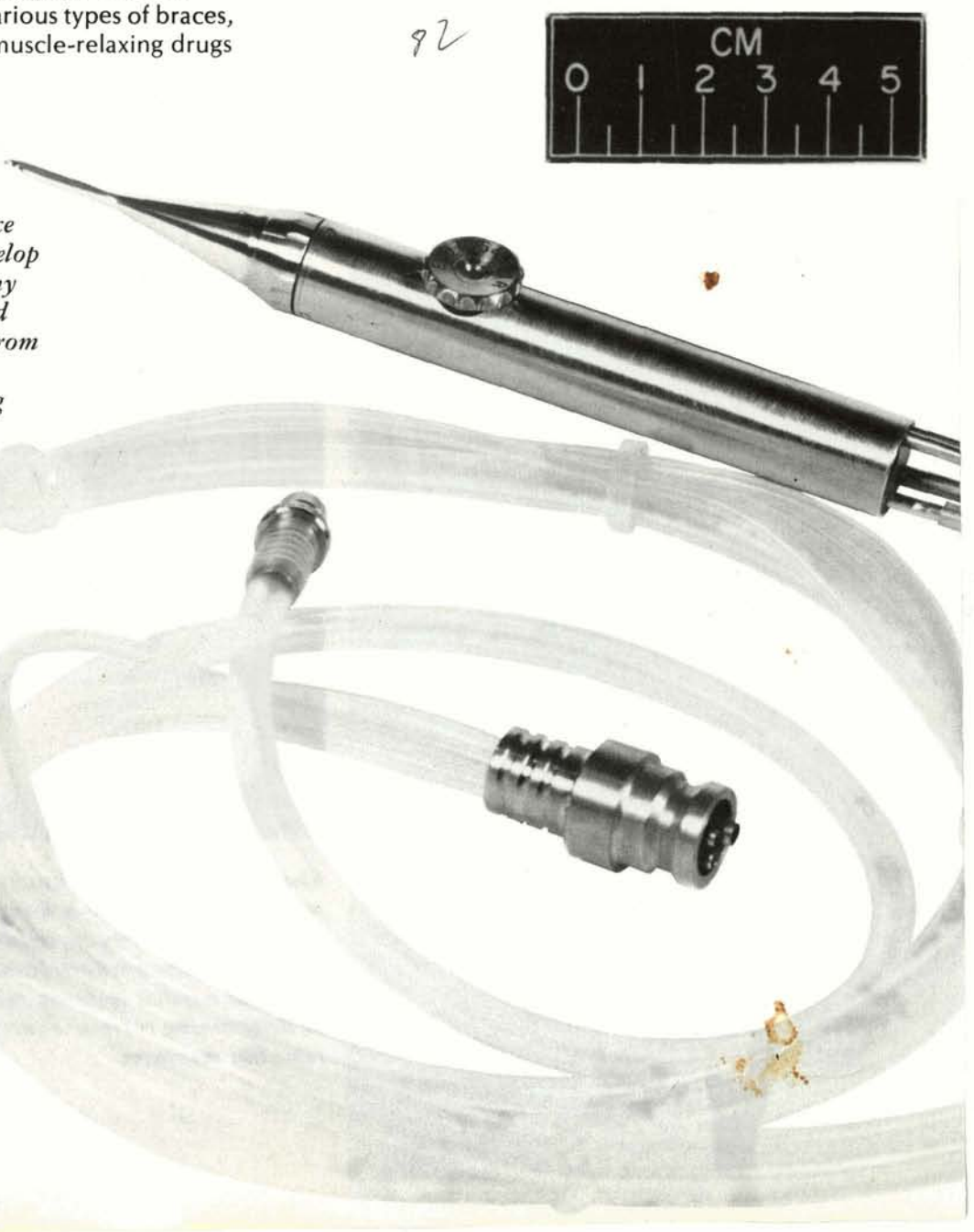

Drawing upon several aerospace technologies, NASA helped develop this cataract surgery tool, a tiny cutter-pump which liquefies and pumps cataract lens material from the eye. The design offers an improved method of performing cataract surgery. Clinical testing of the device is underway.