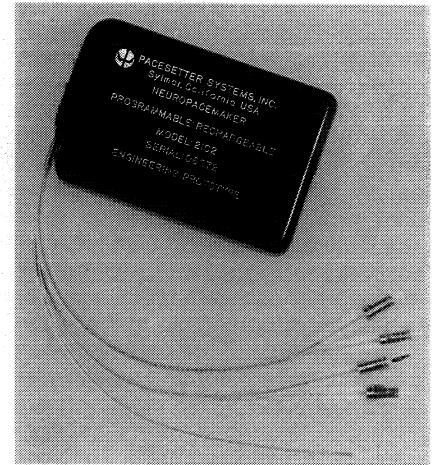




Human Tissue Stimulator

Shown above are the various components of a system for treatment of chronic pain and involuntary motion disorders by electrical stimulation from a device implanted in the body. Called the Human Tissue Stimulator (HTS), it was developed by Pacesetter Systems, Inc., Sylmar, California, in cooperation with the Applied Physics Laboratory of Johns Hopkins University, Howard County Maryland. Sponsored by Goddard Space Flight Center, the system is based on Goddard-developed technology employed in NASA's Small Astronomy Satellite-3. The HTS incorporates a nickel cadmium battery, telemetry and command systems technologies of the same type as those used in the satellite, reduced to microminiature proportions so that the implantable element is the size of a deck of cards. In contrast to earlier stimulating devices—which require cumbersome, externally-carried power packs or which have very limited lifetimes—the HTS is a totally implantable system with a number of additional technological advances.

At right is a close-up view of the implantable stimulator, which includes a tiny rechargeable battery, an antenna and electronics to receive and process



commands and to report on its own condition via telemetry, a wireless process wherein instrument data is converted to electrical signals and sent to a receiver where the signals are presented as usable information. The HTS sends electrical pulses through wire leads to targeted nerve centers or to particular areas of the brain; this provides relief from intractable pain or arrests involuntary motion. The nickel cadmium battery can be recharged through the skin so that frequent surgical replacement is not required.

The first two HTS units were implanted last year. The initial operation—conducted under the direction of Dr. Irving Cooper, Director of the Center of Physiologic Neurosurgery at Westchester County Medical Center, New York—involved a female patient who had severe involuntary movement disorders associated with multiple sclerosis. Several hours after surgery, the stimulator was applied to a part of the thalamus, a small region of the brain. The patient's tremors vanished—although moments earlier she had been unable to guide a cup of coffee to her lips.

The second HTS was implanted by Dr. Donlin M. Long, Chairman of the Department of Neurosurgery at Johns Hopkins School of Medicine, Baltimore, Maryland. The patient had for several years suffered excruciating pain in his left arm, caused by a wrist injury in a fall. Implanted under the left arm (left), the HTS was connected by the wire leads to electrodes on the brachial plexus, a group of nerves that link the spinal cord with the injured arm. When the stimulator was activated, the patient reported immediate relief from the pain. The photo below shows Dr. Long in post-surgery consultation with the implantee. The console next to the physician is used to monitor and program the implanted HTS; the controller Dr. Long is holding enables him to turn the stimulator on or off or to alter the character and strength of the electrical impulses.

Although the initial implants were successful, extensive testing is required before the HTS can be made available for general use. Within the next few years, Pacesetter Systems expects to produce commercial programmable neural stimulators based on the HTS.

