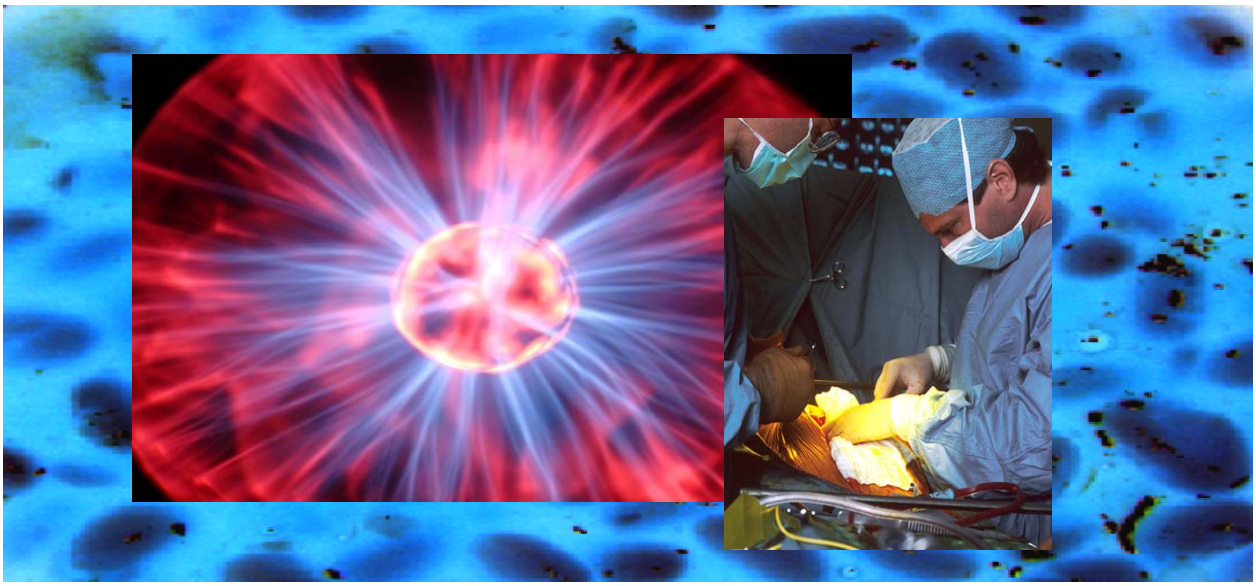
National Aeronautics and Space Administration

technology opportunity

Microwave Treatment of Prostate Cancer and Hyperplasia



The National Aeronautics and Space Administration (NASA) seeks interested parties for the commercial application of a microwave treatment system for prostate cancer and benign prostate hyperplasia that was developed by engineers at the Johnson Space Center In theory, this technology provides precise control within the treatment area, thus allowing for necrosis of only the targeted treatment zone. Current prostate treatment methods, including chemotherapy, cryotherapy, radiation therapy and prostatectomy, often damage the healthy cells surrounding the targeted treatment zone causing undesirable risks and side effects.

Benefits

Small size:

- Less than 2.2 mm diameter
- Fits in a catheter or syringe application

Heat profile:

- Controllable for a wide-variety of needs
- Using multiple energy sources reduces the heat generated in proximity of an antenna
- Reduces and/or eliminates damage to adjacent tissue
- Can be designed for localized cooling to protect the urethra while heating beyond the urethra and into the prostate

Operation:

- Antenna can be focused or rotated up to 360 degrees for a larger area

Applications

Bio-Medical

- **Prostatic Cancer**
- **Hyperplasia**

Technology Status

- ☐ Patent Pending
- ☒ U.S. Patent(s)
- ☐ Copyrighted
- ☒ Available to License
- ☐ Available for No-Cost Transfer
- ☐ Seeking Industry Partner for Co-Development

Technology Details

This microwave catheter design, which was developed for commercial use in treating ventricular tachycardia, can be modified to treat prostate cancer and benign prostatic hyperplasia (BPH).

Why it was Developed

Considering that the occurrence of BPH is increasing — currently 350,000 operations per year are performed in the United States alone to treat this condition — this microwave catheter has significant commercial potential.

How it Works

The microwave operating frequency affects the heating depth. An electrophysiologist will be able to take advantage of the physics of depth of penetration (in particular, the variations of conductivity and permittivity of tissue with frequency) to focus the microwave beam. The power level and delivery time also affect the balance between the increase in heat (due to the absorption of microwave energy) and the loss of heat (due to conduction away from targeted cells). A computer program that simulates the heating profile has been written to assist in determining the balance needed to necrose targeted cells while saving non-targeted cells. There are several variations of microwave radiators suitable for treating specific regions of the prostate or the prostate as a whole.

Single Antenna Within the Urethra

A single antenna radiates within the urethra. A urethra catheter can be made to include a phase-change material surrounding the radiation tip to prevent a significant temperature rise without need for a water cooling system. The phase-change material must, of course, be nearly transparent to the microwave radiation. This material provides localized cooling to protect the urethra from damage, but permits microwave heating to occur beyond the urethra, into the prostate. For treatment over the entire prostate, or over large regions of the prostate, it may be necessary to use several throwaway catheters because one may not contain sufficient phase - change material. Calculations have shown the feasibility of this approach, provided that a phase-change material that has the desired characteristics can be found.

Multiple Colon Antennas

Multiple colon catheter antennas can be phased and directed toward the prostate to provide localized temperature gradients in the regions of the prostate located near the colon. Cooling must be provided to protect the colon and the intervening tissue. Prostate cancer often begins in the prostate near the colon and should be treatable with this technique. Computer simulations show that by adjusting the locations of the microwave radiators and the phases of their microwave signals, the heating centers in the prostate can be adjusted to necrose critical regions only.

Single Urethra Antenna and Two Colon Antennas

Combinations of urethra and colon microwave radiators can be used to provide treatment appropriate to specific problems. Generally, one microwave catheter in the urethra, when working together with one or more catheters in the colon, can provide localized heating to satisfy most requirements. By adjustment of frequency, phase, directionality, and duration of the microwave radiation, one can select from among a wide array of heating profiles in the prostate.

Patents

NASA has patented this and associated technologies. (U.S. 6289249, 6512956, 6592579 and 6675050)

Licensing and Partnering Opportunities

This technology is part of NASA's Innovative Partnerships Program (IPP), which seeks to transfer technology from and to NASA for benefit of the space program and U.S. industry.

NASA invites companies to consider licensing the Microwave Treatment System for Prostate Cancer and Hyperplasia (MSC-23049) for commercial applications along with other related microwave technologies within this portfolio.

For More Information

If you would like more information or want to pursue transfer of this technology please contact us at:

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