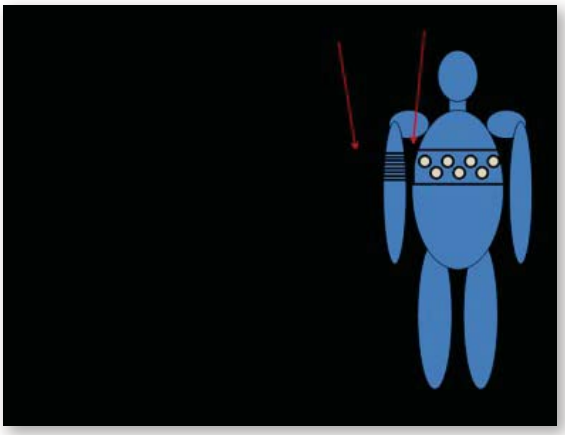
Electrical Impedance Tomography Technology (EITT) Project

Center Innovation Fund: KSC CIF Program

Space Technology Mission Directorate (STMD)

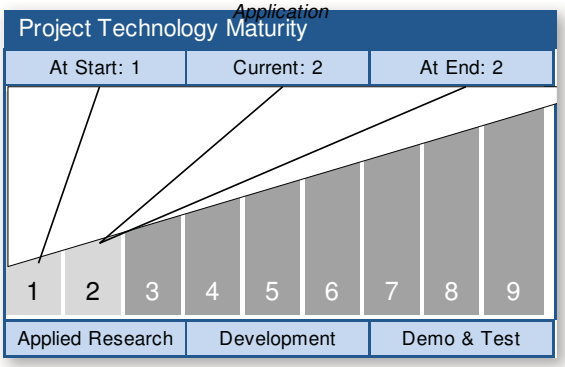
National Aeronautics and Space Administration



ABSTRACT

Development of a portable, lightweight device providing two-dimensional tomographic imaging of the human body using impedance mapping. This technology can be developed to evaluate health risks and provide appropriate medical care on the ISS, during space travel and on the ground.

The EIT Component Block Diagram with Human Thorax Application



Technology Area: Human Health & Performance TA06.3 (Primary)
Human Health, Life Support & Habitation Systems TA06 (Secondary)

ANTICIPATED BENEFITS

To NASA funded missions:

This project addresses critical NASA requirements to improve ICP (Intra-Cranial Pressure) monitoring during launch, ISS flight duration, and postflight. Currently there is no effective way to assess cranial function affected by microgravity or injury. This technology can be developed to evaluate health risks and provide appropriate medical care on the ISS, during space travel and on the ground; real-time imaging of hemodynamics that occur during astronauts in space flight and on return to ground.

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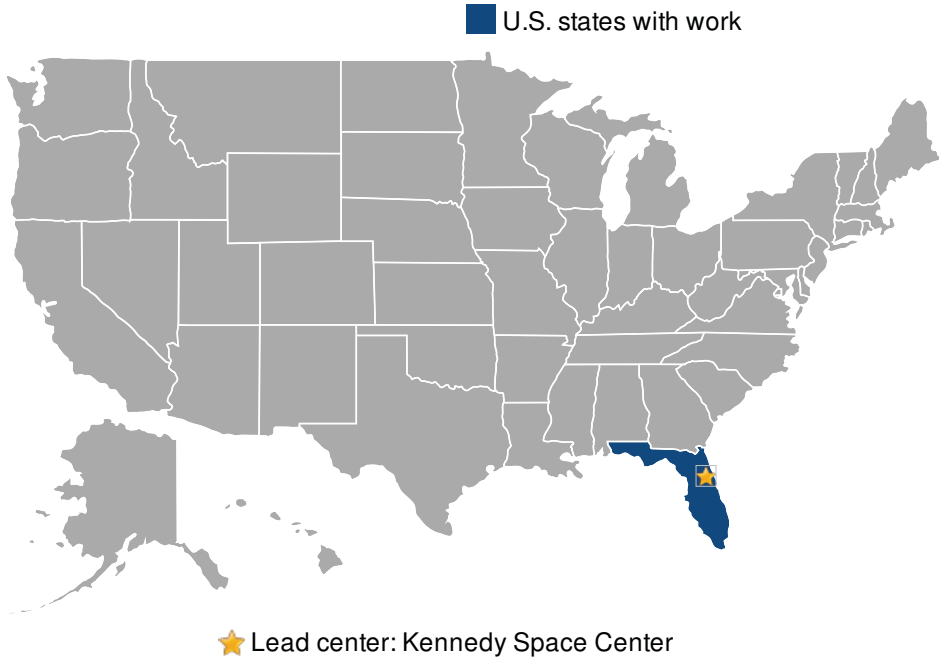
Read more on the last page.



DETAILED DESCRIPTION

Electrical Impendance Tomography (EIT) utilizes a series of electrodes in a circumferential band-like device feeding these signals to a portable computer that generates images similar to a Computerized Tomography (CT) scan using a mathematical algorithm.The development and validatation of this new technoligy could provide reliable portable imaging of the head and chest cavity through the use of EIT. Impedance has been used to gain knowledge of cardiac function for several decades but not used as a scanning technique. Electrical Impendence Tomography (EIT) utilizes a series of electrodes in a circumferential band-like device feeding these signals to a portable computer that generates images similar to a Computerized Tomography (CT) scan using a mathematical algorithm. The development and validation of this new technology could provide reliable portable imaging of the head and chest cavity through the use of EIT. Impedance has been used to gain knowledge of cardiac function for several decades but not used as a scanning technique.

MANAGEMENT

Program Executive:
John Falker

Program Manager:
Nancy Zeitlin

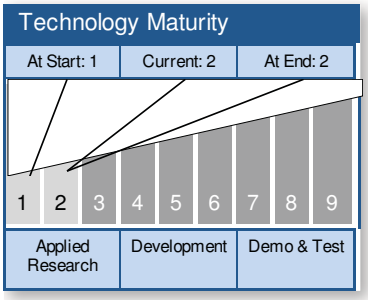
Project Manager:
David Tipton

Principal Investigator:
David Tipton

Co-Investigators:
Kenneth Cohen
Robert Friedman

TECHNOLOGY DETAILS

Electrical Impedance Tomography Technology (EITT)



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This technology is categorized as a hardware system for other applications

- Technology Area
    - TA06.3 Human Health & Performance (Primary)
    - TA06 Human Health, Life Support & Habitation Systems (Secondary)
    - TA07 Human Exploration Destination Systems (Additional)

CAPABILITIES PROVIDED

Real-time imaging of the internal human body. Portable device, noninvasively and unobtrusively EIT technology could be utilized to determine changes in intracranial blood flow and blood pressure during microgravity. EIT may also provide information regarding changes in pulmonary function of flight crew on-orbit. This device could provide non-invasive, real-time, and reliable clinical information for the healthcare provider.

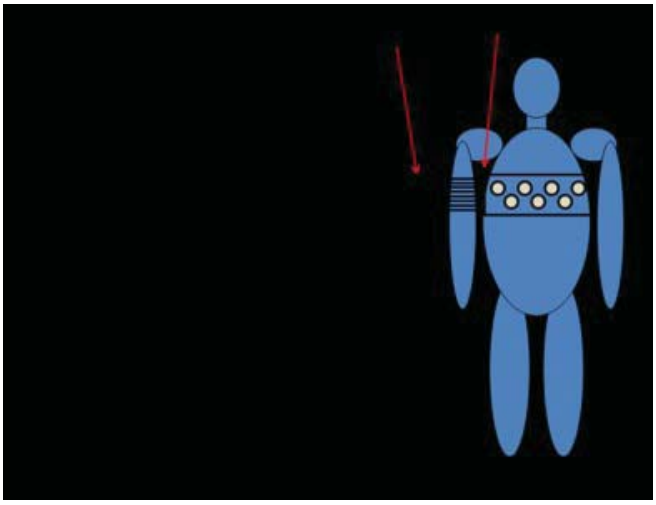
1. Lung Imaging
2. Brain Imaging
3. Breast Imaging
4. Thoracic Cavity Imaging
5. Abdominal Cavity Imaging
6. Imagining of other body areas
7. Fluid or gas flow in pipes
8. Undersurface geology
9. Mine ...

TECHNOLOGY DETAILS

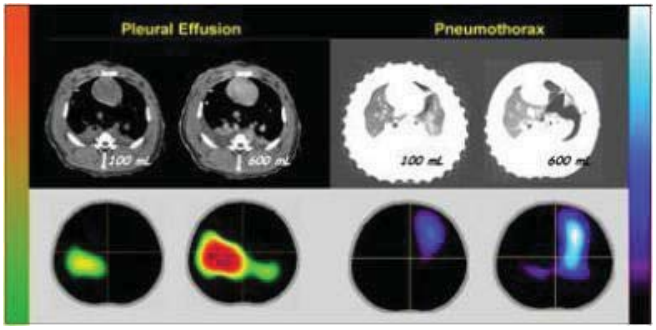
POTENTIAL APPLICATIONS (CONT'D)

detection

IMAGE GALLERY



EITT Block Diagram



Electrical Impedance Tomography Technology (EITT)

ANTICIPATED BENEFITS

To NASA unfunded & planned missions: (CONT'D)

Mathematical algorithms will be used to develop an EIT signal that can be translated into a two-dimensional cross-sectional image. These images can detect lung aeration and blood flows inside the chest cavity and can also assess changes in intracranial blood flow and brain swelling that may occur due to trauma, stroke, or the fluid shifts induced by microgravity. This image should provide a dynamic view of the brain or chest showing their actual movement with blood flow and breathing.

To other government agencies:

This device will make it possible for clinicians to generate images similar to chest x-rays and CT scans with a compact, lightweight and portable device. The method is non-invasive, does not expose the patient to radiation and can provide dynamic images that show movement of blood and of air in the lungs. It is potentially low in cost, and has application in areas ranging from acute and primary care to remote area medicine.

To the nation:

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