

Wideband Single Crystal Transducer for Bone Characterization

Quantifying bone degradation with high-resolution ultrasound

TRS Technologies, Inc., has developed a wideband ultrasound diagnostic tool for quantifying bone degradation of astronauts during long-duration space missions. The tool measures backscatter, attenuation, reflectivity, and other ultrasound parameters of bone in the spine and hip. These parameters have been correlated with physiological bone density, structure, and porosity through systems that provide high fidelity but are not space-capable.

In Phase I, TRS Technologies demonstrated that a compact ultrasound transducer with more than a 4-octave bandwidth could be produced using the special properties of single-crystal piezoelectrics and special processing techniques. (A 4-octave bandwidth is 175 percent larger than that of conventional transducers.) In Phase II, the company extended the capabilities of the Phase I transducer by providing more sensitivity and optimizing the frequency content relative to the acoustic field.

In addition to its use as a bone characterization tool, the technology can be used to examine space structures to evaluate microcrack progression over long-duration missions. The technology also could be useful in wideband medical imaging.

Applications

NASA

- ▶ Quantifying bone degradation
- ▶ Evaluating microcrack progression of space structures

Commercial

- ▶ Wideband medical imaging
- ▶ Cancer analysis
- ▶ Industrial and defense applications, with expansion to other frequency ranges



Phase II Objectives

- ▶ Optimize the Phase I transducer for sensitivity
- ▶ Test different transmit signals for optimum performance
- ▶ Demonstrate compatibility with electronics
- ▶ Confirm additional transducer capabilities over conventional systems by calibrating with other methods

Benefits

- ▶ Low cost
- ▶ Simple to use
- ▶ Launch-capable
- ▶ Robust
- ▶ Nonionizing modality

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