NASA SBIR 2014 Phase I Solicitation

H12.02 Inflight Calcium Isotope Measurement Device

Lead Center: JSC

Bone loss in crewmembers is a major concern for long duration space flight. The ability to rapidly detect changes in bone mineral balance (BMB) in crewmembers living on ISS would have great potential as a surveillance tool for future exploration missions. Calcium isotopes have been shown to detect changes in BMB on very short timescales (e.g., one week). In order to detect these important changes, a technological device could be used in-flight. Thus, we are seeking a device (portable to bench top size) with the same accuracy and precision as is currently available in the non-flyable Multiple Collector Inductively Coupled Plasma mass spectrophotometer.

Phase I Requirements - The sensitivity required to make the Calcium isotope measurements would need to be approximately 10^{12}-10^{16} (i.e., this is how sensitive the machine should be for finding the Calcium isotope; it should be able to pick up one “atom” or unit in a pool of 10^{16} other things). Systems that measure elemental composition typically have sensitivities around 10^{6}-10^{9} for some elements. The absolute concentrations of the isotopes are not required. We are looking for an instrument that can measure the variations in the ratio of any two Calcium isotopes on the order of 0.1-0.5 parts per 10,000 (44Ca/42Ca) but could vary depending on the isotopes used. A successful proposal will include the technologies being considered and detailed test plan for evaluating them during Phase I.

Phase I deliverables - Test results and plan for developing a low volume, low mass, easy-to-operate prototype. TRL of 3 desired.

Phase II deliverables - Prototype in year 1 with sample testing against industry standard in year 2.

HRP IRP Risk - Risk of Early Onset Osteoporosis Due to Spaceflight

Technology Readiness Levels (TRL) of 4 to 5 or higher are sought upon completion of the project.