Fiscal Year:	FY 2005	**Task Last Updated:**	FY 12/14/2010
PI Name:	Qin, Yi-Xian Ph.D.		
Project Title:	A Scanning Confocal Acoustic Diagnostic System for Non-Invasively Assessing Bone Quality		
Division Name:	Human Research		
Program/Discipline:	NSBRI Teams		
Program/Discipline--Element/Subdiscipline:	NSBRI Teams--Technology Development Team		
Joint Agency Name:		**TechPort:**	Yes
Human Research Program Elements:	(1) **HHC**:Human Health Countermeasures		
Human Research Program Risks:	(1) **Bone Fracture**:Risk of Bone Fracture due to Spaceflight-induced Changes to Bone (2) **Osteo**:Risk Of Early Onset Osteoporosis Due To Spaceflight		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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Zip Code:	11794-5281	**Congressional District:**	1
Comments:			
Project Type:	GROUND	**Solicitation / Funding Source:**	2003 Biomedical Research & Countermeasures 03-OBPR-04
Start Date:	11/01/2004	**End Date:**	10/31/2008
No. of Post Docs:		**No. of PhD Degrees:**	
No. of PhD Candidates:		**No. of Master' Degrees:**	
No. of Master's Candidates:		**No. of Bachelor's Degrees:**	
No. of Bachelor's Candidates:		**Monitoring Center:**	NSBRI
Contact Monitor:		**Contact Phone:**	
Contact Email:			
Flight Program:			
Flight Assignment:			
Key Personnel Changes/Previous PI:			
COI Name (Institution):			
Grant/Contract No.:	NCC 9-58-TD00405		
Performance Goal No.:			
Performance Goal Text:			
	The bone loss which parallels extended space missions represent serious threat to astronaut health, both during flight and on return to gravitational fields. Early diagnosis of osteoporosis would enable prompt treatment and thus dramatically reduce the risk of fracture. Currently, the principal method used to diagnose osteoporosis is dual-energy X-ray absorptiometry (DEXA), which provides a 2-D representation of bone mineral density (BMD), but not bone's physical properties per se. Recent advances in quantitative ultrasound have enabled a true characterization of bone quality, including both BMD and mechanical strength. Currently funded by the NSBRI, we have developed a scanning confocal acoustic diagnostic (SCAD) system capable of generating acoustic images at the regions of interest (e.g., in the calcaneus). Both animal and human trials indicate strong correlations between SCAD and microCT determined parameters of bone's material properties, including BMD (R=0.87) and yield strength (R=0.9). The objectives of this		

Task Description:	competitive renewal study are to further develop this unique diagnostic for use in the human, including an improved resolution (up to 0.3mm3), faster scan times (e.g., < 2 min for the calcaneus), the ability to scan multiple sites of the skeleton (i.e., hip), and to validate image based characterization of bone's physical properties to true bone quality as based on material testing. In essence, this next phase of funding will focus on developing the SCAD prototype as a real-time, high-resolution, and portable bone image modality for determining bone quality. A series of four interrelated specific aims are proposed: 1) Bone surface topology will be determined via acoustic surface mapping which can be used for accurately measuring wave velocity. 2) Focal depth of the confocal ultrasound will be enhanced, thus facilitating penetration to evaluate regions such as the femoral head and neck, discriminating between cortical and trabecular bone. 3) Using cadaver specimens, bone's structural and strength properties, as measured by SCAD, will be validated by microCT and mechanical testing, as well as, nanoindentation. 4) Comparisons to standard diagnostics will be performed by clinical assessment on osteoporosis subjects using both SCAD and DEXA. This work will help to refine a non-invasive diagnostic for bone loss, and may potentiate the development of a flight instrument for the precise determination of bone quality during extended space missions.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	
Task Progress:	New project for FY2005. [Ed. note: FY2005 record added in December 2010 for statistical reporting purposes]
Bibliography Type:	Description: (Last Updated: 02/17/2021)