Fiscal Year:	FY 2004	**Task Last Updated:**	FY 04/03/2006
PI Name:	Rubin, Clinton Ph.D.		
Project Title:	A Low Intensity Mechanical Countermeasure to Prohibit Osteoporosis in Astronauts During Long-Term Spaceflight		
Division Name:	Human Research		
Program/Discipline:	HUMAN RESEARCH		
Program/Discipline--Element/Subdiscipline:	HUMAN RESEARCH--Biomedical countermeasures		
Joint Agency Name:		**TechPort:**	No
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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PI Organization Type:	UNIVERSITY	**Phone:**	631-632-8521
Organization Name:	State University of New York		
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City:	Stony Brook	**State:**	NY
Zip Code:	11794-2580	**Congressional District:**	1
Comments:			
Project Type:	FLIGHT	**Solicitation / Funding Source:**	ILSRA 2001
Start Date:	02/01/2003	**End Date:**	07/31/2004
No. of Post Docs:	0	**No. of PhD Degrees:**	
No. of PhD Candidates:	0	**No. of Master' Degrees:**	
No. of Master's Candidates:	1	**No. of Bachelor's Degrees:**	
No. of Bachelor's Candidates:	0	**Monitoring Center:**	NASA JSC
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Flight Program:			
Flight Assignment:			
Key Personnel Changes/Previous PI:			
COI Name (Institution):			
Grant/Contract No.:			
Performance Goal No.:			
Performance Goal Text:			
Task Description:	Osteoporosis, the progressive loss of bone density and strength that cripples tens of millions on our planet, distinguishes itself as perhaps the greatest physiologic obstacle to an extended human presence in space. The principal objectives of this proposal are to establish the efficacy of a unique, mechanical countermeasure to inhibit bone loss - and muscle strength- in the lower appendicular skeleton of astronauts and payload specialists during International Space Station missions. Using a ground based model of microgravity, the tail-suspended rat, we have shown that brief exposure (10 minutes) to extremely low magnitude (0.25g, engendering <5 microstrain), high frequency (30-90 Hz) mechanical signals will inhibit the bone loss which typically parallels disuse, even though 10 minutes of full weightbearing failed to curb this loss. Longer-term experiments in sheep have shown this stimulus to be strongly anabolic, increasing bone mineral density, trabecular number and connectivity, and improving bone strength. Preliminary results in post-menopausal women and children with cerebral palsy indicate that this intervention can inhibit, and perhaps reverse,		

	osteoporosis. To determine this intervention's ability to inhibit bone loss - and muscle strength - in people during prolonged space missions, we will subject astronauts, in single let stance, to brief exposures to the low level stimulus (10 minutes at 30 Hz, 0.3g), allowing the contralateral limb to serve as an intra-subject control. The proposal is structured to "piggy-back" onto ongoing flight studies, and thus the assays for efficacy will be determined by collaborative decisions between NASA teams studying the musculoskeletal system. At a minimum, DXA, QCT, and muscle strength measurements will be made both pre- and post- flight. This work represents a critical step in establishing a physiologically based, non-pharmacologic, non-invasive treatment for osteoporosis, for use on Earth or in space.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	Two clinical studies, evaluating the efficacy of the device, are to be published in the March issue of J. Bone & Mineral Research. In the first study, the intervention is shown to prevent osteoporosis in a group of post-menopausal women. In the second study, the intervention is shown to stimulate bone formation in children with cerebral palsy.
Task Progress:	Two clinical studies, evaluating the efficacy of the device, are to be published in the March issue of J. Bone & Mineral Research. In the first study, the intervention is shown to prevent osteoporosis in a group of post-menopausal women. In the second study, the intervention is shown to stimulate bone formation in children with cerebral palsy.
Bibliography Type:	Description: (Last Updated: 10/22/2009)
Articles in Peer-reviewed Journals	Ward K, Alsop C, Caulton J, Rubin C, Adams J, Mughal Z. "Low magnitude mechanical loading is osteogenic in children with disabling conditions." J Bone Miner Res. 2004 Mar;19(3):360-9. Epub 2004 Jan 27. PMID: 15040823 , Mar-2004
Articles in Peer-reviewed Journals	Rubin C, Recker R, Cullen D, Ryaby J, McCabe J, McLeod K. "Prevention of postmenopausal bone loss by a low-magnitude, high-frequency mechanical stimuli: a clinical trial assessing compliance, efficacy, and safety." J Bone Miner Res. 2004 Mar;19(3):343-51. Epub 2003 Dec 22. PMID: 15040821 , Mar-2004