Fiscal Year:	FY 2016	**Task Last Updated:**	FY 01/14/2016
PI Name:	Bouxsein, Mary Ph.D.		
Project Title:	Vertebral Strength and Fracture Risk following Long Duration Spaceflight		
Division Name:	Human Research		
Program/Discipline:			
Program/Discipline--Element/Subdiscipline:	HUMAN RESEARCH--Space Human Factors Engineering		
Joint Agency Name:		**TechPort:**	Yes
Human Research Program Elements:	(1) **HFBP**:Human Factors & Behavioral Performance (IRP Rev H)		
Human Research Program Risks:	(1) **Bone Fracture**:Risk of Bone Fracture due to Spaceflight-induced Changes to Bone (2) **Dynamic Loads**:Risk of Injury from Dynamic Loads (3) **Osteo**:Risk Of Early Onset Osteoporosis Due To Spaceflight		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
PI Email:	mbouxsei@bidmc.harvard.edu	**Fax:**	FY
PI Organization Type:	UNIVERSITY	**Phone:**	617-667-4594
Organization Name:	Beth Israel Deaconess Medical Center/Harvard Medical School		
PI Address 1:	Department of Orthopedic Surgery		
PI Address 2:	330 Brookline Ave, RN115		
PI Web Page:			
City:	Boston	**State:**	MA
Zip Code:	02215-5400	**Congressional District:**	7
Comments:			
Project Type:	FLIGHT,GROUND	**Solicitation / Funding Source:**	2014-15 HERO NNJ14ZSA001N-Crew Health (FLAGSHIP & NSBRI)
Start Date:	11/16/2015	**End Date:**	11/15/2017
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:**	NASA JSC
Contact Monitor:	Whitmore, Mihriban	**Contact Phone:**	281-244-1004
Contact Email:	mihriban.whitmore-1@nasa.gov		
Flight Program:			
Flight Assignment:			
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Kopperdahl, David Ph.D. (O.N. Diagnostics)		
Grant/Contract No.:	NNX16AC15G		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	Mechanical loading is required for maintenance of the musculoskeletal system. Thus, exposure to microgravity induces marked bone loss in both humans and animals, and is a major concern for astronauts exposed to long-duration spaceflight, as they may be at increased risk for skeletal fragility and bone fractures. Most prior studies have relied on dual-energy X-ray absorptiometry (DXA), a 2D technique used to assess bone mass at different skeletal sites, to assess effects of spaceflight on bone strength and fracture risk. However, DXA-based measurements are limited in several regards. Newer technologies, including 3D quantitative computed tomography (QCT) are able to overcome the limitations of DXA. Moreover, QCT images can be used to estimate bone strength using a standard engineering approach called finite element analysis. Indeed, QCT images have been used successfully to demonstrate negative effects of spaceflight on hip bone density and strength. However, a similar examination of the effects of spaceflight on vertebral strength has not been performed. Thus the degree of spinal deconditioning and subsequent risk of vertebral fracture following long-duration spaceflight remains unknown. Specific Aims: 1) Determine changes in lumbar vertebral strength in long-duration International Space Station (ISS) astronauts 2) Compute subject-specific load-to-strength ratio to estimate risk of vertebral fracture in long-duration ISS astronauts 3) Perform Biomechanical Computed Tomography (BCT) analysis — aka finite element analysis of QCT scans on spine scans for up to 18 astronauts at up to visits (pre, post, and 1 Year, for all n=18; one additional visit for n=8), and analyzing two vertebral levels per subject (total number of BCT analyses = 124)
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	
Task Progress:	New project for FY2016.
Bibliography Type:	Description: (Last Updated: 02/21/2024)