Fiscal Year:	FY 2013	**Task Last Updated:**	FY 09/21/2012
PI Name:	LeBlanc, Adrian Ph.D.		
Project Title:	Bisphosphonates as a Countermeasure to Space Flight Induced Bone Loss: SMO-021		
Division Name:	Human Research		
Program/Discipline:	HUMAN RESEARCH		
Program/Discipline--Element/Subdiscipline:	HUMAN RESEARCH--Biomedical countermeasures		
Joint Agency Name:		**TechPort:**	Yes
Human Research Program Elements:	(1) **HHC**:Human Health Countermeasures		
Human Research Program Risks:	(1) **Osteo**:Risk Of Early Onset Osteoporosis Due To Spaceflight (No longer used, July 2020)		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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PI Organization Type:	NON-PROFIT	**Phone:**	281-244-2012
Organization Name:	Universities Space Research Association		
PI Address 1:	Division of Space Life Sciences		
PI Address 2:	3600 Bay Area Blvd		
PI Web Page:			
City:	Houston	**State:**	TX
Zip Code:	77058	**Congressional District:**	22
Comments:			
Project Type:	FLIGHT	**Solicitation / Funding Source:**	Directed Research
Start Date:	10/01/2006	**End Date:**	08/31/2015
No. of Post Docs:	0	**No. of PhD Degrees:**	0
No. of PhD Candidates:	0	**No. of Master' Degrees:**	0
No. of Master's Candidates:	0	**No. of Bachelor's Degrees:**	0
No. of Bachelor's Candidates:	0	**Monitoring Center:**	NASA JSC
Contact Monitor:	Maher, Jacilyn	**Contact Phone:**	
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Flight Program:	ISS		
Flight Assignment:	ISS NOTE: End date is 8/31/2015 per HRP Master Task List dtd 7/12/11 (Ed., 8/4/11) NOTE: Extended to 9/30/2013 per PI (Ed., 11/5/2010)		
Key Personnel Changes/Previous PI:	Toshio Matsumoto, M.D., Ph.D., is the Japanese Co-Principal Investigator of this study, a joint project between NASA and JAXA. Dr. Matsumoto is affiliated with the Department of Medicine and Regulatory Sciences, University of Tokushima Graduate School of Medicine. His contact information is: Phone 81-88-633-7119/Fax 81-88-633-7407; Toshimat@clin.med.tokkushima-u.ac.jp		
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Grant/Contract No.:	Directed Research
Performance Goal No.:	
Performance Goal Text:	
Task Description:	The purpose of this Supplementary Medical Objective is to determine whether bisphosphonates, in conjunction with the routine in-flight exercise program, will protect ISS crewmembers from the regional decreases in bone mineral density documented on previous ISS flights. Two dosing regimens will be tested: (1) an oral dose of 70 mg alendronate taken weekly during flight and (2) and I.V. dose of zoledronic acid 4 mg, administered just once approximately 45 days before flight. Our rationale for including both alendronate and zoledronic acid is that two dosing options will: maximize crew participation, increase the countermeasure options available to flight surgeons, increase scientific opportunities, and minimize the effects of operational and logistical constraints. Use of both oral and I.V. options can accommodate both crew and flight surgeon preferences (e.g., based on individual drug sensitivity, relevant health conditions, or other considerations). Operational and logistical constraints may favor one option versus the other. For example, stowage limits may limit use of alendronate on certain flights, while the ability to titrate the in-flight dose in response to on-orbit measurements of bone resorption would favor the weekly dosing regimen. Long-duration (e.g., 2+ year) missions would require in-flight re-dosing of I.V. zoledronic acid. The purpose of this study is not to test one dosing option versus the other. Rather, we intend to show that bisphosphonates-plus-exercise will have a measurable effect versus exercise alone in preventing space flight induced bone loss. Secondary goals will be to document the return to normal bone remodeling post-flight in crewmembers who took bisphosphonates.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	While the primary purpose of this research is to develop a countermeasure to protect crewmembers against bone loss during long duration spaceflight, this research may provide insight into the mechanisms and prevention of bone atrophy in other disuse conditions.
Task Progress:	The original intent of this study was to test 10 long-duration crewmembers taking one of two bisphosphonate regimens: either 70 mg per week alendronate or a single infusion of 4 mg of zoledronic acid. After the study began testing in 2009, the JSC CPHS determined that only alendronate would be offered to U.S. crewmembers, while both dosing options could be offered to International Partners. It was further stipulated that only 5 alendronate subjects, plus 2 insurance subjects, would be allowed. We have now completed testing on all 7 of these alendronate subjects (with the exception of R+12mo testing on the last 2 subjects, which will take place in December 2012). No further subjects will be tested with bisphosphonates. All scheduled testing sessions for the 7 treated subjects—pre-flight, in-flight and post-flight--have been completed. The urine specimens for two of the seven however have not been returned to Earth because of the cancellation of the Shuttle program. We expect return of these samples on an upcoming Space-X resupply mission in late 2012. DXA, pQCT, QCT, and blood and urine data have been collated and preliminary analyses of the major parameters of interest have been performed, including some initial statistical analyses. Preliminary results from these 7 subjects were presented in a poster session at the February 2012 Human Research Program Investigators' Workshop in Houston, TX. The Japanese Principal Investigator, Dr. Toshio Matsumoto, plans to give an oral presentation of our results at the September 2012 meeting of the American Society for Bone and Mineral Research. In addition, Dr. LeBlanc gave oral presentations summarizing these results at the International Society of Gravitational Physiology/ESA Conference in Scotland (June 2012), and the ISS Research and Development Conference held in Denver, Colorado (June 2012). Last year, we reported that the study had obtained approval to add a new control group to the study, consisting of approximately 10 ISS crewmembers not taking bisphosphonates, but otherwise participating in essentially the same pre-, in-, and post-flight testing as the 7 treated subjects. The new control group should allow us to distinguish the relative effects of bisphosphonates vs. the confounder of ARED (Advanced Resistive Exercise Device) exercise, particularly at the level of trabecular vs. cortical bone. ((All treated subjects in this study have used the ARED device, whereas our previous control group used the older IRED (Interim Resistive Exercise Device) or other resistive exercise device, capable of much lower loads than ARED.)) Testing on this new control group began in 2012, with the first subject in this group completing a 6-month ISS flight in September, 2012. Two additional subjects are launching later this year, and 2 more have consented to participate. Three other crewmembers have been briefed but have not yet indicated whether they will participate. Depending on participation levels by the eligible ISS crewmembers, it is anticipated that this group will complete testing in approximately 2015. All testing to date for the first 3 control subjects, including QCT, DXA, pQCT, abdominal ultrasound, and blood and urine testing, has been completed on schedule and without incident.
Bibliography Type:	Description: (Last Updated: 10/15/2019)
Abstracts for Journals and Proceedings	LeBlanc A, Matsumoto T, Jones J, Shapiro J, Lang T, Shackelford L, Smith S, Evans H, Spector E, Ploutz-Snyder R, Sibonga J, Nakamura T, Kohri K, Ohshima H. "Antiresorptive Countermeasure For Spaceflight Bone Loss: Preliminary Results." 2012 NASA Human Research Program Investigators' Workshop, Houston, TX, February 14-16, 2012. 2012 NASA Human Research Program Investigators' Workshop, Houston, TX, February 14-16, 2012. , Feb-2012
Abstracts for Journals and Proceedings	Matsumoto T, LeBlanc A, Jones J, Shapiro J, Lang T, Shackelford L, Smith S, Evans H, Spector E, Ploutz-Snyder R, Sibonga J, Nakamura T, Kohri K, Ohshima H. "Prevention of Bone Loss during Spaceflight by Bisphosphonate." 2012 Annual Meeting of the American Society for Bone and Mineral Research, Minneapolis, Minnesota, October 12-15, 2012. J Bone Miner Res 2011;27(Suppl 1):S70-1. , Oct-2012