Fiscal Year:	FY 2004	**Task Last Updated:**	FY 03/31/2006
PI Name:	Thomas, James David M.D.		
Project Title:	Echocardiographic Assessment of Cardiovascular Adaptation and Countermeasures in Microgravity		
Division Name:	Human Research		
Program/Discipline:	NSBRI Teams		
Program/Discipline--Element/Subdiscipline:	NSBRI Teams--Smart Medical Systems Team		
Joint Agency Name:		**TechPort:**	No
Human Research Program Elements:	(1) **HHC**:Human Health Countermeasures		
Human Research Program Risks:	(1) **Cardiovascular**:Risk of Cardiovascular Adaptations Contributing to Adverse Mission Performance and Health Outcomes		
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:**	216-445-6312
Organization Name:	The Cleveland Clinic Foundation		
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PI Address 2:	9500 Euclid Ave		
PI Web Page:			
City:	Cleveland	**State:**	OH
Zip Code:	44195-0001	**Congressional District:**	11
Comments:			
Project Type:	GROUND	**Solicitation / Funding Source:**	2003 Biomedical Research & Countermeasures 03-OBPR-04
Start Date:	08/01/2004	**End Date:**	07/31/2008
No. of Post Docs:	1	**No. of PhD Degrees:**	
No. of PhD Candidates:	1	**No. of Master' Degrees:**	
No. of Master's Candidates:	1	**No. of Bachelor's Degrees:**	
No. of Bachelor's Candidates:	1	**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-SMS00404		
Performance Goal No.:			
Performance Goal Text:			
	Among the most serious of the risks identified by NASA in the area of cardiovascular alterations are serious dysrhythmias and the development of orthostatic intolerance. Prolonged exposure to microgravity may lead to a reduction in cardiac performance, particularly during times of stress and that undiagnosed cardiovascular disease may manifest during long missions. The PI and colleagues have worked closely with NASA and NSBRI over the last six years to optimize use of ultrasound in the space program as an investigative modality, addressing fundamental cardiovascular problems in need of countermeasures development. We propose the following specific aims: 1)Extension of work to calculate two-dimensional myocardial strain, improving sensitivity for detecting preclinical alterations in cardiac function. 2)Since early cardiac disease is usually manifest initially during exercise stress, we will develop and validate the tools to apply 2D strain in graded exercise to detect myocardial dysfunction in its earliest phases, allowing		

Task Description:	both diagnostic capabilities and a means of judging exercise as a countermeasure. 3)To continue our ongoing study of the magnitude and predictors of LV mass regression following acute volume and pressure unloading as a ground-based analog for manned spaceflight. This work will continue to focus on patients undergoing aortic valve surgery, but exploit recent knowledge of the roles of cytokines and integrins involved in cardiac hypertrophy and regression as well as emerging technologies such as gene chip analysis. 4)To develop, in collaboration with OBPR Fundamental Physics scientists from Glenn, a sophisticated fluid-structure model of the left ventricle constrained by the pericardium to investigate the impact that microgravity has on unloading the heart by a removal of pericardial constraint. This work will be closely focused on risks and critical questions identified by the Cardiovascular Alterations Team as described in the Bioastronautics Critical Path Road Map Baseline Document. If successful, this project will enhance assessment of cardiac function during long duration missions and potentially suggest cytokine promoters or signal transduction pathways that could be targeted for cardiac atrophy countermeasures. In addition, we will continue to provide the facilities of our Core laboratory for access by investigators throughout the NASA and NSBRI programs in need of assistance in acquiring or analyzing ultrasonic data.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	• Novice sonographers can be “coached” through an echocardiogram after only 4 hours of training • Ultrasound images successfully acquired with the ISS ultrasound unit and relayed to ground • Wavelet packet compression can be applied to 3D ultrasound at ratios > 100:1 • Digital echo storage and retrieval accomplished at CCF, >200 studies/day, 10 GB/day • Implementation of standalone software for intraventricular pressure gradient measurement • IVPG predictive of exercise capacity • Cardiac strain capable of characterizing LV function better than ejection fraction
Task Progress:	No progress report this period.
Bibliography Type:	Description: (Last Updated: 04/09/2019)