Fiscal Year:	FY 2010	**Task Last Updated:**	FY 02/11/2010
PI Name:	Dulchavsky, Scott A. M.D., Ph.D.		
Project Title:	Intuitive Ultrasound Catalog for Autonomous Medical Care		
Division Name:	Human Research		
Program/Discipline:	NSBRI		
Program/Discipline--Element/Subdiscipline:	NSBRI--Smart Medical Systems and Technology Team		
Joint Agency Name:		**TechPort:**	Yes
Human Research Program Elements:	(1) **ExMC**:Exploration Medical Capabilities		
Human Research Program Risks:	(1) **Medical Conditions**:Risk of Adverse Health Outcomes and Decrements in Performance Due to Medical Conditions that occur in Mission, as well as Long Term Health Outcomes Due to Mission Exposures		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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City:	Detroit	**State:**	MI
Zip Code:	48202-2608	**Congressional District:**	13
Comments:			
Project Type:	Ground	**Solicitation / Funding Source:**	Directed Research
Start Date:	01/01/2007	**End Date:**	06/30/2011
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:**	NSBRI
Contact Monitor:		**Contact Phone:**	
Contact Email:			
Flight Program:			
Flight Assignment:	NOTE: End date is now 6/30/2011 (previously 12/31/2010) per NSBRI (Ed., 10/10/2011) NOTE: Title change in October 2009 (previous title, "Ultrasound Catalog for Autonomous Medical Care").		
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Hamilton, Doug (NASA JSC) Melton, Shannon (Wyle Laboratories) Sargsyan, Ashot (Wyle Laboratories) Peck, Donald (Henry Ford Health System) Soltanian-Zadeh, Hamid (Henry Ford Health System)		
Grant/Contract No.:	NCC 9-58-SMS00002		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	The diagnosis and management of acute health problems in space is problematic; there is no radiological capability aboard the International Space Station (ISS) however, an ultrasound system is operational. Terrestrial investigations suggest expanded clinical applications of ultrasound which could be used to diagnose over 75% of space medical conditions. This proposal will use an outcomes oriented approach to develop an intuitive ultrasound image catalog, coupled with just-in-time training methods, to allow non-experts to acquire and interpret advanced ultrasound examinations. Specific Aim 1: Develop an intuitive ultrasound image cataloging system which incorporates ground acquired ultrasound whole body images. The catalog will acquire ground based crew-member images to use for medical diagnosis in space. Specific Aim 2: A mathematical coupling model will be developed based on existing ground/in-flight ultrasound data which will allow microgravity associated morphometric and topographic changes to be predicted. Specific Aim 3: Assess the ability of non-physician crew medical officers (CMO) analogs to acquire and interpret complex ultrasound examinations autonomously or with remote guidance. The constraints of spaceflight require the development of novel strategies for crew member health problems including ultrasound. Evidence based trials have demonstrated the accuracy of ultrasound in aerospace relevant clinical conditions when performed and interpreted by experts. ISS experiments have shown that just-in-time trained astronaut crew-members, augmented by on-board proficiency enhancement, can acquire complex, diagnostic quality ultrasound images. Expanding just-in-time ultrasound training to autonomous ultrasound operation, coupled with enhanced on-site interpretative capabilities, significantly expands diagnostic capabilities during exploratory class space missions. The majority of the training algorithms in this proposal are readily transferable to terrestrial medicine and provide a significant, clinically relevant advance in space medical capabilities with profound Earth-based ramifications.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	Expanding just-in-time ultrasound training to autonomous ultrasound operation, coupled with enhanced on-site interpretative capabilities, significantly expands diagnostic capabilities during exploratory class space missions. The majority of the training algorithms in this proposal are readily transferable to terrestrial medicine and provide a significant, clinically relevant advance in space medical capabilities with profound Earth-based ramifications. We have already modified these training methodologies for professional sporting activities in the NHL, NFL, Olympics, and baseball. We partnered with the University of Ottawa and the Canadian Space Agency to monitor High Altitude Pulmonary and Cerebral Edema on Mt. Everest this spring. We are working with the United Nations to develop a Maternal Care ultrasound program which will enhance maternal health worldwide. We recently completed a computer based ultrasound education course which is now used by the American College of Surgeons for education of all surgeons in ultrasound, the "Basic Ultrasound Course for Surgeons". We have also completed a textbook "ICU ultrasound" which incorporates all of the materials developed for the catalog grant.
Task Progress:	Specific Aim 1: Develop an intuitive ultrasound image cataloging system which incorporates ground acquired ultrasound whole body images. The catalog will allow ground based crew-member organ system images to be acquired and stored in an enhanced format for medical operations personnel to use for medical diagnosis in space. We are currently 60% complete on developing the intuitive, autonomous catalog grant and have begun populating the backbone with normal and pathologic images. We met with astronaut Leroy Chiao recently for user feedback on the design of the catalog and user interface. We will acquire additional normal and pathologic images in an ongoing fashion. Specific Aim 2: Develop a microgravity predictive, mathematical coupling model based on existing ground/in-flight ultrasound data which will allow microgravity associated morphometric and topographic changes to be predicted in the ultrasound catalog. The catalog will allow ground based crew-member organ system images to be acquired and stored in an enhanced format for medical operations personnel to use for medical diagnosis or research in space. We have converted and decoded 3/4 of the ISS ultrasound imagery (over 20,000 total!) for population and integration into the intuitive catalog. We have MRI/US data on 4 subjects to date to determine the correlation between MRI and ultrasound for use in the catalog. Specific Aim 3: Assess the ability of non-physician crew medical officers (CMO) analogs to acquire and interpret normal and pathologic ultrasound examinations using exam specific, cue cards and computer based proficiency enhancement autonomously or with remote guidance. We have developed and verified cue cards for cardiovascular, renal, eye, and musculoskeletal examinations and have successfully used these aids to teach non-physician medical students to perform advanced ultrasound examinations. We have developed intuitive multimedia videos for the majority of the remaining exam sections included in the catalog and will test these with CMO analogs this summer.
Bibliography Type:	Description: (Last Updated: 03/14/2025)
Books/Book Chapters	Killu K, Dulchavsky S. "ICU ultrasound handbook." Ed. K. Killu, S. Dulchavsky. Electronic Publication, November 2009., Nov-2009