Fiscal Year:	FY 2004	**Task Last Updated:**	FY 08/22/2005
PI Name:	Gerth, Wayne Ph.D.		
Project Title:	Optimization of Astronaut Decompression Sickness Prevention Protocols Using Probabilistic Gas and Bubble Dynamics Models		
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) **EVA**:Risk of Injury and Compromised Performance Due to EVA Operations		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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Zip Code:	32407-7015	**Congressional District:**	2
Comments:			
Project Type:	GROUND	**Solicitation / Funding Source:**	2003 Biomedical Research & Countermeasures 03-OBPR-04
Start Date:	05/15/2004	**End Date:**	06/30/2009
No. of Post Docs:	0	**No. of PhD Degrees:**	
No. of PhD Candidates:	0	**No. of Master' Degrees:**	
No. of Master's Candidates:	0	**No. of Bachelor's Degrees:**	
No. of Bachelor's Candidates:	0	**Monitoring Center:**	NASA JSC
Contact Monitor:		**Contact Phone:**	
Contact Email:			
Flight Program:			
Flight Assignment:	NOTE: Received NCE through 6/30/2009 per J. Dardano/JSC ; previous end date was 6/01/2008 (6/2008)		
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Conkin, Johnny (Baylor College of Medicine) Srinivasan, Ramachandra (Wyle Laboratories)		
Grant/Contract No.:	NNJ04HF52I		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	Astronauts are routinely exposed to atmospheric decompressions that incur significant risks of Decompression Sickness (DCS). These exposures occur during in flight Extravehicular Activity (EVA) and during ground-based operations that include EVA training exercises in neutral buoyancy facilities under hyperbaric conditions followed by flight in hypobaric aircraft cabins. Programmatic management of these risks requires: a) definition of risk/hazard envelopes for all routine and emergency decompressions that may be encountered by NASA training and flightcrew; b) quantitative consideration of the inclusion or introduction of such risks in the design, testing and implementation of new operational procedures and equipment, and; c) real-time monitoring of DCS risk incurred by personnel during various training and spaceflight operations. Proposed work will contribute to meeting these objectives through continued refinement and application of methods that allow DCS risks to be quantitatively estimated throughout the time courses of pressure/respired gas/time profiles of arbitrary complexity. The risks are computed as probabilistic functions of various properties of modeled DCS etiologic processes during the profiles, including in vivo gas exchange and bubble dynamics. These models now account for effects of exercise on the rates of compartmental blood-tissue gas exchange and the efficacy of oxygen pre-breathe, the effects of oxygen as a diffusible gas on bubble growth and resolution, vasoactive effects of oxygen, and how the profusion of bubbles in any given tissue is affected by the magnitude of the prevailing gas supersaturation. They have been successfully used to aid development of a reduced EVA prebreathe protocol, which has supported a total of 34 DCS-free EVAs from Space Station and Shuttle to date since first use on STS 104 in July 2001. Parameters in the models are optimized using maximum likelihood to ensure that the models provide their best-possible reproductions of experience in training data sets that consist of detailed descriptions of actual human decompressions and their observed DCS outcomes. Optimized models are then readily used to estimate DCS risks in particular profiles, or to compute prebreathe protocols and decompression schedules that explicitly limit DCS risk while minimizing time and materiel requirements. In proposed work, model training data sets will be expanded by addition of still-uncoded data from altitude, diving and flying-after-diving man-trials that have been completed at NASA, USAF Armstrong Laboratory and USN laboratories and their contractors. DCS incidence and time-of-occurrence models will be optimized about these expanded datasets and used to support continued development of reduced prebreathe time protocols for EVA in conjunction with the ISS DCS Risk Definition and Contingency Plan program at NASA-JSC. The models will also be used to integrate real-time precordial Doppler Venous Gas Emboli (VGE) data collected from EVA astronauts using the NASA-JSC In-Suit Doppler with previous experience to forward use of such information as a real-time premonitory index of DCS onset. Integrated system software for running the optimized models on personal computers will be packaged and delivered at conclusion of the program for evaluation and use by NASA personnel.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	
Task Progress:	Please note that this is a new grant. There is no research progress to report for this period. For more information on this grant or this PI, please contact the Task Book Help Desk at taskbook@nasaprs.com.
Bibliography Type:	Description: (Last Updated:)