

Fiscal Year:	FY 2005	Task Last Updated:	FY 11/23/2004
PI Name:	Pierson, Duane L Ph.D.		
Project Title:	A Comprehensive Characterization of Microorganisms and Allergens in Spacecraft Environment		
Division Name:	Human Research		
Program/Discipline:	HUMAN RESEARCH		
Program/Discipline--Element/Subdiscipline:	HUMAN RESEARCH--Environmental health		
Joint Agency Name:	TechPort:	No	
Human Research Program Elements:	(1) SHFH :Space Human Factors & Habitability (archival in 2017)		
Human Research Program Risks:	(1) Microhost :Risk of Adverse Health Effects Due to Host-Microorganism Interactions		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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Zip Code:	77058	Congressional District:	22
Comments:			
Project Type:	FLIGHT	Solicitation / Funding Source:	99-HEDS-03
Start Date:	07/01/2002	End Date:	10/01/2007
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
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Flight Program:			
Flight Assignment:			
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Stetzenbach, Linda (Harry Reid Center for Environmental Studies) Ott, C. Mark Mark (EASI/Wyle Laboratories)		
Grant/Contract No.:	None		
Performance Goal No.:			
Performance Goal Text:			
Task Description:	<p>This study of microorganisms, allergens, and microbial toxins in the spacecraft environment was initiated to ensure the health, safety, and performance of crewmembers during flight. As all previous methods evaluating spacecraft ecology utilized culture-based methodology, this study focuses on techniques that can identify most of the previously omitted microorganisms, such as the pathogens Legionella and Cryptosporidium. Likewise, culturable bacteria and fungi have been the only potential allergens studied; the more potent allergens, such as dust mites, have never been analyzed in spacecraft environments. No previous study has targeted microbial toxins. This study utilizes modern molecular biology, advanced microscopy, and immunochemical techniques to examine air, surface, and water samples for bacteria and fungi (total composition and specific pathogens), pathogenic protozoa (e.g., Cryptosporidium), allergens (e.g., dust mites), and microbial toxins (e.g., endotoxin and volatile organic compounds). This study of the International Space Station (ISS) will include (1) sampling and analysis of ISS modules immediately prior to launch to develop baseline</p>		

	levels of contamination, (2) direct on-orbit sampling of the ISS and subsequent ground analysis. This study will reveal previously undetected microorganisms, allergens, and microbial toxins in the spacecraft environment, which we anticipate will result in a more comprehensive health assessment of spacecraft during extended missions.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	The results of this study will provide insight into changes that occur in the microbial ecology of semi-closed systems. While this study is designed to predict trends in spacecraft, it can be applied to terrestrial systems such as office buildings and residential homes. The development of specific primers for bacterial enumeration and fungal identification during this study will also advance the ability of ground-based investigators to diagnose the potential sources of microbial contamination and give insight into the causes of "sick building syndrome."
Task Progress:	<p>The focus of the research over the past year has been to prepare for ground sampling and flight sampling. Due to limitations on time and refrigeration, the goal of the sampling and subsequent analysis was to minimize bacterial growth and protein activity after sample collection in order to retain the DNA of all constituents of the sample. A mixture of SDS and EDTA in Tris buffer was developed that had maximum protective capabilities for the DNA. Because of the potential of limited DNA in a given sample, ground studies have also focused on DNA extraction techniques that would be acceptable for bacterial, fungal, and viral analysis. While these studies continue, significant progress has been made. The research also focused on optimizing the flight hardware for preflight and ISS sample collection. The hardware has passed Critical Design Review with only minimal backup testing required. The engineering expertise of the JSC support team has reconfigured the ASD air sampler for flight use with minimal changes. An association with Charm Sciences has led to the development of a custom subface sampling swab that contains the SDS - EDTA solution for DNA preservation. In addition, specialized water collection bags that are modification of the current ISS water collection bags, have been developed to release the SDS-EDTA solution into the bag without risking contact with the crew. Previous relationships with Russian colleagues at Energia and the Institute of Biomedical Problems helped to incorporate the International Partners and their ISS components into this study.</p> <p>The study is on schedule for sample collection starting in 2005.</p>
Bibliography Type:	Description: (Last Updated: 03/24/2020)
Articles in Peer-reviewed Journals	Castro VA, Thrasher AN, Healy M, Ott CM, Pierson DL. "Microbial characterization during the early habitation of the International Space Station." Microb Ecol. 2004 Feb;47(2):119-26. PMID: 14749908 , Feb-2004
Articles in Peer-reviewed Journals	Ott CM, Bruce RJ, Pierson DL. "Microbial characterization of free floating condensate aboard the Mir space station." Microb Ecol. 2004 Feb;47(2):133-6. PMID: 14569419 , Feb-2004
Presentation	Ott, C. M. "Human Immune Function and Microbial Pathogenesis in Human Spaceflight " 10th International Symposium on Microbial Ecology, Cancun, Mexico Aug-2004
Presentation	Fontenot, S. F.; Castro, V. A.; Molina, T. M.; Thrasher, A. N.; Bruce, R. J.; Ott, C. M.; Pierson, D. L. "Microbial Characterization and Comparison of Isolates during the Mir and ISS Missions" 10th International Symposium on Microbial Ecology, Cancun, Mexico Aug-2004
Presentation	Ott, C. M. "Microbial Survey of the International Space Station" Microbial ecology forum at JPL discussing advancements and direction in microbial ecology and risk aboard long-duration spacecraft Jun-2004
Presentation	Pierson, D. L. "Current US Environmental Monitoring on ISS" NASA Fundamental Space Biology Microbial Workshop at KSC Feb-2004
Presentation	Ott, C. M. "Future Directions in Microbial Analysis of the International Space Station" NASA Fundamental Space Biology Microbial Workshop at KSC Feb-2004