

<b>Fiscal Year:</b>	FY 2012	<b>Task Last Updated:</b>	FY 01/15/2014
<b>PI Name:</b>	Loftus, David M.D., Ph.D.		
<b>Project Title:</b>	Cellular Studies to Support Pulmonary Toxicology Evaluation of Lunar Dust, Dermal Studies of Lunar Dust and Ocular Studies of Lunar Dust		
<b>Division Name:</b>	Human Research		
<b>Program/Discipline:</b>	HUMAN RESEARCH		
<b>Program/Discipline--Element/Subdiscipline:</b>	HUMAN RESEARCH--Environmental health		
<b>Joint Agency Name:</b>		<b>TechPort:</b>	No
<b>Human Research Program Elements:</b>	(1) <b>SHFH</b> :Space Human Factors & Habitability (archival in 2017)		
<b>Human Research Program Risks:</b>	(1) <b>Dust</b> :Risk of Adverse In-Mission Health and Performance Effects and Long-Term Health Effects Due to Celestial Dust Exposure		
<b>Space Biology Element:</b>	None		
<b>Space Biology Cross-Element Discipline:</b>	None		
<b>Space Biology Special Category:</b>	None		
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<b>Zip Code:</b>	94035	<b>Congressional District:</b>	18
<b>Comments:</b>			
<b>Project Type:</b>	Ground	<b>Solicitation / Funding Source:</b>	Directed Research
<b>Start Date:</b>	10/02/2006	<b>End Date:</b>	09/30/2012
<b>No. of Post Docs:</b>		<b>No. of PhD Degrees:</b>	
<b>No. of PhD Candidates:</b>		<b>No. of Master' Degrees:</b>	
<b>No. of Master's Candidates:</b>		<b>No. of Bachelor's Degrees:</b>	
<b>No. of Bachelor's Candidates:</b>	1	<b>Monitoring Center:</b>	NASA JSC
<b>Contact Monitor:</b>	Sullivan, Thomas	<b>Contact Phone:</b>	
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<b>Flight Program:</b>			
<b>Flight Assignment:</b>	<p>NOTE: End date changed to 9/30/2012 per HRP Master Task List information dtd 11/11/2011; however, end date is unclear from PI information (Ed., 12/1/2011)</p> <p>NOTE: Start/end dates changed to 10/2/2006-12/31/2010 (previously 1/30/2008-12/1/2010) per B. Woolford/JSC via S. Steinberg-Wright/JSC (9/2009)</p>		
<b>Key Personnel Changes/Previous PI:</b>			
<b>COI Name (Institution):</b>			
<b>Grant/Contract No.:</b>	Directed Research		
<b>Performance Goal No.:</b>			
<b>Performance Goal Text:</b>			

Task Description:	<p>We propose to carry out biomedical studies of lunar dust in order to characterize possible health effects, and to help set exposure limits for lunar dust for astronauts. Effort will be concentrated in three areas.</p> <p>1) Characterization of the cellular effects of lunar dust, as relate to pulmonary toxicology. We will study the effects of lunar dust on alveolar macrophages and bronchial epithelial cells, focusing on reactive oxygen species generation as well as other biochemical pathways that have been shown to be involved in the pathogenesis of lung disease mediated by terrestrial particulates. By studying lunar dust in comparison to terrestrial reference materials, we expect to be able to estimate the "rank order" of toxicity of lunar dust in comparison to these other well-characterized materials. These studies are designed to complement the animal studies (inhalation studies) that will be carried out at JSC.</p> <p>2) Characterization of the dermal effects of lunar dust. Based on the chemical characteristics of lunar dust and the extreme degree of sharpness and jaggedness of lunar dust particles, we can anticipate that inflammatory effects and abrasion may be issues. We will examine potential irritant effects and sensitization effects, and we will carry out abrasion studies, using cellular models, tissue equivalents models and animal models. These results of these studies will help us to anticipate the nature of skin problems that may arise from exposure to lunar dust, including effects related to lunar dust entry into the spacesuit.</p> <p>3) Ocular effects of lunar dust. We will examine the effects of lunar dust on the eye, by studying in vitro tissue models, isolated animal eyes and, to a limited degree, live animals. Ocular studies will follow dermal studies. Issues such as conjunctival irritation, corneal effects, and canalicular effects will be addressed. Biological evaluation of lunar dust in all three areas of investigation will be carried out using a variety of archived lunar dust specimens, obtained from the Lunar Dust Curation facility at JSC. We will use specimens that match those used by our counterparts at JSC (including particle size fractionation and chemical reactivation), so that our results can be compared directly.</p>
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	
Task Progress:	<p>Ed. NOTE (January 2014): See PI Chiu-wing Lam's final report for "Pulmonary Toxicity Studies of Lunar Dust in Mice and Rats," which includes final information for the entire LADTAG Lunar Dust Health Standard project. Reporting below from October 2012.</p> <p>Our inhalation study has been modified to perform additional inhalation work to demonstrate a no-effect level in test animals. We are about to begin a supplemental inhalation study at lower concentrations, and we have been granted an extension to complete this inhalation work. We have been able to demonstrate adequate performance of our inhalation apparatus down to 2.5 mg/m<sup>3</sup>, well below the previous, lowest concentration of 20 mg/m<sup>3</sup>.</p> <p>Several publications are in process: the ocular toxicity has been accepted for publication in BMC Ophthalmology, and is in final formatting by the journal. Publications on the respiratory instillation studies are in preparation. Three other reports will be submitted to the journal Science within 2-3 weeks. In addition, we have a general manuscript on the mechanisms associated with mineral dust toxicity in test animals that is ready to go once the core of 3 papers is accepted.</p>
Bibliography Type:	Description: (Last Updated: 06/18/2014)
Articles in Peer-reviewed Journals	<p>Linnarsson D, Carpenter J, Fubini B, Gerde P, Karlsson LL, Loftus DJ, Prisk GK, Staufer U, Tranfield EM, van Westrenen W. "Toxicity of lunar dust." Planetary and Space Science. 2012 Dec;74(1):57-71.  <a href="http://dx.doi.org/10.1016/j.pss.2012.05.023">http://dx.doi.org/10.1016/j.pss.2012.05.023</a> , Dec-2012</p>