Fiscal Year:	FY 2020	**Task Last Updated:**	FY 11/12/2019
PI Name:	Boerma, Marjan Ph.D.		
Project Title:	Gamma-Tocotrienol as a Countermeasure against High-Energy Charged Particle-Induced Carcinogenesis, Cardiovascular Disease, and Central Nervous System Effects		
Division Name:	Human Research		
Program/Discipline:			
Program/Discipline--Element/Subdiscipline:			
Joint Agency Name:		**TechPort:**	No
Human Research Program Elements:	(1) **SR**:Space Radiation		
Human Research Program Risks:	None		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
PI Email:	mboerma@uams.edu	**Fax:**	FY
PI Organization Type:	UNIVERSITY	**Phone:**	501-686-6599
Organization Name:	University of Arkansas, Little Rock		
PI Address 1:	4301 W. Markham Street, Slot 522-10		
PI Address 2:	Slot 522-10		
PI Web Page:			
City:	Little Rock	**State:**	AR
Zip Code:	72205-7101	**Congressional District:**	2
Comments:			
Project Type:	GROUND	**Solicitation / Funding Source:**	2017-2018 HERO 80JSC017N0001-BPBA Topics in Biological, Physiological, and Behavioral Adaptations to Spaceflight. Appendix C
Start Date:	01/31/2019	**End Date:**	03/31/2022
No. of Post Docs:		**No. of PhD Degrees:**	
No. of PhD Candidates:		**No. of Master' Degrees:**	
No. of Master's Candidates:		**No. of Bachelor's Degrees:**	
No. of Bachelor's Candidates:		**Monitoring Center:**	NASA JSC
Contact Monitor:		**Contact Phone:**	
Contact Email:			
Flight Program:			
Flight Assignment:	NOTE: End date changed to 3/31/2022 per NSSC information (Ed., 11/4/20)		
Key Personnel Changes/Previous PI:	November 2019 report: No changes.		
COI Name (Institution):	Landes, Reid Ph.D. (University of Arkansas, Little Rock) Weil, Michael Ph.D. (Colorado State University) Pathak, Rupak Ph.D. (University of Arkansas, Little Rock)		
Grant/Contract No.:	80NSSC19K0437		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	Recent evidence shows that radiation encountered during deep space travel is associated with increased risks of cancer. Administration of a dietary radiation countermeasure before and/or during the mission is an attractive option to reduce the carcinogenesis risk. Gamma-tocotrienol is one of the strongest radiation protectors of all natural compounds tested so far. It is safe, non-toxic and well tolerated, exhibits no interactions with other medications and requires no special storage conditions. It has anti-oxidant and anti-inflammatory properties and protects against endothelial dysfunction. Moreover, studies with tocotrienol administration in human subjects and animal models have shown cancer prevention. In our preliminary studies, gamma-tocotrienol reduced radiation-induced genomic instability, as detected by studying chromosomal aberrations, in human endothelial cells and in bone marrow cells of gamma-ray exposed mice. Altogether, based on its safety profile, biological properties, and our preliminary results, gamma-tocotrienol has high potential as radiation countermeasure during space travel. Here, we use a mouse model to test whether gamma-tocotrienol protects against radiation-induced carcinogenesis. For this purpose, genetically modified mice will be used that show a low spontaneous cancer rate, but increased tumor incidence in response to low-dose radiation. Male and female adult mice will be exposed to mixed charged particle beams to mimic galactic cosmic rays at the NASA Space Radiation Laboratory. Twenty-four hours before each radiation exposure, mice will be administered gamma-tocotrienol. Mice will be followed for 18 months after irradiation and inspected daily for tumor formation. In addition, bone marrow cells will be collected to assess the effects of gamma-tocotrienol on genomic instability by cytogenetic analysis. These studies will advance the countermeasure readiness level of gamma-tocotrienol against carcinogenesis risks of space radiation.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	There is concern about increased carcinogenesis risk after chronic exposures to low-dose ionizing radiation, such as from medical treatments, occupational low-dose exposures, and radiological accidents. The current project will provide evidence for gamma-tocotrienol as a safe countermeasure against radiation-induced carcinogenesis. This information will not only contribute to reducing the risk of radiation exposure during deep-space travel, but also the risks of carcinogenesis from exposure to low-dose rate radiation exposures on Earth.
Task Progress:	This is the progress report of year 1 of this project. The project is on schedule. This project makes use of a transgenic mouse model with a mutation in the p53 gene (P53 deltaP mice) on a mixed 129/SvJ and C57BL/6J background. These mice are not commercially available and need to be bred in-house. A breeding colony was established and is on schedule to produce >500 male and female mice as required for this project in year 2. In year 2 of the project, we plan to transport >500 mice to Brookhaven National Laboratory for exposure to simulated galactic cosmic rays at the NASA Space Radiation Laboratory. Twenty-four hours before irradiation, mice will be administered gamma-tocotrienol or vehicle. After irradiation, mice will be shipped to Colorado State University and the University of Arkansas for Medical Sciences for follow-up.
Bibliography Type:	Description: (Last Updated: 09/01/2023)