Fiscal Year:	FY 2021	**Task Last Updated:**	FY 12/17/2020
PI Name:	Jansson, Christer Ph.D.		
Project Title:	C4 Photosynthesis in Space (C4Space)		
Division Name:	Space Biology		
Program/Discipline:			
Program/Discipline--Element/Subdiscipline:			
Joint Agency Name:		**TechPort:**	No
Human Research Program Elements:	None		
Human Research Program Risks:	None		
Space Biology Element:	(1) Cell & Molecular Biology (2) Plant Biology		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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PI Organization Type:	GOVERNMENT	**Phone:**	509-371-6516
Organization Name:	Battelle Memorial Institute (Pacific Northwest National Laboratory)		
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PI Web Page:			
City:	Richland	**State:**	WA
Zip Code:	99354-1793	**Congressional District:**	4
Comments:			
Project Type:	FLIGHT	**Solicitation / Funding Source:**	2018 Space Biology (ROSBio) NNH18ZTT001N-FG. App B: Flight and Ground Space Biology Research
Start Date:	02/11/2020	**End Date:**	02/11/2023
No. of Post Docs:		**No. of PhD Degrees:**	5
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 KSC
Contact Monitor:	Massa, Gioia	**Contact Phone:**	321-861-2938
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Flight Program:			
Flight Assignment:			
Key Personnel Changes/Previous PI:	December 2020 report: Dr. Brian Stanfill has left Pacific Northwest National Laboratory and the project. Dr. Amir Ahkami has left the project due to other commitments.		
COI Name (Institution):	Handakumbura, Pubudu Ph.D. (Battelle Memorial Institute) Hixson, Kim Ph.D. (Battelle Memorial Institute) Rivas-Ubach, Albert Ph.D. (Battelle Memorial Institute)		
Grant/Contract No.:	Department of Energy IAA		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	C4 plants like maize (Zea mays) and sorghum (Sorghum bicolor) have a more efficient photosynthesis than C3 plants such as wheat (Triticum aestivum) and rice (Oryza sativa) due to a CO2-concentrating mechanism (CCM). How this CCM and the performance of C4 plants are impacted by space travel is unknown. We propose to compare the impact of space-station conditions on C3 and C4 metabolism using Brachypodium (Brachypodium distachyon) and Setaria (Setaria viridis) as model systems for C3 and C4 plants, respectively, and develop models that describe the molecular mechanisms for how C3 and C4 metabolisms are reprogrammed in the space environment compared to Earth. The obtained information would provide fundamental knowledge about C3 and C4 metabolism in space and could also be leveraged for evaluating the potential for growing small-stature cereal and vegetable C4 crops like foxtail millet (Setaria italica) and Amaranthus sp. for biogenerative support in future space explorations.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	The research provides fundamental understanding of plant biochemistry in space environments as well as an assessment of the suitability in utilizing C4 crops in biogenerative life support systems in future space explorations.
Task Progress:	During this first year of the project, we have worked with our NASA team to explore hardware and protocols. Per our proposal, we decided to use the two Vegetable Production Systems (Veggies) that can be housed on the International Space Station (ISS). We decided to use Magenta jar assemblies for growing the plants. Brachypodium distachyon and Setaria viridis seedlings will germinate and grow on foams within these assemblies. For the flight experiment we decided to utilize 24 Magenta jar assemblies housed within the two Veggie units (12 assemblies per Veggie unit). Surface-sterilized, dehusked seeds will be inserted embryo-side up within the dry foam and maintained in a dry state for launch to ISS. Upon arrival at the ISS, the Magenta jar assemblies will be transferred into Veggie where germination is triggered either by injection of liquid growth medium into the foam or by slow-releasing fertilizer pellets. Protocols for seed sterilization and germination were established.
Bibliography Type:	Description: (Last Updated:)