Fiscal Year:	FY 2022	**Task Last Updated:**	FY 02/21/2022
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		
PI Email:	pubudupinipa.handakumbura@pnnl.gov	**Fax:**	FY
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:	January 2020: Principal Investigator (PI) Christer Jansson, Ph.D. has retired from Pacific Northwest National Laboratory (PNNL) and will be leaving the project. CoInvestigator (CoI) Pubudu Handakumbura, Ph.D. will be taking over the project as PI for the remainder of the grant. Dr. Handakumbura is also with PNNL. 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 second year of the project, we have worked with our NASA team to further optimize hardware and protocols. We have optimized the seed surface sterilization protocol, and tested seed viability post sterilization and seed storage. Sterilized Brachypodium and Setaria seeds were provided to the NASA team for parallel ground testing at KSC. Two different growth media were tested with two different watering and nutrient amendment regimes. Global metabolite profiles of four-week-old Brachypodium and Setaria were collected as a reference point for the ground control experiments. A handheld fluorometer is currently being tested, using the ground control experiments for capturing photosynthetic measurements, to evaluate its usability in the International Space Station (ISS). A success criterion has been established for the proposed workflow.
Bibliography Type:	Description: (Last Updated:)