Fiscal Year:	FY 2022	**Task Last Updated:**	FY 12/07/2022
PI Name:	Mudawar, Issam Ph.D.		
Project Title:	Analysis of ISS Data from the Flow Boiling and Condensation Experiment (FBCE)		
Division Name:	Physical Sciences		
Program/Discipline:			
Program/Discipline--Element/Subdiscipline:	FLUID PHYSICS--Fluid physics		
Joint Agency Name:		**TechPort:**	No
Human Research Program Elements:	None		
Human Research Program Risks:	None		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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City:	West Lafayette	**State:**	IN
Zip Code:	47907-1288	**Congressional District:**	4
Comments:			
Project Type:	GROUND	**Solicitation / Funding Source:**	Physical Sciences Unsolicited
Start Date:	01/01/2022	**End Date:**	12/31/2024
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 GRC
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Flight Program:			
Flight Assignment:			
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Hasan, Mohammad Mujibul M.Sc. (NASA Glenn Research Center)		
Grant/Contract No.:	80NSSC22K0328		
Performance Goal No.:			
Performance Goal Text:			
	As space missions increase in scope, size, complexity, and duration, so do both power and heat dissipation demands. This is particularly the case for future manned missions to Mars. Paramount to the success of these missions is the ability to reduce size and weight, including those of thermal management sub-systems. One means to achieving this goal is to transition from single-phase to two-phase thermal management. By capitalizing upon the merits of both latent and sensible heat exchange rather than sensible exchange alone, two-phase systems can yield orders of magnitude enhancement in evaporation and condensation heat transfer coefficients compared to single-phase systems. These improvements are evident from recent NASA workshops that culminated in critical recommendations concerning the implementation of flow boiling and condensation in a variety of space applications such as Rankine cycle power conversion, thermal control systems, and advanced life support systems. The Flow Boiling and Condensation Experiment (FBCE) was conceived in 2011 with the intent of developing an integrated two-phase flow		

Task Description:	boiling/condensation facility for the International Space Station (ISS) to serve as a primary platform for obtaining two-phase flow and heat transfer data in microgravity. By comparing the microgravity data against those obtained in Earth's gravity, it will be possible to ascertain the influence of body force on two-phase transport phenomena in pursuit of predictive design tools, and to help determine minimum flow criteria that would ensure gravity independent flow boiling and condensation. FBCE is a joint effort between the Purdue University Boiling and Two-Phase Flow Laboratory (PU-BTPFL) and the NASA Glenn Research Center. On August 10, 2021, FBCE was launched to the International Space Station (ISS) aboard Northrop Grumman's Antares rocket as part of the NG-16 Cygnus Spacecraft. FBCE is configured to accommodate one of two replaceable test modules at a given time. The first series of tests will be performed using the Flow Boiling Module (FBM) and, thereafter, a second series of tests using the Condensation Module for Heat Transfer Measurements (CM-HT), which would replace FBM on the ISS. Key objectives of the proposed project will be to acquire information from the ISS microgravity heat transfer data and video records as well as assess validity and accuracy of recorded data for different operating conditions. The ISS data will be used to (1) assess and retrofit available empirical correlations and demonstrate validity for different gravities, (2) assess and retrofit available theoretical models and demonstrate validity for different gravities, (3) assess and retrofit models for minimum velocity that would ensure gravity independent heat transfer, and (4) develop computational fluid dynamics (CFD) models for both flow boiling and flow condensation.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	
Task Progress:	New project for FY2022.
Bibliography Type:	Description: (Last Updated: 11/24/2023)