Fiscal Year:	FY 2017	**Task Last Updated:**	FY 06/01/2017
PI Name:	Chen, Maijinn M. Arch.		
Project Title:	Computational Model for Spacecraft/Habitat Volume (Spacecraft Optimization Layout and Volume (SOLV))		
Division Name:	Human Research		
Program/Discipline:			
Program/Discipline--Element/Subdiscipline:			
Joint Agency Name:		**TechPort:**	Yes
Human Research Program Elements:	(1) **HFBP**:Human Factors & Behavioral Performance (IRP Rev H)		
Human Research Program Risks:	(1) **HSIA**:Risk of Adverse Outcomes Due to Inadequate Human Systems Integration Architecture		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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City:	Houston	**State:**	TX
Zip Code:	77058	**Congressional District:**	36
Comments:			
Project Type:	GROUND	**Solicitation / Funding Source:**	2013 HERO NNJ13ZSA002N-Crew Health (FLAGSHIP & NSBRI)
Start Date:	02/06/2017	**End Date:**	05/31/2018
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:	Williams, Thomas	**Contact Phone:**	281-483-8773
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Flight Program:			
Flight Assignment:			
Key Personnel Changes/Previous PI:	May 2017: New Principal Investigator is: Maijinn Chen, M. Arch. (KBRwyle). Co-Investigators: Simon Hsiang, Ph.D. (U. of North Carolina- Charlotte) Jerry Myers, Ph.D. (NASA Glenn Research Center). Key Contributors: Debra Goodenow (NASA Glenn Research Center) ; Churlzu Lim, Ph.D. (U. of North Carolina- Charlotte) ; Richard Morency (NASA Johnson Space Center) ; Claudia Ramirez (U. of North Carolina- Charlotte) ; Sam Wald (Massachusetts Institute of Technology)		
COI Name (Institution):	Hsiag, Simon Ph.D. (University of North Carolina-Charlotte) Myers, Jerry Ph.D. (NASA Glenn Research Center)		
Grant/Contract No.:	Internal Project		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	NOTE: Continues "Computational Model for Spacecraft/Habitat Volume (Spacecraft Optimization Layout and Volume (SOLV))" with PI Dr. Sherry Thaxton due to Dr. Thaxton's move to Human Factors & Behavioral Performance Deputy Element Scientist, as of 2/5/2017. A key design challenge for future long-duration exploration missions is determining the appropriate volume of a spacecraft/habitat to accommodate habitability functions and ensure optimal crew health, performance, and safety. Because spacecraft/habitat volume directly drives mass and cost, this information is needed early in the design process. This proposal is in response to the NASA Research Announcement (NRA) NNJ13ZSA002N A.2.i: Computational Modeling and Simulation for Habitat/Vehicle Design and Assessment, and it addresses the Human Research Program (HRP) Program Requirements Document (PRD) Risk of Incompatible Vehicle/Habitat Design. The objective of this proposal is to develop a constraint-driven, optimization-based model that can be used to estimate and evaluate spacecraft/habitat volume. The computational model development will be completed through four Specific Aims: Estimate spacecraft/habitat volume based on mission parameters and constraints, provide layout assumptions for a given volume, assess volumes based on a set of performance metrics, and inform risk characteristics associated with a volume. To accomplish this, the proposed team has been structured to leverage expertise from diverse fields, including architecture and habitation design, human factors engineering, industrial engineering, optimization-based modeling, and simulation. The proposed work will also leverage technical products developed from the HRP-hosted 2012 Habitable Volume Workshop, as well as work performed in the follow-on exploratory project in 2013, including critical task volume estimations and input/output definitions for the computational model. Lessons learned from the development of the Integrated Medical Model (IMM) developed by the Exploration Medical Capability Element (ExMC) of the HRP will also be applied to the proposed work -- lessons ranging from model development approach to compliance with NASA STD 7009, Standard for Models and Simulation. Model validation and verification will be a continuous process occurring throughout model development. The guidelines of NASA-STD-7009 will be followed in establishing parameters and vetting the credibility of the model at all stages of development. The outcome of the proposed work will directly answer to HRP's Risk of Incompatible Vehicle/Habitat Design and the associated Space Human Factors Engineering (SHFE) SHFE-HAB-09 Gap on technologies, tools, and methods for data collection, modeling, and analysis for design and assessment of vehicles/habitats. A computational model for spacecraft/habitat volume will be an invaluable tool for designers, mission planners, integrators, and evaluators who are shaping space habitats and working toward a truly habitable environment for future long-duration exploration missions.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	Earth industries that are concerned with habitability in confined environments for long durations (e.g., shipping, submarines, oil and gas rigs, Antarctic research stations) may benefit from the task-based approach in development for determining overall volume needs.
Task Progress:	New project for FY2017. NOTE: Continues "Computational Model for Spacecraft/Habitat Volume (Spacecraft Optimization Layout and Volume (SOLV))" with PI Dr. Sherry Thaxton due to Dr. Thaxton's move to Human Factors & Behavioral Performance Deputy Element Scientist, as of 2/5/2017. See that project for previous reporting.
Bibliography Type:	Description: (Last Updated: 06/06/2018)