Fiscal Year:	FY 2015	**Task Last Updated:**	FY 07/06/2015
PI Name:	Rajulu, Sudhakar Ph.D.		
Project Title:	Quantification of In-flight Physical Changes - Anthropometry and Neutral Body Posture (NBP)		
Division Name:	Human Research		
Program/Discipline:	HUMAN RESEARCH		
Program/Discipline--Element/Subdiscipline:	HUMAN RESEARCH--Space Human Factors Engineering		
Joint Agency Name:		**TechPort:**	No
Human Research Program Elements:	(1) **HFBP**:Human Factors & Behavioral Performance (IRP Rev H)		
Human Research Program Risks:	(1) **Dynamic Loads**:Risk of Injury from Dynamic Loads (2) **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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Organization Name:	NASA Johnson Space Center		
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City:	Houston	**State:**	TX
Zip Code:	77058	**Congressional District:**	22
Comments:			
Project Type:	FLIGHT	**Solicitation / Funding Source:**	Directed Research
Start Date:	08/31/2012	**End Date:**	09/30/2018
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:	Whitmore, Mihriban	**Contact Phone:**	281-244-1004
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Flight Program:	ISS		
Flight Assignment:	ISS NOTE: Extended to 9/30/2018 per E. Connell/HRP (Ed., 7/20/15)		
Key Personnel Changes/Previous PI:	July 2015: Added Ryan Amick as Co-Investigator.		
COI Name (Institution):	Young, Karen (Lockheed Martin) Reid, Christopher (Lockheed Martin) Dirlich, Tom (Technical University Munich (TUM)) Amick, Ryan Ph.D. (Lockheed Martin)		
Grant/Contract No.:	Directed Research		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	NASA suit engineers and the Extra-Vehicular Activity (EVA) Projects Office have identified that suit fit in microgravity could become an increasing issue. It has also been noted that crewmembers often need to adjust their suit sizing once they are in orbit. This adjustment could be due to microgravity effects on anthropometry and postural changes, and is necessary to ensure optimal crew performance, fit, and comfort in space. To date, the only data collected in space to determine the effects of microgravity on physical human changes have been during Skylab, STS-57, and a recent Human Research Program (HRP) study on seated height changes due to spinal elongation, Spinal Elongation (Master Task List [MTL] 221, Principal Investigator Rajulu-- https://), (Young, 2011). Skylab and the STS-57 studies found that there is a distinct neutral body posture (NBP) based on photographs. Additionally, Skylab studies found that crewmembers could experience a stature growth of up to 3 percent. The Spinal Elongation study identified that the crewmembers could experience about a 6 percent growth in seated height and a 3 percent stature growth, when exposed to microgravity. The results thus prove that not all anthropometric measurements have the same microgravity percent growth factor. In order for EVA and the suit engineers to properly update the sizing protocol for microgravity, they need additional anthropometric data from space. Hence, this study was picked up by the International Space Station (ISS) as Test bed for Analog Research (ISTAR) Program and was sponsored and funded by EVA to gather additional in-flight anthropometric measurements, such as lengths, depths, breadths, and circumferences to determine the changes to body shape and size due to microgravity effects. It is anticipated that by recording the potential changes to body shape and size, a better suit sizing protocol will be developed for ISS and other space missions. In essence, this study will help NASA quantify the impacts of microgravity on anthropometry to ensure optimal crew performance, fit, and comfort. Additional in-flight physical changes due to neutral body postures (NBP) and the effects of spaceflight on NBP during extended exposure to microgravity also need to be quantified. This study will use simplistic data collection techniques, digital still and video data, to perform photogrammetric analyses to determine the changes that occur to the body shape, size, and NBP while exposed to a microgravity environment. The aim of the study is to collect data from a minimum of three subjects per year over a four year time frame leading to a possible 12 subjects total. Data would be collected over multiple six month increments starting with increment 39/40 in November 2013. A minimum of three data collection sessions is required with an initial in-flight data collection session at approximately FD15. Anthropometric measurements will be collected from crew participants during one pre-flight BDC (baseline data collection), three in-flight data collection points (early, mid, and late at minimum), and one post-flight BDC session. In-flight data collection will include photo and video based measurements for body lengths and postures, as well as tape measure measurements for body segment circumferences. Ground based BDC data collection sessions will be performed in the US Lab mockup and in the Anthropometry and Biomechanics Facility at Johnson Space Center (JSC).
Rationale for HRP Directed Research:	This research is directed because it contains highly constrained research, which requires focused and constrained data gathering and analysis that is more appropriately obtained through a non-competitive proposal.
Research Impact/Earth Benefits:	
Task Progress:	Inflight data collection began October 2013 with Expedition 37/38 and has continued during Expeditions 38/39, 39/40, 40/41, 42/43, 44/45. The study will continue till an N=9 has completed the study; to-date six subjects have completed the study, and three are currently performing pre-flight training and data collection sessions. During FY2015 several inflight data collections sessions have occurred, along with training and pre-flight data collection sessions to instruct the crew on the procedures and to obtain their baseline measurements before flight (both as Prime crew and Backup crew).
Bibliography Type:	Description: (Last Updated: 03/25/2020)