Fiscal Year:	FY 2018	**Task Last Updated:**	FY 04/25/2018
PI Name:	Fischer, Ute Ph.D.		
Project Title:	Understanding Key Components of Successful Autonomous Space Missions		
Division Name:	Human Research		
Program/Discipline:			
Program/Discipline--Element/Subdiscipline:	HUMAN RESEARCH--Behavior and performance		
Joint Agency Name:		**TechPort:**	No
Human Research Program Elements:	(1) **HFBP**:Human Factors & Behavioral Performance (IRP Rev H)		
Human Research Program Risks:	(1) **BMed**:Risk of Adverse Cognitive or Behavioral Conditions and Psychiatric Disorders (2) **Team**:Risk of Performance and Behavioral Health Decrements Due to Inadequate Cooperation, Coordination, Communication, and Psychosocial Adaptation within a Team		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
PI Email:	ute.fischer@gatech.edu	**Fax:**	FY
PI Organization Type:	UNIVERSITY	**Phone:**	404-894-7627
Organization Name:	Georgia Institute of Technology		
PI Address 1:	School of Literature, Communication and Culture		
PI Address 2:	686 Cherry Street		
PI Web Page:			
City:	Atlanta	**State:**	GA
Zip Code:	30332-0165	**Congressional District:**	5
Comments:			
Project Type:	GROUND	**Solicitation / Funding Source:**	2015-16 HERO NNJ15ZSA001N-Crew Health (FLAGSHIP, NSBRI, OMNIBUS). Appendix A-Crew Health, Appendix B-NSBRI, Appendix C-Omnibus
Start Date:	06/29/2016	**End Date:**	06/28/2019
No. of Post Docs:	0	**No. of PhD Degrees:**	0
No. of PhD Candidates:	0	**No. of Master' Degrees:**	0
No. of Master's Candidates:	0	**No. of Bachelor's Degrees:**	0
No. of Bachelor's Candidates:	0	**Monitoring Center:**	NASA JSC
Contact Monitor:	Williams, Thomas	**Contact Phone:**	281-483-8773
Contact Email:	thomas.j.will1@nasa.gov		
Flight Program:			
Flight Assignment:	NOTE: Element change to Human Factors & Behavioral Performance; previously Behavioral Health & Performance (Ed., 1/18/17)		
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Mosier, Kathleen Ph.D. (Teamscape LLC) Tofighi, Davood Ph.D. (University of New Mexico, Albuquerque)		
Grant/Contract No.:	NNX16AM16G		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	Exploration space missions will require that space crews manage tasks more autonomously than in current operations, although they will continue to be part of the multi-team system (MTS) comprised of members in space and on the ground. The overall goal of the proposed research is to develop countermeasures that will enhance the ability of MTS members to maintain effective team performance and manage autonomous operations during Long Duration Exploration Missions (LDEMs). We will use NASA Life Sciences Data Archive (LSDA) data collected in space analogs and the International Space Station (ISS) to develop models of the individual- and team-level relationships between crew autonomy, emergent states, and team performance. Additionally, several simulations will be conducted in space analogs to assess the impact of different autonomy implementations on MTS performance in long-duration missions. Data from this study will be used to refine the individual- and team-level models, and to create a MTS-level model of the autonomy-performance relationship. Our approach is comprehensive in that we will examine different implementations and levels of autonomy, experience with interdependent and autonomous operations, individual and team process variables as well as varying task constraints. A set of products to support space and mission control teams during long-duration exploration missions will be delivered. These include: a validated model of factors related to team autonomy and team performance in LDEMs; recommendations for how team autonomy should be managed within a MTS during LDEMs, including countermeasures to mitigate potential negative effects; and recommendations for future research on autonomous team functioning.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	Multiteam collaboration is not a unique feature of spaceflight operations but common to many organizations, as is the question of how best to implement task autonomy within a multiteam system. We therefore expect that our research findings not only generalize to other isolated and confined extreme (ICE) environments, such as Antarctica, but also apply to any organization that require the collaboration by different work units.
Task Progress:	We completed the definition phase for this research at the end of August 2017. Since then work on Phase 1 research (i.e., use of data stored in the Life Science Data Archive, LSDA, in statistical modeling) and on Phase 2 research (studies in analog environments) has commenced. In late October 2017 we obtained approval of the Life Science Advisory Board to proceed with our data request to the LSDA. Next we initiated the re-consent procedures of individuals who had participated in the original (i.e., archived) studies to give their consent that their data be re-used in our study. Data transfer from the LSDA is ongoing. Because currently available data sets include few measures on the level of the space crew/mission control multi-team system, we are conducting supplementary analyses of existing recordings (or transcripts) of crew-mission control communications. This analysis examines the communication frequency and flow, as well as content, and interpersonal aspect of the space-ground communications. Presently we are analyzing space-ground communications in Skylab 4 focusing on the days just prior to and shortly after the crew's "mutiny" as well as towards the end of the mission to identify changes in communication frequency and patterns as a result of increased crew autonomy. Work on Phase 2 research has also begun. We will be part of two space exploration simulations Human Exploration Research Analog (HERA) and Scientific International Research In a Unique terrestrial Station (SIRIUS) (HERA-C5 and SIRIUS) scheduled to start in February 2019 and March 2019, respectively. HERA-C5 missions will have a duration of 45 days. Missions in this campaign will involve communication delays (increasing from 30 seconds to 5 minute, one-way); however, they will not include any crew autonomy manipulation and thus will serve as a base-rate to SIRIUS and future HERA campaigns. The SIRIUS mission will take place in the NEK (Nezemnyy Eksperimental'nyy Kompleks) facility in Moscow, Russia, and will involve a collaboration between the Russian Institute for Biomedical Problems (IBMP), NASA, and other international partners (DLR--German Aerospace Center; JAXA--Japan Aerospace Exploration Agency). The 4-month mission will involve communication delay and crew autonomy and thus will provide us with the opportunity to examine the longitudinal impact of crew autonomy on crewmembers and mission controllers and their collaboration. We participated in design meetings for HERA-C5 (in December 2017) and SIRIUS (March 2018) and have submitted our science requirements. Both campaigns will include the same measurements with the exception of communication measures. We may not be able to analyze the communications between SIRIUS crewmembers or their interactions with flight controllers since they will be conducted in Russian and we may not be able to obtain English translations. To compensate for the absence of these measures, we included self-report measures in which crewmembers and flight controllers assess and provide information on their interactions. Both campaigns will present crewmembers with two types of tasks (Demand Events and Stretch Events) repeatedly throughout a mission. Possible tasks have been developed and will be refined in discussions with the Human Research Program (HRP) Lead and International Implementation Specialists for SIRIUS.
Bibliography Type:	Description: (Last Updated: 03/22/2024)
Abstracts for Journals and Proceedings	Fischer, U, Mosier K, Tofighi D. "A research approach to understanding key components of successful autonomous space missions." Presented at 2018 NASA Human Research Program Investigators' Workshop, Galveston, TX, January 22-25, 2018. 2018 NASA Human Research Program Investigators' Workshop, Galveston, TX, January 22-25, 2018. , Jan-2018
Books/Book Chapters	Fischer U, Mosier K. "Teamwork in Spaceflight Operations." in "The Oxford Handbook of Expertise: Research and Application." Ed. P. Ward, J. M. Schraagen, J. Gore, E. Roth. Oxford, UK: Oxford University Press, in press as of April 2018., Apr-2018