Fiscal Year:	FY 2018	**Task Last Updated:**	FY 03/03/2018
PI Name:	LePine, Jeffrey Ph.D.		
Project Title:	Understanding and Preventing Crew Member Task Entrainment		
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) **HSIA**:Risk of Adverse Outcomes Due to Inadequate Human Systems Integration Architecture (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		
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Comments:			
Project Type:	Flight,Ground	**Solicitation / Funding Source:**	2013-14 HERO NNJ13ZSA002N-ILSRA. International Life Sciences Research Announcement
Start Date:	06/01/2015	**End Date:**	05/15/2019
No. of Post Docs:		**No. of PhD Degrees:**	
No. of PhD Candidates:	3	**No. of Master' Degrees:**	
No. of Master's Candidates:		**No. of Bachelor's Degrees:**	
No. of Bachelor's Candidates:		**Monitoring Center:**	NASA JSC
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Flight Program:	ISS		
Flight Assignment:	NOTE: Extended to 5/15/2019 per NSSC information (Ed., 3/6/18) NOTE: Element change to Human Factors & Behavioral Performance; previously Behavioral Health & Performance (Ed., 1/18/17)		
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Wellman, Edward Ph.D. (Arizona State University)		
Grant/Contract No.:	NNX15AK77G		
Performance Goal No.:			
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Task Description:	The proposal responds to the request for research exploring Team Task Switching in Astronaut Crews on the International Space Station (ISS). We propose ground- and flight-based experiments to understand and mitigate the performance deficits caused by crew members switching between independent and interdependent tasks. Drawing on our own research, as well as that conducted by other scholars, we explain how crew member entrainment is produced by deep levels of cognitive, physical, and affective engagement or immersion in tasks, which make it difficult for members to disengage from those tasks – even after they have switched to a different task. We hypothesize that, as a result of this immersion/engagement, entrainment causes subsequent task engagement and effectiveness to suffer. We further hypothesize that the strength of this effect influenced by perceptions of task closure.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	Scholars have conducted research on task transitions and highly variable work (Louis & Sutton, 1991; Monsell, 2003), considering what generally makes an effective transition or worker. Unfortunately, we do not fully understand how individuals' psychological connections to the tasks they perform fluctuate when they transition between those tasks as well as the impact on subsequent task effectiveness. A more robust understanding of the psychological connections individuals maintain with tasks—after having previously transitioned—are critical to improving and maintaining the effectiveness of crew members as well as individuals on Earth. Leroy, S. (2009). Why is it so hard to do my work? The challenge of attention residue when switching between work tasks. Organizational Behavior and Human Decision Processes, 109(2), 168-181. http://dx.doi.org/ Louis, M. R., & Sutton, R. I. (1991). Switching cognitive gears: From habits of mind to active thinking. Human Relations, 44(1), 55-76. http://dx.doi.org/ Monsell, S. (2003). Task switching. Trends in cognitive sciences, 7(3), 134-140. http://dx.doi.org/
Task Progress:	Aims of Proposal: The proposed research program begins to address the performance effects of entrainment to a particular work style and then switching to another style during an operational space flight context. Specifically, we explore what can be done to mitigate the negative effects of entrainment and improve individual and team capabilities to engage in effective task switching. In addressing these questions, the proposed studies also contribute to answering the following identified Integrated Research Plan (IRP) gaps: Team Gap 1 (need to understand threats to teams during long duration missions), Team Gap 3 (need to identify countermeasures to support team function for all phases of autonomous, long duration missions), and Team Gap 8 (need to identify psychosocial and psychological factors, measures, and combinations thereof that can be used to compose effective crews for autonomous, long-duration missions). We consider how crew member entrainment (Ancona & Chong, 1996) is influenced by the linkage between employee engagement and effectiveness in the context of jobs that vary in regard to required physical, cognitive, and emotional energies. The problem of entrainment may be especially problematic as astronauts shift between individual and crew tasks that may vary significantly in their physical, cognitive, and emotional demands (Smith-Jentsch, 2015). Although individual, job, and organizational attributes foster a base of job engagement (Kahn, 1990), features of the specific tasks that individuals transition between can also foster attention residue, or the inability to decouple one's energies from previous tasks (Leroy, 2009), which in turn, can hinder effectiveness in subsequent tasks. In other words, lingering engagement in prior tasks after a transition has occurred makes it difficult for individuals to mentally disengage and disconnect from their prior task and focus their full attention on the new task. The difficulty in transitioning also creates problems with transitions between tasks, and in turn, hinders effectiveness in subsequent tasks. We are currently conducting ground experiments within HERA (Human Explorations Research Analog) and have begun to extend our research with astronauts aboard the ISS. The findings from these experiments will enhance our understanding of the psychological and interpersonal pathways through which entrainment operates, and individual and task attributes that can mitigate its effects. This could lead to the development of interventions to improve individual and team effectiveness in a variety of organizational contexts including exploration missions. HERA Campaigns: In 2017, we tested our hypotheses in three HERA missions, one of which was cut short by Hurricane Harvey. Consequently, we plan to continue testing our hypotheses with HERA missions in 2018. Prior to analog participation, we collected relevant personality characteristics and demographic information of participants. In order to integrate our study as seamlessly as possible into the natural workflow of HERA non-astronaut crew members, we identified transitions between independent and interdependent tasks that are performed regularly by all crew members and for which performance data is already available. In other words, we did not introduce any new tasks, but rather utilized the existing maintenance and other payload tasks which were scheduled to occur during the mission. With this information in mind, we were able to select a finalized series of "task-transition-task" episodes to serve as the focal point of the study. After the completion of the second task, crew members completed a brief survey about their engagement and attention residue in the tasks. Individuals in HERA mission control recorded notes about crew member task effectiveness. In total, we have thus far analyzed 477 task-transition-task episodes. We employed multilevel path analysis (transitions nested within individuals) to test our hypotheses. We found that NASA crews experienced attention residue when transitioning from one task to another that partially offset the positive spillover of engagement. Our results suggest that individuals may find it challenging to let go of engaging tasks, and the degree to which they hang on cognitively appears to hinder their subsequent task engagement and task effectiveness. Overall, our findings from HERA and previous Arizona State University (ASU) lab studies reveal a better understanding of the transitional process that influences effectiveness in multifaceted work as crew members transition between tasks. Importantly, we find that engagement in a prior task can have both positive and negative consequences on subsequent tasks. On the positive side, individuals who exhibit higher levels of engagement in an initial task are more likely to experience positive affect and thereby engage in subsequent tasks, increasing their effectiveness. However, on the negative side we find that engagement in a prior task can also linger after individuals move on to subsequent tasks, negatively impacting subsequent task engagement and effectiveness. Achieving a sense of closure is critical in reducing the negative cognitive effects that can linger. When tasks are incomplete, the negative pathway remains active and reduces subsequent engagement and effectiveness. However, when previous tasks are completed, then the negative effects are short-circuited. Our ongoing research aims at helping NASA leverage the benefits of engaging work during task transitions, while limiting the associated risks of attention residue.

	References Ancona, D., & Chong, C. L. (1996). Entrainment: Pace, cycle, and rhythm in organizational behavior. Research in Organizational Behavior, 18, 251-284. Smith-Jentsch, K. A. (2015). On shifting from autonomous to interdependent work: What we know and what we need to learn (pp. 1-31). Houston, TX: National Aeronautics and Space Administration (NASA). Kahn, W. A. (1990). Psychological conditions of personal engagement and disengagement at work. Academy of Management Journal, 33(4), 692-724. Leroy, S. (2009). Why is it so hard to do my work? The challenge of attention residue when switching between work tasks. Organizational Behavior and Human Decision Processes, 109(2), 168-181.
Bibliography Type:	Description: (Last Updated: 03/20/2020)
Articles in Peer-reviewed Journals	Bush JT, LePine JA, Newton DW. "Teams in transition: An integrative review and synthesis of research on team task transitions and propositions for future research." Human Resource Management Review. In press, Corrected proof. Available online July 15, 2017. https://doi.org/10.1016/j.hrmr.2017.06.005 , Jul-2017