Fiscal Year:	FY 2019	**Task Last Updated:**	FY 04/07/2020
PI Name:	Rose, Raphael Ph.D.		
Project Title:	Asynchronous Behavioral Health Treatment Techniques		
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		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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Zip Code:	90095-1563	**Congressional District:**	33
Comments:			
Project Type:	Ground	**Solicitation / Funding Source:**	2014-15 HERO NNJ14ZSA001N-Crew Health (FLAGSHIP & NSBRI)
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No. of PhD Candidates:	2	**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:			
Flight Assignment:	NOTE: End date changed to 7/19/2019 per NSSC information (Ed., 8/9/18) NOTE: Element change to Human Factors & Behavioral Performance; previously Behavioral Health & Performance (Ed., 1/18/17)		
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Craske, Michelle Ph.D. (University of California Los Angeles) Wu, Peggy M.S. (United Technologies)		
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Task Description:	There are many potential challenges and dangers in carrying out human spaceflight. From a behavioral health standpoint, stress and anxiety-related problems, fatigue/sleep disturbance, and interpersonal conflict, are common problems that can arise for those working in operational environments. Such problems, if not addressed in advance via training, can potentially escalate into significant problems (i.e., anxiety disorder, depressive episode, severe sleep disturbance or conflict) that can seriously impact performance, safety, and well-being. Furthermore, exploration missions present unique challenges to addressing behavioral health issues due to communication delays where real-time communication limitations could hamper the delivery of behavioral health support. The NASA Human Research Roadmap (HRR) identifies the following risks involved with human spaceflight relevant to Behavioral Health and Performance: “Risk of Adverse Behavioral Conditions and Psychiatric Disorders; Risk of Performance Decrements due to Inadequate Cooperation, Coordination, Communication, and Psychosocial Adaptation within a Team; and Risk of Performance Errors Due to Fatigue Resulting from Sleep Loss, Circadian Desynchronization, Extended Wakefulness, and Work Overload.” The NASA Human Research Program Integrated Research Plan (IRP) also identified the following potential gaps in training; “BMed1: We need to identify and validate countermeasures that promote individual behavioral health and performance during exploration class missions." “BMed6: We need to identify and validate effective treatments for adverse behavioral conditions and psychiatric disorders during exploration class missions.” This proposal addresses these risks and gaps by examining and evaluating existing behavioral health techniques and determining the best practices for addressing behavioral health concerns that could arise on exploration missions where asynchronous communication can be a barrier to delivering real-time behavioral healthcare. Our final research product comprised several components. The main deliverable is data from a randomized controlled trial (RCT) examining the efficacy, feasibility, and acceptability of asynchronous behavioral techniques which was a self-guided internet-based cognitive behavioral therapy program (iCBT) in comparison to videoconference-delivered psychotherapy focusing on a behavioral health condition of relevance to spaceflight (i.e., stress, depression, and/or anxiety). The behavioral health techniques examined are evidence-based (i.e., CBT), transdiagnostic in content, and do not consist of new or unvalidated treatments. The RCT was conducted at UCLA (University of California Los Angeles) with high functioning participants (i.e., UCLA Medical Center faculty, residents, medical or dental students, or STEM (Science, Technology, Engineering and Mathematics) graduate students)) who reported current symptomatology (i.e., stress, anxiety, and/or depressive symptoms, and functional impairment). The techniques examined in the RCT were selected, in part, by conducting a comprehensive review of current standards of behavioral health practice for spaceflight, including consultation with behavioral health clinicians at NASA Johnson Space Center (JSC) and subject matter experts. We also conducted a systematic review of the literature of behavioral health approaches (e.g., computer-guided, bibliotherapy, smart phone apps) suitable for use in an asynchronous communication environment, in comparison to in-person psychotherapy. The results of our RCT (N=108) comparing iCBT (N=55) to videoconference delivered CBT (N=53) was that both conditions improved on all major outcome measures of symptomatology and functioning with no significant differences between conditions. Based on information from our reviews and data from the RCT, we formulated a “best practice guidelines” for addressing behavioral health issues of relevance to exploration missions where communication delays are a concern. The best practice guidelines comprise implementing an autonomous or self-guided tiered (or stepped) approach to behavioral health care at NASA where users would essentially train and treat themselves with remote support from NASA behavioral health experts. The first step involves training, in advance of a mission, to build resilience by learning and implementing evidence-based skills (e.g., CBT and mindfulness) that ideally can prevent the onset of a behavioral health issue on a long duration mission. Programs such as SMART-OP (Stress Management and Resilience Training for Optimal Performance) developed and evaluated, by this research team, in prior projects would be an example of such training. The second step, if needed, is to treat an issue should it arise using programs/approaches such as those tested in our RCT. The stepped approach should use evidence-based approaches that are transdiagnostic and address the most likely behavioral health issue of concern (i.e., anxiety, depression, stress). This stepped approach to care would encompass pre-mission, mission, and post-mission phases of exploration class missions.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	This project delivers a set of best-practice guidelines to NASA regarding behavioral health treatment techniques for potential future long-duration exploration-class missions where asynchroous communication is an issue. The best practice guidelines are based on subject matter expert interviews, literature reviews, and data from a randomized controlled trial comparing self-guided internet-based delivery of cognitive behavioral therapy (iCBT) to real-time video-conference delivered therapy among healthy and high-functioning individuals with at least mild symptoms of anxiety, depression, and/or stress and some functional impairment. Anxiety, depression, and stress are some of the most common and costliest behavioral health conditions on Earth, but most people who need or seek treatment do not receive appropriate evidence-based care due to barriers to access in care, such as logistics of schedules, stigma, and finding clinicians trained in evidence-based approaches. Increased knowledge on evidence-based behavioral health treatments that involve remote or self-guided delivery of care can potentially result in significant improved access to such behavioral healthcare for the broader US population.
	This is the final report of this task so we are summarizing our overall progress. There are many potential challenges and dangers in carrying out human spaceflight. From a behavioral health standpoint, stress and anxiety-related problems, fatigue/sleep disturbance, and interpersonal conflict, are common problems that can arise for those working in operational environments. Such problems, if not addressed in advance via training, can potentially escalate into significant problems (i.e., anxiety disorder, depressive episode, severe sleep disturbance or conflict) that can seriously impact performance, safety, and well-being. Furthermore, exploration missions present unique challenges to addressing behavioral health issues due to communication delays where real-time communication limitations could hamper the delivery of behavioral health support. The NASA Human Research Roadmap (HRR) identifies the following risks involved with human spaceflight relevant to Behavioral Health and Performance: “Risk of Adverse Behavioral Conditions and Psychiatric Disorders; Risk of Performance Decrements due to Inadequate Cooperation, Coordination, Communication, and Psychosocial Adaptation within a Team; and Risk of Performance Errors Due to Fatigue Resulting from Sleep Loss, Circadian Desynchronization, Extended Wakefulness, and Work Overload.” The NASA Human Research Program Integrated Research Plan (IRP) also identified the following potential gaps in training; “BMed1: We need to identify and validate countermeasures that promote individual

Task Progress:	behavioral health and performance during exploration class missions." “BMed6: We need to identify and validate effective treatments for adverse behavioral conditions and psychiatric disorders during exploration class missions.” This proposal addressed these risks and gaps by examining and evaluating existing behavioral health techniques and determining the best practices for addressing behavioral health concerns that could arise on exploration missions where asynchronous communication can be a barrier to delivering real-time behavioral healthcare. Our final research product comprised several components. The main deliverable is data from a randomized controlled trial (RCT) examining the efficacy, feasibility, and acceptability of asynchronous behavioral techniques which was a self-guided internet-based cognitive behavioral therapy program (iCBT) in comparison to videoconference-delivered psychotherapy focusing on a behavioral health condition of relevance to spaceflight (i.e., stress, depression, and/or anxiety). The behavioral health techniques examined in our RCT are evidence-based (i.e., CBT), transdiagnostic in content, and do not consist of new or unvalidated treatments. The RCT was conducted at UCLA with high functioning participants (i.e., UCLA Medical Center faculty, residents, medical or dental students, or STEM graduate students) who reported current symptomatology (i.e., stress, anxiety, and/or depressive symptoms, and functional impairment). The techniques examined in the RCT were selected, in part, by conducting a comprehensive review of current standards of behavioral health practice for spaceflight, including consultation with behavioral health experts at NASA Johnson Space Center (JSC) and other subject matter experts. We also conducted a systematic review of the literature of behavioral health approaches, (e.g., computer-guided, bibliotherapy, smart phone apps) suitable for use in an asynchronous communication environment, and reviewed a selected number of those programs. The results of our RCT (N=108) comparing iCBT (N=55) to videoconference delivered CBT (N=53) was that both conditions improved on all major outcome measures of anxiety, depression and stress symptomatology as well functioning, with no significant differences between conditions. This suggests that both self-guided iCBT and video-conference delivered CBT are equally effective for addressing anxiety, depression, and stress. Video-conferencing is the current standard of behavioral health delivery on International Space Station (ISS) so this RCT demonstrates that self-guided or asynchronous behavioral health care works as well as the current NASA standard for addressing the most common behavioral health conditions (i.e., anxiety, depression, and stress). Additional qualitative analyses showed that both conditions were viewed as very useful and acceptable and had very good treatment completion rates. This finding is important in addressing prior literature findings of high dropout rates in self-guided behavioral health care studies. The user experience can also impact other barriers to care among the broader population such as stigma, not having access to evidence-based care, or not having time or knowing where to receive such care. Self-guided approaches have unlimited scalability. Based on information from our literature and program reviews, and data from our RCT, we formulated a “best practice guidelines” for addressing behavioral health issues of relevance to exploration missions where communication delays are a concern. The best practice guidelines comprise implementing an autonomous or self-guided tiered (or stepped) approach to behavioral health care at NASA where users would essentially train and treat themselves with remote support from NASA behavioral health experts. The first step involves training, in advance of a mission, to build resilience by learning and implementing evidence-based skills (e.g., CBT and mindfulness) that ideally can prevent the onset of a behavioral health issue on a long duration mission. Programs such as SMART-OP (Stress Management and Resilience Training for Optimal Performance) developed and evaluated, by this research team, in prior projects would be an example of such training. The second step, if needed, is to treat an issue should it arise using programs/approaches such as those tested in our RCT. The stepped approach should use evidence-based approaches that are transdiagnostic and address the most likely behavioral health issue of concern (i.e., anxiety, depression, stress). This stepped approach to care would encompass pre-mission, mission, and post-mission phases of exploration class missions.
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