Paramet: Banstow, Thomas Ph.D. Project Title: Standardized Pre-flight Exercise Tests to Predict Performance during Extravibicular Activities in a Lanar Environment Deision Name: Ituman Research Program/Discipline: HUMAN RESEARCH Organization Standistics IUMAIN RESEARCH Organization Standistics IUMAIN RESEARCH Deision Name: TechPort: Ves Illuman Research Program Ellenem: (1) MECHImom Iteliah Construments Capabilities Due to Reduced Actobic Capacity (2) Mosel (Eksko of Impuired Performance Capabilities Due to Reduced Actobic Capacity (2) Mosel (Eksko of Impuired Performance Due to Reduced Muscle Size, Strength and Lindurance Space Biology Element: None Impuired Performance Capabilities Due to Reduced Actobic Capacity (2) Mosel (Eksko of Impuired Performance Capabilities Due to Reduced Actobic Capacity (2) Mosel (EKSko of Impuired Performance Capabilities Due to Reduced Actobic Capacity (2) Mosel (EKSko of Impuired Performance Capabilities Due to Reduced Actobic Capacity (2) Mosel (EKSko of Impuired Performance Capabilities Due to Reduced Actobic Capacity (2) Mosel (EKSko of Impuired Performance Capabilities Due to Reduced Actobic Capacity (2) Mosel (EKSko of Impuired Performance Capabilities Due to Reduced Actobic Capacity (2) Mosel (EKSko of Impuired Performance Capabilities Due to Reduced Actobic Capacity (2) Mosel (EKSko of Impuired Performance Capabilities Due to Reduced Actobic Capacity (2) Mosel (EKSko of Impuired Performance Capabilities Due to Reduced Actobic Capacity (2) Mosel (EKSko of Impuired Performance Capabilities Due to Reduced Actobic Ca				
Project Title: Randardized Pro-flight Exercise Tasts to Predict Performance during Extra vehicular Activities in a Lanar Environment Program Discipline: Program Discipline: IUMAN RISELARCII - biomedical countermeasure Program Discipline: IUMAN RISELARCII - biomedical countermeasure Program Discipline: IUMAN RISELARCII - biomedical countermeasure International Micro Program Element IUMAN RISELARCII - biomedical countermeasure International Research Program Element IUMAR RISELARCII - biomedical Countermeasure Space Biology Element: None Space Biology Special Category None Program Discipline: None Space Biology Special Category None Program Discipline: None <	Fiscal Year:	FY 2015 Task Last Updated: FY 09/30/2015		
brion Name in Ground Michael Schwerk in Marken Keiner Schwerk in Keiner	PI Name:	Barstow, Thomas Ph.D.		
Program/Discipline:- Clement/Sublicyline:- Clement/Sublicyline:- Clement/Sublicyline:- Clement/Sublicyline:- Subscription:- Insta Agency Name: IUMAN RESEARCH-Biomedical contermeasures TechPares Insta Agency Name: TechPare: Yes Insta Agency Name: () IHC:-Binan Haalh Contermeasures Clement/Sublicy Die to Reduced/Masel Size, Strength and Endurance () OnescleRisk of Reduced Physical Performance Due to Reduced/Masel Size, Strength and Endurance () OnescleRisk of Reduced Physical Performance Due to Reduced/Masel Size, Strength and Endurance () OnescleRisk of Reduced Physical Performance Due to Reduced/Masel Size, Strength and Endurance () OnescleRisk of Reduced Physical Performance Due to Reduced/Masel Size, Strength and Endurance () OnescleRisk of Reduced Physical Performance Due to Reduced/Masel Size, Strength and () OnescleRisk of Reduced Physical Performance Due to Reduced/Masel Size, Strength and () OnescleRisk of Reduced Physical Performance Due to Reduced/Masel Size, Strength and () OnescleRisk of Reduced Masel Size, Strength and () OnescleRisk of Reduced Masel Size, Strength and () Particut of Kinesiology Pl Andres 1: OnescleRisk of Reduced Masel Size, Strength and () Reduced Size, Strength () Reduced Size, Strength and () One of Parl Deal Reset () Parl Marcet () Reduced Size, Strength () Reduced Size, Strength () Reduced Size, Strength () () Reduced Size, Strengt () () Reduced Size, Strength () () Reduced Size, S	Project Title:	Standardized 'Pre-flight' Exercise Tests to Predict Performance during Extravehicular Activities in a Lunar Environment		
Program/Dicipine- tements/subdicipine- tements/	Division Name:	Human Research		
Edment/Subdicipline: Fight/Rest Rest Are Handback Contermessares Idman Research Program Risks () Arrobic Risk of Reduced Physical Performance Capabilities Due to Reduced Aerobic Capacity () Ausele Risk of Impaired Performance Due to Reduced Muscle Size, Strength and Endurance Space Biology Edenent: Non Space Biology Special Category: Non Space Biology Special Category: Non Space Biology Special Category: Non Organization Type: UNIVERSITY P1 Famil: Buartoz'i katate dalu P1 Granization Type: UNIVERSITY P1 Organization Type: UNIVERSITY P1 Address 1: Opatment of Kinesiology P1 Address 1: Opatment of Kinesiology P1 Address 1: Mathafan Stare Direct Contract (Kinesiology Congressional District: P1 Address 1: GotoOn Congressional District: P1 Address 1: Astatorium 200 Ension Ave. P2 Veb Page: Image: P3 red Calu Congressional District: P3 red Calu Solicitation / Funding Source: P3 red Calu Solicitation / Funding Source: P3 red Calu No. of PhD Degres: P3 red Page 2: Solicitation / Solicitation / Funding Conter Solicitation Source: Solicitation / Solicitation / Solicitation / Solicitation / Solicitation / So	Program/Discipline:	HUMAN RESEARCH		
Human Research Program Element (1) MEC:Human Health Countermeasures Human Research Program Riske (1) Acrobic:Risk of Reduced Physical Performance Capabilities Due to Reduced Acrobic Capacity Space Biology Element: None Space Biology Cross-Element: None Space Biology Cross-Element: None P1 Email: Dearstoi? Kasta cedu Fax: P4 Organization Type: UNIVERSITY Plone: 785-532-0712 P1 Qroganization Name: Constraints' Fax: FX P1 Qroganization Name: Constraints' Fax: FX P1 Address 1: Department of Kinesiology Fax: KS P1 Address 2: Lo Natotrium, 920 Denison Ave. Fax: KS P2 Grodalization Name: GSOUND Congressional District: 1 Comments: Forology Congressional District: 1 P1 Organization Nami: GROUND Solicitation / Funding Source: 2 No. of Phal Degress: 2 0 0 0 0 Solicitation / Funding Source: 3 0 0 0 0 0 0 0 0 0	Program/Discipline Element/Subdiscipline:	HUMAN RESEARCHBiomedical co	untermeasures	
Haman Research Program Risk: Overbeic-Risk of Inequired Performance Capabilities Due to Reduced Aerobic Capacity (2) MuscleRisk of Impaired Performance Due to Reduced Muscle Size, Strength and Endurance Space Biology Rement: None Space Biology Cross-Element Discipline: None Space Biology Special Category: None P1 Email: the strength distance due Operational Type: UNIVERSITY P1 Organization Nume: Kanses State University P1 Address 1: Department of Kinesiology P1 Address 1: Department of Kinesiology P1 Address 1: Department of Kinesiology P1 Address 2: IA Natatorium, 920 Demison Ave. P1 Web Page:	Joint Agency Name:		TechPort:	Yes
Human Research Program Risks (2) Muscle Risk of Impaired Performance Due to Reduced Muscle Size, Strength and Endurance Space Biology Element: None Space Biology Special Category: None Pl Email: door Pl Email: barstoficil/statue edu Fax: Pl Organization Type: UNIVERSITY Plone: 785-532-0712 Organization Name: Boartment of Kinesiology Plone: 785-532-0712 Pl Address 1: Department of Kinesiology Plone: 785-532-0712 Pl Address 2: IA Natatorius, 920 Depairon of Kinesiology Plone: 785-532-0712 Pl Address 1: Department of Kinesiology Plone: 785-532-0712 Pl Address 2: IA Natatorius, 920 Depairon Ave. Plone: 785-532-0712 Pl Address 2: IA Natatorius, 920 Organesional District 1 1 City: Manhatan State: KS Signe: Date: Goodo: 106-0102 60-0102 So of Post Docs: 0701/2010 End Pate: 60-03/2015 So, of Past Docs: 1 1040 Contact Phone: So, of Past Docs: 1 Sone of Master's Candid	Human Research Program Elements:	(1) HHC :Human Health Countermeasu	res	
Space Biology Cross-Element None Spice Biology Special Category: None Pl Email: tharstofic State edu Fax: FY Pl Organization Type: UNIVERSITY Phone: 785-532-0712 Organization Name: Kansas State University Phone: 785-532-0712 Vel Arge: Investore Vel Arge:	Human Research Program Risks:			
Discipline: Nume Space Biology Special Category: None PI Email: farretorike-state.edu Fax: PI Maranization Type: UNVERSITY Phone: 2PI Address 1: Department of Kinesiology Phone: 785-532-0712 2PI Address 1: Department of Kinesiology Image: State University PI Address 1: Department of Kinesiology Image: State University PI Address 2: In Antatorium, 920 Denison Ave. Image: State University PI Veb Page: State: KS City: Manhattan State: KS Connents: Image: State University 1 Comments: Image: State University 2009 Crew Health NNJ09ZSA002N Start Date: OROUND Solicitation / Funding Source: 2009 Crew Health NNJ09ZSA002N No. of Pho Doses: O No. of Master' Degress: 3 No. of Pho Doses: O No. of Master' Degress: 3 No. of Bachelor's Candidates: Jenerch. Linda Contact Phone: Contact Monitor: Imah.execht.infamas.exec None: Firstended to 6/30/2015 per Jen MNSSC information (Ed., 5/19/14) Skate State University and is no longer on the project. We are actively pursuing a replacement engineer. Col Name (Institution): Nox100Ake0G Schinsto	Space Biology Element:	None		
Pl Email: hearsof (k state edu) Fr P1 Organization Type: UNIVERSITY Pione 78532-0712 P1 Address 1: Gansas State University 785532-0712 P1 Address 1: Department of Kinesiology Image: State University P1 Address 2: Image: State University Image: State University P1 Web Page: Image: State University Image: State University P2 Web Page: Image: State University Image: State University P3 Gode: G600-009 Congressional Distriction Image: State University P1 Gode: GROUND Solicitation / Funding Source 0090 Grow Health NN109ZSA002N Start Date: On On On Orlo PloD Degress 06030015 06030015 Son Orbot Docs: On On On Orlo PloD Degress 3 06030015 Son Orbot Chadidates: On On On Orbot PloT Degress 3 06030015 Son Orbot Chadidates: Image: Contact Plone: SAS ASC 06030015 0604005 0604005 060405 060405 060405 060405 060405 060405 060405 060405 060405 060405 060405 060405 060405 06040	Space Biology Cross-Element Discipline:	None		
Control Control Control P1 Organization Type: UNIVERSITY Phone: 785-532-0712 P2 Organization Type: Conversity Phone: 785-532-0712 P2 Organization Type: Department of Kinesiology Phone: 785-532-0712 P1 Address 1: Department of Kinesiology Phone: 785-532-0712 P1 Mode: Gongressional District: 1 1 Context Fupe: GROUND Solicitation / Funding Source: 2009 Crew Health NNJ09ZSA002N No. of PhoD Candidates: 0 No. of Master' Degree: 5 No. of Daddidates: <td< td=""><td>Space Biology Special Category:</td><td>None</td><td></td><td></td></td<>	Space Biology Special Category:	None		
Arganization Name: Kasa Sata University Praductes 1: Opertment of Kinesiology PI Address 2: IA Nataorium, 920 Denison Ave. PI Web Page: Image: State: KS Clip: Manhatan State: KS Clip: Manhatan State: KS Comments: Image: State: KS Image: State: KS Project Type: GROUND Solicitation / Funding Source: 2009 Crew Health NNJ09ZSA002N Star Date: 0701/2010 End Date: 06/302015 Star Date: 0701/2010 End Date: 06/302015 Star Date: 0701/2010 No. of PhoD Degree: 3 Star Date: 0 No. of Master'Degree: 3 Star Date: 1 Manhater: Contact Phone: Star Date: 1 Manderch-Igmasa gov Contact Monitor: 1 Manderch-Igmasa gov Contact Monitor: Imalater: State Ido fo/S02015 pr PI and NSSC information (Ed., S/19/14) Star Parsen: Star: State Iniversity and is op/22014 pr NSSC information (Ed., S/19/14) Star Parsen: Start: Startendet of S02015 pr PI and NSSC information (Ed., S/19/14) Star Parsen:	PI Email:	tbarsto@k-state.edu	Fax:	FY
P1 Address I: Department of Kinesiology P1 Address I: IA Natatorium, 920 Denison Ave. P1 Web Page: P1 Web Pag	PI Organization Type:	UNIVERSITY	Phone:	785-532-0712
PI Address 2: 1. A Natatorium, 920 Denison Ave. PI Address 2: Natatorium, 920 Denison Ave. PI Address 2: Manhattan Stat: KS City: Manhattan Stat: KS Concents: 1 Project Type: GROUND Solicitation / Funding Source: 2009 Crew Health NNJ09ZSA002N Start Date: 07/01/2010 End Date: 06/30/2015 Sol of PhD Candidates: 0 No. of PhD Candidates: 1 Sol of Master's Candidates: 1 Sol of Bachelor's Candidates: 3 Sol of Bachelor's Candidates: 6 Contact Email: Inda locrch-1@masa.gov Flight Program:	Organization Name:	Kansas State University		
Pi Web Page: City: Manhatan State: KS Congressional Distric: 1 Comments: Project Type: 66506-109 Congressional Distric: 1 Comments: Project Type: 0ROUND Solicitation / Funding Sourc: 2009 Crew Health NNJ09ZSA002N Solor Post Docs: 007. End Date: 06/302015 Cond Post Docs: 070./ 2010 End Date: 06/302015 No. of PhD Degrees: 2 No. of PhD Candidates: 2 No. of PhD Candidates: 3 No. of Master' Degrees: 3 No. of Master' Degrees: 3 No. of Master' Degrees: 5 Solor Candidates: 4 No. of Bachelor's Candidates: 4 No. of Bachelor's Candidates: 5 No. of Bachelor's Candidates: 4 No. of Bachelor's Candidates: 4 No. of Bachelor's Candidates: 5 No. of Bachelor's Candidates: 5 No. of Bachelor's Candidates: 4 No. of Bachelor's Candidates: 5 No. of	PI Address 1:	Department of Kinesiology		
CityMahtanSterKSCip Code:6506-0109Congressional District1Comments:0000 (Songressional District)0000 (Songressional District)Project Type:GROUNDSolicitation / Fund District0000 (Songressional District)Start Date:0701/2010Solicitation / Songressional0000 (Songressional District)No. of Post Does:0No. of Pho Dense:0No. of Pho Candidates:2No. of Master' Dense:3No. of Bachelor's Candidates:4Monitoring Cente:No. SA JSCContact Monitor:Leoch, LindaContact Phone:No. SA JSCContact Monitor:Indal Cerch-Lifanasa covIndal Cerch-Lifanasa covIndal Cerch-Lifanasa covFight Program:Justice And date is sly/2012 Sper Pl and Spice S	PI Address 2:	1A Natatorium, 920 Denison Ave.		
Zip Code:66506-0109Congressional District:IComments:Project Type:GROUNDSolicitation / Funding Source:2009 Crew Health NNJ09ZSA002NStart Date:07/01/2010End Date:06/30/2015No. of Post Docs:0No. of PhD Degrees:2No. of PhD Candidates:2No. of Master' Degrees:3No. of Master's Candidates:3No. of Bachelor's Degrees:5No. of Bachelor's Candidates:4Monitoring Center:NASA JSCContact Monitor:Loerch, LindaContact Phone:Contact Email:inda loerch-1/@nasa.govIIFlight Arssignment:NOTE: Extended to 6/30/2015 per PI and NSSC information (Ed., 5/19/14)Solicitation / S/9/2013)Key Personnel Changes/Previous PIMay 2012 report: Chris Lewis, Ph.D. has left Kansas State University and solonger on the project. We are actively pursuing a replacement engineer.COI Name (Institution):Warren, Steven (Kansas State University)Schinstock, Dale (Kansas State University)Grant/Contract No.:NN104K60G	PI Web Page:			
Comments: Project Type: GROUND Solicitation / Funding Source: 2009 Crew Health NNJ09ZSA002N Start Date: 07/01/2010 End Date: 06/30/2015 No. of Phot Decrees: 0 0 No. of PhD Degrees: 2 No. of PhD Candidates: 2 No. of Master' Degrees: 3 No. of Master's Candidates: 3 No. of Bachelor's Degrees: 5 No. of Bachelor's Candidates: 4 Monitoring Center: NASA JSC Contact Monitor: Loerch, Linda Contact Phone: Contact Email: Inda.loerch-1@nasa.gov Flight Program: Flight Assignment: NOTE: Extended to 6/30/2015 per PI and NSSC information (Ed., 5/19/14) NOTE: New end date is 9/2/2014 per NSSC information (Ed., 5/19/14) NOTE: New end date is 9/2/2014 per NSSC information (Ed., 5/19/14) NOTE: New end date is 9/2/2014 per NSSC information (Ed., 5/19/14) Key Personnel Changes/Previous PI Grant/Contract No.: NNX10AK60G	City:	Manhattan	State:	KS
Project Type:GROUNDSolicitation / Funding Soure:2009 Crew Health NNJ09ZSA002NStart Date:07/01/2010End Date:06/30/2015No. of Pot Docs:0No. of PhD Degrees:2No. of PhD Candidates:2No. of Master' Degrees:3No. of Master's Candidates:3No. of Bachelor's Degrees:5No. of Bachelor's Candidates:4Monitoring Center:NASA JSCContact Monitor:Loerch, LindaContact Phone:Contact Email:inda. loerch-1@inasa.govContact Phone:Flight Assignment:NOTE: Extended to 6/30/2015 per PI and NSSC information (Ed., 5/19/14)Soliest are placement engineer.Key Personnel Changes/Previous PIMay 2012 report: Chris Lewis, Ph.D. has left Kansas State University and is no longer on the project. We are actively science activ	Zip Code:	66506-0109	Congressional District:	1
Start Date:07/01/2010End Date:06/30/2015No. of Post Docs:0No. of PhD Degrees:2No. of PhD Candidates:2No. of Master' Degrees:3No. of Master's Candidates:3No. of Bachelor's Degrees:5No. of Bachelor's Candidates:4Monitoring Center:NASA JSCContact Monitor:Loerch, LindaContact Phone:Contact Email:Inda.loerch-1@nasa.govFlight Program:VOTE:Stetended to 6/30/2015 per PI and NSSC information (Ed., 5/19/14)Stere Personnel Changes/Previous PI:May 2012 report: Chris Lewis, Ph.D. has left Kansas State University and is no longer on the project. We are actively pusting a replacement engineer.COI Name (Institution):Warren, Steven (Kansas State University) Schinstock, Dale (Kansas State University) Schinstock, Dale (Kansas State University) Schinstock, Dale (Kansas State University) Schinstock, Dale (Kansas State University)Grant/Contract No.:NX10AK60G	Comments:			
No. of Post Docs:0No. of PhD Degrees:2No. of PhD Candidates:2No. of Master' Degrees:3No. of Master's Candidates:3No. of Bachelor's Degrees:5No. of Bachelor's Candidates:4Monitoring Center:NASA JSCContact Monitor:Loerch, LindaContact Phone:Contact Email:iinda.loerch-1@nasa.govFlight Program:NOTE: Extended to 6/30/2015 per PI and NSSC information (Ed., 5/19/14) NOTE: New end date is 9/2/2014 per NSSC information (Ed., 5/9/2013)Selencer on the project. We are actively pursuing a replacement engineer.COI Name (Institution):May 2012 report: Chris Lewis, Ph.D. has left Kansas State University and is no longer on the project. We are actively Schinstock, Dale (Kansas State University) Schinstock, Dale (Kansas State University)	Project Type:	GROUND	Solicitation / Funding Source:	2009 Crew Health NNJ09ZSA002N
No. of PhD Candidates: 2 No. of Master' Degrees: 3 No. of Master's Candidates: 3 No. of Bachelor's Degrees: 5 No. of Bachelor's Candidates: 4 Monitoring Center: NASA JSC Contact Monitor: Loerch, Linda Contact Phone: Contact Email: linda.loerch-1@nasa.gov Flight Program: Intel.loerch (Janasa.gov) Flight Assignment: NO. Of E: Extended to 6/30/2015 per PI and NSSC information (Ed., 5/19/14) NOTE: New end date is 9/2/2014 per NSSC information (Ed., 5/9/2013) Key Personnel Changes/Previous PI: May 2012 report: Chris Lewis, Ph.D. has left Kansas State University and is no longer on the project. We are actively pursuing a replacement engineer. COI Name (Institution): Warren, Steven (Kansas State University) Schinstock, Dale (Kansas State University) Schinstock, Dale (Kansas State University) Grant/Contract No.: NNX10AK60G	Start Date:	07/01/2010	End Date:	06/30/2015
No. of Master's Candidates: 3 No. of Bachelor's Degrees: 5 No. of Bachelor's Candidates: 4 Monitoring Center: NASA JSC Contact Monitor: Loerch, Linda Contact Phone: Contact Email: linda.loerch-1@nasa.gov Flight Program: NOTE: Extended to 6/30/2015 per PI and NSSC information (Ed., 5/19/14) NOTE: New end date is 9/2/2014 per NSSC information (Ed., 5/19/14) NOTE: New end date is 9/2/2014 per NSSC information (Ed., 5/19/2013) Key Personnel Changes/Previous PI: May 2012 report: Chris Lewis, Ph.D. has left Kansas State University and is no longer on the project. We are actively pursuing a replacement engineer. COI Name (Institution): Warren, Steven (Kansas State University) Schinstock, Dale (Kansas State University) Grant/Contract No.: NNX10AK60G	No. of Post Docs:	0	No. of PhD Degrees:	2
No. of Bachelor's Candidates: 4 Monitoring Center: NASA JSC Contact Monitor: Loerch, Linda Contact Phone: Contact Email: Iinda.loerch-1@nasa.gov Flight Program: NOTE: Extended to 6/30/2015 per PI and NSSC information (Ed., 5/19/14) Flight Assignment: NOTE: Extended to 6/30/2015 per PI and NSSC information (Ed., 5/19/14) Key Personnel Changes/Previous PI May 2012 report: Chris Lewis, Ph.D. has left Kansas State University and is no longer on the project. We are actively pursuing a replacement engineer. COI Name (Institution): Warren, Steven (Kansas State University) Schinstock, Dale (Kansas State University) Schinstock, Dale (Kansas State University) Grant/Contract No.: NNX10AK60G	No. of PhD Candidates:	2	No. of Master' Degrees:	3
Contact Monitor: Loerch, Linda Contact Phone: Contact Email: linda.loerch-1@nasa.gov Flight Program: NOTE: Extended to 6/30/2015 per PI and NSSC information (Ed., 5/19/14) NOTE: New end date is 9/2/2014 per NSSC information (Ed., 5/19/14) NOTE: New end date is 9/2/2014 per NSSC information (Ed., 5/19/2013) Key Personnel Changes/Previous PI May 2012 report: Chris Lewis, Ph.D. has left Kansas State University and is no longer on the project. We are actively pursuing a replacement engineer. COI Name (Institution): Warren, Steven (Kansas State University) Schinstock, Dale (Kansas State University) Schinstock, Dale (Kansas State University) Grant/Contract No.: NNX10AK60G	No. of Master's Candidates:	3	No. of Bachelor's Degrees:	5
Contact Email:linda.loerch-1@nasa.govFlight Program:NOTE: Extended to 6/30/2015 per PI and NSSC information (Ed., 5/19/14) NOTE: New end date is 9/2/2014 per NSSC information (Ed., 5/9/2013)Flight Assignment:May 2012 report: Chris Lewis, Ph.D. has left Kansas State University and is no longer on the project. We are actively pursuing a replacement engineer.COI Name (Institution):Warren, Steven (Kansas State University) Schinstock, Dale (Kansas State University) Schinstock, Dale (Kansas State University)Grant/Contract No.:NNX10AK60G	No. of Bachelor's Candidates:	4	Monitoring Center:	NASA JSC
Flight Program: Flight Assignment: NOTE: Extended to 6/30/2015 per PI and NSSC information (Ed., 5/19/14) NOTE: New end date is 9/2/2014 per NSSC information (Ed., 5/9/2013) Key Personnel Changes/Previous PI: May 2012 report: Chris Lewis, Ph.D. has left Kansas State University and is no longer on the project. We are actively pursuing a replacement engineer. COI Name (Institution): Warren, Steven (Kansas State University) Schinstock, Dale (Kansas State University) Grant/Contract No.: NNX10AK60G Performance Goal No.: NNX10AK60G	Contact Monitor:	Loerch, Linda	Contact Phone:	
Flight Assignment:NOTE: Extended to 6/30/2015 per PI and NSSC information (Ed., 5/19/14) NOTE: New end date is 9/2/2014 per NSSC information (Ed., 5/9/2013)Key Personnel Changes/Previous PI:May 2012 report: Chris Lewis, Ph.D. has left Kansas State University and is no longer on the project. We are actively pursuing a replacement engineer.COI Name (Institution):Warren, Steven (Kansas State University) Schinstock, Dale (Kansas State University)Grant/Contract No.:NNX10AK60GPerformance Goal No.:	Contact Email:	linda.loerch-1@nasa.gov		
Flight Assignment: NOTE: New end date is 9/2/2014 per NSSC information (Ed., 5/9/2013) Key Personnel Changes/Previous PI: May 2012 report: Chris Lewis, Ph.D. has left Kansas State University and is no longer on the project. We are actively pursuing a replacement engineer. COI Name (Institution): Warren, Steven (Kansas State University) Schinstock, Dale (Kansas State University) Grant/Contract No.: NNX10AK60G Performance Goal No.: Varen Steven (Kansas State University)	Flight Program:			
COI Name (Institution): Warren, Steven (Kansas State University) Schinstock, Dale (Kansas State University) Grant/Contract No.: NNX10AK60G Performance Goal No.: Variant of the state of t	Flight Assignment:	NOTE: Extended to 6/30/2015 per PI at NOTE: New end date is 9/2/2014 per N	nd NSSC information (Ed., 5/19/14) SSC information (Ed., 5/9/2013)	
Grant/Contract No.: NNX10AK60G Performance Goal No.: V	Key Personnel Changes/Previous PI:		as left Kansas State University and is r	no longer on the project. We are actively
Performance Goal No.:	COI Name (Institution):			
	Grant/Contract No.:	NNX10AK60G		
	Performance Goal No.:			
'erformance Goal Text:	Performance Goal Text:			

....

Task Description:	The original Apollo missions and more recent extravehicular activities on the International Space Station have provided basic information that can be applied to activities that may occur during future long-duration lunar missions. However, despite these previous efforts, significant gaps remain in our understanding of the more complex physiological costs of different activities in a true lunar environment. Recently a ground-based simulation of a 10-kilometer Lunar Walkback was conducted to better understand the physical capabilities of a suited astronaut in partial gravity. Unfortunately, this study was limited because of the use of a stationary treadmill that did not accurately simulate the lunar environment (i.e., landscape and terrain). To date this overall lack of physiologic data collected during true lunar activities or their accurate simulation has limited the ability of NASA physicians and scientists to predict if an astronaut candidate is physically capable of completing the multiple lunar activities that may be required during long-duration missions. Therefore, the goals of this proposal are to 1) develop a mobile testbed to accurately simulate partial-gravity lunar activities, and 2) determine subject performance and the concomitant physiological responses to these activities, which will allow us to 3) create a series of standardized tests that can be performed in a pre-flight setting to determine the readiness of the astronaut to perform physically demanding activities during a lunar mission.
Rationale for HRP Directed Research	h:
Research Impact/Earth Benefits:	The results of these studies will help identify which key components of physical fitness are required to perform different physical tasks. These results will, therefore, be applicable in a wide variety of settings, from rehabilitation to athlete evaluation, to determining the relative preparedness of astronauts for in-flight and destination extravehicular activity (EVA). These insights will be especially important when astronauts return to a gravitational environment, either on Earth or at their destination. These results will provide target information regarding minimum required strength and endurance from which in-flight and destination exercise countermeasures can be based. The strategy employed here can also function as a template for approaching the establishment of field tests for other occupations in which there is a demand for minimal physical performance, such as what has been done for firefighters and police officers.
	The proposed projects have been completed and most of the data has been published. General findings include: Project 1: The purpose was to evaluate the relationships between tests of fitness and several activities that simulate components of Lunar- and Martian-based extravehicular activities (EVAs). Seventy-one subjects completed four field tests: 1) a physical abilities test which consisted of 6 stations stair climbing, forward-backward zigzag, ladder climb and descent, horizontal rock wall, lifting heavy objects, and side step duck/step over; 2) a 10 km Walkback test; 3) material transport field test requiring the loading, transport, and unloading of geological samples; and 4) a device operations field test consisting of tasks associated with equipment set-up and the operations of controls and valves. The relationships between test times for each of these tests and the following parameters were determined: running: O2max, gas exchange threshold (GET), speed at O2max (s- O2max), highest sustainable rate of aerobic metabolism [critical speed (CS)]; arm cranking: O2peak, GET, critical power (CP).
	Important Findings:
	A) Across the 4 tests, CS, running O2max, s- O2max, and arm cranking O2peak had the highest correlations. CS and to a lesser extent O2max are most strongly associated with tasks that simulate aspects of EVA performance, highlighting CS as a method for evaluating astronaut physical capacity.
	B) Arm cranking tests are strongly associated with upper-body dependent tasks, highlighting that the nature of mission tasks needs to be considered when evaluating astronaut physical capacity.
Task Progress:	C) When comparing arm to leg responses, as expected arm responses were lower than those seen with leg exercise. There was a significant correlation between arm-cranking and lower body O2max, GET, and the O2 at LCS. Backward stepwise regression analyses revealed that arm-cranking physical fitness could explain 67%, 40%, and 49% of the variance in lower body O2max, GET, and CS, respectively. Discussion: Results suggest arm-cranking exercise can be used to obtain an approximation of lower body aerobic capacity.
	Project 2: The purpose of the second project was to determine the physiological parameters associated with the ability to complete simulated exploration type tasks at metabolic rates which might be expected for Lunar and Martian ambulation. Two simulated extravehicular activity field tests were completed in 1-g at two intensities designed to elicit metabolic rates of ~20.0 and ~30.0 ml kg-1 min-1, which are similar to those previously reported for ambulation in simulated Lunar- and Martian-based environments, respectively. Important Findings:
	A) All subjects were able to complete the field test at the Lunar intensity, but 28% were unable to complete the field test at the Martian intensity (non-Finishers).
	B) During the Martian field test there were no differences in O2 between Finishers and non-Finishers, but the non-Finishers were performing at a greater % O2max compared to Finishers.
	C) Logistic regression analysis revealed fitness thresholds for a predicted probability of 0.5, at which Finishing and non-Finishing are equally likely, and 0.75, at which an individual has a 75% chance of Finishing, to be a O2max of 38 ml kg-1 min-1 and 40 ml kg-1 min-1, both significantly greater than the current minimum standard of ~32 ml kg-1 min-1 for the astronaut corps.
	D) Logistic regression analysis also revealed that the expected % O2max required to complete a field test could be used to successfully predict performance (X2=19.3).
	Project 3: the purpose of the current project was to develop an offload hoist system that is able to simulate the gravitational environments of expected future mission destinations that may be used to determine insightful physiological variables and responses to monitor in an astronaut in order to assess mission readiness and EVA performance.
	Important Findings:
	A) The offload system was successfully designed, implemented, and tested.
	B) Proof-of-concept data were collected for ambulatory activities in Earth (1-g), Martian (3/8-g), and Lunar (1/6-g) simulated gravitational environments. Metabolic and ventilatory measurements were collected during ambulation at constant-speeds in each of the gravitational environments.

	C) Metabolic and cardiovascular responses were greatest in 1-g and least in Lunar microgravity. While responses for Martian gravity were lower than for 1-g Earth, they were substantially greater than for Lunar gravity. These data emphasize the need for careful consideration of critical mission tasks and the minimum fitness required for astronaut safety and mission success.
Bibliography Type:	Description: (Last Updated: 01/23/2020)
Abstracts for Journals and Proceedings	 Wilcox SL, Broxterman RM, Ade CJ, Schlulp SJ, Craig JC, Mendoza Y, Chavez L, Barstow TJ. "The relationship between physiologic parameters in upper versus lower body exercise." American College of Sports Medicine 60th Annual Meeting, Indianapolis, IN, May 28-June 1, 2013. Program, American College of Sports Medicine 60th Annual Meeting, Indianapolis, IN, May 28-June 1, 2013. , May-2013
Abstracts for Journals and Proceedings	Craig JC, Ade CJ, Broxterman RM, Wilcox SL, Schlup SJ, Mendoza Y, Chavez L, Barstow TJ. "The relationship between critical speed and the respiratory compensation point." American College of Sports Medicine 60th Annual Meeting, Indianapolis, IN, May 28-June 1, 2013. Final Program, American College of Sports Medicine 60th Annual Meeting, Indianapolis, IN, May 28-June 1, 2013. , May-2013
Abstracts for Journals and Proceedings	Broxterman RM, Ade CJ, Wilcox SL, Craig JC, Barstow TJ. "Determination of appropriate physiological measurements for predicting EVA task-failure." 2014 NASA Human Research Program Investigators' Workshop, Galveston, TX, February 12-13, 2014. 2014 NASA Human Research Program Investigators' Workshop, Galveston, TX, February 12-13, 2014. <u>http://www.hou.usra.edu/meetings/hrp2014/pdf/3140.pdf</u> , Feb-2014
Abstracts for Journals and Proceedings	Broxterman RM, Ade CJ, Wilcox SL, Craig JC, Barstow TJ. "Lunar and Mars simulated extravehicular activity (EVA) evoked physiological responses." Experimental Biology 2014, San Diego, CA, April 26-30, 2014. FASEB Journal. 2014 Apr;28(1 Suppl):882.7. <u>https://www.fasebj.org/doi/abs/10.1096/fasebj.28.1_supplement.882.7</u> , Apr-2014
Abstracts for Journals and Proceedings	Ade CJ, Broxterman RM, Barstow TJ. "Standardized "Pre-Flight" exercise tests to predict performance during extravehicular activities in a lunar environment." 2015 NASA Human Research Program Investigators' Workshop, Galveston, TX, January 13-15, 2015. 2015 NASA Human Research Program Investigators' Workshop, Galveston, TX, January 13-15, 2015.
Abstracts for Journals and Proceedings	Broxterman RM, Ade CJ, Wagner WJ, Wilcox SL, Craig JC, Warren S, Schinstock D, Barstow TJ. "Development of an offload hoist system for the simulation of microgravity during activity." 2015 NASA Human Research Program Investigators' Workshop, Galveston, TX, January 13-15, 2015. 2015 NASA Human Research Program Investigators' Workshop, Galveston, TX, January 13-15, 2015.
Articles in Peer-reviewed Journals	Broxterman RM, Ade CJ, Craig JC, Wilcox SL, Schlup SJ, Barstow TJ. "The relationship between critical speed and the respiratory compensation point: Coincidence or equivalence." Eur J Sport Sci. 2015;15(7):631-9. Epub 2014 Oct 13. http://dx.doi.org/10.1080/17461391.2014.966764 ; PubMed <u>PMID: 25307937</u> , Jan-2015
Articles in Peer-reviewed Journals	Broxterman RM, Craig JC, Ade CJ, Wilcox SL, Barstow TJ. " The effect of resting blood flow occlusion on exercise tolerance and W'." Am J Physiol Regul Integr Comp Physiol. 2015 Sep 15;309(6):R684-91. Epub 2015 Jul 29. http://dx.doi.org/10.1152/ajpregu.00283.2015; PMID: 26224689, Sep-2015
Articles in Peer-reviewed Journals	Wilcox SL, Broxterman RM, Barstow TJ. "Constructing quasi-linear VO2 responses from nonlinear parameters." J Appl Physiol (1985). 2016 Jan 15;120(2):121-9. Epub 2015 Nov 12. <u>http://dx.doi.org/10.1152/japplphysiol.00507.2015</u> ; PubMed <u>PMID: 26565018</u> , Jan-2016
Articles in Peer-reviewed Journals	Ade CJ, Broxterman RM, Craig JC, Schlup SJ, Wilcox SL, Barstow TJ. "Standardized exercise tests and simulated terrestrial mission task performance." Aerosp Med Hum Perform. 2015 Nov;86(11):982-9. http://dx.doi.org/10.3357/AMHP.4332.2015, Nov-2015
Articles in Peer-reviewed Journals	Ade CJ, Broxterman RM, Craig JC, Schlup SJ, Wilcox SL, Warren S, Kuehl P, Gude D, Jia C, Barstow TJ. "Prediction of lunar- and Martian-based intra- and site-to-site task performance." Aerosp Med Hum Perform. 2016 Apr;87(4):367-74. <u>https://doi.org/10.3357/AMHP.4399.2016</u> ; PubMed <u>PMID: 27026120</u> , Apr-2016
Articles in Peer-reviewed Journals	Broxterman RM, Skiba PF, Craig JC, Wilcox SL, Ade CJ, Barstow TJ. "W' expenditure and reconstitution during severe intensity constant power exercise: mechanistic insight into the determinants of W'." Physiol Rep. 2016 Oct;4(19). <u>https://doi.org/10.14814/phy2.12856</u> ; PubMed <u>PMID: 27688431</u> ; PubMed Central <u>PMCID: PMC5064128</u> , Oct-2016
Articles in Peer-reviewed Journals	Craig JC, Broxterman RM, Wilcox SL, Chen C, Barstow TJ. "Effect of adipose tissue thickness, muscle site, and sex on near-infrared spectroscopy derived total-[hemoglobin + myoglobin]." J Appl Physiol (1985). 2017 Dec 1;123(6):1571-8. Epub 2017 Sep 21. <u>https://doi.org/10.1152/japplphysiol.00207.2017</u> ; PubMed <u>PMID: 28935822</u> [reported in Sept 2017 as Epub], Dec-2017
Articles in Peer-reviewed Journals	Craig JC, Broxterman RM, Smith JR, Allen JD, Barstow TJ. "Effect of dietary nitrate supplementation on conduit artery blood flow, muscle oxygenation, and metabolic rate during handgrip exercise." J Appl Physiol (1985). 2018 Aug1;125(2):254-62. Epub 2018 May 3. <u>https://doi.org/10.1152/japplphysiol.00772.2017</u> ; PubMed <u>PMID: 29722627</u> , Aug-2018
Articles in Peer-reviewed Journals	Ade CJ, Broxterman RM, Craig JC, Schlup SJ, Wilcox SL, Barstow TJ. "Upper body aerobic exercise as a possible predictor of lower body performance." Aerosp Med Hum Perform. 2015 Jul;86(7):599-605. http://dx.doi.org/10.3357/AMHP.4181.2015, Jul-2015

Articles in Peer-reviewed Journals	Poole DC, Barstow TJ. "The critical power framework provides novel insights into fatigue mechanisms." Exerc Sport Sci Rev. 2015 Apr;43(2):65-6. Comment on Skeletal muscle fatigue and decreased efficiency: two sides of the same coin? Exerc Sport Sci Rev. 2015 Apr;43(2):75-83. <u>http://dx.doi.org/10.1249/JES.0000000000000045</u> ; PubMed <u>PMID: 25688764</u> , Apr-2015
Articles in Peer-reviewed Journals	Ade CJ, Broxterman RM, Barstow TJ. "V'O2max and microgravity exposure: Convective versus diffusive O2 transport." Med Sci Sports Exerc. 2015 Jul;47(7):1351-61. <u>http://dx.doi.org/10.1249/MSS.000000000000557</u> ; PubMed <u>PMID:</u> 25380479, Jul-2015
Articles in Peer-reviewed Journals	Ade CJ, Broxterman RM, Craig JC, Schlup SJ, Wilcox SL, Barstow TJ. "Relationship between simulated extravehicular activity tasks and measurements of physical performance." Respir Physiol Neurobiol. 2014 Nov 1;203:19-27. Epub 2014 Aug 25. <u>http://dx.doi.org/10.1016/j.resp.2014.08.007</u> ; PubMed <u>PMID: 25169116</u> , Nov-2014
Articles in Peer-reviewed Journals	Broxterman RM, Craig JC, Smith JR, Wilcox SL, Jia C, Warren S, Barstow TJ. "Influence of blood flow occlusion on the development of peripheral and central fatigue during small muscle mass handgrip exercise." J Physiol. 2015 Sep 1;593(17):4043-54. Epub 2015 Aug 2. <u>http://dx.doi.org/10.1113/JP270424</u> ; PubMed <u>PMID: 26104881</u> ; PubMed Central <u>PMCID: PMC4575585</u> , Sep-2015
Articles in Peer-reviewed Journals	Broxterman RM, Ade CJ, Craig JC, Wilcox SL, Schlup SJ, Barstow TJ. "Influence of blood flow occlusion on muscle oxygenation characteristics and the parameters of the power-duration relationship." J Appl Physiol (1985). 2015 Apr 1;118(7):880-9. Epub 2015 Feb 5. <u>http://dx.doi.org/10.1152/japplphysiol.00875.2014</u> ; PubMed <u>PMID: 25663673</u> , Apr-2015