Fiscal Year:	FY 2018	**Task Last Updated:**	FY 03/19/2024
PI Name:	Main, Bob M.S.		
Project Title:	Development of a Self-Imaging, Wide Angle, High Resolution Retinal Imaging System for Human Spaceflight Applications		
Division Name:	Human Research		
Program/Discipline:			
Program/Discipline--Element/Subdiscipline:	TRISH--TRISH		
Joint Agency Name:		**TechPort:**	No
Human Research Program Elements:	None		
Human Research Program Risks:	None		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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Comments:			
Project Type:	GROUND	**Solicitation / Funding Source:**	TRISH--Focused Investigations
Start Date:	09/01/2017	**End Date:**	08/31/2018
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:**	TRISH
Contact Monitor:		**Contact Phone:**	
Contact Email:			
Flight Program:			
Flight Assignment:			
Key Personnel Changes/Previous PI:			
COI Name (Institution):			
Grant/Contract No.:	NNX16AO69A-FIP0002		
Performance Goal No.:			
Performance Goal Text:			
Task Description:	Focused Investigation Project To develop a compact, desk mounted (slightly larger than an augmented reality headset) self-imaging, non-mydriatic, 45+ degree wide-angle, high resolution retinal imaging device. Machine vision algorithms will demonstrate the ability to detect differences in retinal images (current scan vs. baseline image). The device will be referred to as the Advanced Retinal Imager (ARI). Lessons learned from this device will be used to refine a final design suitable for use in spaceflight that can be built in a future phase. This device will save significant astronaut time due to the self-testing feature (only one astronaut needed to image the retina vs. two with the current technology) and not needing to dilate the pupil of the astronaut being imaged (vs. currently dilation takes an astronaut out of commission for several hours).		

Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	
Task Progress:	FIP0002 Project Goals: During this project (Phase 2 of technology development), we were to develop a compact, desk mounted, self-imaging (single user), non-mydriatic, 45+ degree wide-angle, high resolution retinal imaging device; the first of its kind available today. Results: We were successful in developing a functional retinal imaging device that has no-touch operation. A single user (no skilled operator needed) is able to look into the device (focus on a small green fixation point) and the device automatically: 1) moves the internal optics to align with the eye (keys off the pupil), 2) locates the retina, 3) focuses on the retina, and 4) takes the image of the retina. At that point the image is displayed on a laptop screen next to the device. The image can be magnified, moved, and stored (as requested). The device remains in a “powered down” state until it recognizes that someone is looking into the device. This will save power on the spacecraft. The Problem Being Solved: Prolonged exposure to microgravity results in multiple alterations to the visual system, including hyperopic shifts, globe flattening, papilledema, and choroidal folds. It is essential to monitor the astronauts on a regular basis and to intervene before unresolved significant vision issues arise or permanent vision loss occurs. Currently, the COTS retinal imaging equipment on the ISS to view/monitor the retina is bulky, requires two astronauts to operate, and is prone to breaking down. As a result, images of the retina are taken very infrequently at a rate of about one time per month and requires pupil dilation which incapacitates the astronaut for a few hours. This is currently a high priority need for NASA. Key Findings: The following are key findings, and benefits the retinal imaging device will have over the current COTS device being used on the ISS and on future deep space missions (with smaller spacecraft). • Save Significant Astronaut Time - This is possible due to the self-testing feature (only one astronaut needed to image the retina vs. two with the current technology). • Save Astronaut Time - No need to dilate the pupil of the astronaut being imaged (vs. currently dilation -- takes an astronaut out of commission for several hours). • Better Quality Images & Easy to Operate - The device requires no astronaut skillset to operate the device, therefore the quality of the images will be greatly improved and will allow NASA to get more retina imagine sessions (providing better overall quality data). • Save Imaging Session Time & More Data - Because the device works automatically (as defined above) this will significantly reduce time needed for an imaging session. This project aims to develop a compact, desk mounted (slightly larger than an augmented reality headset) self-imaging, non-mydriatic, 45+ degree wide-angle, high resolution retinal imaging device. Machine vision algorithms will demonstrate the ability to detect differences in retinal images (current scan vs. baseline image). The device will be referred to as the Advanced Retinal Imager (ARI). Lessons learned from this device will be used to refine a final design suitable for use in spaceflight that can be built in a future phase. This device will save significant astronaut time due to the self-testing feature (only one astronaut needed to image the retina vs. two with the current technology) and not needing to dilate the pupil of the astronaut being imaged (vs. currently dilation takes an astronaut out of commission for several hours). During the Phase 2 Retinal Imaging development project, we were successful in developing a functional retinal imaging device that has no-touch operation (first of its kind). A single user (no skilled operator needed) can look into the device (focus on a small green fixation point) and the device automatically: 1) moves the internal optics to align with the eye (keys off the pupil), 2) locates the retina, 3) focuses on the retina, and 4) takes the image of the retina. At that point the image is displayed on a laptop screen next to the device. The image can be magnified, moved, and stored (as requested). The device remains in a “powered down” state until it recognizes that someone is looking into the device. This will save power on the spacecraft.
Bibliography Type:	Description: (Last Updated:)