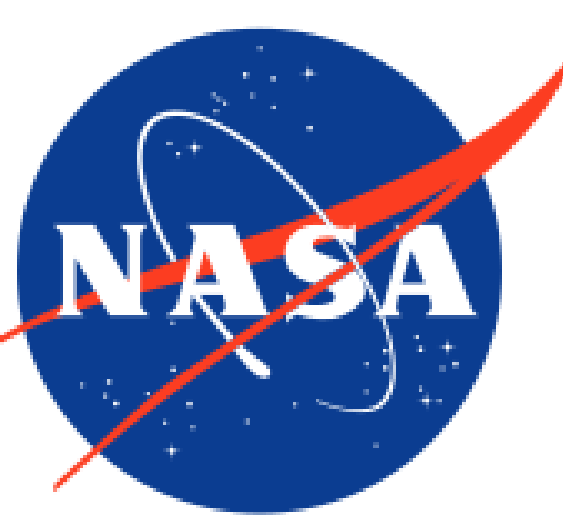


Comparison of active and passive head impulse testing of the horizontal vestibulo-ocular reflex: exploring the feasibility of different approaches for spaceflight



CIPHER: Complement of Integrated Protocols for Human Exploration Research

MJ Carey¹, MR Ehrenburg^{2,3}, TR Macaulay⁴, SJ Wood⁵

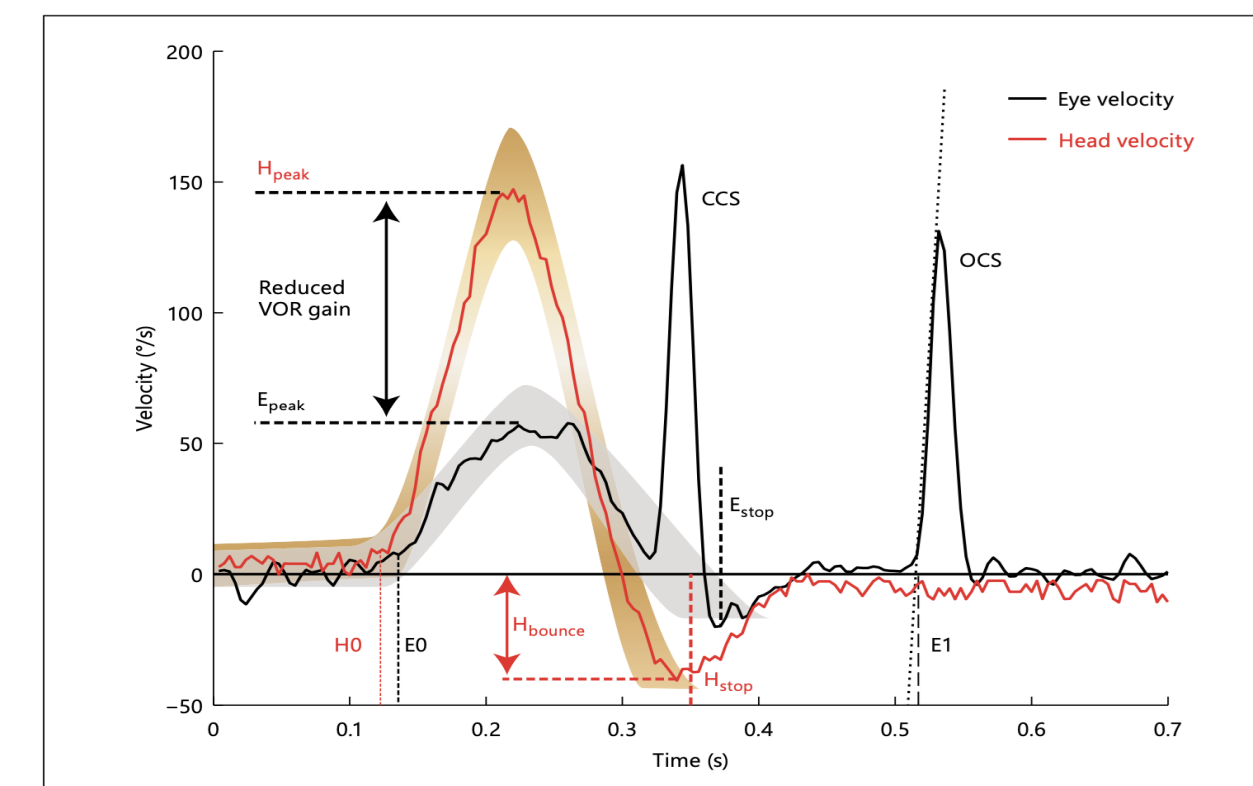
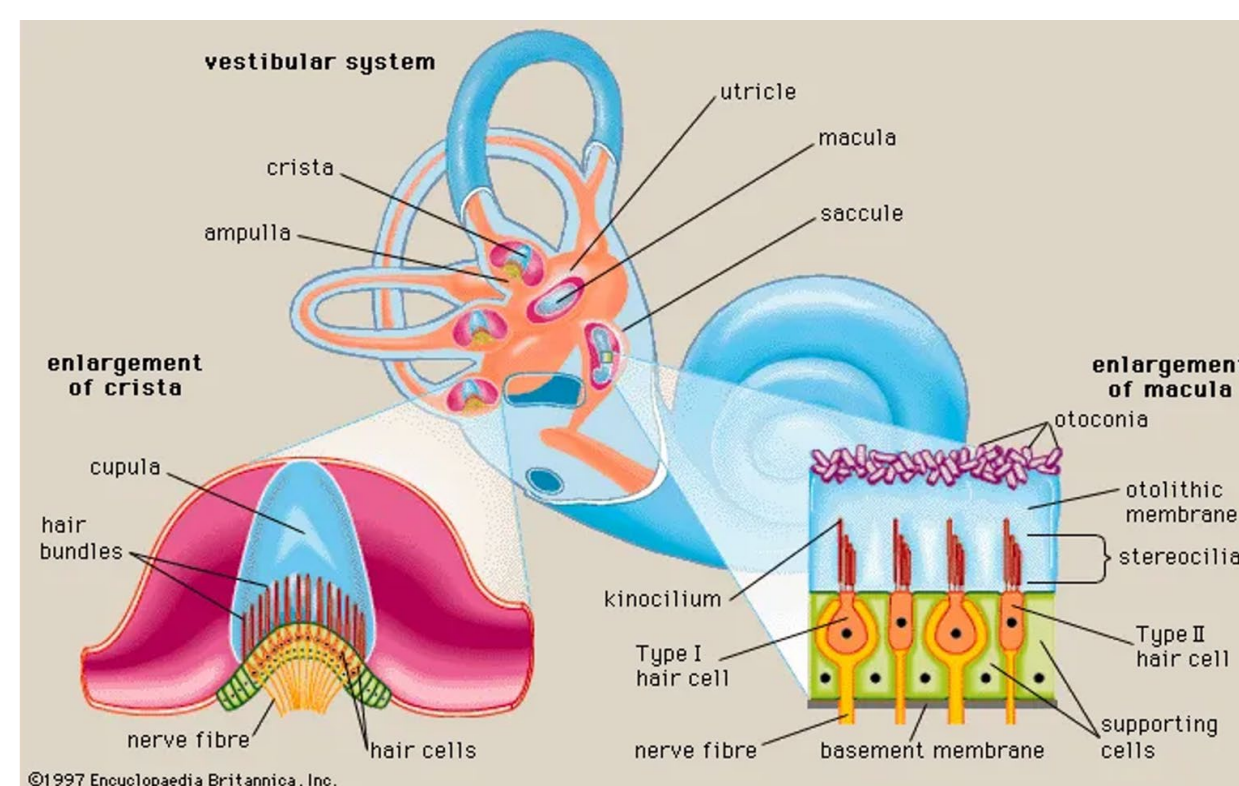
¹UT Southwestern Medical School, Dallas, TX; ²Medical Scientist Training Program (MSTP), Baylor College of Medicine, Houston, TX;

³Geologics, Houston, TX; ⁴KBR, Houston, TX; ⁵NASA Johnson Space Center, Houston, TX

*Contact: matthew.carey@utsouthwestern.edu; matthew.ehrenburg@bcm.edu

INTRODUCTION

- Astronauts experience a variety of sensorimotor disturbances primarily due to **microgravity induced vestibular adaptations** during spaceflight (e.g., space motion sickness and **vestibulo-ocular reflex (VOR) changes**)
- The **video head impulse test (vHIT)** assesses the canal-specific **VOR** in response to high-velocity head movements, and is utilized as a part of CIPHER Vestibular Health study



Mantokoudis et al., 2015

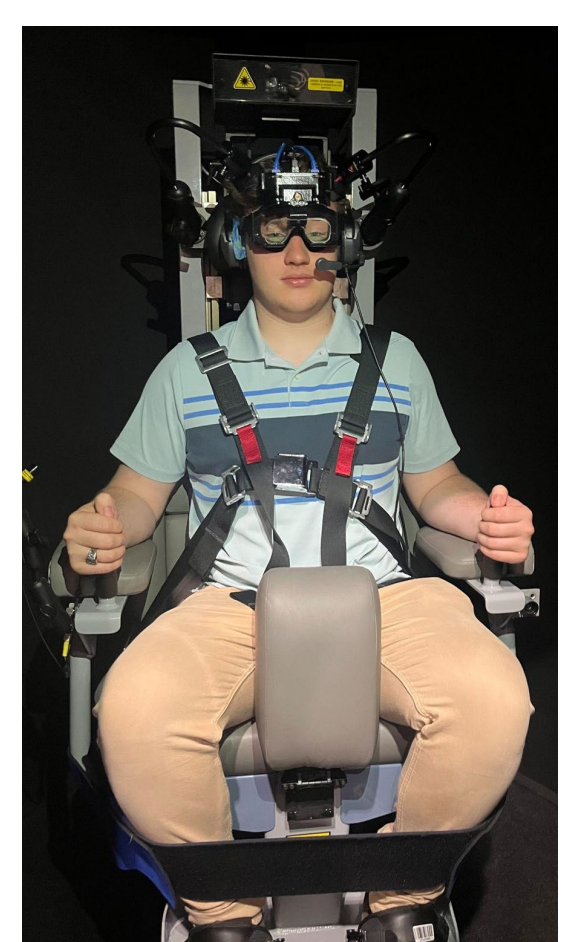
AIMS

- vHIT's reliability using different testers, conditions (*vision and vision-occluded*), and modes (*tester-administered, subject-administered, and rotary chair*) remain unclear
- The aims of this study are:
 - (1) examine the **reliability of vHIT measures** across different test operators
 - (2) **compare passive vs active approaches** to evaluate the feasibility of self-administered versus operator-assisted approaches



Photo Credit-NASA

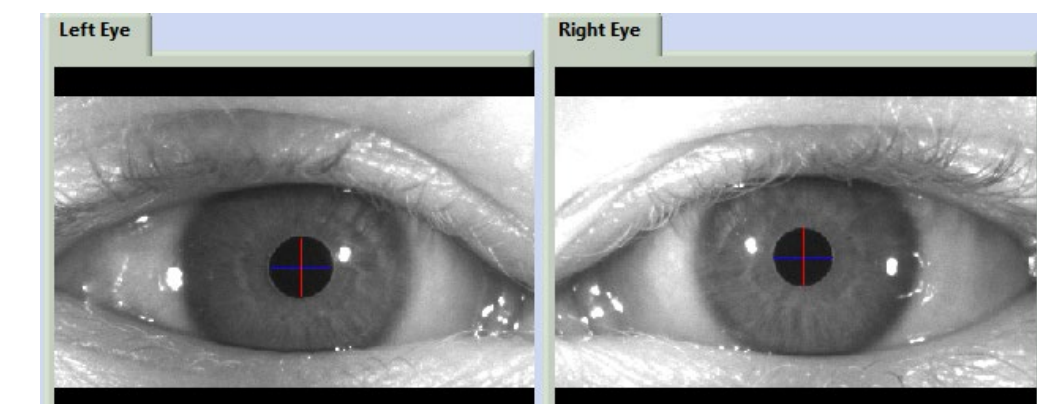
METHODS



- Neurolog's video-oculography (VOG) goggles and VEST™ software
- Seventeen healthy, non-astronaut volunteers (**male n=12, age 23.8 ± 2.98; female n=5, age 27.0 ± 6.04**)
- Modes of impulse administration:**
 - Passive head-on-torso (*pHIT*, default condition for flight study)
 - 2 test operators (*Op1* and *Op2*) for reliability comparison
 - Active head-on-torso (*aHIT*, subject initiated)
 - Passive head and torso movements (*rHIT*, using rotary chair)
- Additional conditions for pHIT and aHIT:**
 - Default* (eyes fixated on a wall target)
 - Vision-occluded* (eyes fixated on an imaginary target)

RESULTS

- pHIT gains were similar with vision (**1.032 ± 0.043**) and vision occluded (**1.029 ± 0.038**)
- Reliability between Op1 and Op2 was greater for pHIT gain (**Intraclass Correlation, ICC = 0.66, p = 0.001**) than for pHIT asymmetry (**ICC = 0.57, p = 0.01**)
- There was a greater percentage of acceptable trials for pHIT (**Op1 = 93.0%, Op2 = 93.2%**) than for aHIT (**76%**) or rHIT (**83%**)
- Despite poor correlation, pHIT and aHIT gains were not significantly different for either vision or vision-occluded conditions
- Asymmetry measures were poorly correlated across all conditions, although no subjects had asymmetries greater than 16%



Comparison of left VOR gain between operators

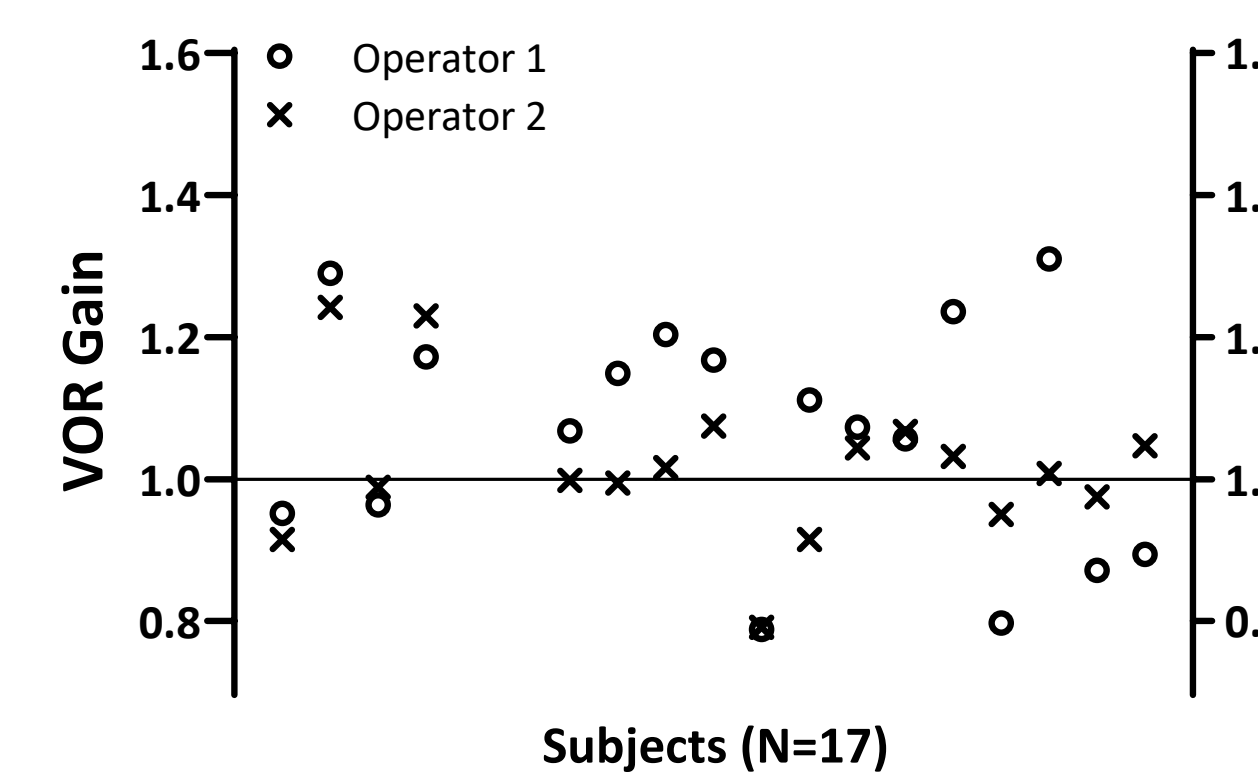


Figure 1. Comparison of leftward pHIT between Op1 and Op2 for the not visually occluded condition.

Comparison of right VOR gain between operators

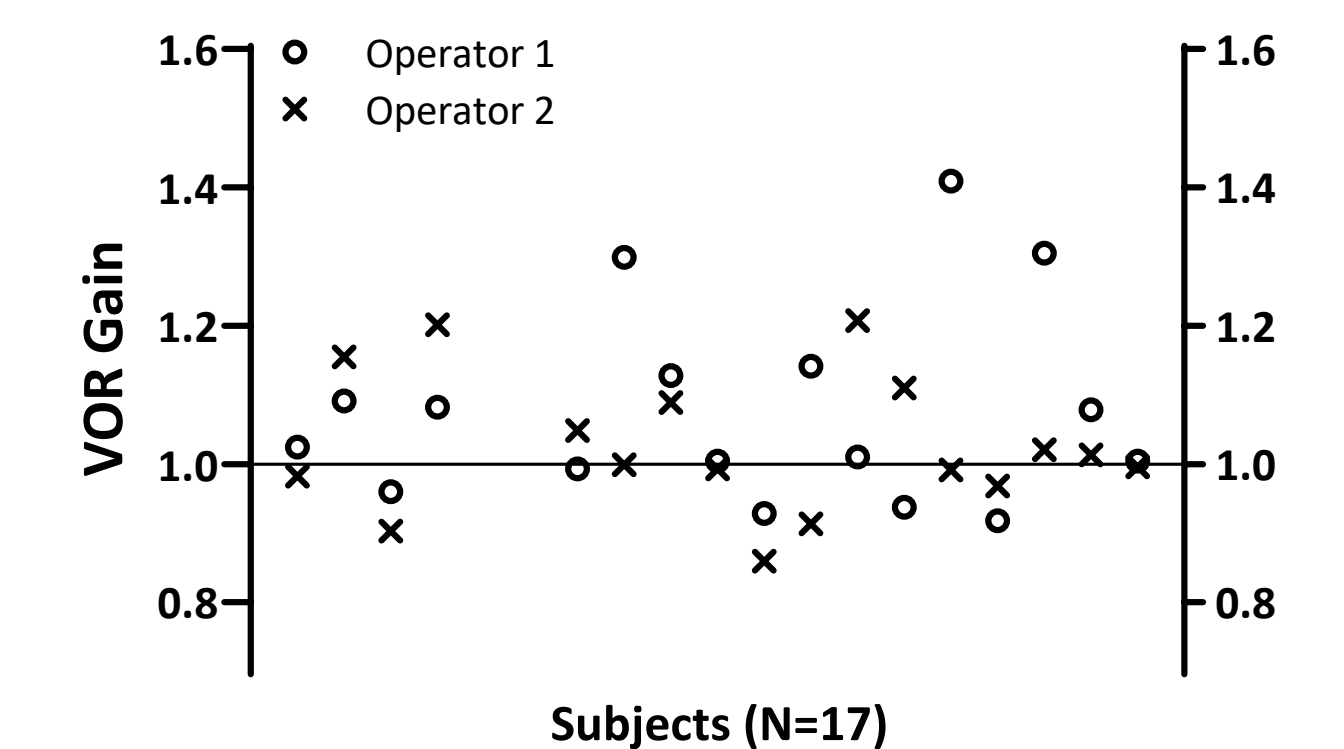


Figure 2. Comparison of rightward pHIT between Op1 and Op2 for the not visually occluded condition.

DISCUSSION & CONCLUSION

- Standard pHIT methodology** is feasible for use in spaceflight
- Inter-tester reliability was sufficient** despite differences in training, suggesting that astronauts could administer this test with sufficient time and training
- Similarities in visual conditions reflect **responses dictated by the peripheral lateral canals** and not other oculomotor mechanisms
- pHITs resulted in a higher percentage of acceptable trials** and should result in more efficient and reliable measures during spaceflight

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