



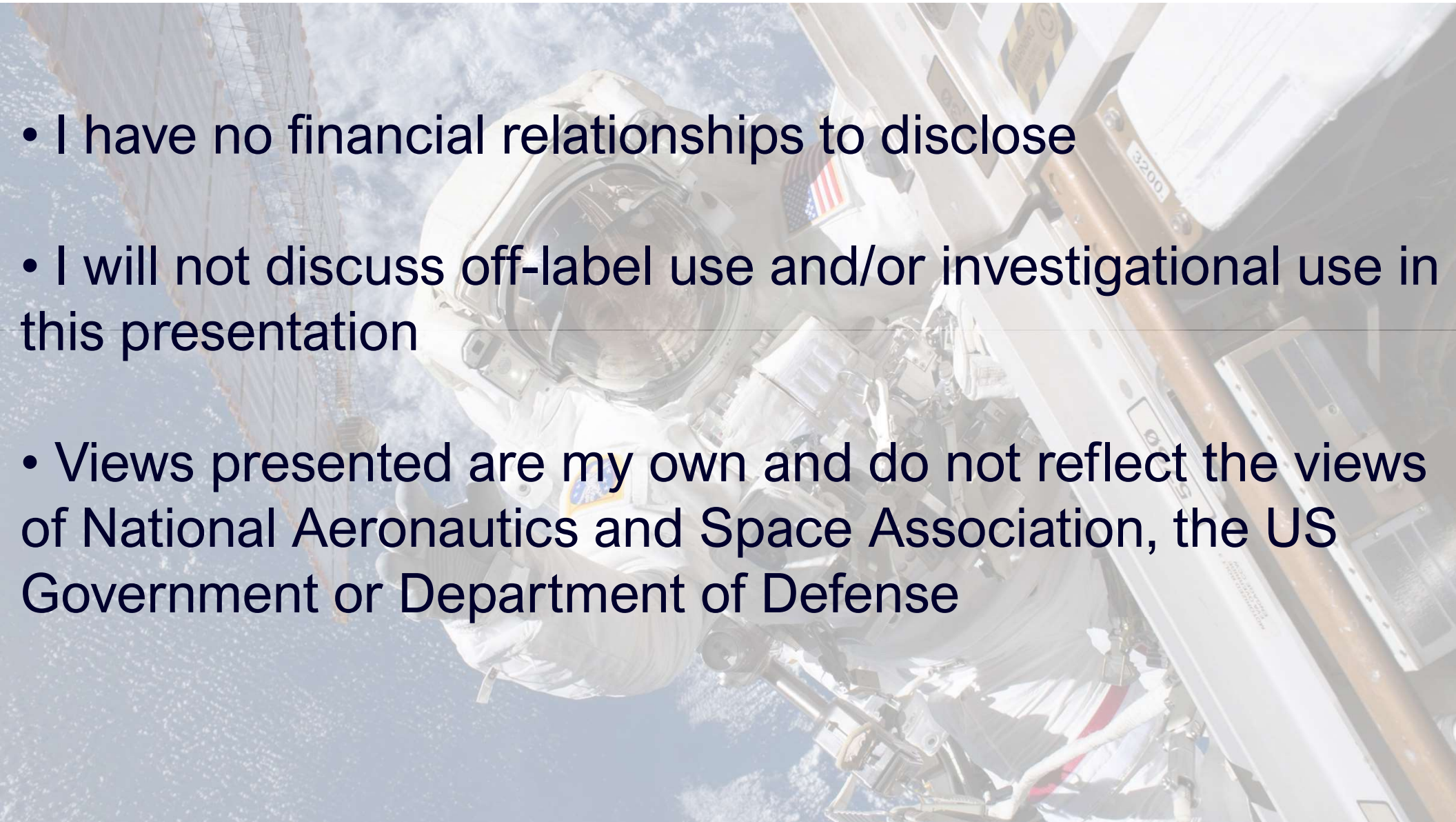


Future of PT... Human Performance Optimization

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- I have no financial relationships to disclose
- I will not discuss off-label use and/or investigational use in this presentation
- Views presented are my own and do not reflect the views of National Aeronautics and Space Association, the US Government or Department of Defense





OBJECTIVES

- ① Key Tenants of Human Performance Optimization
- ② Space Flight... A Team Sport
- ③ Success of Human Performance Optimization
- ④ Future of the Profession

KEY TENANTS OF HUMAN PERFORMANCE OPTIMIZATION

A definition...

"the process of applying knowledge, skills and emerging technologies to improve and preserve the capabilities of 'individuals' (military members), and organizations to execute essential tasks"

Needs Assessment



Team Collaboration



MULTIDISCIPLINARY



INTERDISCIPLINARY



TRANSDISCIPLINARY

Additive

Interactive

Holistic



Clinical Care

Optimal Readiness/Quality of Life

Program Effectiveness

End-product and Need Fully Understood

Reliable, valid tools that utilize as few measurements to tell you many things and keep you mission focused

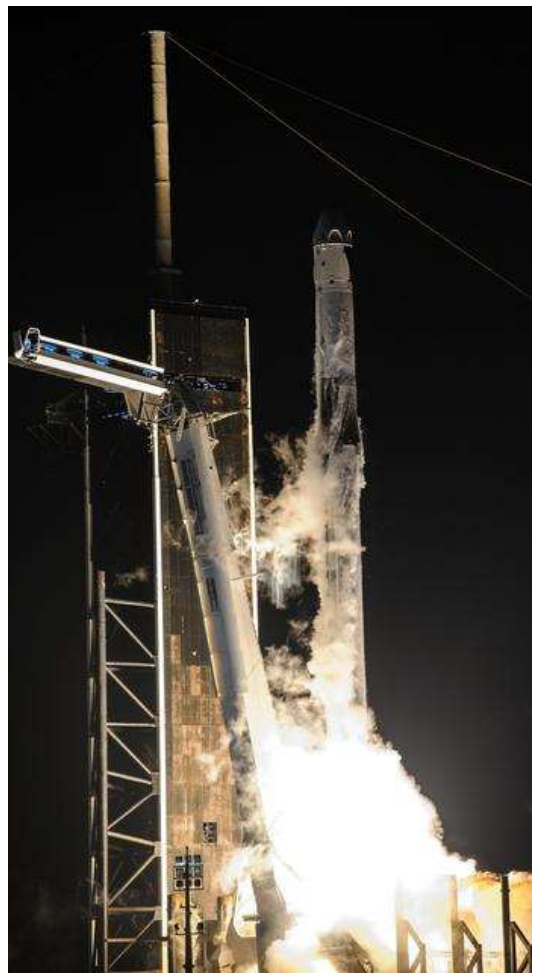
Leverages Technology for End User Feasibility

Interdisciplinary Nature

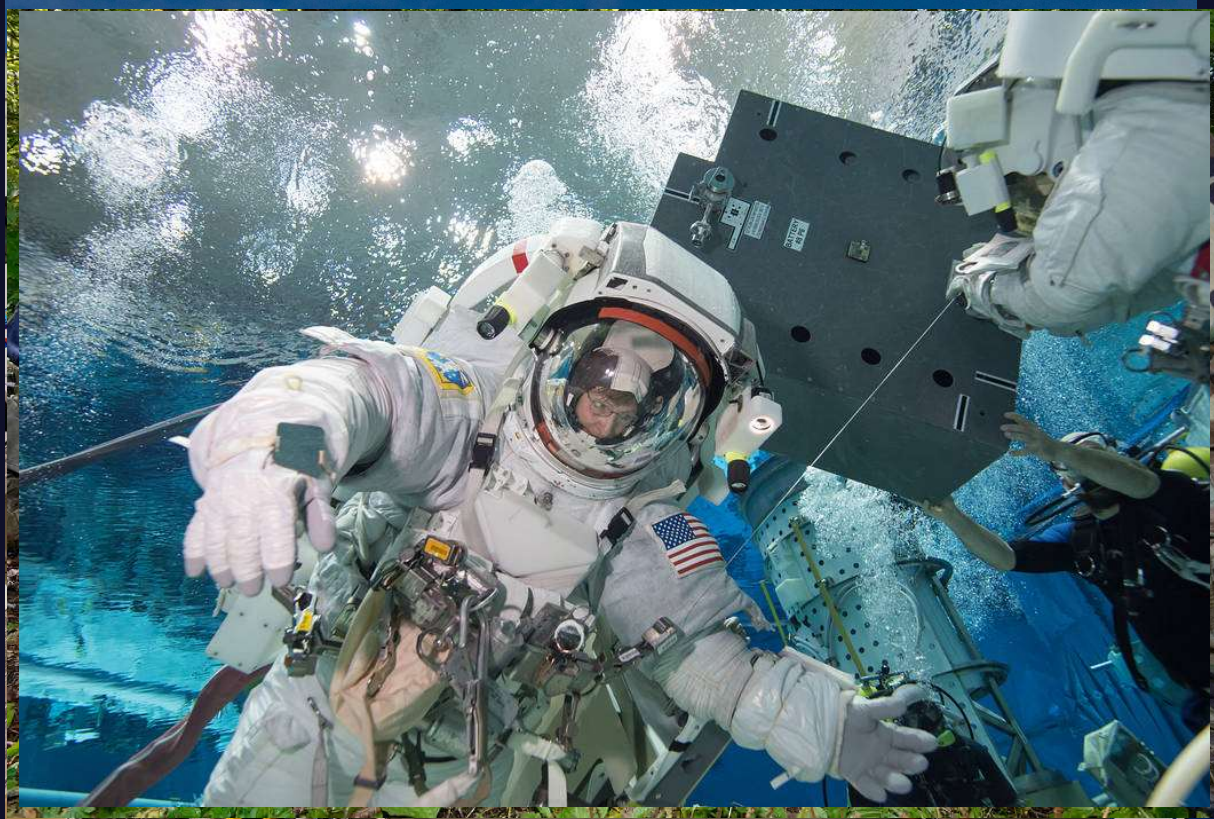
Data is quickly and easily accessible to the user and the team!!



SPACE FLIGHT... A TEAM SPORT



Training Demands



Human Response to Spaceflight

Astronauts experience a spectrum of adaptations in flight and post flight

Exposures:

- Launch & Landing Loads
- Microgravity
- Closed Life Support System
- Confined Habitat
- Radiation Exposure

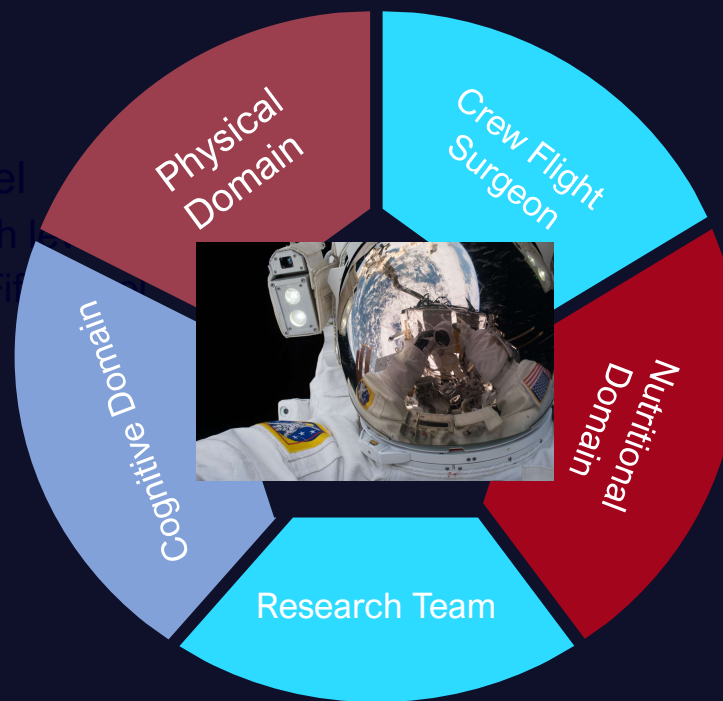
- Balance disorders
- Cardiovascular deconditioning
- Bone loss
- Muscle atrophy
- Decreased immune function
- Vision changes



- Neurovestibular
- Cardiovascular
- Skeletal
- Muscular
- Immunological
- Nutritional
- Behavioral
- Occular

Team Integration- ISS Support

- Third level
- Fourth level
- Fifth level



***Expert skill set, of necessary disciplines, across the continuum of Human Performance Optimization
Service provided across the lifespan.....***

On Orbit Medical Support

- Orbit 2 console (7a-4p M-F), on-call 24/7
- Video conferences
- Periodic health and fitness evaluations
- Weekly cardiovascular and strength training program updates
- On-orbit medical testing
- Mission management meetings
- Support research with crew as subjects



ISS medical and monitoring capabilities

- Ultrasound
- Medical Kits
- Supplemental oxygen, ventilator
- IV Fluids, injectable medications
- ECG
- Basic splinting, wound management
- VO2 Max Testing Capabilities
- Exercise Equipment Force Plate Data
- Vision surveillance hardware
- Countermeasures for physical and cognitive domains



Select crew members trained as medical officers
Surgeon is available 24-7 via video or audio

In-Flight Exercise Countermeasures

2.5 hours of exercise scheduled daily

T2
(Treadmill 2)



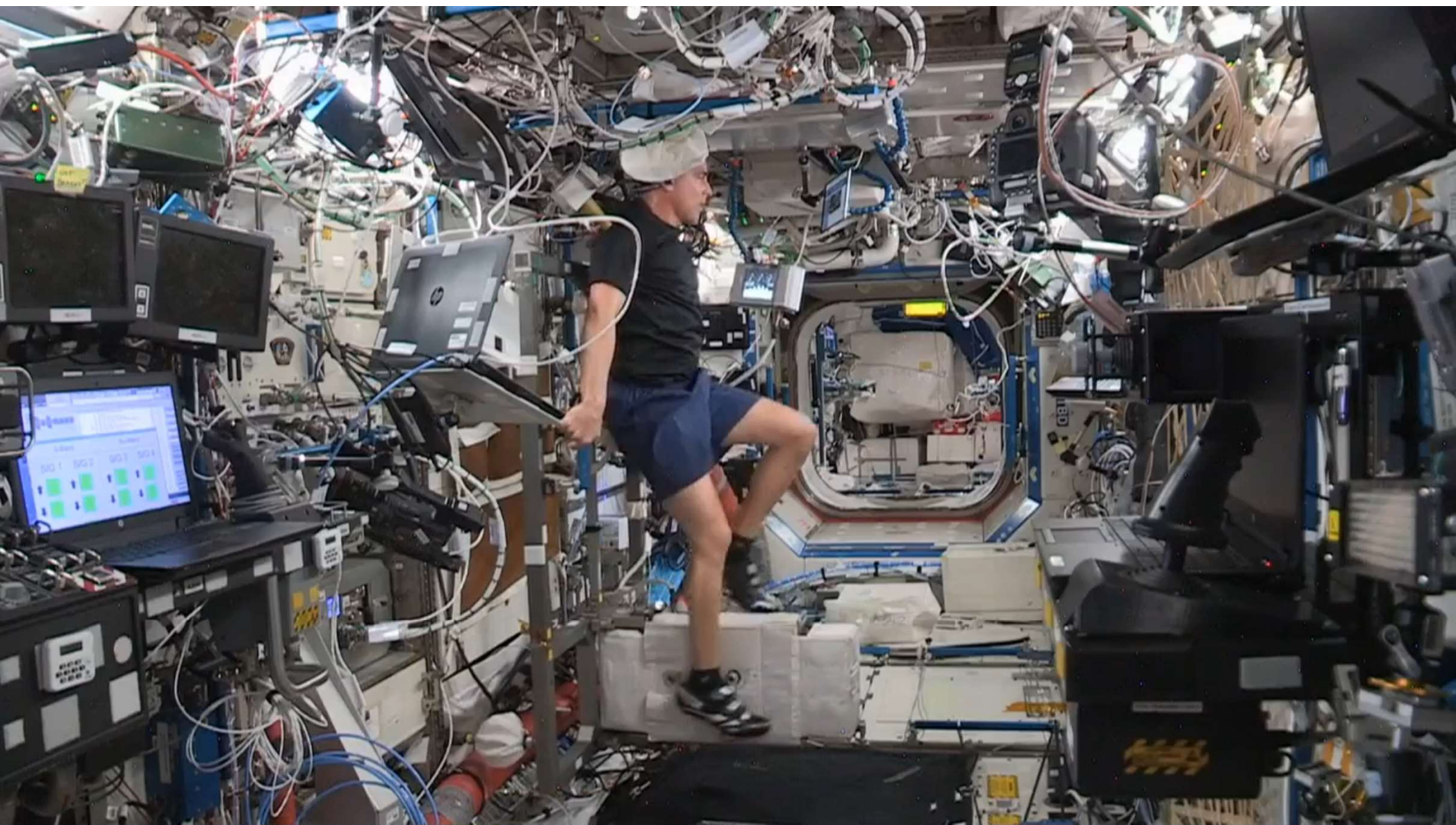
CEVIS
(Cycle Ergometer with
Vibration Isolation & Stabilization)



ARED
(Advanced Resistive
Exercise Device)



Neurovestibular	✓		
Cardiovascular	✓	✓	
Musculoskeletal	✓	✓	✓

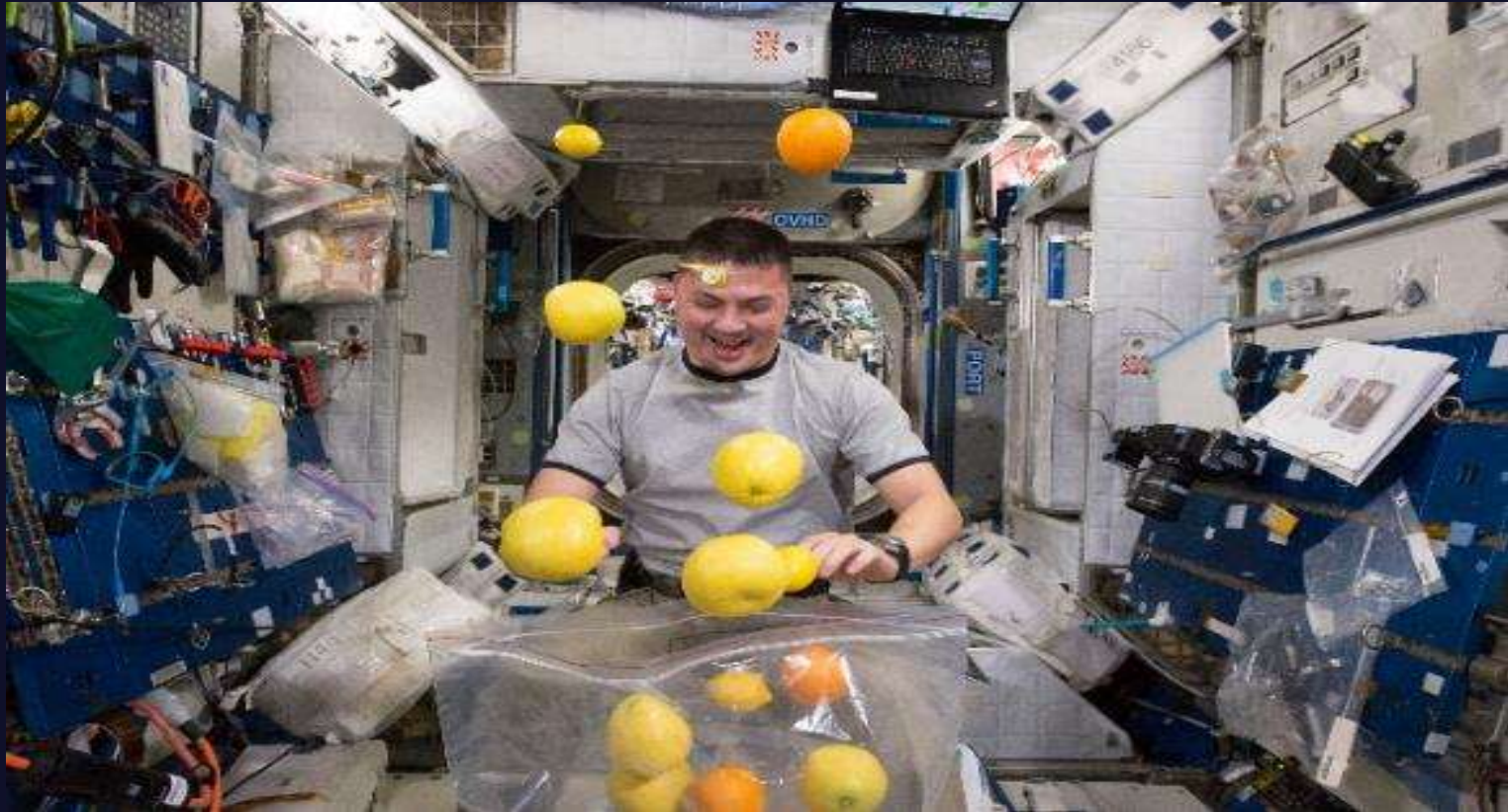








NASA Stock Photo, Astronaut Peggy Whitson



NASA Stock Photo, Astronaut Kjell Lindgren

Back to 1G...



Extrication from Capsule



Medical Tent



Helo Transport



Direct Return

- Continue rest, hydration, medication if required
- 1-2 refuel stops
- Science experiments
- Walk and shower if feeling well enough
- Land at Ellington Field to the joyous faces of friends and family

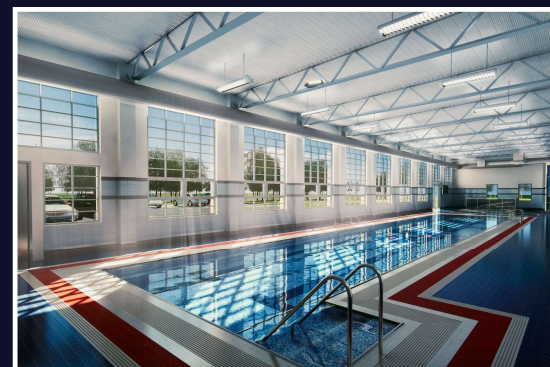


Reconditioning

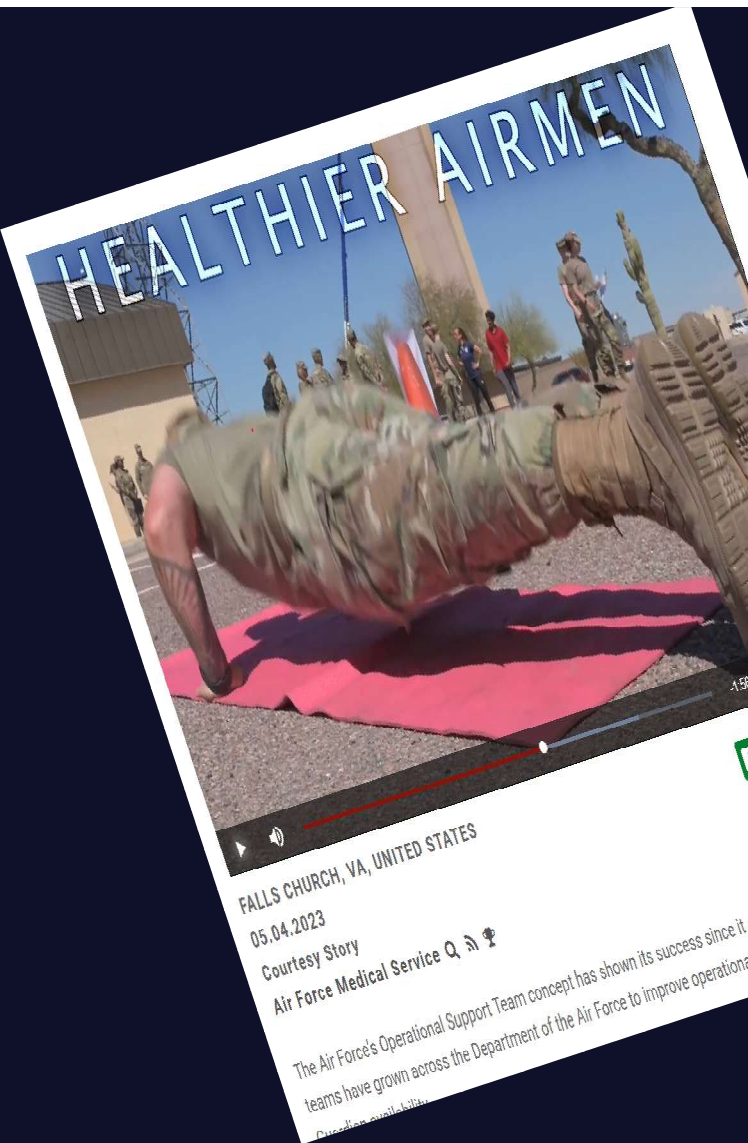
Crew stays taken in astronaut crew quarters where they can be further monitored overnight if necessary.

Baseline data collection for science immediately starts

Focused reconditioning program with the Astronaut Human Performance Team



SUCCESS OF HUMAN PERFORMANCE OPTIMIZATION



Your Army

Early data shows 37% suicide decrease in units with holistic health

By Todd South

Wednesday, Apr 26



FUTURE OF PHYSICAL THERAPY

Team Collaboration



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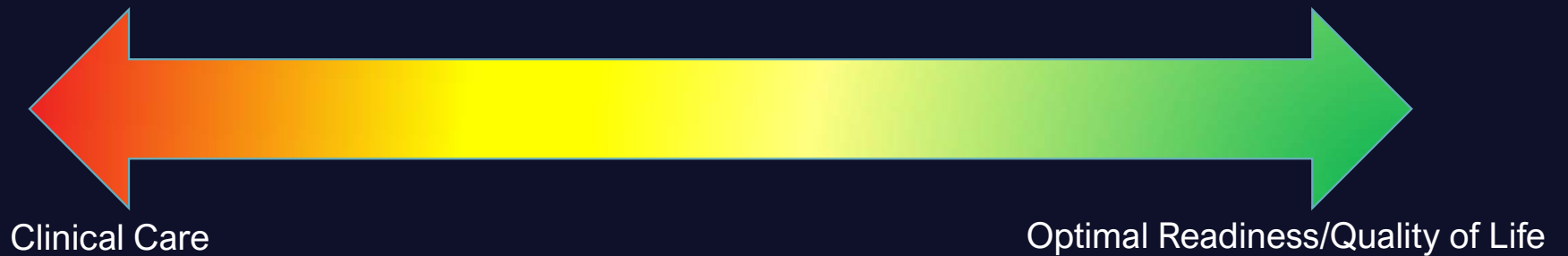
Holistic



Clinical Care

Optimal Readiness/Quality of Life

Doctors of Physical Therapy



Doctors of Physical Therapy

Direct Access

*Inter/Transdisciplinary
Communities- PCPs, ERs*



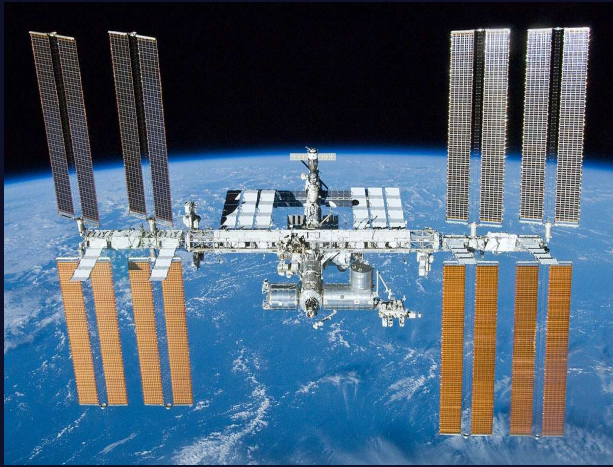
*Reliable Technology
For Expanded Care*

*Diagnostic Imaging
Capabilities*

*Funding for Prevention
Services/Appropriate
reimbursement*

Consistency Across States

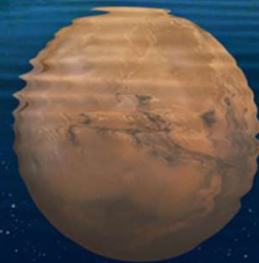
Expanding Care by Leveraging Technology





EXPLORE MOON_{to}MARS

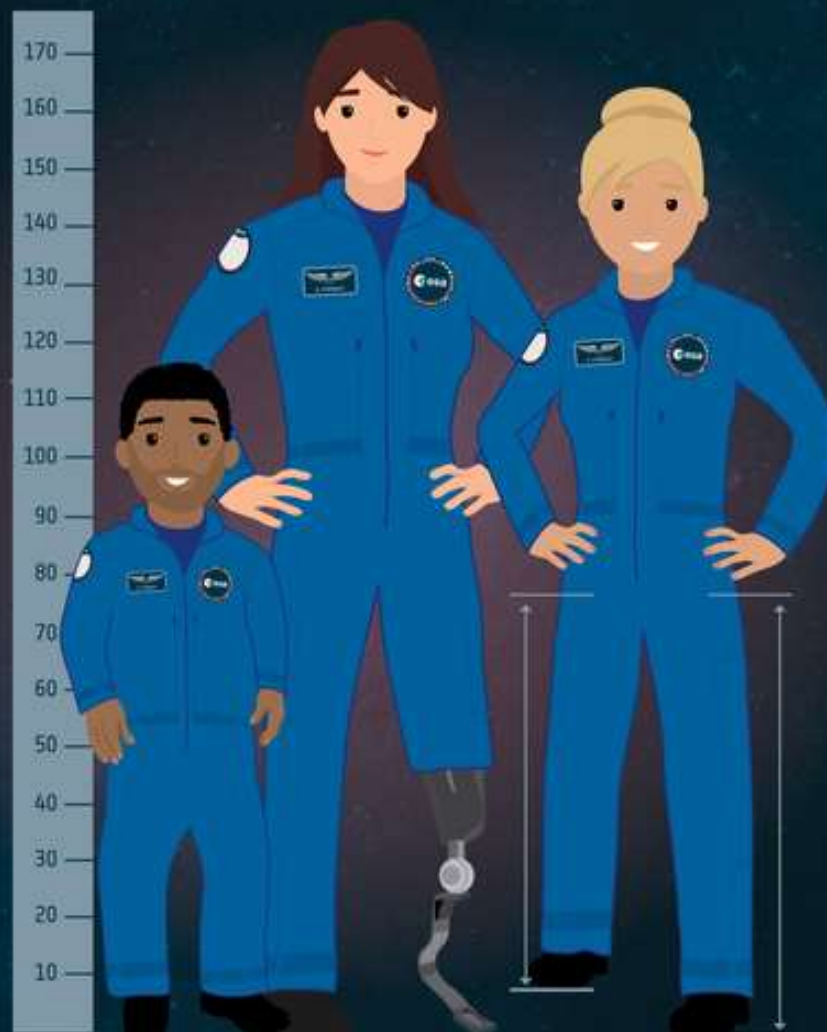
MOON LIGHTS THE WAY



PARASTRONAUT PROJECT

As part of ESA's commitment to enhance inclusiveness and fair representation, the Agency is launching the parastronaut feasibility project to assess the conditions for including **astronauts with disabilities** to work in space. This project is a new endeavour for Europe and a global first.

The feasibility project aims at offering **professional spaceflight opportunities** to a wider pool of talents. Starting with selected disabilities to have a thorough understanding of the potential challenges in terms of safety and operations in space, the scope of disabilities may then be extended aiming at broader inclusion.



The selected candidate(s) will work with ESA to assess and optimise the conditions allowing people with physical disabilities to **work and live in space**.

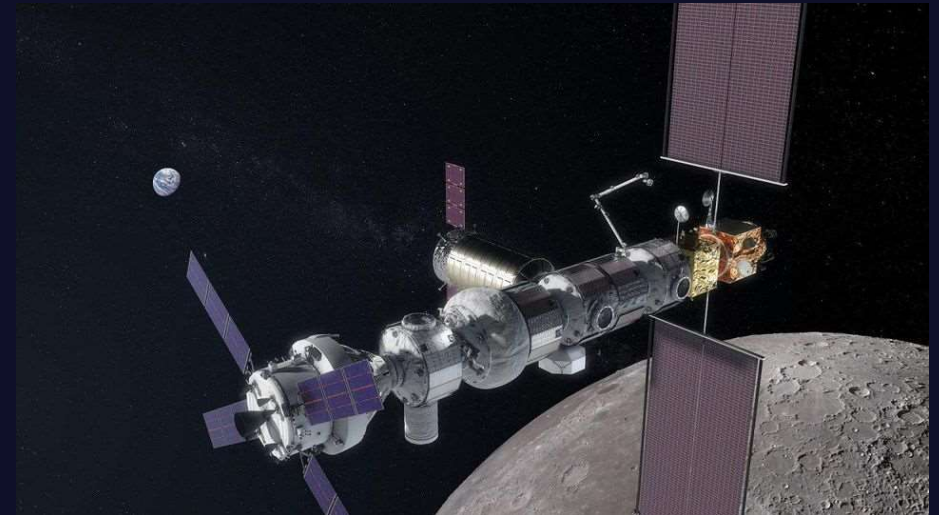
The educational and psychological requirements for these candidates are the same as for the ESA astronaut selection. However, with respect to **physical requirements**, this feasibility project will allow the inclusion of candidates with the following disabilities:

- a lower limb deficiency, as follows:
 - Single or double foot deficiency through ankle
 - Single or double leg deficiency below the knee
- a pronounced leg length difference
- a short stature (<130 cm)

Exploration

New medical challenges will arise:

- Increased distance from Earth = delays in communication
- Less frequent opportunities for re-supply
- Evacuation of sick or injured astronauts may become impossible
- Requires innovative Countermeasures due to changes in vehicles and physical demands of longer missions



Exploration



References

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1. Nindl BC, Jaffin DP, Dretsch MN, Cheuvront SN, Wesensten NJ, Kent ML, Grunberg NE, Pierce JR, Barry ES, Scott JM, Young AJ, O'Connor FG, Deuster PA. Human Performance Optimization Metrics: Consensus Findings, Gaps, and Recommendations for Future Research. J Strength Cond Res. 2015 Nov;29 Suppl 11:S221-45.

Thank You

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