



Surface EVA Readiness and Performance Optimization- An Integrated Approach

Presented by: Danielle N. Anderson | US Air Force, DPT, DSc, OCS, CSCS, FAAOMPT

SERPO Leads: Rachel Thompson | KBR, PhD and Danielle Anderson | USAF, DPT, DSc, Key Contributor: Corey Twine | KBR, SCCC, CSCS

Surface EVA Readiness and Performance Optimization Overview



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Surface EVA Readiness and Performance Optimization (SERPO): An Integrated Human Performance Approach

Rachel L. Thompson¹, PhD, Danielle Anderson², DPT, DSc, Lt. Col, Corey Twine³, MS, Kathleen Rubins⁴, PhD, Kristine Davis⁴, Lauren Hickox⁵, PhD, Emily Matula³, PhD, Patrick Estep⁴, MS, Zachary Wusk³, MS, Jason Norcross³, MS, Sarah Moudy⁵, PhD, Hannah Weiss³, PhD, Caroline Howes³, ME, Steven Anderson³, PhD, Timothy Macaulay⁴, PhD, Robert Sanders⁴, MD, James Pattarini⁴, MD, Suzanne Bell⁴, PhD, Richard Scheuring⁴, MD, Raja Chari^{2,4}, MS, Brig. Gen., Jessica Wittmer^{4,7}, MS, CDR

- Holistic integration to strengthen performance across all mission phases
- Data-driven insights guide training, design, and operational decisions
- Framework scales to Artemis and future Mars-class exploration demands

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Mission Cycle and Human Performance Support Integration

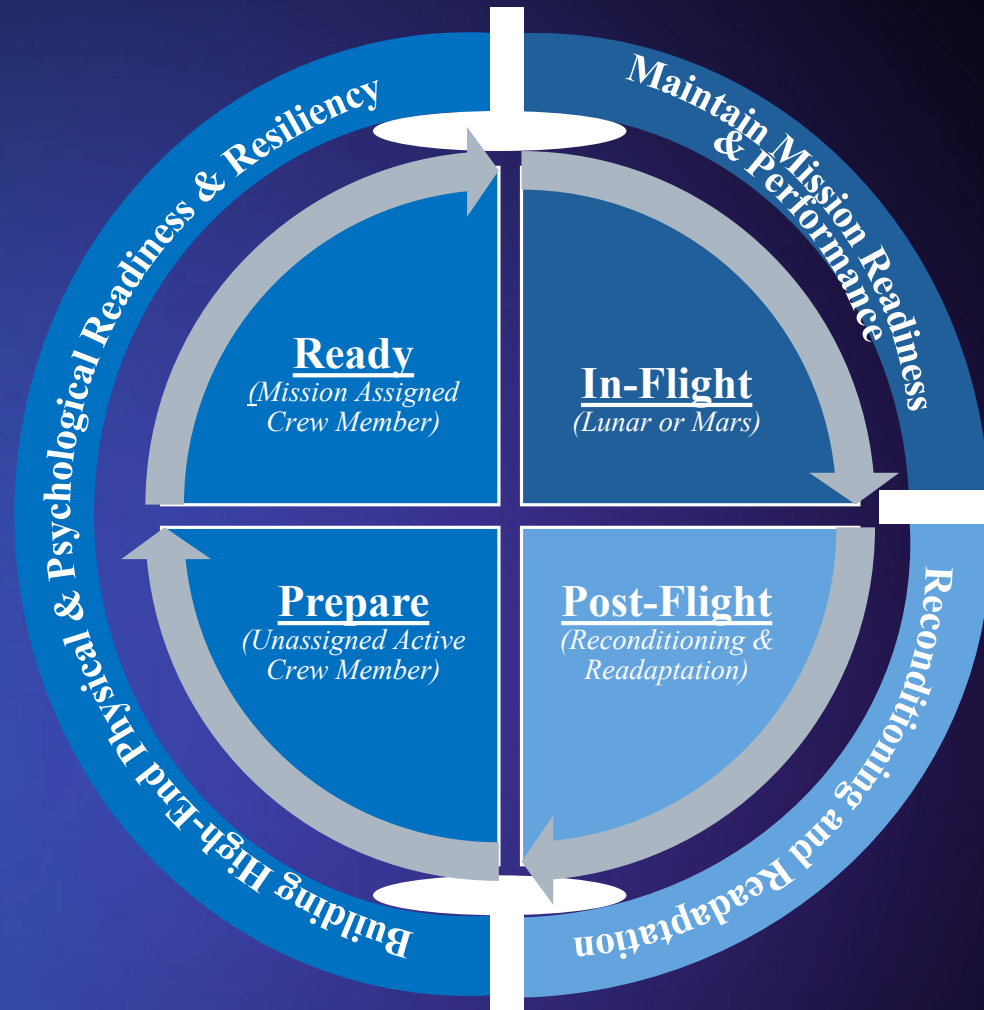


Ready:

- Sustaining peak readiness
- Human performance optimization (e.g., data-driven training)
- Integration of physical and psychological health and wellness (e.g., comprehensive model of optimizing performance (CMOP))

Prepare:

- Training and skill development
- Building foundational skills
- Emphasis on human performance factors (e.g., building foundational fitness and cognitive strategies)



In-Flight:

- Fulfill mission requirements
- Remote human health and performance support to sustain physical and psychological readiness
- Continuation of the interdisciplinary support model (e.g., CMOP)

Post-Flight:

- Focus on readaptation, reintegration and reconditioning
- Continuation of the interdisciplinary support model (e.g., CMOP)
- Return the crew member to the prepare phase



Prepare Phase: Training and Skill Development

Foundational Capability Development

Prepare phase builds astronauts' physical, cognitive, and operational skills for mission readiness through structured training and skill acquisition.

Injury Risk Mitigation

Emphasizes progressive overload and movement quality to reduce injury risk during mission preparation and training. Ongoing interdisciplinary support.

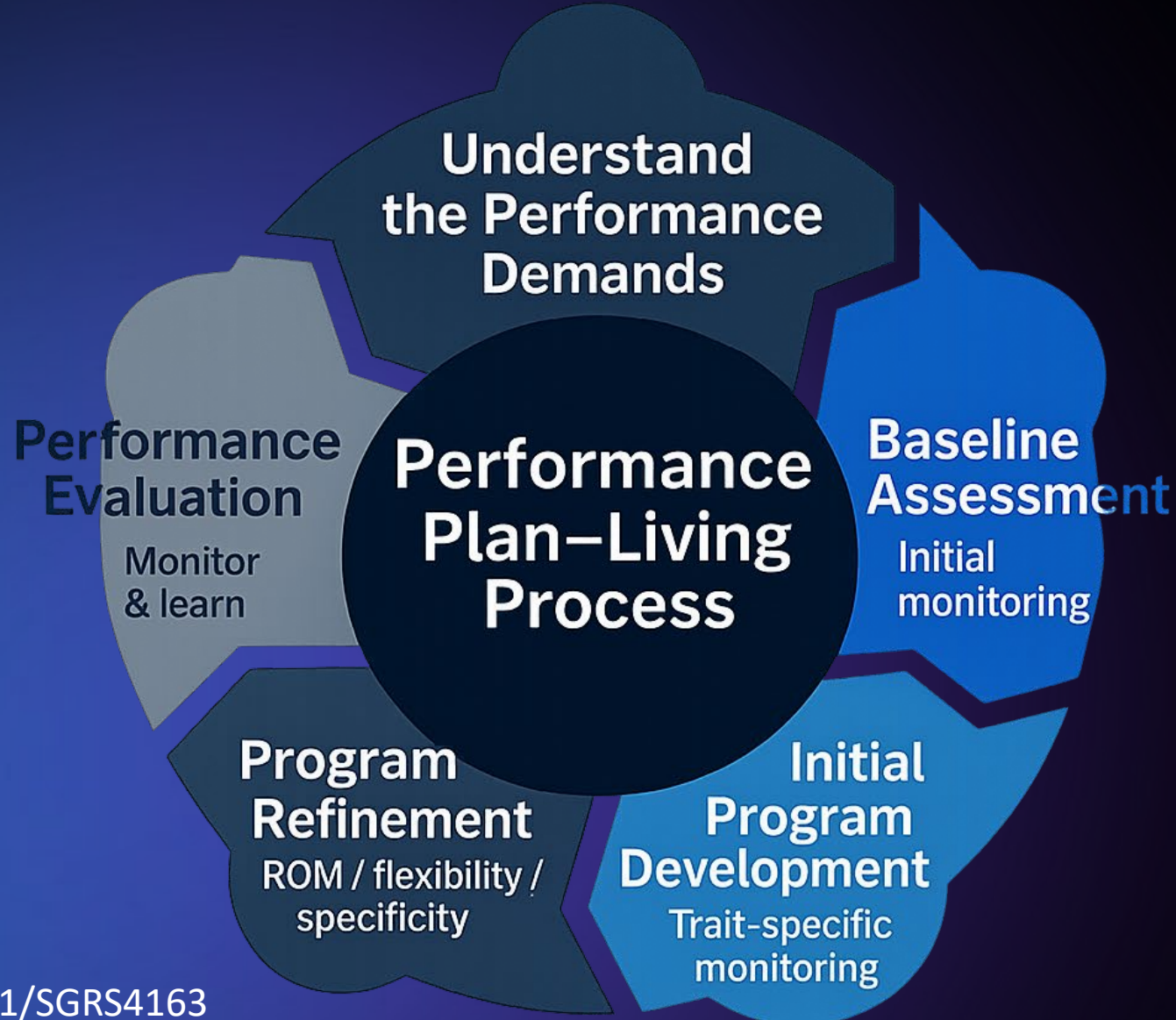
Long-term Performance Preparation

Performance is viewed as dynamic, refined through repeated exposure, assessment, and continuous development over time (a living process).





Prepare Phase- Living Process





Ready Phase: Sustained Peak Performance

Balancing Training and Recovery

The Ready Phase emphasizes balancing high training intensity with adequate recovery to avoid fatigue and maintain readiness.

Maintaining Strength and Managing Stress

Sustained peak performance requires maintaining physical strength and effectively managing cognitive and stress loads.

Recovery Strategies

Sleep optimization and low-intensity aerobic work are key recovery strategies to sustain high readiness during the Ready and Inflight Phase.



Inflight Phase: Maintain Mission Readiness and Performance



Microgravity Challenges

Microgravity causes rapid physiological deconditioning requiring tailored fitness strategies during spaceflight.

Strength Maintenance

The right dose, at the right time, for the right purpose. Integrated within the aspects of mission demands.

Cardiovascular Conditioning

Low-intensity, steady-state, and HIIT cardiovascular to support cardiovascular health and aid in recovery. Dose is relative to mission cadence.

Sleep and Recovery Protocols

Structured sleep and recovery protocols are essential to sustain performance and mission readiness in space.



Post Flight Phase: Readaptation and Paradigm Shift

Multidisciplinary Recovery Support

Recovery requires structured, multidisciplinary planning including neuromuscular, cognitive, and psychological support. Recovery may become more of a priority based on mission demands, a shift from physiological readaptation to recovery.

Physiological Readaptation

Progressive physical and cognitive re-adaption for neurovestibular, cardiovascular, and muscular deconditioning. Consequence will vary based on mission duration and shorter duration will likely experience more fatigue and mechanical stress vs true deconditioning.

Cognitive Recalibration

Post-flight phase involves cognitive workload management and mental recalibration for reintegration into Earth environments.



Summary:

- NASA's SERPO framework outlines an integrated human performance strategy that expands beyond physical training integrating multiple domains to reduce musculoskeletal injury risk and enhance overall astronaut readiness and performance across all mission phases
- Inflight mission requirements may shift priorities from solely mitigating environmental threats, but to emphasize maintaining performance and enabling recovery through appropriately structured and designed exercise programming