

This Directed Acyclic Graph and write-up is an excerpt from a larger NASA document.

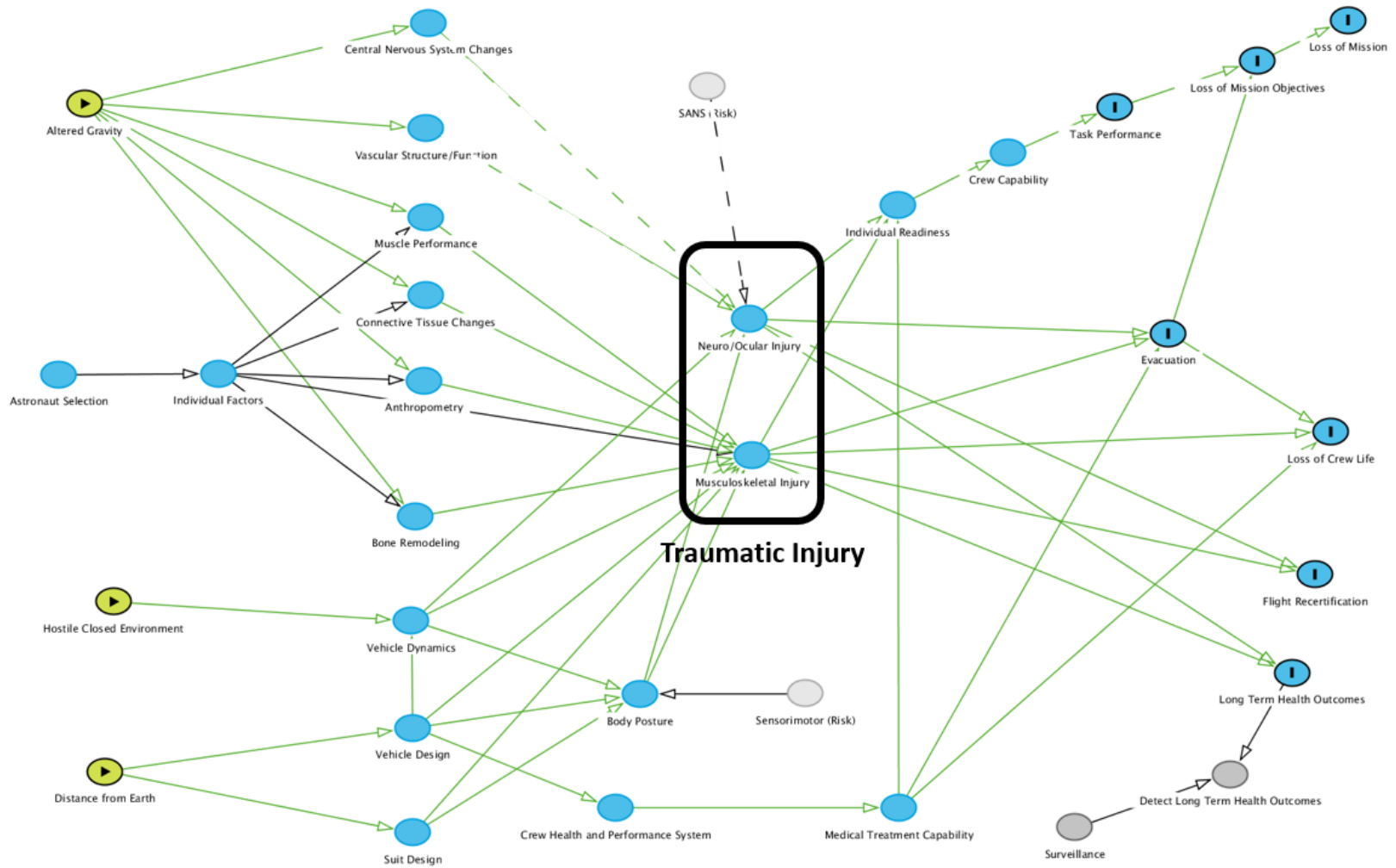
**NASA/TP-20220015709**

**Directed Acyclic Graphs: A Tool for Understanding the NASA  
Spaceflight Human System Risks**

**Human System Risk Board**

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## Risk of Injury from Dynamic Loads (Dynamic Loads Risk)



## Dynamic Loads Risk DAG Narrative

- The central issue in the Dynamic Loads Risk is the **Traumatic Injuries** that are caused by acceleration/deceleration forces.
- Two categories of traumatic injuries are shown here – **Musculoskeletal Injury** and **Neuro/Ocular Injury**.
- Evidence shown in the risk package supports the occurrence of **Musculoskeletal Injuries** after landings in the Soyuz and other vehicles.
- The dotted lines to **Neuro/Ocular Injury** show a speculative concern given these have not been experienced to date. Predisposing factors for **Neuro/Ocular Injuries** may include **Central Nervous System Changes** and **Vascular Structure/Function** as well as **Vehicle Dynamics** and **Body Posture**.
- Predisposing factors for **Musculoskeletal Injuries** include **Muscle Performance**, **Connective Tissue Changes**, **Anthropometry** and **Bone Remodeling** as well as **Vehicle Dynamics** and **Vehicle and Suit Designs**.
- Restraints and occupant protection measures are included in **Vehicle Design**.
- The **Sensorimotor (Risk)** influences **Body Posture** through Postural Control and Locomotion.
- Given Design Reference Mission (DRM) categories that include Lunar and Martian Landings, the pathway through **Crew Health and Performance System -> Medical Treatment Capability** is shown to illustrate that the consequences of inadequate medical system planning will be felt in **Crew Capability**, likelihood of **Evacuation**, and potentially **Loss of Crew Life**. Any **Neuro/Ocular** or **Musculoskeletal Injuries** incurred have the potential to affect **Flight Recertification** of crew as well as **Long Term Health Conditions**.