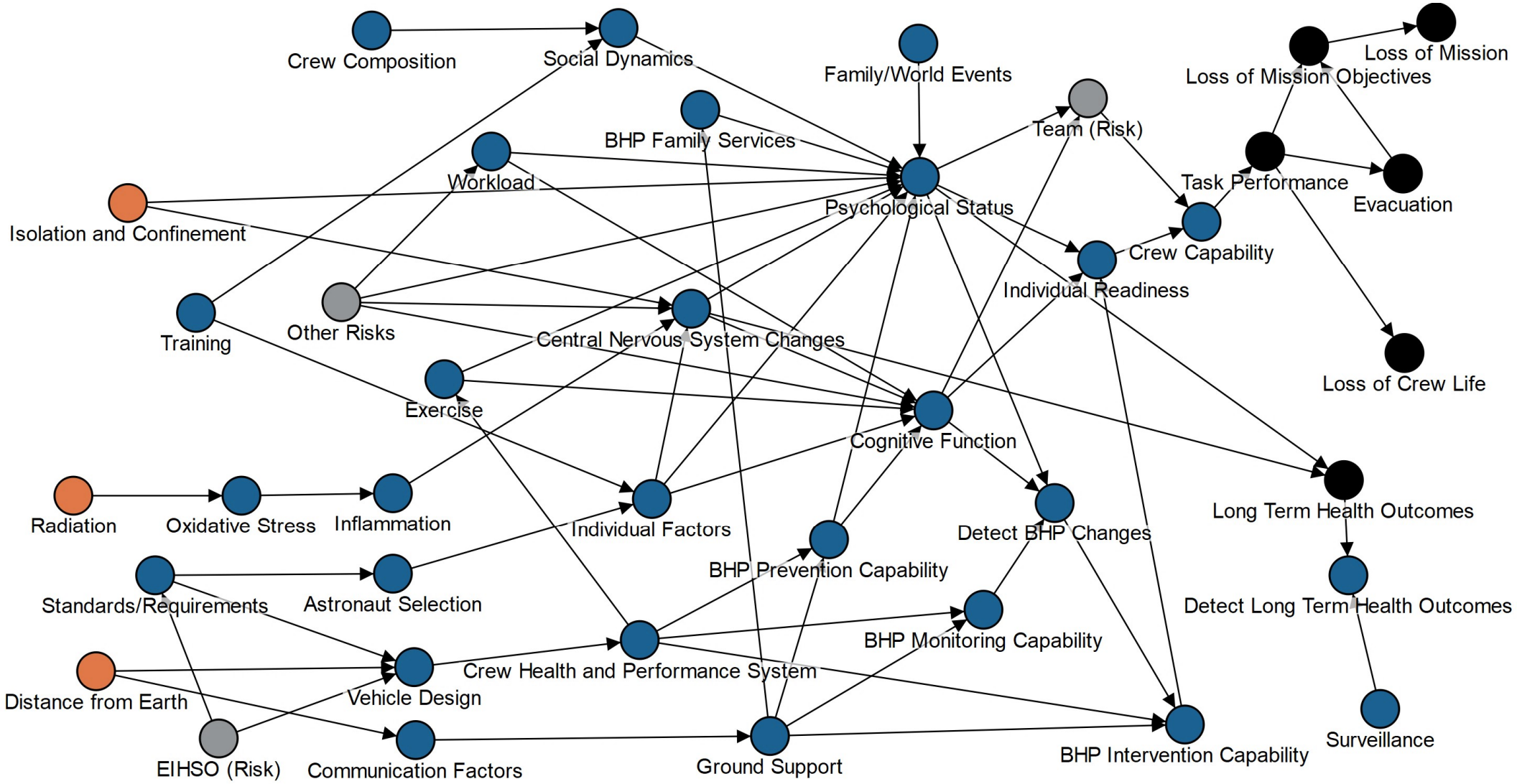
Crew Composition
Social Dynamics
Family/World Events
Loss of Mission
Loss of Mission Objectives
BHP Family Services
Team (Risk)
Workload
Task Performance
Evacuation
Isolation and Confinement
Psychological Status
Crew Capability
Individual Readiness
Training
Other Risks
Central Nervous System Changes
Loss of Crew Life
Exercise
Cognitive Function
Radiation
Oxidative Stress
Inflammation
Individual Factors
Detect BHP Changes
Long Term Health Outcomes
BHP Prevention Capability
Standards/Requirements
Astronaut Selection
Detect Long Term Health Outcomes
BHP Monitoring Capability
Crew Health and Performance System
Distance from Earth
Vehicle Design
Surveillance
EIHSO (Risk)
Communication Factors
Ground Support
BHP Intervention Capability

Behavioral Health Risk

Directed Acyclic Graph (Narrative)

The Behavioral Risk is centered around two nodes: **Psychological Status** and **Cognitive Function**.

- **Psychological Status** refers to the mood and psychological state of the crew at any given time during a mission. These factors can directly affect **Crew Capability** by decreasing an individual's readiness for **Task Performance** if crew are distracted, preoccupied, dysregulated, unmotivated, fatigued, or uncooperative. This also affects the **Team (Risk).** The equilibrium that is present in Psychological Status for an individual astronaut is affected by:
  - **Family/World Events** that can occur while an astronaut is on a long mission. These can include deaths and loss that provoke grief and affect mood and motivation for example.
  - **Social Dynamics** with the rest of the crew are dependent on **Crew Composition**. NASA typically does not select crews for their compatibility, but this may be required in longer duration exploration missions.
  - **Central Nervous System (CNS) Changes** that can occur as a result of **Isolation and Confinement** or can occur because of **Other Risks** including **Medical (Risk), Pharm (Risk), Food and Nutrition (Risk), Sensorimotor (Risk), SANS (Risk), Sleep (Risk), CO2 (Risk), Hypoxia (Risk),** and **Immune (Risk),** Extravehicular Activities (EVA) Risk) changes. This can also be affected by **Oxidative Stress/Inflammation** as a result of **Radiation** and other causes.
  - **Workload** can affect mood and psychological state. Workload is impacted by operational tempo in the context of EVAs, science tasks, maintenance tasks, and public outreach.
  - **Individual Factors** including Age, Sex, Genetic Predispositions and more affect the resilience of individual astronauts and the magnitude of impact to **Psychological Status** that may occur.

- **Cognitive Function** refers to the astronaut's attributes like planning, reasoning/decision-making, attention, memory, cognitive speed, and other thought processes that can be affected by a variety of factors in the spaceflight environment. Disruption in **Cognitive Function** can also directly affect Crew Capability and decrease readiness for **Task Performance** required for a variety of mission objectives. This can affect the **Team (Risk)** by requiring other team members to compensate for the individual's deficits. The equilibrium that is present in **Cognitive Function** for an individual astronaut is affected by:
  - **Central Nervous System (CNS) Changes** as described above can affect Cognitive Function. .
  - **Workload** which can affect ability to focus and general cognitive function. Workload is impacted by operational tempo in the context of EVAs (EVA Risk), science tasks, maintenance tasks, and public outreach through cognitive and

physical fatigue (Medical Risk and Sleep Risk).
  - **Individual Factors** including Age, Sex, Genetic Predispositions and more affect the resilience of individual astronauts and the magnitude of impact to **Cognitive Function** that may occur.

- Countermeasures to issues with **Psychological Status** and **Cognitive Function** can occur pre-flight or in-mission and in some cases must be included in **Vehicle Design** allocations and the **Crew Health and Performance System** in order to realize risk reduction. These include:
  - **Selection** of crew who are resilient to decrements in **Psychological Status** and **Cognitive Function**.
  - **Training** historically has occurred pre-flight and enables crews to develop individual resilience as well as team cohesion. This may need to be included in-flight as well in future missions.
  - **Exercise** has a strong connection with mood and motivation of the crew affecting both **Psychological Status** and **Cognitive Function** in positive ways.
  - **BHP Prevention Capability** could include **Exercise** as above, but there are other preventive measures that are performed including care packages, family conferences, private psychological conferences, and more.
  - BHP Monitoring Capability enables the crew to identify when there are changes to **Psychological Status** or **Cognitive Function** and determine appropriate times to implement **BHP Intervention Capability**. This includes regular assessments of **Cognitive Function** and evaluations during Private Medical Conferences as well as Private Psychological Conferences.
  - **BHP Intervention Capability** includes as clinically indicated Private Psychological Conferences, Private Family conferences, ground-based family support services intervention by other crewmembers, and other BHP interventions that may include medications if warranted.

- Most of the current countermeasures are dependent on real-time communication and resupply. As **Communication Factors** change with **Distance from Earth**, access to **Ground Support** that enables successful **BHP Monitoring Capability** and **BHP Intervention Capability** becomes strained or non-existent.

- Central Nervous System Changes and **Psychological Status** of an individual astronaut throughout a mission both have the possibility of causing **Long Term Health Outcomes**. **Surveillance** post-flight and post-career enables us to **Detect Long Term Health Outcomes** of interest and better characterize the long-term risk to astronauts.