Human Factors and Behavioral Performance Challenges for Lunar Surface Exploration. J.J. Marquez[1], M.J. Miller[2], and C.H. Null[1], [1]NASA Ames Research Center, [2]Jacobs/NASA Johnson Space Center.

Introduction: As the agency focuses on lunar missions, it is important to revisit the human factors and behavioral performance (HFBP) challenges for long duration exploration missions. Successful missions will leverage lessons learned from the Apollo program, the long duration experience gained onboard International Space Station (ISS), and HFBP research applicable to exploration-class missions.

Beyond Apollo: For this paper, we assume the following mission parameters which differ from the Apollo Program: long duration missions for lunar outpost [1]; habitat location in south pole [2]; small crew with international astronauts [3]; long communication drop outs [4], some communication latency (several seconds), limited bandwidth [5,6], and modern-day technological capabilities [7]. These mission characteristics lead to a different concept of operations beyond ISS and Apollo, including one where crew will have to operate more autonomously from Earth flight controllers. We will focus on lunar surface exploration, as astronauts with the aid of robotic agents and decision support systems to conduct scientific extravehicular activity (EVA).

Space Environment Hazards: Additional space environment hazards will impose additional challenges on humans explore the lunar surface, be it with or without robotic agents. Two aspects that are significantly different than ISS is radiation effects on astronauts and physical environment (lighting conditions, dust, 1/6 gravity) affecting mobility and visibility.

Human Factors and Behavioral Performance: Lunar surface exploration is a multi-faceted operation and we will present the challenges in the context of human performance. We will discuss:

- cognitive decrements and/or fatigue: what is the possibility of cognitive decrements dues to radiation and/or fatigue?
- surface visibility: what countermeasures should be in place to overcome the harsh lighting conditions and the potential for decreased visual acuity?
- autonomous crew operations: how will astronauts conduct surface exploration autonomously, with and without robotic agents?
- training challenges: what are the knowledge and skills required to train astronauts for the variety of scientific objectives in the lunar south pole?
- multi-team performance: how will distributed teams communicate, coordinate, and cooperate across the communication limitations?
- human-system interaction: what type of interfaces are required to easily operate robotic agents and digital support tools? what type of automation will be most beneficial for exploration?

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