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CREATING AN INTEROPERABLE NETWORK COMMUNICATION ARCHITECTURE (INCA) FOR CIS-LUNAR SPACE

Abstract

An evolving set of commercial Technology Development, Demonstration, and Deployment (TD3) Missions can help start an Interoperable Network Communication Architecture (INCA) for Cis-Lunar space. This paper provides a substantive update on the mission development work that has been accomplished since the original paper was presented at IAC 2016.

This paper will address the characterization, optimization, and operation of a frequency-agnostic INCA for Cis-Lunar space and reverse engineer one or more paths forward from the integrated ISS TD3 mission set to accomplish these objectives under a proposed public-private partnership.

More specifically, the combination of the following related set of developments can be leveraged to develop and enhance an INCA for Cis-Lunar infrastructure:

• small communications satellite systems derived from the NASA CubeQuest Challenge Team Alpha Cube Satellite (ACS) mission including UHF-Ka Band Software Defined Radio and reflectarray technology;

• the advanced propulsion and alternate minimum energy trajectories work from the Halfway to Anywhere (HTA) mission;

• the radiant energy beaming technology and the advanced integrated rectennas from the Space-to-Space Power Beaming (SSPB) mission;

• the near realtime state models from the Mission Operations Control Applications (MOCA) work;

• as well as specific INCA related technology elements including the Xrosslink Internet Services Protocol (Xlink), general purpose scalable computer resources for virtualized functions, and Delay and Disturbance Tolerant Networking (DTN) enabled pervasively networked gateways.

The cited missions are commercial missions which are going forward with multiple additional proposals requesting the allocation of direct and indirect support to the public-private Consortiums that have been or are being created with the expressed intent to foster INCA for Cis-Lunar space starting from TD3 missions leveraging the International Space Station (ISS).

This work begins with Intra Vehicular Activity testbed work which becomes a resource for other mission work on the ISS and elsewhere. Elements will be deployed for the ISS, co- orbiting operations, Earth-facing applications, and space-facing applications extending further into Cis-Lunar space.

Potential mission markets that would be impacted by a Cis-Lunar INCA have increased in number and the growing specificity of their requirements is providing significant mission requirements pull. There are at least thirty-two (32) proposed lunar missions from a range of international space agencies and commercial entities planed for the next decade. The paper will discuss how the ability to orchestrate the TD3 investments to better utilize the planned exploration, science, and resource development investments can be transformative.