Hybrid Mobile Communication Networks for Planetary Exploration

A paper discusses the continuing work of the Mobile Exploration System Project, which has been performing studies toward the design of hybrid communication networks for future exploratory missions to remote planets. A typical network could include stationary radio transceivers on a remote planet, mobile radio transceivers carried by humans and robots on the planet, terrestrial units connected via the Internet to an interplanetary communication system, and radio relay transceivers aboard spacecraft in orbit about the planet. Prior studies have included tests on prototypes of these networks deployed in Arctic and desert regions chosen to approximate environmental conditions on Mars. Starting from the findings of the prior studies, the paper discusses methods of analysis, design, and testing of the hybrid communication networks. It identifies key radio-frequency (RF) and network engineering issues. Notable among these issues is the study of wireless LAN throughput loss due to repeater use, RF signal strength, and network latency variations. Another major issue is that of using RF-link analysis to ensure adequate link margin in the face of statistical variations in signal strengths.

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