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Author: Mr. Kieron von Buchstab
Faculty of Engineering, Carleton University, Canada, kieronvonbuchstab@cmail.carleton.ca

Mr. Alex Jurgutis
Faculty of Engineering, Carleton University, Canada, alexjurgutis@cmail.carleton.ca
Mr. August Lear
Faculty of Engineering, Carleton University, Canada, augustlear@live.com
Dr. HOOMAN JAZEBIZADEH
Carleton University, Canada, hooman.jazebizadeh@carleton.ca
Mr. Bruce Burlton
Faculty of Engineering, Carleton University, Canada, bruceburlton@sympatico.ca

THE RECEIPT AND ANALYSIS OF WEATHER DATA IN A SIMULATED MARTIAN ENVIRONMENT

Abstract

Mars' first colonies could interact with a network of weather satellites orbiting the red planet to receive real-time weather data and be warned about incoming atmospheric and weather conditions. Currently, Martian weather information is only provided by the Mars Reconnaissance Orbiter. In the near future, a constellation of martian weather satellites will have to be established to adequately provide weather data to incoming habitants. By adapting and miniaturizing the Earth weather communication technology of Automatic Picture Transmission (APT) and High Resolution Picture Transmission (HRPT) for Martian weather satellites, this paper proposes an adaptive communication system to distribute and analyze Martian weather data. Trials designed to be conducted at Flashline Mars Arctic Research Station, a Mars analog habitat, assess the feasibility of using proposed APT and HRPT ground stations on Mars.

Since the invention of APT, ground station technology has greatly improved. While APT receiving technology is typically more robust relative to HRPT receiving technology, the HRPT technology provides higher resolution images. An amalgamation of adaptive APT and HRPT receiving technologies allows for the use and deployment of different antennas for various weather conditions such as dust storms and thermal tides. After reception of weather data, machine learning algorithms are used in the analysis and prediction of future hazardous weather events on Mars.

By tracking spacecraft that employ APT and HRPT transmission, terrestrial ground stations can be tested as they would be on the red planet. By tracking NOAA weather satellites, which transmit both APT and HRPT signals, this paper explores the use and deployment of adaptive APT and HRPT receiving ground stations to receive weather data from orbiting satellites within a Martian environment. Studying the difficulties encountered through the testing proposed in this paper leads to an augmented understanding of weather data receipt, processing, and analysis on Mars.