IAF SPACE EXPLORATION SYMPOSIUM (A3)
Mars Exploration – Science, Instruments and Technologies (3B)

Author: Mr. Jia Tian
China Academy of Space Technology (Xi'an), China, jia_epfl_tian@163.com

Mr. Yu Han
China Academy of Space Technology (CAST), China, hanyu1@163.com
Prof. Wei Wang
CAST, China, wwei98@163.com
Prof. pingyan Shi
China, Shipingyan@gmail.com

THE HIGH EFFICIENT CCSDS PROXIMITY-1 BIDIRECTIONAL ARQ COMMUNICATION
METHOD FOR MARS EXPLORATION

Abstract

Mars is the next milestone in our exploration of solar system. Because of the really long distance, 20 minutes are needed to transmit a message between mars and earth. Therefore a total automatic communication system is needed between the mars rover and orbiter. The forward link includes the telecommand form earth which is usually transmitted through the orbiter to the rover; the return link contains the key telemetry of the rover and the information which are collected by the payload of the rover. The information of both forward link and return link are very important, any possible error frame or missing frame is not allowed. Therefore, the ARQ (Automatic Repeat Queuing) is introduced in the full duplex mode of the CCSDS proximity-1 protocol. However, although the current ARQ mechanism could guarantee the bidirectional messages transmission with no error, the communication of both sides cannot reach the maximum throughput in some cases (e.g. frame length, transmission window, the ratio between the return and forward speed). In this paper, the high efficient CCSDS Proximity-1 bidirectional ARQ communication method is presented, which could change the link parameters automatically to ensure that the bidirectional data throughputs are optimized, and the method is used in Chinese first MARS exploration mission (TW-1). Compared with the current ARQ mechanism, more data could be transmitted in the arcs between the orbiter and rover, which means that more tasks could be done in the mars mission. By using the conception product with limited FPGA resource, real tests shows that the presented method performs well in any possible communication condition.