Paper ID: 46313

IAF SPACE OPERATIONS SYMPOSIUM (B6)
Ground Operations - Systems and Solutions (1)

Author: Mrs. Chiara Brighenti
S.A.T.E., Italy

Mr. Leonardo Amoruso
Planetek Italia, Italy
Mr. David Evans
European Space Agency (ESA), Germany
Dr. ATTILIO BRIGHENTI
Italy
Mr. Daniele Moretto
S.A.T.E. S.r.l, Italy
Mr. Mattia Ricatto
S.A.T.E. S.r.l, Italy
Mrs. Francesca Ferrari
Italy
Mrs. Marianna Carbone
Planetek Italia, Italy

ADVANCES IN CONTEXT AWARE SPACECRAFT TELEMETRY CHECKING

Abstract

This paper addresses the topic of spacecraft telemetry checking. The number of telemetry parameters that Flight Control Engineers have to check every day is contantly increasing. The techniques used to check telemetry data are normally based on thresholds that have to be identified and may change during the mission. In 2014, the Advanced Operation Concepts Office at ESA/ESOC performed a study project with SATE to develop new techniques based on Big Data approaches to automatically define suitable and reliable checks on telemetry data, without using any knowledge on the data (ignoring physical meaning and definition of the signals). The approach proposed by SATE was based on the definition of algorithms that identify features of the telemetry parameters that have a constant behaviour (e.g. the mean, minimum, FFT coefficients), named FETCH (FeaTure CHeckability). The validation of the algorithms was conducted on a set of 2 years of data from the Venus Express mission, in which a set of events occurred, such as one day data loss and aero-braking maneouvres. The result of the validation was positive in the sense that the checks identified a significant number of novelties during these events. However, they also raised some false alarms during other time periods, in which no events occurred. In 2017, the Advanced Operation Concepts Office at ESA/ESOC and the Italian National Space Agency (ASI) decided to continue the activities related to the development of spacecraft telemetry checking tools based on FETCH, by improving the approach introducing mission "context" information at the moment of applying the FETCH algorithms and then the checks. The use of context information allows introducing some knowledge about the status of the spacecraft when the checks are performed (e.g. telecommands, distance and angle with respect to sun, mission plans, etc.), which would allow improving anomaly detection. The activities also include the development of a Human Machine Interface to help engineers monitoring and understanding the spacecraft behaviour during operations, to allow easy access, visualisation and understanding of the mission data and the algorithm generated data. The CASTEC

software tool developed integrating algorithms and visualization tools, will be deployed to exploit the Hadoop/Spark framework available at ESOC for big data analysis.