

IAF SPACE OPERATIONS SYMPOSIUM (B6)
Interactive Presentations - IAF SPACE OPERATIONS SYMPOSIUM (IP)

Author: Mrs. Chiara Brighenti
S.A.T.E., Italy, chiara.brighenti@sate-italy.com

Mr. Mattia Ricatto
S.A.T.E. S.r.l, Italy, mattia.ricatto@sate-italy.com

Mr. Leonardo Amoruso
Planetek Hellas epe, Italy, amoruso@planetek.it

Mrs. Marianna Carbone
Planetek Italia, Italy, carbone@planetek.it

Mrs. Arianna Zorzi
S.A.T.E. S.r.l, Italy, arianna.zorzi@sate-italy.com

Dr. Francesco Brighenti
S.A.T.E. S.r.l, Italy, francesco.brighenti@sate-italy.com

Mr. Marco Barison
S.A.T.E. S.r.l, Italy, marco.barison@sate-italy.com

CONSTELLATIONS MONITORING WITH CASTEC

Abstract

As of today, the increasingly high number of flying satellites will make impracticable for Satellite Controllers (SCs) to monitor effectively the health status of satellites, especially in large constellations. The typical methodologies to investigate the presence of anomalies in test telemetry data are based on fixed thresholds. These techniques, even though ensuring that the system remains within the allowed bounds, do not allow to detect trends of incipient anomalies, which may result in unexpected behaviours of the system during operations. For avoiding this undesirable situation, new solutions are needed to process S/C telemetries on-ground, identify upcoming anomalies and correlated events, and mitigate related risks during operations. This paper introduces CASTeC (Context Aware Spacecraft Telemetry Checking), a software tool improving constellations monitoring and diagnostics, performing:

- 1) Automatic identification of anomalous telemetries and relevant events that require investigation by SCs;
- 2) Early detection of anomalies in the behaviour of the satellites/constellation;
- 3) Automatic identification of correlated telemetries and events.

Therefore, CASTeC can support Satellite Controllers in the identification of critical operative conditions affecting service performance and mitigation strategies definition.

With respect to potential existing competing solutions, the benefits of CASTeC are the following:

- CASTeC provides early alerts on the status of the satellites constellations, based on a detailed analysis of each single telemetry of the constellation;
- CASTeC identifies relevant events from the degree on anomaly detected;
- CASTeC supports events troubleshooting by guiding the SC in the identification of potential cause-effect relations among events;
- The implemented algorithms do not need experts' knowledge on Artificial Intelligence to be configured, but only limited information and knowledge to define the relevant operative conditions of the satellites;

- CASTeC can be easily interfaced with different ground segment operations platforms.

CASTeC diagnostic capabilities are based on an innovative Machine Learning based approach, applied to contextualised periods of satellites operations. The advantage of CASTeC with respect to traditional threshold-based approaches is that it allows anticipating the detection of an anomaly even when signals stay within nominal bounds. In addition, compared to conventional Machine Learning, it allows understanding the reasons for an anomaly detected in the telemetry. With CASTeC the user can:

- Check the behaviour of a satellite against other satellites of the same constellation;
- Monitor and understand the spacecraft behaviour during operations through the visualization of: raw parameters timeseries, derived features, CASTeC Index and events (such as telecommands), through different views and maps.