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UTILIZATION OF UNSUPERVISED ANOMALIES DETECTOR AS A TOOL FOR MANAGING THE  
TRACKING AND DATA RELAY SATELLITE (TDRS) CONSTELLATION AT GODDARD SPACE  
FLIGHT CENTER (GSFC)**Abstract**

NASA/GSFC operates a constellation of ten geosynchronous TDRS spacecraft. The mission of the TDRS constellation is to provide relay communications from low-earth orbiting spacecraft to the primary ground station at the White Sands Complex in Las Cruces, NM. Major customers include the International Space Station and the Hubble Space Telescope. The NASA Space Network Project Office at GSFC manages the constellation of spacecraft. Consequently, a wide range of technologies and manufacturing techniques are represented on-orbit. Over the life of the constellation, thousands of gigabytes of telemetry data has been recorded. The spacecraft telemetry data has changed from generation to generation of spacecraft, however each spacecraft has the same basic functions with some enhancements over the life of the constellation. The constellation includes a number of spacecraft that have significantly outlived the manufacturer's projected lifetime. This has provided NASA with a significant benefit in terms of return on investment, however it places a burden on efficient management of the assets for maximum life without permitting a TDRS spacecraft to become stranded in its geosynchronous orbital slot. Consequently, the highest level of attention is paid to systems whose failure could strand a spacecraft in orbit. In this paper,

we proposed two stages of analyzing anomalies using data mining to enhance on-going predictions of spacecraft life, subsystem performance, and analysis of subsystem anomalies. The first stage conducts the unsupervised anomaly detector to detect potential anomalies in real time telemetry data. The second stage introduced telemetry weight (TW) to each telemetry parameter in order to determine which parameter caused the strongest anomaly. We will present case studies of some of these analyses and how the data can impact decisions on the management of the constellation.