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OPTIMIZING SDARS SYSTEM PERFORMANCE IN A HYBRID CONSTELLATION

Abstract

Satellite Digital Audio Radio Services (SDARS) became an operational reality for North America in the year 2000 and is now in the process of bringing online its second generation of satellites. This SDARS platform is currently comprised of a total of eight on-orbit assets, with five in geostationary orbits (GEO) and three in Highly Inclined Elliptical Orbits (HIEO). The system is split between two services, namely XM and SIRIUS Satellite Radio. The SIRIUS constellation currently delivers content via a hybrid constellation of three HIEO and one GEO spacecraft along with a ground based terrestrial repeater network. The XM constellation is comprised entirely of GEO spacecraft. In the hybrid constellation, at any given time, the GEO and one of the three HIEO spacecraft are actively broadcasting.

Numerous engineers and analysts have completed various studies and tests in order to maximize overall system performance of both SDARS services. This paper will address several of the programmatic, technical, and operational considerations that span across many engineering disciplines which have lead to improvements in both service availability and mission life.

The first operational change was an improvement to the station keeping strategy on the HIEO satellites. The new strategy takes advantage of additional mission life on one of the HIEO satellites and extends the life of the satellite with least amount of remaining propellant, with no impact to system performance.

SIRIUS XM engineers completed another study in order to determine the amount of time each HIEO platform would operate, and where within its orbit. These factors also have a direct impact on the HIEO spacecraft's useful lifetime. For this reason, the introduction of the GEO asset into the constellation extended the lifetime of the HIEOs. SIRIUS' satellite operations group has implemented new power management procedures to exploit the additional power availability resulting from the decreased workload of the HIEO spacecraft.

Frequency selection and payload output levels were also considered to enhance service availability for both the SIRIUS and XM customer. This paper will go on to describe the methods and result of this system performance effort.