“Black Box” RF Sat-Link for Space Debris, Mission Success and Risk Mitigation

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ABSTRACT

Expensive satellites may be lost without a Black Box by identifying problems early before they reach a ground station (several hours). The Black Box is currently in SBIR phase II and has been tested in orbit. It provides 24/7 real-time health and status visibility (latency in seconds) provides for rapid response to sensor data and orbit pass preparations. Also, the Black Box is a redundant downlink if a satellite is “lost” ensuring critical mission success and diagnostics for the duration of several years or orbit lifetime. Satellite debris can be accurately tracked with included GPS option to reduce collision probability by giving more orbit certainty even if the primary satellite is disabled.

We now can monitor a satellite 24/7 Anywhere in LEO orbits with data available Anytime without the need for expensive ground stations. With a 100% success in orbit using the NSL EyeStar processor and Globalstar comm systems (70+ radios in space with several tumbling) the commercial, educational, and research small satellite market is rapidly growing. The EyeStar radio with appropriate FCC, NCIA, and ITU licenses is ideal for the next step to advance many NASA, Air Force satellites from small to large with a redundant and omnipresent Black Box Radio Frequency (RF) link. The standalone Black Box is very small and low power requiring little resources.

The airplane Black Box is well known and is essential for crash diagnostics after the fact but in addition the proposed satellite Black Box and processor will operate in Beacon mode during the whole mission AND will continue to beacon in orbit after a completed or failed mission. The Black Box transmits vital data, health and safety info, GPS, and summary data while in orbit at up to 8 Bytes/sec for 24/7 coverage. With its included solar arrays, the Black Box would operate for many years after the primary satellite fails so that essential data and tracking is continuous, and attitude known. If the satellite reawakens after some long failure the Black Box reports the new status and the satellite may be reactivated. We have experienced this mode after a year on one of our Black Box communication processors after a two-month dead phase and was reactivated.

ThinSats are very similar to the “Black Box” with low power, military spec components, and small size(10 by 10 by 1.7 cm) and include the Simplex Globalstar radios. NSL launched its first constellation of 60 ThinSats. The capacity of the Globalstar network can handle 1000s of satellites over the earth with the big advantage of transmitting real time data anywhere in the world at any time.