Paper ID: 14297
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SPACE OPERATIONS SYMPOSIUM (B6)
New Operations Concepts and Commercial Space Operations (2)

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EVOLUTION OF SATELLITE OPERATIONS COMPLEXITY FROM SYMPHONIE TO GALILEO

Abstract

From Symphonie 1A launched end of 1974 to GALILEO IOV1 (In Orbit Validation) launched in October 2011, CNES has often been involved in satellites operations of new generation : from telecommunications satellites (Symphonie, TDF (french direct broadcast satellites), Telecom1&2 (french dual telecommunications satellites), STENTOR (telecommunications demonstration satellite) ...) to navigation ones (GALILEO). CNES performed fifty one GEO (Geostationary Earth Orbit) LEOP, twelve GEO on station routine operations with eleven End Of Life management (last one will occur at the end of this year) and two MEO (Medium Earth Orbit) LEOP. All the operational lessons learned feed new projects: @bus, Newcom or GALILEO FOC (Full Operational Capability) for instance.

Spatial technology evolution boosts new concepts of controlling/commanding spacecrafts, "adding/ involving" more sophisticated interfaces, more knowledge and know-how to capitalize. This complexity increase is required by accuracy and availability needs, and is allowed by more and more powerful on-board computers and flight proven technologies. Even if spatial system complexity is mitigated by more on-board autonomy (i.e.: FDIR (Failure Detection Isolation & Recovery) evolution), more standardization (i.e.: PUS (Packet Utilisation Standard)), more interoperability (i.e.: station network interoperability) and more user friendly control center (i.e.: telemetry visualisation & analysis tools), complexity of the systems still increases quickly whereas human performance remains quite stable. Then, mastering space operations is still an important issue especially for commercial missions which request highest mission availability at low cost.

The paper and the presentation will analyze the evolution of on-board operations complexity since 1980s through GEO-MEO sub-systems and system evolution, then will focus on degradations and benefits for operational teams and finally will highlight some "news" issues to deal with (for instance the requirement to take into account French Space Law in case of on board failures occurrence) and good practices to keep in mind, in order to face present and next steps of space operations evolution.