66th International Astronautical Congress 2015

SPACE OPERATIONS SYMPOSIUM (B6)
New Operations Concepts, Advanced Systems and Commercial Space Operations (2)

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ON-BOARD AUTONOMY FOR ON-ORBIT GEO SATELLITE PLATFORMS

Abstract

Currently, it is the duty of the ground satellite control centers to provide daily operation services for on-orbit GEO satellites, which include telemetry monitoring, orbit measure and determination, station keeping and so on. With the evolution in technologies and human cognition, if an on-orbit GEO satellite can take over the task by itself, it will dramatically mitigate the burden born by the ground, alone with improving its independent survivability and lowering the entire system operational cost, being the trend for future on-orbit satellite management. This paper presents daily operation items of a typical on-orbit GEO satellite and studies their algorithms and methods which are used to perform them. Then the feasibility of entire autonomy for an on-board GEO satellite is discussed. The result manifests that it is high likely for a satellite to manage itself in a short period without any attention from the ground or a long term with a little attention from the ground. Finally we design an autonomy system prototype which includes five subsystems: scheduler, anomaly diagnosis, fault fixing, calculation, GNSS/GPS space receivers and orbit function. This autonomy system prototype can carry out the daily operations autonomously . But on the other hand, autonomy will cause the concern about the safety. To solve the problems and lower the risks caused by autonomy, some measures are presented here. Our study shows that it is practical, based on the currently satellite manufacture technologies and accumulating control experience, to produce such satellites with autonomous operation capability. Autonomy will be an effective way to solve the dilemma between tough tasks caused by the swelling satellite development and the shortage of resource of ground satellite control centers.