

SPACE SYSTEMS SYMPOSIUM (D1)  
Space Systems Architectures (4)

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ON-ORBIT SERVICING OF A FLEET OF GEO SATELLITES

**Abstract**

Currently, satellites in orbit can be functionally reconfigured through automatic or ground commands, or software modifications. This on-board evolution is limited by the architecture, the redundancy approach, and the on-board resources. On-Orbit Servicing seems an attractive approach as providing the satellite with additional degree of freedom in the management of its configuration and in its mission evolution. The On-Orbit Servicing of a fleet of geostationary satellites is currently analysed in an ESA funded study named Satellite Servicing Building Block. This paper presents the main results of this study led by EADS Astrium. The first point consists in identifying the user interest and rationale for on-orbit servicing. The attractive services appear to be on orbit maintenance or lifetime extension, repositioning or transfer to graveyard, and unplanned services like in orbit repair (exchange of equipment) or mission evolution. The economical aspects will be one of the drivers to assess their attractiveness. Then, the paper describes the proposed servicing system architecture, defined with respect to drivers such as the unplanned missions, the short delay required for some in orbit repair missions, or the cost minimisation. It is based on the use of a long lifetime servicer and an adequate logistic support. The composite configuration, that means the servicer attached to the satellite, is driven by the user requirements in terms of operations, by the type of servicing and the duration of the attached phase. Thus, the servicer will ensure the attitude and orbit control of the composite, while each vehicle will be autonomous in terms of power, communications, etc. Solar arrays shadowing, communications with ground have been taken into account for the composite configuration. Typical exchangeable equipment have been proposed on the satellite in order to evaluate the necessary evolution of the design of these equipment and to analyse the location and size of the robotic system, taking into account the various appendages and relevant safety corridors. Based on that and on possible servicing scenarii, an evaluation of the servicer vehicle has been done. Exchangeable equipments have to be provided with adequate servicing items so that they can be removed from the satellite or installed on the satellite. These items include various connector, latches, alignment guides. Different solutions have been reviewed, sometimes depending on the type of exchangeable elements, and one proposed solution will be illustrated in the paper. The servicing tasks have an impact on the satellite design. Although these impacts are minimized in case of on orbit refuelling, orbit maintenance or lifetime extension, transfer to graveyard, they are more important in case of equipment exchange, with modifications on mechanical or thermal architecture. The paper will review the main impacts. Finally, the paper will propose a short description of the ground test of the proposed design for the exchangeable equipment.