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ON-ORBIT SERVICING READINESS ASSESSMENT: THE SERVICER PERSPECTIVE

Abstract

The servicing of spacecraft on orbit will enable capabilities absent on space systems nowadays. From the point of view of a Client spacecraft, the possibility of repair, maintenance, refuelling, lifetime extension, and even the assembly will relax the constraints of space missions. In addition, such capabilities will demand systems to be designed differently. However, on-orbit servicing (OOS) is also dependent on the other side: the Servicer, in charge of executing all the tasks. Since the first manned servicing activities on Solar Maximum (1984), Westar-6 (1992) and Hubble (1993) several concepts have explored the different OOS applications, more recently with specific focus to autonomous and robotic servicing. Today the general view of OOS encompasses a broad field of research from both Servicer and Client sides. The full implementation of OOS relies on the concurrent approach of both sides and the complex interactions between them. Servicing technologies have been investigated independently in different Servicer concepts, but it is important to assess the current state of these technologies before understanding the relations with the Client. Given the different approaches and objectives of servicing concepts and missions, it is difficult to analyse all of them under the same point of view. A breakdown of all the different functions required allows a standardization to equally analyse OOS capabilities, presenting a snapshot of the readiness of each application. This work presents a readiness assessment of different applications for on-orbit servicing. First the main OOS applications and definitions are presented. Then a functional decomposition related to each application is introduced. The overall readiness level for each function is described based on the general space technology developments. Next, the functions are associated to a database of missions and systems concepts for OOS. Taking into account the design maturity for each concept, a project phase metric is used to calculate a corrected readiness level for each function. A final assessment of OOS applications is presented and the interfaces to cooperate with the Client side are discussed. The outcome of this assessment permits to address the problem from the point of view of the Client, independently from a specific servicing concept or mission. Thus, to link the readiness of the analysed functions to the design process of a serviceable spacecraft is the next step to complete the first iteration between the two sides of OOS. With this, both sides will be able to be addressed concurrently for future space missions.