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Spacetugs: Towards New Solutions for Satcom Operators

1. Background

The spacetug concept encompasses a variety of space systems and mission architectures, based on orbital rendezvous and docking capabilities, to deliver a range of in-orbit services to other spacecraft. In general, spacetug applications can be grouped into three categories: space object de-orbiting, satellite repositioning and tugging, satellite refuelling and maintenance. One aspect that will not be addressed in this brief is the dual-use nature of spacetug capabilities. The idea of satellite in-orbit servicing is not new, but recent announcements from the space industry suggest a renewed interest in the concept in particular for satellite lifetime extension purposes. Operators and governments have long waxed on the idea of cheaply extending the operational lifetime of their satellites, and many manufacturers are looking closely into how spacetugs can offer a cost-effective solution to prolong satellite operations. In this context, the spacetug concept can offer satellite life extension services in various ways: spacetug-based satellite disposal[1], spacetug-based station-keeping[2], or satellite refuelling.[3]

Various spacetug initiatives have recently emerged on the budding GEO communication satellite lifetime extension service market. The most advanced initiatives are the ones of Orbital ATK and MDA/SSL which have signed customer agreements and have launches planned. Orbital ATK plans to launch its first mission-extension vehicle (MEV-1) toward the end of 2018[4], to provide extensions services to Intelsat for an initial five years[5] period. And MDA/SSL has signed its first satellite life extension agreement with SES for an initial mission using SSL's on-orbit refuelling vehicle which is planned to launch in 2021.[6] In Europe, Airbus Defence & Space announced its intention to enter this market but has not yet communicated specific details on the project or agreements with potential customers.

2. Business Perspectives

The most notable business developments for spacetugs concern the delivery of life extension services to geostationary communication satellites. This actually already represents a rather large addressable market with more than 300 telecommunications satellites to be potentially served. Various factors will determine the market success of spacetug services, including cost-effectiveness and reliability of the concept, and also the actual interest from satcom operators to extend their satellites' operations. This last factor is certainly the most difficult to assess, and should

[1] Spacetug-based disposal service: the spacetug docks with the satellite and moves it to a disposal orbit enabling the satellite to use the share of fuel that is usually saved for end-of-life operations.
[2] Spacetug-based station-keeping service: the spacetug docks with the satellite and takes over the attitude and orbit control of the combined vehicle, ensuring station-keeping for the satellite.
[3] Satellite refuelling: the spacetug docks with the satellite and refuels it.
[4] MEV-1 will provide life extension services in the form of spacetug-based station-keeping
[5] "Orbital ATK on Track to Launch Industry's First Commercial In-Space Satellite Servicing System in 2018." 24 Jan. 2017. Orbital ATK 1 Oct. 2017 <https://www.orbitalatk.com/news-room/feature-stories/MEV/default.aspx?prid=92>.
[6] "SES and MDA Announce First Satellite Life Extension Agreement." 28 June 2017. SES 1 Oct. 2017 <https://www.ses.com/press-release/ses-and-mda-announce-first-satellite-life-extension-agreement>.

not be underestimated, especially in a time when the satcom sector is experiencing substantial evolutions and uncertain prospects in its core markets. In regard to economic viability, several studies have already attempted to evaluate the potential profit from using spacetug-based services to extend satellite operations and consequently delay satellites replacement. In general, these studies compare the value of deferring satellite replacement, estimated by Analysis Mason in the order of $20-30 million per annum for a $300-350 million satellite[7], with the possible price of spacetug services. In the case of station-keeping services, with spacetug leasing prices announced around $11-14 million per year[8], some operators and manufacturers have warmed up to the idea of spacetug services as a cost-effective mean to delay the replacement of a satellite. In the case of satellite refuelling, the low technology readiness level makes economic analyses of the concept even more uncertain, but the probable option to serve multiple satellites with a single spacetug could support a robust business case.

3. European Initiatives

In Europe, various on-going initiatives are supporting the development of spacetug-related standards and technologies. ESA considers that grasping and refuelling are promising capabilities for future space missions, and would require minimal add-ons on commercial or scientific satellites to enhance their serviceability. As a first step to prepare an international standard, ESA launched the ASSIST activity, in collaboration with the space industry and operators, to address the analysis, design and validation of provisions to support servicing/refuelling systems for GEO satellites with minimum impact on satellite architecture and no additional risks.[9] The European Commission also supports the development of in-orbit servicing related technologies in the frame of the Horizon 2020 R&D programme and more particularly within the orbital robotics track of the roadmap prepared by the PERASPERA consortium for H2020 Strategic Research Cluster on space robotics.[10]

4. Conclusion

The spacetug and related in-orbit services concepts have been considered for a long time; however, it has taken longer to reach an economic and technical model that would raise sufficient confidence to lead to the launch of actual missions. As for any highly innovative model, doubts will remain with the viability of the concept. Nevertheless, the commercial and technical landscape has changed and could grow more fertile for the spacetug. This is what the recent agreements between operators and industry appear to suggest. Spacetugs and in-orbit services would provide new capabilities and solutions for operators to deal with new business challenges. This new dynamic is likely what motivated the CTO of SES, Martin Halliwell, to declare that “in-orbit servicing is of upmost importance to next-generation [...] satellites (and) enables operators to have more flexibility in managing our fleet and meeting [their] customers’ demands”.[11] Should upcoming spacetug missions be successful from an operational and business perspective, the concept certainly holds the capacity to profoundly disrupt satellite operators, launch service providers and space system manufacturer businesses altogether.

[7] Bates, Philip. “The Business case for satellite life extension: running on empty”. 13 July 2016. Analysis Mason 1 Oct. 2017 <http://www.analysysmason.com/About-Us/News/Newsletter/Satellite-life-extension-Jul2016/>.
[8] Ibid.
[9] “Towards a standardized grasping and refuelling on-orbit servicing for geo spacecraft” 19 January 2017. Acta Astronautica 1 Oct. 2017 <https://nereus.mech.ntua.gr/Documents/pdf_ps/AA17.pdf >
[10] “High Level SRC Roadmap.” 21 May 2015. H2020 Peraspera 1 Oct. 2017 <http://www.h2020-peraspera.eu/?page_id=32>.
[11] Henry, Caleb. “MDA restarts satellite servicing business with SES as first customer” 29 June 2017. SpaceNews 1 Oct. 2017 <http://spacenews.com/mda-restarts-satellite-service-business-with-ses-as-first-customer/>.

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