

# McGill Space Group

## Space Policy & Industry Research Group

### DAWN OF COMMERCIAL SPACE EXPLORATION AND ON-ORBIT SATELLITE SERVICES

On 4<sup>th</sup> October 1957 at 10.29 pm Moscow time, Russia launched the world's first artificial satellite, *Sputnik* from the Tyuratam launch base in the Kazakh Republic and thereby marking the inauguration of the Space Age.<sup>1</sup> Throughout 50 years, Space exploration has continued to inspire humans and has branched out in to an industry worth of USD 329 billion worldwide.<sup>2</sup> The space industry comprises of several components ranging from the manufacturing of space objects to space tourism. However, upto date the satellite industry has remained the most vital element of space based economic activities. By 2016, the global revenue was estimated at USD260.5 billion comprising of satellite services, launch industry, ground equipment and satellite manufacturing.<sup>3</sup> Given the crucial importance of satellites for the smooth functioning of day to day work on Earth, one can only envisage the continuing growth of the industry.

The proliferation of satellites, especially in the GEO has many economic advantages, but with the severe problems such as creating space debris, and exhaustion of limited orbital slots. More than 500,000 pieces of debris are currently tracked orbiting Earth, some capable of travelling at a speed of 17,500 mph.<sup>4</sup> The potential danger posed by space debris was well demonstrated at China's anti-satellite test in 2007<sup>5</sup> and the crash between the US commercial satellite Iridium 33 and the defunct Russian satellite, Cosmos 2251 in 2009.<sup>6</sup> Hence it is absolutely necessary to act in the interest of mitigating and removing space debris without the constant reference to the theory of the vastness of space.<sup>7</sup>

Considering the above, attempts for on orbit servicing of satellites<sup>8</sup> is indeed an important step in the satellite industry. According to some industry experts on orbit satellite servicing could be the transforming factor, changing not only the technical structure of the satellite industry but the

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<sup>1</sup> <http://www.history.com/this-day-in-history/sputnik-launched> - accessed 8 October 2017

<sup>2</sup> <https://www.spacefoundation.org/media/press-releases/space-foundation-report-reveals-global-space-economy-329-billion-2016> accessed 8 October 2017

<sup>3</sup> <http://www.sia.org/wp-content/uploads/2017/07/SIA-SSIR-2017.pdf> - accessed 9 October 2017

<sup>4</sup> [https://www.nasa.gov/mission\\_pages/station/news/orbital\\_debris.html](https://www.nasa.gov/mission_pages/station/news/orbital_debris.html) - accessed 9 October 2017

<sup>5</sup> [https://swfound.org/media/9550/chinese\\_asat\\_fact\\_sheet\\_updated\\_2012.pdf](https://swfound.org/media/9550/chinese_asat_fact_sheet_updated_2012.pdf) - accessed on 9 October 2017

<sup>6</sup> 2009 Iridium – Cosmos Collision Fact Sheet

[https://swfound.org/media/6575/swf\\_iridium\\_cosmos\\_collision\\_fact\\_sheet\\_updated\\_2012.pdf](https://swfound.org/media/6575/swf_iridium_cosmos_collision_fact_sheet_updated_2012.pdf)

<sup>7</sup> Ram S. Jakhu, "Iridium-Cosmos collision and its implications for space operations" in *The Yearbook of Space Policy* (Springer, 2009)

<sup>8</sup> "On-orbit servicing refers to the performance of activities to maintain, repair, upgrade, refuel, or deorbit spacecraft while it is in or near its operational orbit" *Legal and Political Implications of Future On-Orbit Servicing Missions* (PDF Download Available). Available from:

[https://www.researchgate.net/publication/282979175\\_Legal\\_and\\_Political\\_Implications\\_of\\_Future\\_On-Orbit\\_Servicing\\_Missions](https://www.researchgate.net/publication/282979175_Legal_and_Political_Implications_of_Future_On-Orbit_Servicing_Missions) [accessed 10 October 17].

economics of fleet management and related activities as well.<sup>9</sup> The refueling, retrofitting of satellites and even the salvaging of defunct satellites via on - orbit services are efficient and provides the much-needed preservation of orbit real estate. With the rapid development of space robotics and close quarter maneuvering and docking capabilities coupled with the upsurge of commercial space activities, private companies have already come forward with proposals for building required infrastructure and providing services.<sup>10</sup> Thus it is safe to say that comprehensive on-orbit satellite services are not too far away.

The implementation of on orbit satellite services by private companies is not however, without serious concerns. For example, given the requirement of a servicer spacecraft approach and interact with the object to be serviced and the dependence on a high level of automation, diversified robotic technology with the ability of adapting to other tasks and the ability to use servicer spacecraft as weapons. There are several legal concerns relating to on-orbit servicing as well. With debris removal being an integral part of on-orbit satellite services, a clear distinction is necessary between space object and space debris. The lack of such definition can complicate the issues of liability and responsibility.

Although no clear national or international regulations or laws have been drafted to specifically cover on-orbit services at this point, it cannot be said that no law applies for the private service providers. By virtue of Art. VI of the Outer Space Treaty, which vests international responsibility upon the State for non-governmental space activities,<sup>11</sup> private service providers will be subject to the authorization and the inspection of the State. Art III of the Liability Convention<sup>12</sup> stipulates that in the event of damage to a space object (elsewhere than on the surface of Earth), the launching State is liable. It is therefore to be expected that, similar to the current risk-sharing structures for commercial space launches in several countries including US, Russia, France and China<sup>13</sup> governments may require on-orbit service providers to enter into risk-sharing agreements for indemnification, and make it compulsory to obtain insurance, when granting licenses. Apart from the legal concerns stated above additional policy concerns may arise due to the ability transforming of active debris removal operations into anti-satellite operations.<sup>14</sup> Such concerns could lead to the imposition of severe limitations on commercial on orbit servicing and debris removal operations.<sup>15</sup>

In the words of the Apollo 8 astronaut Frank Borman, “[e]xploration is really the essence of the human spirit.” Hence space exploration and space based activities will only continue to grow. The need will then arise to maximize the use of flight systems, construct larger structures, maintain

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<sup>9</sup> Next Generation On-Orbit Satellite Servicing and Refueling Programmes- International Astronautical Congress - <http://www.iafastro.org/events/iac/iac-2017/plenary-programme/next-generation-on-orbit-satellite-servicing-and-refueling-programs/> accessed on 8 October 2017

<sup>10</sup> For example, see <https://www.ses.com/press-release/ses-and-mda-announce-first-satellite-life-extension-agreement> accessed on 8 October 2017

<sup>11</sup> OST Include art. IX

<sup>12</sup> Full term for Liability Convention

<sup>13</sup> See eg US Commercial Space Launch Act – 51 USC and see generally <http://www.gao.gov/assets/670/660635.pdf>

<sup>14</sup> Ram S. Jakhu & Hoseph Pelton (eds) *Global Space Governance*

<sup>15</sup> *ibid*

constellations, to maintain them in top condition and continue to upgrade.<sup>16</sup> The private on-orbit satellite service industry will therefore be the much-needed paradigm shift of the space industry.

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<sup>16</sup> NASA, “On-orbit satellite servicing study” - [https://sspd.gsfc.nasa.gov/images/NASA\\_Satellite%20Servicing\\_Project\\_Report\\_0511.pdf](https://sspd.gsfc.nasa.gov/images/NASA_Satellite%20Servicing_Project_Report_0511.pdf) accessed on 9 October 2017