

Internet and Space – the blurring of technological boundaries

Article based on study by Lei Gao, delegate of the [Toulouse Business School MBA aerospace program 2016](#) and winner of the SIRIUS prize for research excellence in 2017*

Developments in the space industry strongly impact the balance between great powers and the internet industry continues to dramatically revolutionize everyday life. The convergence of these two influential industries will provide unprecedented opportunities as well as risks for businesses and the society at large.

When talking about the convergence of the space and internet industries, the ambitious [OneWeb](#) project springs to mind. Marking a new era for the space industry with the production of several hundred small satellites within a limited period, the start-up, in partnership with [Airbus](#), plans to provide global broadband coverage at ultra-competitive rates.

The convergence of the two industries is far from limited to this symbolic project and can be observed in many space and internet technological developments. Quantitatively speaking, the number of published articles jointly addressing these two subjects has been increasing since 2010, from 297 to 606 publications in 2016. Not only is the convergence obvious, but it has also been speeding-up over time. The influence of each industry on the other is reciprocal, as developments in each industry impact the other. However, the internet industry is clearly dominating the convergence process, illustrating the unprecedented advances in internet technology that are transforming other industries and the world in general at an ever-increasing pace.

The USA, China and the EU are the main contributors behind the development of convergent internet and space technologies. Cooperation between countries is also driving the convergence, with the largest collaborative effort by the USA and China. The EU tends to cooperate the most with partners all

over the world, while Japan, India, Brazil and South Korea on the other hand tend to work independently.

Convergence scenarios

Six scenarios, each at a different phase of maturity, are developed to explore the convergence of the two industries. Generally driven by related technologies, different scenarios are supporting each other. Some scenarios are quite mature (e.g. space technology, such as GPS supporting the internet), some are still in the preliminary phase (e.g. satellites supporting IoT and space imagery services), and some are upgrading to a new phase (e.g. satellite-based internet access service). Three of the six scenarios are presented below:

Internet technology supporting the space industry

The other way around, we have internet technology, such as IoT and artificial intelligence supporting space operations. For example, improvements in data processing and transmission contribute significantly to enhanced communications in space. This kind of convergence drives progress especially in the space industry.

Satellite-based internet services

In this scenario, space facilities are integrated into the connectivity part of the internet value chain, bringing us back to the example of OneWeb's constellation deployment of small LEO satellites to provide global internet broadband. Satellite telecommunication is one of the most mature space applications today, and is attracting more and more attention from both the space and internet industries.

Satellite supporting IoT

The data-transmitter role of satellites has a strong potential to contribute to the progress of IoT, one of the buzzwords of the internet today. Satellites are used in smart cities, smart grid environments, smart transportation, and the use of satellite communications is critical in enabling the use of sensors in remote unserved areas.

Risks and opportunities

The convergence is emerging inside both the internet and space industries, where by technologies developed in one industry are then used in the other to improve performance or change a product altogether. Known as substitution convergence, this presents many opportunities for development in both industries. The risk however is that technologies will be substituted as a result. The convergence is also complementary, involving the fusing of technologies. This gives rise to entirely new industries but may also lead to industry disruption. Complementary convergence encourages the creation of sub-industries particularly in the internet industry. This explains the internet industry's higher competitiveness relative to the space industry and the higher risk firms face of lagging behind or of leaving the industry all together.

What is driving the convergence?

Economic factors have a strong role to play in the convergence process. The decreasing cost of space operations, increasing ROIs, increasing cost effectiveness of sensor networks, and the rapid growth of data traffic are all largely contributing to the convergence of the two industries. The convergence, a technologically-led process, is also heavily influenced by the technological advances in both sectors, presented in the above convergence scenarios. Social factors, such as increasing awareness of environmental issues and demand for internet connectivity in least developed countries, have a positive, although less significant effect. On the negative side, space debris concerns and legal issues associated with domestic political resistance due to the borderless quality of the internet are seen to have an adverse influence on convergence but this is limited for the moment.

What does this mean for each industry?

Industries worldwide are being confronted with the convergence of key industries, which will inevitably be accompanied by intensified competition and cooperation between countries. The convergence of the internet and space industries will not only revolutionize access to internet on a global scale, but also allow for the monitoring of the whole planet Earth from space. From the industry perspective, adopting the right strategy and being aware of risks and crucial technological developments is paramount for firms operating in each industry. Firms operating in the space industry, need to be more aggressive in

pursuing space technologies at a lower cost and with cutting edge developments. These firms also need to consider investing in non-space technologies to be able to steer the convergence between the two industries. On the internet side, it is vital to take risk management into consideration. The immaturity of internet technologies released on the market will lead to catastrophic failure. Business models should be evaluated with caution, carefully assessing and controlling for potential political and legal issues. Choosing the appropriate strategy is key for firms in the two industries to not only survive during the convergence process but also leverage the convergence to thrive.

+ Methodology

To analyze the convergence between the two industries, bibliometrics (statistical analysis of publications, with co-occurrence of keywords method, is applied. The PESTEL tool is used to analyze the external drivers behind the convergence.

*About the SIRIUS chair and the SIRIUS prize

[SIRIUS](#) is a business chair dedicated to the management and the law of space activities. Based on an original partnership between three leading operators in the space sector ([Airbus Defence & Space](#), [CNES](#) and [Thales Alenia Space](#)), the chair's research activities are led jointly by [Toulouse Business School](#) and [Toulouse Capitole 1 University](#). Every year, the SIRIUS chair awards at least one prize for high quality research work. The award targets students in Master 2 and MBA programs for outstanding research work on legal, economic, managerial and social issues confronting the space sector.

About the study author

Lei GAO graduate of the [TBS](#) Aerospace MBA program 2016, dedicated his research project to analyzing the convergence of the space and internet industries. He has been the Director of the Human Resources Department of Qian Xuesen Laboratory of Space Technology, China Academy of Space Technology (CAST) since 2014. After pursuing a Master's degree in thermal engineering from the Tsinghua University, Lei Gao, joined CAST back in 2006, working as an engineer.

Reference: This article is based on the research project carried out by Lei Gao, graduate of the TBS Aerospace MBA class of 2016, entitled "Study on the convergence between the space industry and internet industry", available here: <http://chaire-sirius.eu/wp-content/uploads/2017/10/Gao-2017-Study-on-the-Convergence-Between-the-Space-Industry-and-the-Internet-Industry-min.pdf>