Leaf Space - Ground Segment Services for Microsatellites

LEAFSPACE

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Leaf Space – Our Mission



Leaf Space is a New Space company delivering a complete set of ground segment services to support microsatellite missions and enable new applications.





Leaf Space - Timeline

Startup Founders (2014, Milan):

- Jonata Puglia, CEO
- Giovanni Pandolfi Bortoletto, CTO
- Michele Messina, COO

PoliMi PoliHub Incubation (2015)

Business plan consolidation Conceptualization - systems and infrastructure Prototyping and testing

ComoNExT Expansion (2016)

First company office - dedicated lab and assembly areas Development - GS technology and infrastructure for commercial service First GS installation

Current Development to SME (2017 – present)

Development - System architecture, software and hardware, continuously increasing team know-how Team FTEs growth Infrastructure (GSs) deployment and installation worldwide Commercial service provision since 2018

Investment history and latest Series-A round closing

Leaf Space had already gathered **€4M** in funding from 2014 up to the end of 2019, and despite the Covid-19 crisis was capable of closing in April 2020 the latest Series-A funding round amouting to **€3M**.

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Services Overview



LEAF LINE, a telecommunication service redefining the ground segment by creating the first ever infrastructure-as-a-service network of antennas fully dedicated to microsatellites.

The Leaf Line service is based on a proprietary network of customer-shared ground stations where each client pays for the links its satellites make with a Leaf Space's ground stations.



LEAF KEY, a network of ground stations dedicated exclusively to a single client. The ground stations implemented remain under the property and management of Leaf Space.

The mission-dedicated ground station network is designed and deployed following a specific client's satellite mission or constellation requirements.

To enable the use of the Leaf Line and Leaf Key, the company provides also consultancy and hardware provision services.



Our Hardware

AN EXAMPLE OF LEAF SPACE'S GROUND STATION ADELAIDE, AUSTRALIA



Infrastructure and Customers

Currently Leaf Space has five active ground stations for the Leaf Line network, with other GSs to be activated soon overseas. It has also sold several similar systems to customers, of which one delivered to Australia and one to ESOC.

With the Leaf Line and Leaf Key networks, Leaf Space has been providing ground segment service since 2018 to over 14 customers for LEOP service and operational ground segment support.





Company structure and roles

25 employees





International Law Background and Regulatory Framework 01 **Space Telecommunications** Licensing

...in which we will cover:

- I. The International law basis of international and national regulatory frameworks
- II. The actual international and national regulatory frameworks
- III. Regulatory considerations for emerging communciations technologies and trends

I. International law basis

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See in particular the Articles I, IX, VI

UNITED NATIONS TREATIES AND PRINCIPLES ON OUTER SPACE

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II. National & International Regulatory Frameworks

To explain the key points of the regulatory frameworks at national and international levels, we'll take a simple example mission and walk through the regulatory steps that need to be completed.

Situation: a company is launching a spacecraft and will use the GS as provided by another company as a service. It's a 4-year, 2 satellite mission studying the functionality of a new communications technique.

- TC Tx: centre frequency, narrow bandwidth, near 2050 MHz
- Data Rx: centre frequency, narrow bandwidth, near 2280 MHz
- Operator is an Italian company
- Ground Segment is operated by a different Italian company

So, what do they actually have to do, to license this operation?



II. National & International Regulatory Frameworks

Step 1: Get prepared: Look at the legislation, regulatory guidance, and Table of Frequency Allocations

- Codice delle Comunicazioni elettroniche
- Tabella di Attribuzione del Piano Nazionale di Ripartizione delle Frequenze

Step 2: Speak with the regulatory staff: Explain your mission and the companies' relationship to each other, ask questions, answer questions, and respond to any concerns. Build a line of communication.

Step 3: Finally, the actual filings and applications:

- Space segment licensing: API/A + licensing application to regulator. Respond to comments from other countries' "Administrations" during the API/B phase. Notification.
- Ground segment: Upon API/A publication of space segment, prepare GS filing for ITU, incl. output files from Spacecap (for RR V2 Appendix 4, Annex 2 coordination data) and GIBC (for Appendix 7 producing the coordination contour diagram), leading finally to Notification.

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III. Future regulatory matters

Looking ahead, there are emerging technologies and/or trends in space communications for which the regulatory frameworks are not clear. Let's take a look at a couple specific issues:

- **Optical links** (or free space optical communications), are, as per ESA: « the future of satellite communications. They are capable of connecting across greater distances more reliably and relaying higher quantities of data ». However, currently they are neither a mainstream mature technology nor one which is subject to a robust regulatory regime.
 - Encryption of propulsive satellites: Where is the regulation heading?
 - We can look to the **British** regulatory frameworka as a key example in which successful licensing depends on satisfying specific requirements built around security risks, which does take encryption into account.
 - In the United States, the regulatory framework does take security/encryption into account, but specifically in the case of Remote Sensing missions. There is still progress to be made.
 - As for Europe, we turn to the Network and Information Security Directive, adopted in 2016. It boosts cyber security preparedness of Member States, provides the means for cooperation among MSs as well as for sharing information on breaches, and does cover space-ground communications (depending on interpretation of its definitions)



Questions?

Grazie!