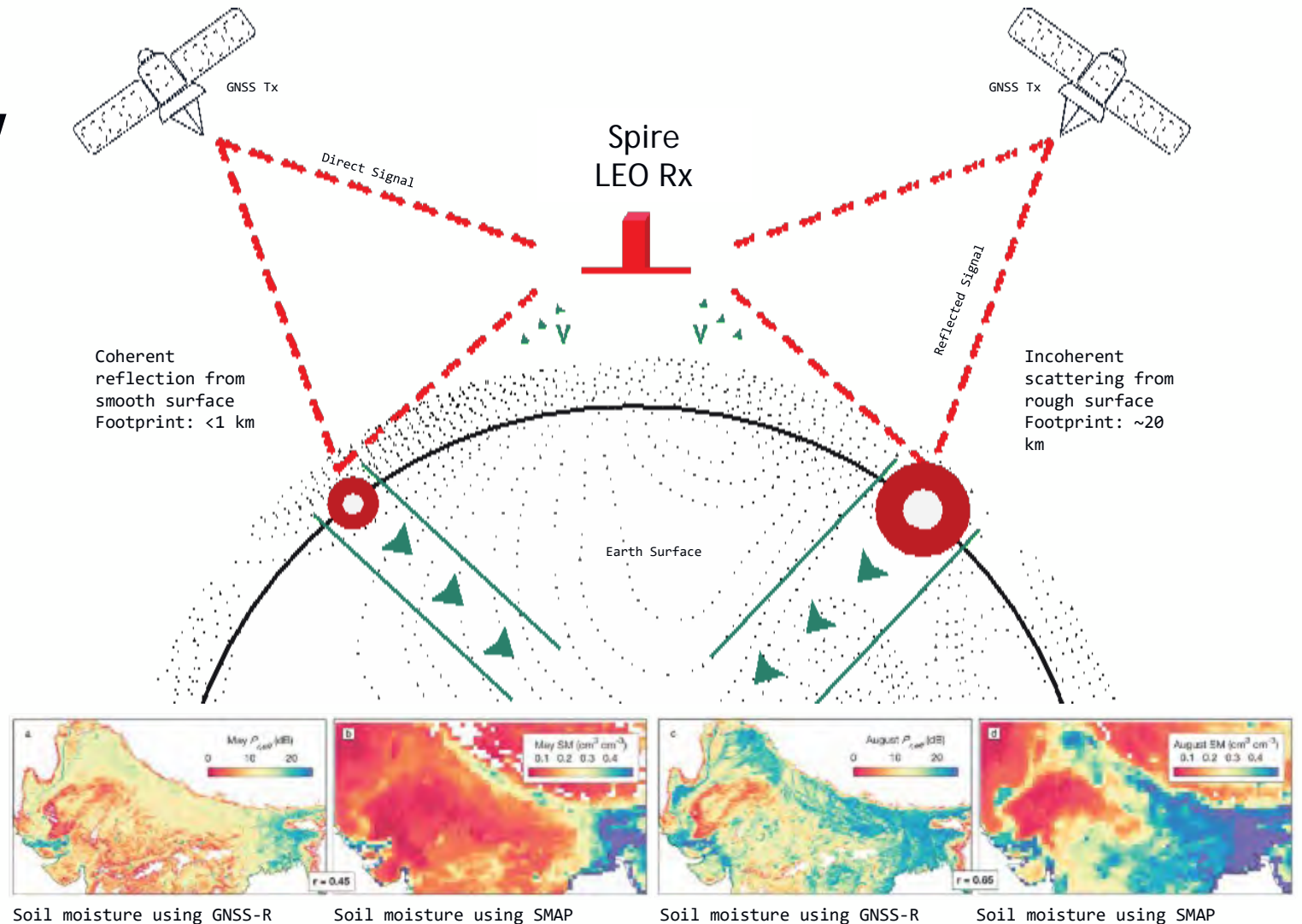


GNSS-Reflectometry (GNSS-R)

GNSS-R Explained

GNSS-R is a form of bistatic radar using GNSS signals (e.g., GPS, Galileo, QZSS, GLONASS) to perform measurements of Earth surface properties

These measurements can be used to derive soil moisture content, sea surface wind speed, and mode



GNSS-R is a novel method which provides **higher-resolution mapping** of soil moisture for **drastically reduced cost** relative to traditional methods (radiometers, radars, etc).

Access to Spire Products for Researchers

New L1 and L2 products are now available for free via ESA Earth Online

<https://earth.esa.int/eogateway/news/announcement-of-opportunity-for-spire-data>

- GNSS-R - Raw IF samples
- GNSS-RO - Raw IF samples
- Grazing Angle GNSS-R - L1A
- Grazing Angle GNSS-R - L1B (Georeferenced)
- Conventional GNSS-R - L1A (Calibrated reflectivities)
- Conventional GNSS-R -L1B (Calibrated cross-sections)

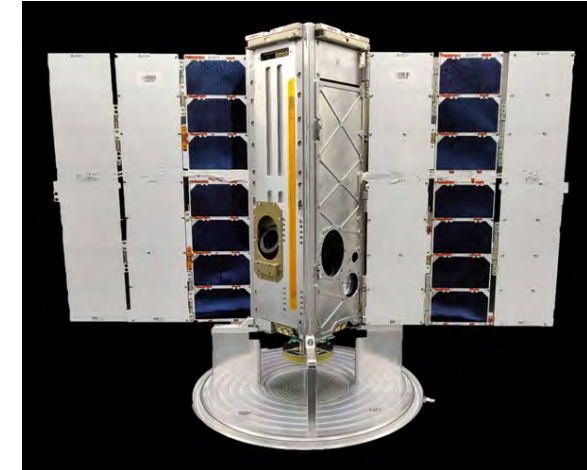
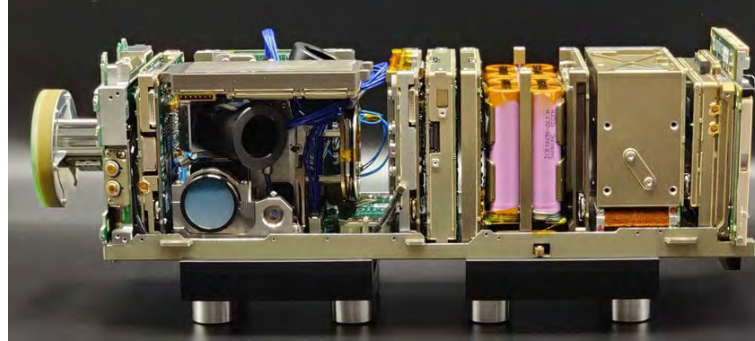
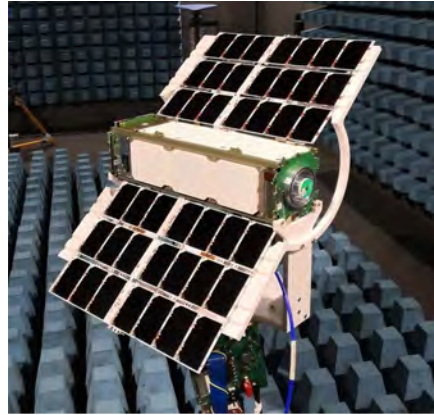


Welcome to the submission area for the Spire Call

This ESA Third Party Mission (TPM) call offers an opportunity for scientists and researchers to access Spire data to support the assessment of the potential of such data as an ESA Third Party Mission. The following Spire products are available free of charge, for scientific research and application development:

- Monthly subscription to ADS-B Satellite Data Stream, Historical and Live
- Monthly subscription to AIS messages, Historical and live
- GNSS-Radio Occultation archived profiles

Enabling technologies - Intersatellite links



RF Intersatellite links

- Low-power, low-data rate S-band intersatellite
- Two batches of two satellites were launched to demonstrate a variety of scenarios, both in-plane and cross-plane
- Data throughput is consistent with the expected theoretical models (data rates of >100kbps were achieved up to 4000km distance and relative velocity >10km/s)
- Further rollout planned as part of Spire's constellation replenishment

Optical Intersatellite links

- Optical ISLs are more complex but offer higher data rates to support Spire's and its customer's future operations
- First batch with critical enabling technologies launched in July 2021
- Follow-on batches of 6U satellites following in 2022

Enabling technologies - Onboard processing

Spire developed two types of on-board computing devices:

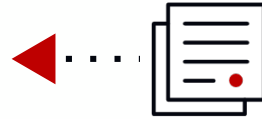
- “Marsupial” - based on UltraScale+ MPSoC family → payload backend for continuous operation
- “Sabertooth” - based on Nvidia TX2i → high-performance batch post-processing engine
- Both devices have been demonstrated in-orbit and have been operating without major anomalies
- Spire is now flying these devices for various in-house and customer payloads



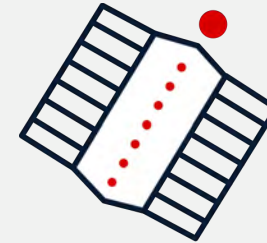
Spire Space Services: How it Works

You design an application

Your hardware and/or software is hosted on a Spire platform in LEO



Spire Nanosatellite



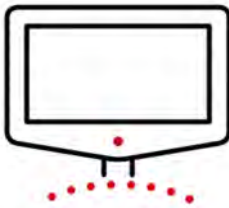
Spire provides the Earth-to-space platform for you to operate and automate



Spire GSN

You control your application

Using web APIs, you schedule operations, perform upgrades, and retrieve your data



Spire Cloud-Based Constellation Operations



[Watch this space for ride-share opportunities](#)

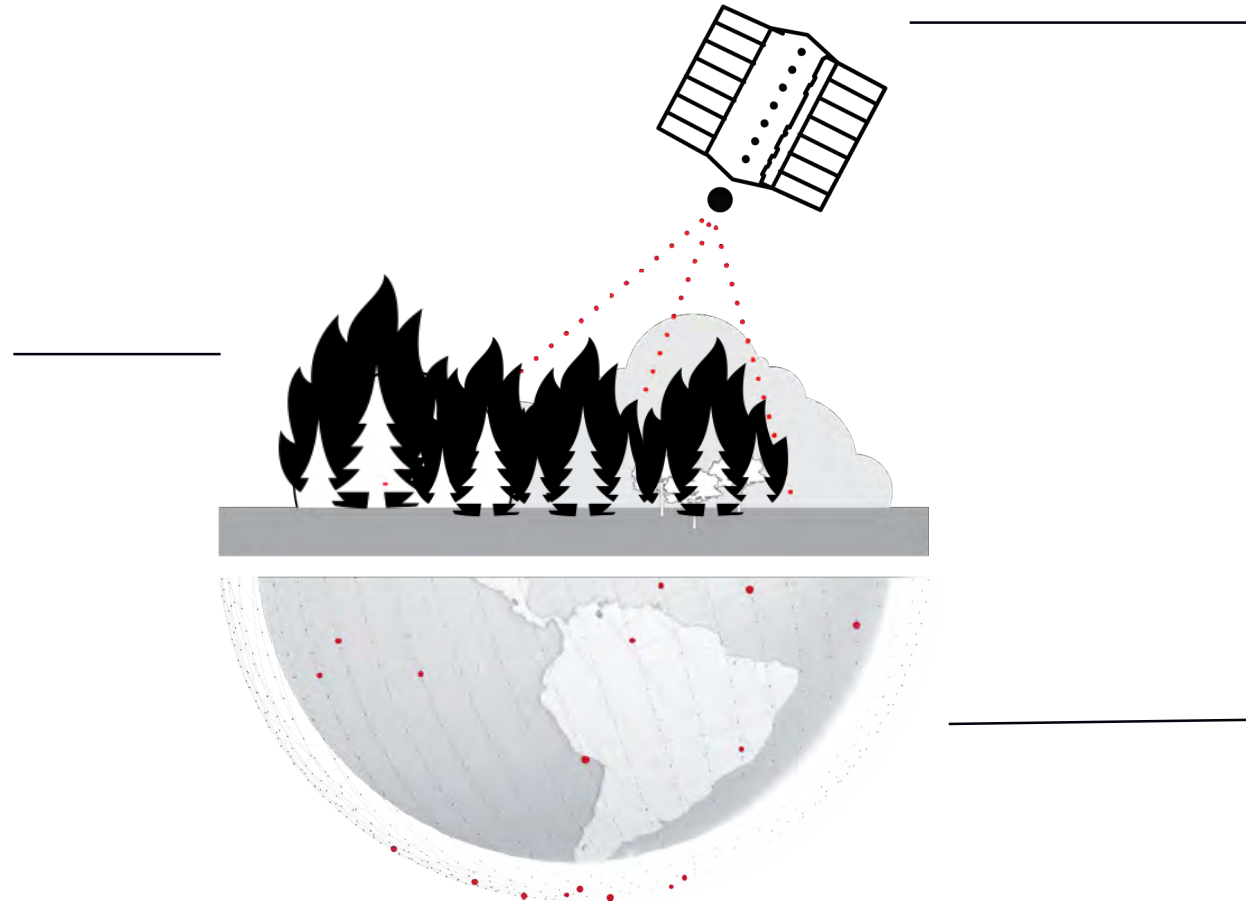
Spire Space Services: Case study



Customer

OroraTech

OroraTech has developed and provides a leading global wildfire intelligence service that processes data from satellites in low Earth orbit (LEO) and geostationary orbit (GEO) to detect wildfires and monitor their spread. OroraTech plans to have a full constellation of 100 nanosatellites in LEO offering high speed fire detection by 2026.



Mission

In orbit demonstration of Ororatech's wildfire early detection system consisting of new optical payload - their proprietary thermal-infrared camera and data processing unit designed to detect fires.

Our Services

Spire will host Ororatech sensor alongside other Spire payloads on a LEMUR 6U satellite planned for launch at the end of 2021. Spire will provide as well launch, the global ground station network and provision of sensor data via API.

Key Takeaways

GLOBAL CONSTELLATION

Spire has built an operational Earth observations constellation (110+ sats) that is improving weather forecasting and enabling new Earth science and applications

NEW APPLICATIONS

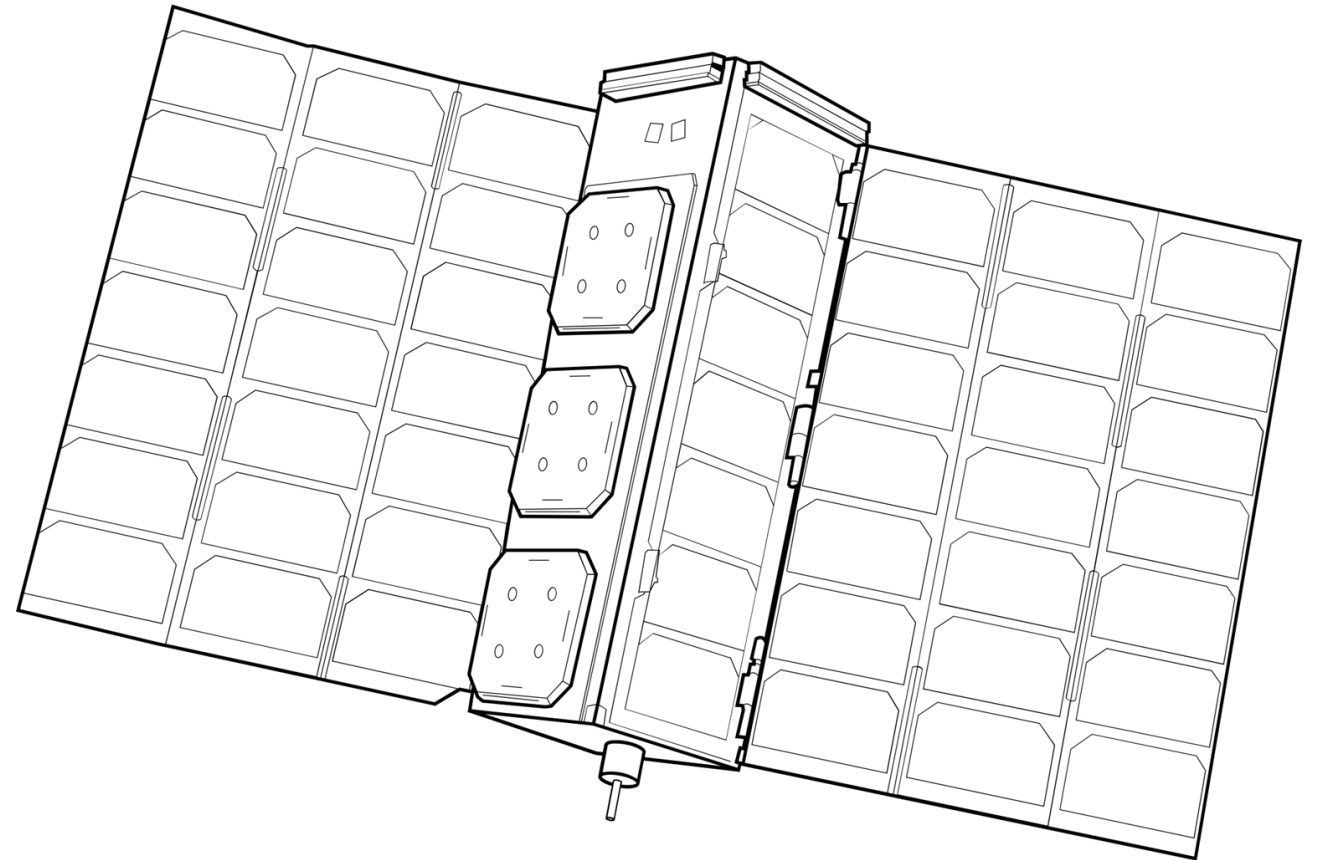
Having proved the viability of commercial RO, Spire is now expanding into more SpWx science, GNSS-R applications, and new Earth observation payloads

SIGNIFICANT VOLUME AND COVERAGE

We cost-effectively harness nanosatellites to collect large quantities of Earth observations to positively impact applications that benefit from high spatial and temporal sampling and low-latency

CONTINUED IMPROVEMENT

Spire aims for continuous scaling, replenishment, and improvement for sustained, long-term Earth observations



Thank you!

Dr. Tom Greig - Business Development Executive

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